A STUDY OF SELF-EFFICACY BASED INTERVENTIONS ON THE CAREER DEVELOPMENT OF HIGH ACHIEVING MALE AND FEMALE HIGH SCHOOL STUDENTS

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Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

in

Student Personnel Services

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January 1992

Blacksburg, Virginia

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(ABSTRACT)

Over the last twenty years women have gradually entered a number of occupations that have been considered "traditionally male". Despite recent gains, women continue to be underrepresented in science, mathematics and engineering career fields. Based on the application of Bandura's self-efficacy theory as applied to career development, the purpose of this study was to determine whether there was any difference in career choice self-efficacy, career decision-making self-efficacy or career maturity after participating in one of two performance-based research programs, specifically, a community-based mentorship program or a school-based research program. In addition the study investigated gender and personality differences between the groups, the student and mentor/supervisor perceptions of the quality and enjoyment of the experience, the quantitative application, the time involved and ways to improve the programs.

The quasi-experimental study used a non-randomized control-group pretest-posttest design with two experimental

groups and one control group. To determine the reliability and validity of the student perception instrument and the mentor/supervisor validation assessment, a pilot study was conducted. The groups were pre and post tested using the Career Decision-Making Self-Efficacy Scale, the Career Development Inventory and the Self-Efficacy for Technical/Scientific Fields Scale. The data were analyzed using multivariate analysis of variance (MANOVA) with PSAT scores and grade point averages serving as covariates.

The results of the study found no differences in gain scores between the experiential programs and ordinary maturation. However, students in the mentorship program felt more positive about their mentor, the scientific/technical nature of the experience, and the application and enjoyment of the program than did the school-based group. The groups differed generally on the judging/perceiving characteristic of the Myers-Briggs Personality Indicator scale. Gender differences were found in time supervisors spent with students: whereas, mentors spent over twice as much time helping females, school-based teachers spent twice as much time with males.

Recommendations include further validation of self-efficacy measures, further investigation of the effectiveness of self-efficacy based interventions, and replication with more diverse and special populations as well as with elementary and junior high school students.

ACKNOWLEDGEMENTS

I would like to acknowledge the contributions of my dissertation committee for their help, guidance and patience through this learning process.

I deeply thank Dr. Charles Humes, my chairperson, for his inspiration and leadership throughout my doctoral program, for his coordinating efforts with committee members, and for his encouragement over the many years this effort represents.

A very special thanks must go to Dr. Peter Malpass, who worked so patiently and positively with me throughout the statistical analysis portion of my study. When I stumbled, Pete was always there to encourage and cheer me on; he has been my mentor throughout this process.

I also cherish the recommendations of Dr. Johnnie Miles, who shared her background in career development; the creativity of Dr. Linda Little, who gave me an appreciation for the counseling interventions of family systems theory; and the treasured support and encouragement of Dr. Fredda Gill, a respected professional and colleague in the counseling field.

I extend my appreciation to the Fairfax County School system, in general and specifically to Dr. Robert Spillane, Dr. Beatrice Cameron, and to Geoffrey A. Jones, my building Principal for their approval and assistance in allowing me to do the research necessary for this study.

A special thanks must go out to the teachers, mentors and students who participated in the study; without their cooperation, this literally would never have been possible.

For emotional and technical support, I am indebted to my husband, Tom Dungan who provided the inspiration and encouragement through the doctoral journey as well as the technical support necessary to wrap up the final product.

And finally, to my children, Ann, Tom Jr. and Elizabeth, who encouraged my pursuit and listened to my frustrations with kindness and love.

You all participated in this effort and I appreciate each one of you.

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CHAPTER I

Introduction

In 1983, The National Science Board Commission of Precollege Education in Mathematics, Science and Technology sounded an alarm concerning the crisis in science and technology education. The Commission noted that educators were falling behind on two counts: (i) failing to correct the decline in quantity and quality of scientists and engineers so vital to research, industry and higher education to such an extent that our nation's security could be in danger, and (ii) failing to educate a technologically trained citizenry that is able to cope with tasks and decisions concerning human welfare and the environment in our technological world.

In 1988, a similar concern was voiced by The Task Force on Women, Minorities and the Handicapped in Science and Technology:

> Science and engineering workers are vital to our advanced industrial society. But by the year 2010, we could suffer a shortfall of as many as 560,000 science and engineering professionals. As a

result, America's economic strength, security and quality of life are threatened (p. 11).

Compounding the problem of declining entry into the sciences is a significant change in America's work force. Between 1985 and 2000, white males will comprise only 15 percent of the new additions to the labor market, with the balance being women and minorities. Women are entering the workplace at such a rate that by the year 2000, 47 percent of the workforce will be women (Hudson Institute, 1988).

Background

Over the last twenty years women have gradually entered a number of occupations that have been considered "traditionally male". For example, by 1986, women had increased their representation from 10 to 15 percent in the legal profession; from 34 to 45 percent in accounting; from 28 to 40 percent in computer programming; and from 22 to 29 percent in management and administration (Hudson Institute, 1988). Despite these gains, women continue to be underrepresented in science, mathematics and engineering. In 1986, women accounted for only 15 percent of all the employed scientists and engineers: 27 percent in science and only 4 percent in engineering (National Science Foundation, 1987).

What has been done to address the problem of enabling women to move out of low paying, female dominated occupations? Several approaches have been taken: legislation has been passed to prevent discrimination against women wishing to enter male dominated fields; research has resulted in a plethora of information on the internal and external barriers preventing women from competing equally with men; and specialized high schools for mathematics, science and technology have been established to provide a rich science/mathematics curriculum for college-bound females and males.

The first approach legislation, opened the door to equal opportunity through the Equal Pay Act of 1963. This was followed closely by the Civil Rights Act of 1964 and the Executive Order 113/75 in 1967 prohibited discrimination in employment based on sex, age, race and ethnicity. Five years later, Title XI of the Education Amendments insured equal access to federally-funded educational programs for women (Ethington & Smart, 1987).

The second approach, research, was aimed at encouraging women to enter non-traditional fields by investigating the reasons women have not entered male dominated fields in equal numbers. These studies identified the internal and external barriers preventing women from going into nontraditional fields so that corrective measures could be taken. Haring and

Beyard-Tyler (1984) determined that there were three factors that were mainly responsible for keeping women from pursuing nontraditional occupations: a) sex-role socialization, b) poor self-efficacy, and c) negative attitudes held by women about peers working in "male occupations". In an extensive survey of personality and motivation traits of women in non-traditional occupations, Chusmir (1983) concluded that these women display many of the same characteristics commonly attributed to men. In a study of factors affecting career choice among high-achieving college women in engineering, science, humanities and social sciences, Fitzpatrick and Silverman (1989) found significant differences only in parental support and work characteristics: engineering majors perceived stronger support from both parents than did other majors, and science and engineering majors reported salary and availability of jobs to be a stronger influence than humanities and social science majors.

The third approach concentrated on answering the public demand for strong mathematics and science education. Specialized schools in mathematics, science and technology multiplied around the country in the late 1970's. Ranging from elementary to secondary programs in a variety of formats, some were established as schools within a school, some as residential institutions serving an entire state, and others as regional commuting schools (Sawyer, 1986; Cox & Daniel,

1983; Sender, 1984). Whatever the organizational structure, their mission was to attract and serve the high ability, college-bound student interested in pursuing a career in mathematics, science, computer science and related technological fields (Sawyer, 1987). Are these specialized schools helping to encourage females to enter mathematics, science or technology fields? Although no follow-up studies have been conducted, one could assume that they are because:

1. Students are chosen from a large field of applicants who demonstrate talent, abilities, and interest in mathematics and science fields (Sawyer, 1986).

2. Students are required to complete a rigorous curriculum in the fields of mathematics and science. Since it is well documented that females tend to take fewer mathematics courses than males and that mathematics self-efficacy expectations are related to the selection of science-related majors in college, a strong required curriculum in mathematics and science could equip females with a more competitive background (Betz & Hackett, 1983).

3. The staff provides an environment which encourages females to compete equally with males and accepts female interest in male-dominated fields which promotes positive self-esteem (Sawyer, 1987).

4. Students choose to leave their neighborhood schools to attend the science and mathematics high school. Research on

schools of choice has shown that students who choose their own schools are more motivated, participate in more school-related activities, and are more committed to educational pursuits (Gillenwaters, 1986).

However, it was not until some researchers turned their attention to social learning theory and cognitive/behavioral processes that the concept of self-efficacy began to emerge as a possible explanation of woman's career development process. (Bandura, 1977, 1982; Krumboltz, Michell & Jones, 1971).

Developing from his experimental work with phobics, Bandura (1977) outlined a theoretical model attributing changes in fearful and avoidant behavior to the concept of self-efficacy. Efficacy expectations were directly related to effort and persistence in the face of obstacles and difficult situations and varied in level, strength and generality.

Judgements of self-efficacy were based on four sources of information: performance attainments, vicarious experiences of observing the performance of others, verbal persuasion and reduction of anxiety. Bandura found performance accomplishments to be especially effective in raising efficacy expectations because they were based on the success of personal mastery experiences (Bandura, 1977).

In 1981, Hackett and Betz also reasoned that self-efficacy was a major mediator in career choice. They were the first researchers to suggest that self-efficacy could be a

significant factor affecting women's underrepresentation in traditionally male fields. They also concluded that low expectations of self-efficacy could be creating some internal barriers as well as affecting the ability to manage external obstacles in female career-related behaviors.

Post-Kammer and Smith (1985) replicated the Betz and Hackett (1981) work with a population of eighth and ninth graders; they also repeated the work with some modifications using a disadvantaged pre-college population of students interested in mathematics and science careers (Post-Kammer & Smith, 1986). Wheeler (1983) investigated two occupational preference approaches: the expectancy model which relates individual work values and rewards in different occupations to occupational preferences and the self-efficacy model which stresses personal perceptions of ability to perform in difference occupations. His findings confirmed that the self-efficacy model was more highly related to occupational preference.

In 1987, Branch studied self-efficacy and career choice with college undergraduates essentially replicating the Betz and Hackett (1981) work. Nevill and Schlecker (1988) looked at the relationship of self-efficacy and assertiveness to willingness to engage in traditional or nontraditional career activities.

All of these studies came to the same conclusion: regardless of the population used, males demonstrated equivalent self-efficacy with regard to traditional and nontraditional sex-role careers while females reported significantly higher levels of self-efficacy with regard to traditionally female-dominated occupations and significantly lower levels of self-efficacy toward nontraditional male-dominated careers.

In three similar studies, Lent, Brown and Larkin (1984, 1986, 1987) looked at career self-efficacy in forty-two college students majoring in technical/scientific career fields. In contrast to the above findings, they did not find gender differences in career self-efficacy; however, they did find that self-efficacy contributed significantly to academic performance and consideration of career options.

The research on self-efficacy reviewed up to now has been concerned with the content of career choice. Another variable worth considering, career decision-making self-efficacy, focuses on the process of career choice. Taylor and Betz (1983) studied college students' self-efficacy expectations regarding skills and experiences necessary for effective career decision-making. Finding no overall gender differences, they concluded that high self-efficacy for career decision-making was associated with low career indecision.

A third variable which has been associated with affective and cognitive growth in career choice is career maturity. A career development concept introduced by Super (1957), high career maturity scores were positively related to realism of choice as well as career adjustment (Crites, 1973).

Many studies have been done examining the effect of career education programs on career maturity (Canna, 1982; Caston, 1982; Gadzera, 1988). Results indicated that career maturity as a developmental process could be enhanced through career education programs.

Returning to social learning theory, Bandura (1977) postulated that the most effective method of raising self-efficacy was through performance based experiences. One might measure the effectiveness of career education programs in terms of the gain in self-efficacy experienced by the participants.

The mentorship or internship experience advocated by Daniel and Cox (1984) pairs individual students with adult professionals who serve as guides, role models, advisors and friends. These programs have been found to be effective with gifted students by emphasizing education as preparation for a work experience, by helping students to narrow their career choices, and by exposing them to a variety of future careers through hands-on experiences (Borman, Nach & Colson, 1978).

Another experiential program, modeled on the vocational method of instruction, is the laboratory experience in which students are able to design, develop and test original research projects (Sawyer, 1986). Both programs are intended to enhance the career experiences of students, but have not been measured with respect to their impact on self-efficacy and career maturity variables.

Problem Statement

A review of the literature on factors contributing to the under-representation of females in non-traditional fields revealed many factors both internal and external which could serve as barriers to discourage females from seeking careers traditionally entered by males. The literature shows that self-efficacy is a major factor in career choice for students at all levels, and that for college students, it is not gender-specific in engineering, science, and mathematics fields.

The study of self-efficacy in the framework of career interventions is promising for counselors. Lent and Hackett (1987) in a paper reviewing research findings which applied self-efficacy to career development theory, noted that "a potentially significant next realm of research, ... involves studying self-efficacy within the context of career

interventions" (p. 375). As noted in the literature, some methods are more effective than others in raising the level and strength of efficacy expectations. Bandura (1977) contended that performance accomplishments were especially effective in raising self-efficacy, being based on mastery experiences. Omvig, Tulloch and Thomas (1975) noted significantly higher levels of career maturity among students who had participated in career education programs.

The problem addressed by this study is to assess and compare the impact of two experiential performance-based programs or the lack of a program on career choice self-efficacy, career decision-making self-efficacy and career maturity of students attending a specialized high school for mathematics, science and technology. It will also investigate gender differences within and among the groups before and after participation in the programs.

Purpose Statement

The purpose of the study is to determine whether there is any difference in career choice self-efficacy, career decision-making self-efficacy or career maturity after participating in one of two performance-based research programs. Specifically:

1. The study will synthesized the extant literature.

2. The study will measure the career choice self-efficacy, the career decision-making self-efficacy and the career maturity of students before participating in the programs.

3. The study will measure the career choice self-efficacy, the career decision-making self-efficacy and the career maturity of students after participating in the programs.

4. The study will measure the gain due to maturity of career choice self-efficacy, career decision-making self-efficacy and career maturity of students in a control group who have not participated in either program.

5. The study will determine the relative effectiveness of the programs in achieving higher levels of career choice self-efficacy, career decision-making self-efficacy or career maturity.

6. The study will assess gender differences related to career choice self-efficacy, career decision-making self-efficacy and career maturity together with their interactions with the programs.

7. The study will assess intent and personality characteristics of students choosing the different programs and the quality of the different experiences.

8. The study will assess the quality and quantity of the different experiences by evaluating the students' perceived

relationship with the mentor/instructor and by assessing the percent of time students are involved in tasks directly related to mathematics, science or technology.

9. The study will validate two research programs at a specialized mathematics/science high school which are designed to encourage an interest in science, mathematics, engineering and related career fields.

Research Questions

The descriptive study will be guided by the following research questions:

1. For purposes of this study, the mentorship program is designed to provide opportunities for students to do concentrated research, or project development in a specialized field under the leadership and direction of highly trained and experienced experts in scientific and technological business firms and government agencies. Is there a significant difference ($p < .05$) between this program and the school-based program on gain scores of career choice self-efficacy, of career decision-making self-efficacy and of career maturity?

2. For purposes of this study, the school-based research program also provides opportunities for students to do concentrated research, or project development in a specialized field but under the direction and leadership of a resource

teacher in one of eleven specialized laboratories located at the school. These laboratories are in the fields of biotechnology, computer science, material science, optics and modern physics, microelectronics, chemical analysis, energy and engineering, television production, telecommunications, computer assisted design, and robotics. Is there a significant difference ($p < .05$) between this program and the mentorship program in gain scores on career choice and decision-making self-efficacies or career maturity of students?

3. Is there a significant difference in career maturity, career choice self-efficacy or career decision-making self-efficacy after participating in the mentorship, the school-based research program or the control group?

4. Is one program more effective than the other in increasing gain scores on these variables?

5. Do females demonstrate a greater change in gain scores than males after participating in either of the programs?

6. Are there any differences between students within the groups in personality characteristics as measured by the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), in achievement as measured by the grade point average or in ability as measured by Preliminary Scholastic Aptitude (PSAT) scores?

Assumptions

This study will be guided by the following assumptions:

1. It is assumed that Bandura's social learning theory is a valid approach to understanding the career development of females.

2. It is assumed that performance mastery is the most effective method of raising self-efficacy expectations.

3. It is assumed that the two performance-based programs, mentorship and school-based laboratory research, will encourage students to pursue careers in mathematics, science and technology through a hands-on experiential approach.

4. It is assumed that mathematics, science, and technological careers will be those commonly recognized as requiring a strong preparation in mathematics, science or technology.

5. It is assumed that the Self Efficacy for Technical/Scientific Fields Scale (Lent et al., 1984), the Career Decision-Making Self-Efficacy Scale (Taylor & Betz, 1983) and the Career Development Inventory (Super, 1974) are appropriate instruments for measuring career choice self-efficacy, career decision-making self-efficacy and career maturity, respectively.

Research Hypotheses

In order to assess the effectiveness of two performance-based methods of treatments on the career choice self-efficacy, career decision-making self-efficacy, and career maturity of high school students, the following hypotheses, stated in null form, will be tested:

1. There is no significant difference between the mentorship, school-based research and control groups on career choice self-efficacy as measured by the gain scores on the Self-Efficacy for Technical/Scientific Fields Scale.

2. There is no significant difference between the mentorship, school-based research and control groups on career maturity as measured by the gain scores on the Career Development Inventory.

3. There is no significant difference between the mentorship, school-based research and control groups on career decision-making self-efficacy as measured by the gain scores on the Career-Decision-Making Self-Efficacy Scale.

4. There are no significant gender differences in career choice self-efficacy, career maturity or career decision-making self-efficacy between the groups.

5. There is no significant difference between the groups in perceived characteristics of students and mentors nor in

the experiential/quality characteristics of the programs as measured by the student and mentor instruments.

6. There is no significant difference between the groups in personality characteristics as measured by the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), in achievement as measured by the grade point average (GPA) after junior year, or in intellectual ability as measured by the Preliminary Scholastic Aptitude (PSAT) scores.

Need for the Study

Very few studies have investigated any of the intervention strategies suggested by Bandura's self-efficacy research. This study will contribute to the knowledge base of self-efficacy theory by comparing two methods of career interventions in the area of performance attainment by measuring the increase in career development and self-efficacy variables. It will investigate gender gain differences between the two programs. It will also validate two experiential research programs designed to encourage students to pursue mathematics, science and technological careers. The results of this research will be useful in extending these programs to other high school settings as a means of encouraging students to pursue careers in these fields. It may also provide counseling insight as to the relative benefits of

experiential program types based on personality or related attributes measurable prior to assignment or selection of a program type.

Definition of Terms

Self-efficacy expectations are defined as a person's beliefs concerning his or her ability to successfully perform a given task or behavior; these expectations are considered major mediators of behavior and behavior change (Bandura, 1977).

Mentorship program is a curriculum program in which students design and develop a research project under the leadership and direction of a professional in a scientific or technological firm, business or government agency.

School-based research program is a curriculum program in which students design and develop a research project under the leadership and direction of school personnel in a school-based laboratory environment.

Career maturity, development or adaptability is a "multidimensional trait that is part affective, part cognitive, and increases irregularly with age and experience" (Thompson, Lindeman, Super, Jordaan & Myers, 1984, p. 7).

Affective career maturity consists of planning for the future, awareness and willingness to focus on exploration, decision-making, and implementation of plans. Cognitive career maturity includes knowledge of oneself and decision-making principles, acquisition of information about the world of work, realism in relating self to situational information and the ability to flexibly relate career objectives to experience.

Career choice self-efficacy as defined by Betz and Hackett (1986) is a generic term for "self-efficacy expectancies in relation to the wide range of behaviors necessary to the career choice and adjustment processes" (p. 280).

Career decision-making self-efficacy is defined as confidence in one's abilities with respect to the specific tasks and behaviors required in making career decisions (Taylor & Betz, 1983).

Limitations

The study will be limited as follows:

1. Due to a difference of four mouths between the first and the second testings, pretesting may act as a learning

experience that will cause subjects to alter their responses on the second testing.

2. The population selected for the study is a group of high-achieving students generally interested in mathematics and science; therefore, due to the interactive effects of selection bias the results cannot be generalized to high school students beyond those attending a similar specialized and selective high school.

3. Teachers and mentors vary in their backgrounds, styles of teaching and methods of guidance and support.

Delimitations

The study will be delimited as follows:

1. Students will be those enrolled in a specialized high school for science, mathematics and technology.

2. The population will include a sample of students enrolled in the senior class during the 1990-91 school year.

3. Students will be high-achievers selected on their ability, achievement, and interest to attend a specialized high school of mathematics and science.

4. Students will be randomly chosen from a pool of volunteers for each experimental method.

Organization of the Study

This study will be divided into five chapters:

Chapter I includes the introduction, the background, the statement of the problem, the purpose statement, the research questions, the assumptions, the research hypotheses, the need for the study, definitions of terms, the limitations, the delimitations and the organization of the study.

Chapter 2 will include a review of relevant research and literature to provide a historical and theoretical background for the study.

Chapter 3 will describe the research methodology, the research design, the pilot study, the selection of subjects, instrumentation, data collection and processing, and statistical analysis.

Chapter 4 will present an analysis and evaluation of the findings of the study in relation to each hypotheses under investigation.

Chapter 5 will include a summary of the study with the conclusions reached, recommendations for implementation of the findings and for future research.

CHAPTER II

Review of the Literature

In this chapter, the literature is reviewed as it relates to the hypotheses under study. It is organized into the following major topics:

1. Self-efficacy theory
2. Career choice self-efficacy
3. Factors contributing to gender differences in career choice
4. Career decision-making self-efficacy
5. Career maturity
6. Performance based experiential programs

Self-Efficacy Theory

Introduced by Bandura in 1977, perceived self-efficacy was defined as "judgements of how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p.122). Over the last decade, self-efficacy as a construct has received increasing attention from

researchers interested in the dynamics underlying a variety of human behaviors.

While self-efficacy is a relatively new term in the field of social cognitive theory, studies concerned with aspiration and expectancy for success have been dealing with similar concepts since the 1940's. In the earliest studies focusing on aspiration, researchers compared levels of aspiration and self-efficacy (without actually using this term). They found that levels of aspiration were usually higher than self-efficacy levels (Diggory, 1949; Irwin & Mintzer, 1942), and that self-efficacy was more highly correlated that level of aspiration with past performance (Irwin, 1944). While investigating a similar construct, these early studies served to validate Bandura's (1978) notion that self-efficacy and aspiration differ.

In a contrasting argument, Rotter's (1954) social learning theory purported that expectancy and reinforcement value were the key mediators of human behavior. Following this line of thinking, behavior was a function of a person's expectancy that performance would lead to reinforcement of a subjective value. Implicit in this theory was the assumption that success on a task was a form of reinforcement.

A third precursor of Bandura's self-efficacy theory, Atkinson's (1957) theory of motivation stated that engagement and persistence at a particular task was determined by

expectancy for success, the incentive value of success, and the motive. He defined expectancy as the probability of task success and incentives as potential rewards and punishments. These constructs were similar to self-efficacy and outcome expectancies as defined by Bandura (1977).

As an outgrowth of his work with phobics, Bandura (1977) outlined a theoretical model attributing changes in fearful and avoidant behavior to the concept of self-efficacy. According to Bandura, behavior was motivated by efficacy expectations, or the conviction that one could successfully complete a task necessary for a desired outcome. Efficacy expectations were directly related to effort and persistence in the face of obstacles and difficult situations. "Given appropriate skills and adequate incentives, ... efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend, and of how long they will sustain effort in dealing with stressful situations"(p.194).

Bandura believed efficacy expectations varied on several dimensions: in magnitude, strength and generality. That is, people differed in the amount of difficulty they were willing to attempt (magnitude), in the amount of persistence they would demonstrate (strength) and in the degree to which self-efficacy expectations were able to be transferred to different situations (generality). In his research, he induced pre-

assigned levels of self-efficacy in phobic subjects by enabling subjects to master increasingly more threatening tasks. After studying self-efficacy within individual subjects, he concluding that performance varied as a function of perceived efficacy (Bandura, 1982).

Bandura based judgements of self-efficacy on four informational sources: performance attainment, vicarious experiences, verbal persuasion and the physiological reduction of anxiety. In research which exposed subjects to situations using all four methods, he determined performance attainment was most effective method in raising efficacy expectations. Interestingly, he maintained that "perceived self-efficacy was a better predictor of subsequent behavior than was performance attainment... " (Bandura, 1982, p.125).

A study by Wheeler (1983) compared self-efficacy with expectancy models of occupational preferences for college students. In this study, he administered a questionnaire of 17 occupational preferences, which incorporated 68 per cent of the total U.S. labor force, to 82 males and 62 females. Subjects were asked to rank their preferences for each occupation on a seven point bipolar scale. The expectancy model also included fifteen outcomes which had been used in previous research on expectancy theory. While the results of the study supported both an expectancy model of occupational preference and a self-efficacy model, Wheeler found the self-

efficacy model was more highly related to occupational preference.

In a another study of self-reactive influences, Bandura and Cervone (1986) conducted an experiment with 44 male and 44 female college students in which they were assigned a task designed to measure changes in motivation using an ergometer exercising devise. After obtaining a baseline performance for all subjects, students were assigned randomly to treatment conditions in which they chose a goal which was preset by the researcher to be a 50 per cent increase in effort over the baseline measure. Following the performance of a second five minute ergometer task, subjects were informed that they fell in either the large, the moderate or the small substandard discrepancy group in reaching their goals. The findings revealed that perceived self-efficacy contributed to motivation across a wide range of discrepancy conditions. As predicted, the stronger the perceived self-efficacy, the more determined was the subject to reach the pre-set goal. The study also found no significant sex differences on any of the three self-reactive influences.

Due to the considerable experimental work of Bandura and his associates (Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy & Howell, 1980) along with other researchers (Condiotte & Lichtenstein, 1981; Flemming & Thornton, 1980), there has been extensive support for the hypothesis that self-efficacy

expectations are highly correlated with changes in behavior (Maddux & Barnes, 1984).

Career Choice Self-Efficacy

In 1981, Hackett and Betz proposed that Bandura's self-efficacy theory might provide a means of understanding women's career development by linking efficacy expectations with avoidance of nontraditional career choices. As they stated "...examination of the degree to which low or weak efficacy expectations are related to women's rejection of potential career options may be informative" (p.336).

In their study which investigated the relationship between occupational choices and self-efficacy expectations, 134 female and 101 male college students of equal ability, were asked to assess their self-efficacy expectations with regard to the educational requirements and the job duties of ten traditional and ten nontraditional occupations. The occupations, selected to appeal to a range of interests, had been designated traditional if 70% or more members were women and nontraditional if males represented 70% or more of the membership.

Their findings indicated significant gender differences in self-efficacy with regard to career choice. While males reported equal self-efficacy with regard to traditional and

nontraditional occupations, females, on the other hand, indicated significantly lower self-efficacy expectations regarding nontraditional than traditional careers. In addition, self-efficacy was related to the type and number of career considerations as well as interest in nontraditional or traditional occupations. An important conclusion indicated by the findings was that perceptions of low self-efficacy may play a crucial role in the elimination of possible career choices (Betz & Hackett, 1981).

Following on this research were several replicating studies which varied the populations under consideration. Post-Kammer and Smith (1985) repeated the same study using eighth and ninth graders. While they did find sex differences emerging as early as junior high school for many occupations, girls and boys indicated similar self-efficacy expectations for several nontraditional occupations such as accountant, physician and lawyer.

In 1986, Post-Kammer and Smith replicated the study using disadvantaged students ranging in age from 16 to 24. Using an instrument similar to that used by Betz and Hackett (1981) with the addition of four math/science careers, students rated their perceived self-efficacy regarding twelve math/science and twelve non-math/science occupations. Gender differences were found in only three of the traditionally math (usually male) oriented careers with no sex differences noted in the

non-math oriented occupations. Another interesting factor emerged from their research. While males' choice of math-oriented careers involved interest and consideration, females' choice of similar careers involved interest, consideration and confidence in meeting the educational requirements for these careers (Post-Kammer & Smith, 1986).

Varying this study in 1991, Post, Stewart and Smith examined self-efficacy and interests as they related to math/science careers among Black college freshmen. With this population, findings indicated that self-efficacy was not as significant a factor in consideration of non-math/science careers as was interest. Gender differences were absent in 19 of the 24 occupations, with males reporting greater confidence, self-efficacy, interest and consideration of math/science careers than did females for whom interest was the most significant factor.

In another replication, Matsui, Ikeda and Ohnishi (1989) examined self-efficacy and gender differences with a population of Japanese college students. Despite the cultural and social differences in the populations, their findings were similar to those of previous studies. They also found three major factors related to females' low self-efficacy in nontraditional careers. Females felt they had fewer successful female role models in male dominated occupations; they associated a lack of femininity with nontraditional

occupations, and females with little confidence in their math ability also reported low self-efficacy for male dominated occupations.

In a series of studies by Lent, Brown, and Larkin (1984, 1986, 1987, 1989a, 1989b) self-efficacy was highly effective in predicting academic achievement and persistence in math, science and engineering college majors. Similarly, Steward, Robbie, Jackson and James (1989) supported these findings with Black college students; they also concluded that students who perceived themselves as being more competent tended to persist academically.

Replicating and extending these studies while using three different factors, population (community college students), data analysis and instrumentation, Rotberg, Brown and Ware (1987) confirmed the previous studies' findings that career interest was a strong predictor of both range of career choice and career self-efficacy expectations. However, they found that gender was not a significant predictor of occupational choice which contradicted the previous mentioned career self-efficacy research.

Another researcher, Clement (1987) criticizing Betz and Hackett's (1981) methodology and instrumentation, conducted a similar study with 121 college students. She found that while women have lower self-efficacy expectations than men, they were not deterred from entering most of the

nontraditional careers. She concluded that self-efficacy failed to predict women's consideration of traditionally male occupations.

To summarize the numerous studies investigating career choice self-efficacy, the majority of the studies found self-efficacy and interest to be positively correlated with consideration of a greater number of nontraditional career options. Most of the studies found that females exhibited lower self-efficacy than males concerning nontraditional careers. Interest and confidence in mathematical ability were important variables in females' consideration of math/science (or nontraditional) career choices.

Factors Contributing to Gender Differences in Career Choice

The extensive research on career choice self-efficacy, as noted above, underscores the notion that gender alone is not a significant predictor of females' consideration of nontraditional careers and that women may be more strongly influenced than men by self-efficacy in choosing possible occupations.

While not the main focus of this study, in order to provide the reader with a background in recent gender research, three areas of study will be reviewed: 1) barriers

preventing women from going into nontraditional fields, 2) motivational factors, and 3) the effect of interest and ability in mathematics on nontraditional career choice.

Barriers

Numerous studies have identified internal and external barriers preventing women from entering nontraditional fields. Some of the societal factors include discrimination in the workplace, lack of encouragement from parents, teachers and counselors, media advertising, sex-role specific textbooks, instructional materials and career publications (Patteson, 1973). In a review of the literature, Farmer (1976) suggested that female motivation differed from that of males as a result of a) reduced academic self-confidence, b) fear of success, c) vicarious achievement modification, d) home-career conflict, e) myths about women and the world of work, f) lower risk taking, and g) sex-role orientation.

Are the gender differences found in past research still true in the 1980's and 90's? Haring and Beyard-Tyler (1984) determined that there were three factors that were responsible for keeping women from pursuing nontraditional careers: a) sex-role socialization, b) poor self-efficacy, and c) negative attitudes held by women about peers working in "male occupations".

Contrasting this view is a more recent study by Swanson and Tokar (1991) in which 48 college students were asked to respond to a free-response, thought-listing instrument containing five stimulus statements representing common career-related experiences, plus a sixth statement eliciting special concerns for women. Analysis of the results indicated that subjects did perceive the existence of barriers, such as, not being informed, not being capable, current and future financial concerns, and significant others' influence. However, no significant gender differences emerged in the barriers listed by women and men. These findings would lead one to conclude that since the subjects did not perceive career related barriers as being more prevalent for women than for men, the perception of barriers on women's career considerations must have decreased in the last twenty years.

In a study investigating the underrepresentation of women among physicians, Fiorentine (1988) interviewed 319 male and 251 female high school students intending to pursue a premed college program. He found that females in the sample rated themselves slightly lower on all of the academic and social skills included in the study. Gender differences in the subjective ratings of academic, leadership, speaking and math abilities were statistically significant; this lower level of confidence explains some of the lack of female premed persistence.

While these differences were noted in a young adult population, Shaw and Gorrell (1985) in a study examining the attitudes of 66 fifth and eighth graders in Louisiana toward traditional sex-role typed occupations found age did not appear to influence students' attitudes toward occupational choice. These researchers concluded that "...the more superficial levels of attitudes toward traditional sex-typed occupations are relatively nonconservative in children at these ages, but that deeper attitudes, reflected by self-efficacy beliefs, maintain more traditional orientations" (p.9).

To summarize the more recent studies, perceptions of barriers to female occupational choices have diminished over the last twenty years. Whereas lack of confidence had been noted in female persistence in premedical programs for eighteen years olds, no difference in attitudes toward career options was found in younger elementary and intermediate students.

Motivational Factors

Self-esteem has been studied extensively in gender research. Campbell (1985) investigated the effects of success and failure experiences on self-efficacy expectations using task interest as a covariate. Using 120 subjects randomly

assigned to a success or failure condition, she found that women in the success group were significantly more likely than men to attribute their performance to luck; women in the failure group were significantly more likely than men to attribute their failure to their lack of ability.

Diedrick (1986, 1988a, 1988b) investigated similar constructs in a series of studies on self-esteem, self-worth and self-efficacy of women. In a study of 309 college females, forty-seven aspired to a traditionally female career while 141 planned on a traditionally male career with the remainder planning on careers which were not sex-role specific. She found that while there were no significant differences in the level of self-worth of the groups, the traditionally male career group had a higher level of self-efficacy than did the traditionally female career group. She concluded that self-efficacy was the most relevant dimension of self-esteem for both groups (Diedrick, 1986).

In a follow-up study of 40 male and 50 female college students who completed measures of self-esteem, she found that males equated self-esteem more with self-efficacy and females equated self-esteem with self-worth. Overall she found no difference in the level of self-esteem between males and females (Diedrick, 1988a). A similar study with 94 college students ranging in age from 18 to 58 concluded that females

were more likely to describe themselves as worthy, whereas males as efficacious (Diedrick, 1988b).

From the recent self-esteem research, it is reasonable to conclude that women associate success with luck, and failure with lack of ability more so than do men. Self-esteem is related to self-efficacy for males whereas it is related to self-worth for females.

Cooper and Robinson (1984) compared 100 male and 100 female college students enrolled in science and engineering majors on home, career and leisure values using Super's Work Salience Inventory. They found that females rated the importance of task completion, job involvement, meaning from work, and career importance higher than did males. In addition, there was no difference between males and females on importance of home and family. These findings indicate a social change in which women are perceiving a career to be central to their adult roles more than they did in the past.

In a study by Fitzpatrick and Silverman (1989), the background and motivational factors of 113 female high-achieving students from two northeastern colleges were compared on factors affecting career choice. No significant differences were found on some of the variables which had previously been found to differentiate traditional and nontraditional women. Significant differences were found only in sources of support and work characteristics; the support

by both parents of respondents' career choice and the father's employment was more likely to be in science or engineering were significant differences between nontraditional and traditional women.

In studies concerned with college influences on the entry of women into predominately male occupations, Ethington, Smart and Pascarella (1987) analyzed data from the Cooperative Institutional Research Program which inquired about factors in the college experience with a follow-up nine years later. Initial aspirations were almost three times more important for women in scientific fields as for those in nonscientific fields. In addition, entry into nontraditional fields had been impacted by stronger high school and college performance, enrollment in public colleges and assumption of leadership roles, as well as by earning graduate degrees.

Lauria, Sedlacek, and Waldo (1983) compared 390 college freshmen on the amount of encouragement they received to pursue career goals, as well as on SAT scores, GPA's and persistence in original major after four semesters. In relation to males of similar career interests, nontraditional females received more encouragement to pursue their career interests, were earning higher grades and persisting in their majors as well as their male counterparts.

Motivational differences between women and men entering science and engineering careers have also decreased over the

last twenty years. However, women still demonstrate a need for stronger aspirations, greater academic effort, higher academic goals, and more encouragement to persist in nontraditional majors. In a synthesis of research findings, Chusmir (1983) concluded that women choosing male-dominated career paths were likely to possess many of the same personality and motivation characteristics commonly attributed to men.

Effect of Interest and Ability in Mathematics on Nontraditional Career Choice

In a landmark study investigating ways to increase women's representation in math/science oriented fields, Berryman (1985) encouraged either increasing the pool of available talent or decreasing the attrition from the pool. She noted that the pool of females interested in studying and pursuing nontraditional careers is greatest prior to ninth grade.

Interested in the effect of mathematics self-efficacy expectations to the selection of science-based majors in college, Betz and Hackett (1983) studied the responses of 153 female and 109 male undergraduates on a mathematics self-efficacy scale which they designed, the Fennema-Sherman scale and the Bem Sex Role Inventory. As expected they found that

mathematics self-efficacy expectations were related to the choice of science-based careers; however, they also discovered that college females were consistently and significantly weaker in mathematics self-efficacy than were males. Therefore, the underrepresentation of females in math/science careers may be related to a combination of lower self-efficacy expectations and the relationship of mathematics self-efficacy to college major choices.

Hollinger (1985) investigated the self-perceptions of several career abilities reported by mathematically talented female adolescents who were aspiring to math/science careers and compared them with a similar sample of females interested in non-math/science careers. Results of this study indicated that while nontraditional math career aspirants did not rate themselves significantly higher in math ability than either nontraditional science, math or neutral career aspirants, they did report lower self-estimates of friendliness.

In another study concerned with the factors predicting female and male enrollment in college preparatory mathematics, Sherman (1983) tested 337 students in the eighth grade and again in the eleventh grade. She found that males expressed more confidence in their mathematics performance than did females, though their measured performance was lower than that of females.

These studies seem to indicate that overall, females exhibit lower mathematics self-efficacy expectations; this is an important finding because interest and perceived ability in mathematics has been found to be an essential component in pursuing math/science based careers (Blackman, 1986; Bendow, 1986).

To summarize the findings in gender research over the last twenty years, external barriers which previously prevented women from entering nontraditional fields have diminished; however, internal obstacles still remain. While women choosing male-dominated careers paths seem to possess many of the same personality and motivational characteristics as men in those fields, women who persist must demonstrate stronger aspirations, greater academic effort, higher academic goals and receive more encouragement from significant others, which could be interpreted as a need to overcome lower self-efficacy expectations than their male counterparts. Coupled with the tendency for females to exhibit lower mathematics self-efficacy expectations, applications of self-efficacy theory to women's career development seems to be a valid area of exploration.

Career Decision-Making Self-Efficacy

The research on self-efficacy reviewed up to now has been concerned with the content of career choice. Another variable worth considering, career decision-making self-efficacy, focuses on the process of career choice.

In 1983, Taylor and Betz investigated the application of Bandura's self-efficacy theory to further the understanding of career indecision. From the perspective of self-efficacy theorists, they reasoned that career indecision could be redefined as predominately low expectations of self-efficacy concerning specific tasks and behaviors required in making career decisions.

In this landmark study, their purposes were threefold: 1) to develop an instrument designed to measure self-efficacy expectations as related to career decision-making tasks, 2) to investigate the properties of that assessment instrument, and 3) to explore the relationship between self-efficacy and career decision-making. Since Bandura (1977) postulated that self-efficacy expectations were domain specific, Taylor and Betz defined career decision-making behaviors along the lines of Crites (1973) model of career maturity as 1) accurate self-appraisal, 2) gathering occupational information, 3) goal selection, 4) making plans for the future, and 5) problem solving. Using these constructs, they developed an instrument

consisting of 50 items designed to measure these career decision-making components and administered it along with Osipow's (1980) Career Decision Scale to 346 college students from two institutions.

Analyzing their findings, they concluded there was a moderately strong relationship between career decision-making self-efficacy and career indecision. That is, students who were most likely to report vocational indecision were also lacking confidence in their ability to engage in decision-making tasks. In addition, they found there was no relationship between gender or ability and career decision-making self-efficacy. The researchers concluded that experiences of successful performances should raise self-efficacy expectations thus increasing vocational decidedness. While the assessment instrument proved to be a valid and reliable measure of general readiness for career choice, it did not prove to measure individual components of career decision-making as expected.

Further validation of the Career Decision-Making Self-Efficacy Scale (CDMSE) (Taylor & Betz, 1983) was provided by Robbins (1985), who conducted concurrent and discriminant validity studies which supported the construct validity of the measure. He also suggested that the CDMSE was a measure of generalized self-efficacy rather than a measure of specific decision-making tasks.

Continuing the exploration of vocational indecision and career decision-making self-efficacy, Taylor and Popma (1990) extended the investigation of the CDMSE by partially replicating the Taylor and Betz (1983) study. Confirming previous studies, they concluded the CDMSE measured efficacy expectations across a broad range of career decision-making behaviors.

Recent investigations have studied the relationship between career decision-making self-efficacy and variables associated with vocational choice. Nevill and Schlecker (1988) administered the CDMSE and an assertiveness measure to 122 female undergraduates. They confirmed that women who were highly assertive were more willing to engage in nontraditional occupations than were women who were highly self-efficacious.

Layton (1984) examined the relationship between locus of control, self-efficacy expectations and women's career behavior using two groups of female undergraduates from two different states. She found locus of control predicted only a small amount of self-efficacy expectations, with career salience raising the accounted for variance. The self-efficacy model proved to be most predictive for high career salient subjects in both samples.

Taylor and Popma (1990) while investigating the relationship between career decision-making, career salience, and locus of control, found a moderate and negative

relationship between career decision-making self-efficacy and locus of control which led them to conclude that the more people attribute control over events to external forces, the lower their career decision-making self-efficacy. In contrast to Layton's (1984) findings, Taylor and Popma (1990) found no relationship between career decision-making self-efficacy and career salience.

Seeking to test the hypothesis that goal-directedness and career decision-making self-efficacy were positively associated with exploratory activity in 106 college undergraduates, Blustein (1989) found that while goal-directedness seemed to enhance career exploration, career decision-making self-efficacy was a greater predictor of exploration activity. Blustein recommended that career interventions be supportive, interactional and either experiential or vicarious.

Another study by Lent, Brown and Larkin (1987) explored the contribution of self-efficacy, interest congruence and consequence thinking in predicting career related behaviors of undergraduates interested in math/science careers. Findings indicated self-efficacy to be the most useful predictor of grades and retention in technical majors. The researchers also concluded both self-efficacy and congruence contributed significantly to the range of career options with self-efficacy as the more powerful variable.

Finally, O'Hare and Tamburri (1986) examined coping styles as related to career indecisiveness in 248 college students. After classifying the students by type of coping behavior, they found only Type II (self-efficacy behaviors) discriminated among the state-anxious groups; students using this type of coping style, appeared to have a sense of personal control as well as a low sense of anxiety.

O'Hare and Beutell (1987) also looked at the relationship between coping behavior and career indecision in addition to investigating gender differences. They found that men and women differed in three of the four coping factors. Interestingly, males used self-efficacious coping behaviors significantly more often than did women who tended toward using a reactive coping strategy. However, the relationship between career indecision and coping factors was identical for males and females. Self-efficacy behaviors were inversely related to indecision; that is, regardless of gender, persons who tend toward a "can do" attitude, considering career decisions as a challenge, tended to be more decided.

Several implications can be drawn from these studies: 1) the Career Decision-Making Self-Efficacy Scale does measure self-efficacy across a broad range of career decision-making activities, 2) persons who have a high degree of self-efficacy are more likely to engage in greater career exploration than those who are goal directed, who have a high degree of career

salience or are highly assertive, and 3) males tend to engage in self-efficacious coping behaviors more frequently than do women. If women consistently demonstrate lower self-efficacy expectations in relationship to career exploration and decisiveness, they would be less likely to consider nontraditional occupations which are male or mathematically oriented. These conclusions suggest that interventions designed to increase self-efficacy could be most beneficial to women's consideration of nontraditional careers if they were mathematically oriented and experientially based as recommended by Bandura (1982).

Career Maturity

In addition to self-efficacy and career decision-making, a third variable, career maturity, is also related to career development. Introduced by Super et al. (1957) in the Career Pattern Study, the construct of career maturity has been expanded through the extensive work of Super and his associates to include a broad range of traits. Defined as "a multidimensional trait that is part affective, part cognitive, and increases irregularly with age and experience", (Thompson, et al., 1984) career maturity includes planning, exploration, decision-making, information gathering, knowledge of oneself, flexibility and ability to apply information.

Over the last thirty-five years, researchers have studied the effect of socioeconomic status, gender, age and ability on career maturity as well as the effect of various career education programs on raising levels of career maturity.

In a study designed to investigate the relationship of socioeconomic status, self-esteem, parental influence and significant others to career maturity, Lee, Hollander and Krupsaw (1986) administered the Rosenberg Scale (a self-esteem measure) and the Career Maturity Inventory to 147 high school students participating in an applied science/mathematics summer program. These researchers found a significant relationship among the variables of self-esteem, parental influence, socioeconomic status and mentor influence with career maturity, each accounting for approximately 14 per cent of the variance.

These findings partially contradicted those of Super and Nevill (1984) in a study of 202 high school students drawn from a cross-section of socioeconomic backgrounds. They concluded neither socioeconomic status nor sex were related to career maturity. However, work salience, the relative importance of work, was directly related to career maturity.

Several researchers investigating gender differences as related to career maturity arrived at findings that were unsupportive of Super and Nevill (1984). Cesarano-Delacruz (1985) in a dissertation examining the relationship of self-

efficacy expectations to vocational maturity in graduate students, found that males scored significantly higher on the Career Planning (CP) and the Career Development Attitude (CDA) scales of the Super's Career Development Inventory (a career maturity measure). While self-efficacy was found to be related to career maturity variables for males, it was not true for females.

In a 1987 study, Post-Kammer examined sex differences in work values and career maturity among high school freshmen and juniors. She found that intrinsic work values increased over the high school years to a greater extent than did extrinsic values. Finding gender differences in many of the work values led her to conclude that work values and career maturity differed according to gender rather than age.

In another interesting study comparing adolescents with a causal model of career maturity, King (1989) found age to be the single most important variable affecting career maturity in males, whereas an internal sense of control and family cohesiveness proved to increase career maturity in females.

In an investigation comparing gifted, regular curriculum and special learning needs students, Kelly and Colangelo (1990) concluded that although gender differences were not evident, higher levels of career maturity were associated with high academic ability. This study contradicted Smith's (1987) earlier work with community college students, in which he

found that 1) females displayed significantly higher career maturity levels than males, but 2) there was no correlation between career maturity and either intelligence or achievement.

Numerous studies have also investigated internal versus external locus of control. Gable, Thompson and Glanstein (1976), in a study examining differences in career maturity of women across different levels of internal and external control, found that women with higher levels of career maturity demonstrated greater internal control than externally controlled women.

Confirming these findings, Khan and Alvi (1983), in a study of 272 high school students, found that students with high career aspirations, self-efficacy and self-esteem, more internal locus of control and intrinsic work values exhibited greater career maturity. In a later work, Stebbing et al. (1985) examined the effect of locus of control and sex role orientation with 61 undergraduate college women. She found locus of control was the most valid predictor of career maturity.

To summarize the recent research on career maturity, many of the studies reported mixed results in determining what variables seem to have an affect on career maturity. These studies report conflicting findings regarding the relationship between socioeconomic status and gender to career maturity.

Age also does not seem to be directly related to career maturity. Work salience and internal locus of control seem to be related to higher levels of career maturity indicating that career education programs which enhance these traits could be beneficial.

Performance Based Experiential Programs

Referring again to Bandura's self-efficacy research, levels of self-efficacy expectations proved to be increased most effectively through performance attainment than through vicarious experiences, verbal persuasion or physiological anxiety reduction (Bandura, 1977, 1982). Confirming this observation and offering directions for future research, Lent and Hackett (1987) noted that "...performance-based components, engaging clients in personal mastery experiences, are hypothesized to be especially impactful on future behavior vis-a-vis their influence on self-efficacy beliefs" (p.376).

While initial application studies of Bandura's theory have centered around women's career development in relation to choice, career decision-making process and mathematics self-efficacy, they have only partially explained a continuing problem: the underrepresentation of females in male-dominated career fields. In a review of applications of Bandura's (1977,1982) theory, Betz and Hackett (1986) recommended that

an important test of self-efficacy theory would be through studies of theory-based interventions which facilitate more satisfying career choices or overall career development.

A review of the literature indicates very limited studies on the direct application of Bandura's theory. Foss and Slaney (1986), in a study based on vicarious experiences, tested Bandura's theory using 80 college women. Subjects were divided into traditional, neutral and nontraditional occupational groupings based on attitudinal responses. Pre and post measures of self-efficacy were analyzed after the women viewed a videotape (vicarious experience) on successful female career development. Results showed that although the women did not change their attitudes concerning their own career goals, they did envision their daughters as able to pursue more nontraditional occupations. Commenting on the videotape intervention, the researchers suggested that this vicarious experience may not have been effective (p.200).

Heeding this recommendation and interested in investigating the impact of performance-based or experiential programs on self-efficacy variables, this researcher found the literature yielded several articles noting the positive impact of experiential work experience and mentor programs on the career development variables under consideration.

Yongue, Todd and Burton (1981) compared two methods of career training, didactic classroom and field exposure, to

determine which was more effective in increasing career maturity. Although there was not a significant difference between the groups in career maturity gain scores, the field exposure training group showed some gains in scores while the classroom group did not.

In a review of relevant literature, Canna (1982) cited studies comparing cooperative and non-cooperative education in terms of personal growth, career attitudes and maturity. Research indicated that cooperative education students ranked higher on these variables than did students in general education (Martello & Shelton, 1981; Wilson, 1974; Stead, 1977). Caston (1982) also reported career maturity to be enhanced through career programs in which subjects were involved in internships or on-the-job training programs. In a later study, Gadzera (1988) investigated the effects of cooperative education on the career maturity and self-esteem of college undergraduates. Analyzing the results, she found that while both the control and treatment groups gained in career maturity, the cooperative education (treatment) group scored significantly higher. While both groups decreased in self-esteem, the cooperative education group decreased less than the control group.

These studies validate the effectiveness of cooperative education programs in raising levels of career maturity and self-efficacy; therefore, it seems reasonable to conclude that

cooperative education or work experience programs might prove valuable in enhancing the self-efficacy and career maturity of females.

Mentoring is a specific type of work experience program which has proven to be an effective educational intervention with gifted students (Comer, 1989; House, 1983; Borman, Nash & Colson, 1978). Gladstone (1987) defines a mentor as "...someone who helps another person to become what that person aspires to be. The term mentor may be taken to mean a trusted counsellor or guide or a more experienced person who takes a special interest in the development of another person" (p. 9). Mentors exhibit characteristics of openness, patience, and sincere concern; they provide direction and guidance as well as help the young person learn to negotiate the politics of the work environment. Through the experience, mentorees grow in independence, self-confidence and work related values (Gladstone, 1987).

Research has also been done on the effectiveness of mentoring programs in enhancing career development variables. Beck (1989) investigated the benefits participants gained from the "Mentor Connection", an eighteen week course which included fourteen weeks of mentor/work experience. Results indicated mentorship was significantly more effective than classroom experience in the following areas: risk taking, developing independence, learning new material and advanced

skills, using research skills, networking, and learning about the work environment and professionals in the field. Females felt strongly that the mentorship experience had helped them consider new ways of integrating family responsibilities and careers.

In another study concerned with the effect of mentoring on the development growth of gifted adolescents, Weiner (1985) compared fifty-six students involved in a mentoring relationship to sixty-five who did not have a mentor. She found students with mentors scored significantly higher on career maturity, educational orientation and leadership potential than did students without mentors.

The research would indicate that two experiential or performance based programs which have proved effective in raising career development variables are the cooperative education and the mentorship experience. While both programs include a "supervisor", the mentorship experience provides a unique personal involvement and investment between the mentor and the mentoree. In settings designed to enhance direct experiences with mathematics, science and technology, this study will investigate gain in career development variables with students engaged in two experiential research programs: a school-based program, similar to cooperative education, and a mentor program, based in a community work environment.

Summary

This chapter reviewed the current literature and educational research on self-efficacy theory, career choice and career decision-making self-efficacy, career maturity and experiential educational programs.

CHAPTER III

Research Methodology

As noted in Chapter I, the purpose of the study is to determine the effect of two experiential research programs on three variables: career choice, decision-making self-efficacy and career maturity. This chapter will describe the design of the study, the sample population, the instruments used including the pilot study conducted, the data collection procedures, and the analysis of data.

Research Design

The quasi-experimental study used a randomized control group pretest posttest design with two experimental groups and one control group. The 3 X 2 factorial design consisted of three treatment groups by gender. The independent variables were gender and the treatment methods: school-based experiential method, the mentorship method and the control group. The dependent variables were career choice self-efficacy, career decision-making self-efficacy and career maturity which were measured as interval data. Grade point average (GPA) at the end of junior year and verbal and

mathematical scores on the Preliminary Scholastic Aptitude Test (PSAT) administered in October 1989 were used as covariates to control for differences in ability and achievement between the groups.

Subjects

The subjects of this study, which was conducted from September 1990 to February 1991, were high school seniors attending a selective mathematics and science high school located in the suburbs of a large metropolitan city. Students who attend this school were chosen, through a competitive process, based on their aptitude and interest in mathematics, science, computer science and related technological fields. Generally, they were highly motivated students engaged in a rigorous college-preparatory academic program. Seniors were selected for the study because they were all required to participate in an experiential research project during their senior year as a graduation requirement.

One hundred seven students were randomly selected from three groups of volunteers totaling 430 students. Using a table of random numbers, the researcher selected thirty-three students from the 170 seniors who had chosen the school-based research program, thirty-five students from the 110 that had selected the mentorship program and thirty-nine subjects were

randomly chosen for the control group from the 148 students who were not scheduled to begin the project until second semester. The researcher contacted each student to explain the project and to seek participation. Over the four month period of the study, fourteen subjects were eliminated due to incomplete data.

The groups were distributed by gender as follows: 15 males and 12 females in the school-based group; 13 males and 20 females in the mentorship group; and 13 males and 20 females in the control group. Overall 41 males and 52 females participated in the study. The age of the sample ranged from 16.5 to 18.0 years with a median age of 17.5 years.

Socioeconomic factors have been found not be related to career development attitudes and knowledge (Super & Nevill, 1984). Therefore, little socioecomonic data was collected on the sample. Overall the subjects came from professional families in the upper middle class; most of their parents had a college education and were employed with the federal, state or local government, the military or private companies in the area.

Instrumentation

The instruments preferred for this study have been chosen for the following reasons: (a) prior use in professional

research, except for the student career efficacy and mentor validation instruments which were designed by the researcher, (b) reliability and validity, (c) ability to measure variables under consideration, (d) readability and ease in administration, and (e) time required for administration.

The Career Development Inventory (CDI) was designed by Donald E. Super after thirty years of vocational development research to assess career maturity. The high school (S) form (grades 9-12) consists 120 items and is divided into five scales: Career Planning (CP), Career Exploration (CE), Decision Making (DM), World of Work Information (WW), and Knowledge of Preferred Occupational Group (PO). The first four scales consist of twenty items each, while the last scale contains forty items. The CDI can be administered in a group, at either one or more sessions requiring about sixty minutes. The response format consists of multiple choice answers. Results are machine scored and reported as five career development scores based on each of the subtests (CP, CE, DM, WW, and PO), and three composite scales based on combinations of the subtests. These include a Career Development Attitudes (CDA) which combines the CP and the CE scales; a Career Development Knowledge and Skills (CDK) which combines the DM and WW scales; and a Career Orientation Total (COT) which

combines CP, CE, DM, and WW and serves as a composite measure of four aspects of career maturity (Thompson et al., 1984).

The CDI has been subjected to extensive studies of its reliability and validity. The inventory was normed on a sample of 5,000 high school students consisting of groups that differed in gender, grade and urban-suburban-rural locations. Measures of the internal consistency of the five CDI scales and reliability estimates of the combined scales suggest that the combines scales have clearly adequate reliability (median = 0.86). The individual scales have a mixed pattern with scales CP, CE and WW having median reliabilities of 0.89, 0.76, and 0.84 respectively while the DM and PO scales have reliability estimates of 0.67 and 0.60. Test-retest correlations ranged from .70's to .80's for Form S in two suburban high school studies. (Thompson et al., 1984).

Content validity is apparent in that the items were drawn from basic work conducted by Super and Jordaan as part of a career pattern study and from several other independent investigations. The model was tested by Crites (1973) and Super (1974). Construct validity was demonstrated through meaningful differences among subgroups in the CDI standardization sample within gender, grade and curricular subgroups.

This instrument was chosen over Crites' (1973) Career Maturity Inventory which tends to measure cognitive constructs rather than career development attitudes (Westbrook et al.,

1980). Unlike the Career Maturity Inventory, it has been reexamined and revised several times based on empirical studies (Thompson et al., 1984).

The Career Decision-Making Self-Efficacy Scale (CDMSES), developed by K.E. Taylor and N.E. Betz (1983), measures an individual's level of confidence associated with career decision tasks. On fifty items which take about twenty minutes to complete, respondents are asked to report on a (0) no confidence to a (10) complete confidence scale. The composite score provides an overall index of an individual's level of confidence with respect to career decision-making.

The internal consistency of the total CDMSES has ranged from coefficient alpha of .88 to .97 (Robbins, 1985; Taylor & Betz, 1983). Reliability coefficients of .88, .89, .87, .89 and .86 were found for the five subscales: Self-Appraisal, Occupational Information, Goal Selection, Planning and Problem-Solving.

Evidence for the construct, content and criterion validity of the CDMSES can be inferred from the theoretically driven approach to item construction (Taylor & Betz, 1983), occupational self-efficacy beliefs (Taylor & Popma, 1988) and self-efficacy (Robbins, 1985). The CDMSES has also demonstrated discriminant validity with respect to gender and academic ability (Taylor & Betz, 1983).

This instrument was chosen as a measure of career self-efficacy because it was the only instrument in the literature that measured the process of career decision-making self-efficacy.

The Self-Efficacy for Technical/Scientific Fields Scale (Lent et al., 1984) asks subjects to indicate their confidence in their ability to complete the educational requirements and job duties of 15 science and engineering occupations on a ten point scale ranging from completely unsure (1) to completely sure (10). Strength of self-efficacy is found by taking an average; the inventory takes about fifteen minutes to complete.

Lent et al. (1984) reported an eight week test-retest reliability of .89 and internal consistent reliability of .89. Regarding validity, previous studies using the instrument found it to predict grades, level of persistence in a chosen major, and a range of perceived options in technical and scientific majors; it related moderately to vocational interests and academic self-efficacy but not to general self-efficacy or career indecision (Lent et al., 1984, 1986).

This instrument was chosen from one of the few in the literature that measured the content of career self-efficacy because it contained scientific career choices which would be of interest to the sample population.

The Myers-Briggs Type Indicator (MBTI) (Myers & McCaulley, 1985) is the most widely used measure of personality dispositions and preferences. Based on Carl Jung's theory of conscious psychological type, the MBTI provides four bipolar scales that can be reported as continuous scores or reduced to a four-letter code of "type". The MBTI scales indicate relative preferences for: Extraversion-Introversion (E-I), Sensing-Intuition (S-I), Thinking-Feeling (T-F), and Judging-Perceiving (J-P). Various combinations of these preferences result in sixteen personality types. The MBTI is self-administered requiring twenty to thirty minutes to complete.

Reliability reports utilizing Form F, have been estimated by phi coefficients and tetrachoric coefficients. Phi coefficient estimates range from .55 to .65 (E-I), .64 to .73 (S-N), .43 to .75 (T-F), and .58 to .84 (J-P). Tetrachoric coefficients range from .70 to .81 (E-I), .82 to .92 (S-N), .66 to .90 (T-F), and .76 to .84 (J-P). Conversion of data into continuous scores produced estimates of .76 to .82 (E-I), .75 to .87 (S-N), .69 to .86 (T-F), and .80 to .84 (J-P).

Test-retest reliability with test intervals from five weeks to twenty-one months found coefficients ranging from .73 to .83 (E-I), .69 to .87 (S-N), .56 to .82 (T-F), and .60 to .87 (J-P).

Validity data are based on whether the scales of the MBTI accurately measure Jung's constructs. Numerous correlational

studies have compared it with the Allport-Vernon Lindzey Study of Values, the Gray-Wheelwright Psychological Type Questionnaire, the Edwards Personal Preference Schedule, the Personality Research Inventory, the Scholastic Aptitude Test, and the Strong Vocational Interest Blank. These studies indicate the results appear to be consistent with Jungian theory (Myers & McCaulley, 1985).

The researcher chose the Myers-Briggs Type Indicator over other learning style instruments (Kolb Learning Style Inventory, Canfield Learning Styles Inventory or Gregoric Style Delineator) because of greater test-retest reliability and an acceptable degree of construct validity in comparison to the other three learning style instruments (Sewall, 1986).

Pilot Study

The study included two instruments which were researcher designed: a student career efficacy and experience instrument and a mentor validation instrument. The requirements for new instrumentation are validity and reliability : Are the questions related to concepts to be addressed, and are the respondents answering them "correctly"? Instruments must pass "face validation" (Delphi committee of experts agree). For Likert scale items (ranked preferences), a principle components factor analysis provides validation of the expert

consensus that items are the right questions to ask (Morrison, 1975). For these items, Guttman's lower bounds for true reliability are appropriate for each validated component scale of an instrument. Once validated and demonstrated to be reliable (that is, a reliability coefficient of at least 0.70), a scale's item responses may be added to provide a single numeric proxy score for the attribute measured with a high degree of credibility.

To determine the reliability and validity of the student career efficacy and the mentor validation instruments, a pilot study was conducted using responses from 39 spring 1990 students and their 20 project mentors. The validation results for the student instrument are provided in Table 1.

As can be seen, the factors include items as predicted and constructed for the most part. The items in factor 1 (at the top of the list) came earliest in the instrument and were designed to identify mentor characteristics as suggested in the literature (Farren C., Gray, J. & Kaye, B., 1984). Items loading on factor 2 were at the end of the list and were used to identify students' motivation to apply the experience.

Items on factor 3 were designed to identify any strong characteristics inherent in the experiences. As an example of the last significant factor, factor 4 showed a distinct experience we labelled "little help" because there was a high

Table 1

Principle Components Factor Analysis for Student Instrument

Factor Matrix Items	Factor 1	Factor 2	Factor 3	Factor 4
Knows	0.84	-0.28	0.26	-0.26
Helps	0.14	-0.13	0.35	0.15
Empathy	0.83	-0.27	-0.89	0.39
Enthusiasm	0.77	0.27	0.31	-0.31
Teaches	0.77	-0.04	0.31	-0.31
Independence	0.10	0.93	-0.01	-0.19
Mistakes	0.27	-0.09	-0.38	0.55
Directs	0.89	0.02	-0.38	0.07
Relates	0.92	-0.30	0.13	0.15
Guides	0.22	-0.23	0.56	-0.59
Expects	0.82	0.42	-0.12	0.32
Placement	0.88	0.28	0.23	0.21
Social	0.70	-0.17	-0.43	-0.25
Rates	0.61	-0.27	0.33	-0.36
Quantitative	0.24	0.44	-0.33	-0.61
Scientific	0.09	0.93	0.19	0.12
Application	0.23	0.30	-0.60	-0.09

Table 1 continued

Principle Components Factor Analysis

for Student Instrument

Factor Matrix

Item	Factor 1	Factor 2	Factor 3	Factor 4
Environment	0.27	0.28	-0.69	-0.45
Prefer School	-0.41	0.08	-0.77	0.27
Prefer Mentor	-0.21	0.33	0.60	-0.10
Required	-0.41	-0.16	0.56	0.47
Helped	0.02	0.81	0.21	0.25
Interest	0.02	0.68	0.21	-0.33
Write-up	0.10	0.64	-0.22	-0.00
Job	0.10	0.81	0.61	0.31
Career	-0.16	0.85	-0.01	0.02

Summary

Factor	Eigenvalue	Percent of Variance	Cumulative Percent
1	7.49	28.8	28.8
2	5.89	22.7	51.4
3	3.69	14.2	65.6
4	2.55	9.8	75.4

positive loading on "mentor tolerated mistakes", a negative loading on "mentor guides research", a negative loading on "quantitative experience", a negative loading on "enjoyable environment" and a positive loading on "motivation for doing the project because it was required". In contract factor 6 was labelled "independent kids" because they loaded high on "mentor tolerated mistakes", "preferences for non-school project", and their project motivation was from "personal interest" alone. The general validation criteria for construct validation is that the three key construct items appear on the first three to five factors (on the first three in this case), and that the top five factors accumulate at least 70% of all variance (which allows us to use sum scores of items on those factors as construct scores). As the student instrument constructs, approved through Delphi, were validated by factor analysis, the student instrument satisfied the requirements to be valid.

The construct scales identified by the factor analysis were then subjected to SPSS sub-program reliability to demonstrate that students were answering the items asked. The Guttman six coefficients were calculated for all items and for the two multi-item scales. Overall, the scales achieved reliability coefficients between .83 and .96 (lambda 6), easily satisfying the requirement of reliability of at least 0.70. For the "characteristics of the experience" scale,

lambdas 1 and 4 were 0.55 but all the others exceeded 0.70, particularly lambda 6 at 0.75 which is the best coefficient for a scale without identically scaled response items (Norusis, 1983). Similarly, for scale 3 which was the "motivation for the experience" lambdas 1 and 4 were 0.55 but the others exceeded 0.73 with lambda 6 at 0.75.

The mentor instrument was also face validated by the Dissertation Committee and subjected to principle components and reliability statistical analysis. The factor analysis results are in Table 2. We note that the constructs here support a different perception of the mentor/student interaction than those on the student instrument. The first factor presents items reflecting the students' capabilities within the work environment. The second simply differentiates engineering and scientific content of the project. The third shows that preparation to be a mentor (or lack thereof) is a key factor in mentor satisfaction with the project and student. The fourth consists of items that are basically uncontrollable: perceived motivation and independence of the student. The top three factors are of interest and account for 71% of variance, satisfying our construct validity requirement.

The reliability coefficients for the " student capability" scale ranged from 0.78 to 0.94 (lambda 6).

Table 2

Principle Components Factor Analysis for Mentor Instrument

Factor Matrix Item	Factor 1	Factor 2	Factor 3	Factor 4
Quantitative	0.59	-0.13	-0.52	0.20
Scientific	0.43	0.77	-0.22	0.15
Application	0.66	0.42	-0.35	0.21
Enjoyable	0.66	0.37	0.20	-0.39
Capable	0.83	-0.34	-0.28	-0.18
Enthusiasm	0.92	-0.03	0.22	-0.02
Technical skills	0.75	-0.55	-0.09	0.27
Communication skills	0.76	0.38	0.21	0.19
Independence	0.71	-0.46	-0.11	-0.41
Social fit	0.75	0.14	0.23	-0.39
Motive	0.47	-0.20	0.31	0.69
Preparation	0.28	-0.08	0.70	0.08

Table 2 continued

Summary

Factor	Eigenvalue	Percent of Variance	Cumulative Percent
1	5.44	45.3	45.3
2	1.76	14.6	60.0
3	1.32	11.0	71.0
4	1.20	10.0	81.0

The "scientific/engineering" and "preparation to be a mentor" scales, at two and one item respectively, have insufficient co-variance items to be processed by statistical reliability methods so must be assumed to be reliable.

Data Collection Procedures

Prior to beginning the study, approval was obtained from the school division and the building Principal. With parent permission, subjects consented to participate in the study and that academic and test information be available to the researcher. Subjects were informed that data was being collected to measure the effect two research programs had on career efficacy and career decision-making. They were also assured that only summary data would be reported, their anonymity would be preserved and their participation was voluntary.

Three of the instruments, the Career Development Inventory, the Career Decision-Making Self-Efficacy Scale, and the Self-Efficacy for Technical/Scientific Fields Scale were administered by the researcher to the students for the first time in early September. The administration was divided into two sessions of sixty minutes each over a two day period. Subjects were instructed to answer the questions as they pertained to their career plans; they should not be concerned about any time limit for completing the instruments. The

subjects completed the Career Development Inventory in the first session; during the second session, they were administered the Career Decision-making Self-Efficacy Scale and then the Self-Efficacy for Technical/Scientific Fields Scale. At the time of testing, the school-based experiential and the mentorship groups had been in their programs for two weeks. Both groups were still in the initial stages and had not begun their research projects. Administration of the Myers-Briggs Type Indicator was done through the English classes in mid-September as part of the curriculum and those results were obtained for use in the study.

The students participated in one of three programs over the next four months: a school-based research project, a community-based research program or no research component during the fall semester. This last group, used as a control, was enrolled in other elective courses during this time. Students were able to chose the laboratory and teacher with whom they would work, with many students using the facilities of several laboratories.

In the school-based group of thirty-three students, the scientific/technology research graduation requirement was met by doing concentrated research or project development under the leadership and direction of a teacher in one of the eleven technology laboratories: Chemical Analysis, Computer Systems, Energy Systems, Computer-Assisted Design, Industrial

Automation and Robotics, Life Sciences and Biotechnology, Micro-electronics, Optics and Modern Physics, Prototyping and Engineering or Telecommunications/Television Production. Examples of projects designed and developed by the students included: 1) a study of bacteria which has been genetically engineered to produce the raw product of plastics, 2) an analysis of low concentrations of silver ion by differential reaction ratios involving complexation of silver ion, and 3) a study of image transformations through curved mirrors to predict and correct distorted images.

During the same period, 39 students were enrolled in the mentorship program in which students had the opportunity to conduct a similar research project while working with scientists and engineers in the local community as well as to use the facilities of those mentors' organizations. Students in this program worked at the U.S. Geological Survey, the Naval Research Laboratory, Georgetown University Hospital, the National Institute of Health, WNVT/Channel 53 and many other private businesses, government facilities and laboratories in the metropolitan area. Examples of projects developed in the mentorship program included: 1) an investigation of the increased level of glutathione peroxidase in human breast tumor cells and its effect on doxorubicin therapy, 2) the development and maintenance of an information database concerning the storage of toxic hazardous wastes, and 3) the

calculation of aerodynamic forces on bobsled trajectories to design, test and modify existing bobsleds. Results of this experiment were to be used to suggest changes to the bobsleds which would be used in the 1992 Olympics.

Both the school-based and the mentorship programs had the same project requirements and academic goals for the students: to design, conduct, analyze and evaluate independent research of a scientific, technical or engineering nature. While the time students spent in the laboratories varied, all were involved in their projects from five to twenty hours a week.

After a period of four and a half months, three career instruments were administered again: the Career Development Inventory, the Career Decision-Making Self-Efficacy Scale and the Self-Efficacy for Technical/Scientific Fields Scale. The testing situation and time of administration were similar to the first administration. The students in the two research groups also completed a student career efficacy and experience instrument while the supervisors and mentors completed a validation instrument.

Students were instructed to take the survey home to be done at their leisure. The supervisor/mentor instrument was mailed to the mentors or distributed to the laboratory project teachers. Follow-up procedures were initiated two weeks later which consisted of mailing a second instrument to all supervisors who had not returned the first survey. After the second

request, fifty-three mentor/supervisor instruments had been returned out of a possible sixty. There were no unreturned student surveys.

Statistical Analysis

The following research hypotheses were tested using SPSS statistical package (Norusis, 1983):

1. There is no significant difference between the mentorship, school-based research and the control groups on career choice self-efficacy as measured by the gain scores on the Self-Efficacy for Technical/Scientific Fields Scale.

2. There is no significant difference between the mentorship, school-based research and control groups on career maturity as measured by the gain scores on the Career Development Inventory.

3. There is no significant difference between the mentorship, school-based research and control groups on career decision-making self-efficacy as measured by the gain scores on the Career Decision-Making Self-Efficacy Scale.

4. There is no significant gender difference in career choice self-efficacy, career maturity or career decision-making self-efficacy between the groups.

5. There is no significant difference between the groups in perceived characteristics of students and mentors nor in

the experiential/quality characteristics of the programs as measured by the student and mentor instruments.

6. There is no significant difference in the three groups of students on career self-efficacy due to personality characteristics as measured by the Myers-Briggs Type Indicator, or due to intellectual ability as measured by scores on the Preliminary Scholastic Aptitude Test and grade point average.

In this study, the independent variables were gender and the school-based experiential program, the mentorship program and the control group; the dependent variables were career choice self-efficacy, career decision-making self-efficacy and career maturity. Under these conditions, the most appropriate statistical technique for analyzing the data was chosen to be multivariate analysis of variance (MANOVA).

Hypotheses H1 through H4 were tested using MANOVA. MANOVA was performed for the self-efficacy measures (CPGAIN through CDMSES) using the gain scores found by subtracting the first testing scores from the second testing scores by group and by sex. In order to eliminate any differences between the groups in achievement or ability, grade point average (GPA), the Preliminary Aptitude Test verbal (PSATV) and mathematics (PSATM) served as covariates.

Hypothesis H5 was tested using MANOVA for the mentor\supervisor and student perceptions of the experience

measures (M-CHAR through PREP-T); PSATV, PSATM and GPA served as covariates.

In testing hypothesis H6, MANOVA was performed for achievement (GPA, PSAT) and self-efficacy measures (CPGAIN through CDMSES) by group, by gender and each of the four Myers-Briggs Type Indicator factors (EI, NS, JP, and TF).

Analyses were tested for statistical significance at the $p<.05$ probability level.

CHAPTER IV

Results

Introduction

This chapter is divided into three sections: 1) tests of the hypotheses related to career self-efficacy, 2) tests of the hypothesis concerning student/mentor perceptions of the project experience, and 3) tests of the hypothesis related to students' personality attributes.

Subprogram multivariate analysis of variance (MANOVA) in SPSS was used to test all hypotheses. As with ANOVA, MANOVA requires that the data meet certain basic assumptions: independent observations, normality of the population and homogeneity of variance. The use of covariates also requires the assumption that similar relationships exist among the dependent variables and the covariates in each group (Hand & Taylor, 1987).

The SPSS MANOVA output provided normalized plots and means by variances which showed no aberrant distributions. Using chi-square tests of significance, the researcher confirmed that the multivariate observations were independent samples.

The data for testing Hypothesis 1 through 4 were calculated as the gain between the pretest and posttest scores on the CDI, CDMSES and the SEED/SEJD. The covariates were ability as measured by the PSAT verbal and mathematics scores and achievement as measured by GPA.

Tests of Hypotheses H1 through H4

The summary results for testing Hypotheses H1 through H4 are in Table 3. Only Hotellings T-squared statistic is presented since all achieved significance levels were within .01 for the multiple response tests (Pillais, Wilks, and Hotellings).

Hypothesis 1 (H1) states there will be no significant difference among the mentorship, school-based research and control groups on career choice self-efficacy as measured by the gain scores of the SEED or SEJD. As indicated in Table 3, no significance was found in career choice self-efficacy, between groups, genders or in terms of prerequisite achievement or aptitude.

Hypothesis 2 (H2) states that there will be no significant difference among the mentorship, school-based research and control groups on career decision-making self-efficacy as measured by the gain scores on the CDMSES. Table 3 shows that no significant difference was found in career

Table 3

Hotelling Tests of Model Effects

Effect	Value	Approx. F	Hypoth. d.f.	Error d.f.	p-value
Covariates	0.98	1.36	33	137	.114
Group X Gender	0.33	0.69	22	92	.835
Gender	0.28	1.20	11	47	.315
Group	0.54	1.13	22	92	.331

*p<.05

decision-making self efficacy between the groups.

Hypothesis 3 (H3) states that there will be no significant difference among the mentorship, school-based research and control groups on career maturity as measured by the gain scores on the CDI. Table 3 indicates no significance was found in career maturity between the groups.

Hypothesis 4 (H4) states that there will be no significant gender differences in career choice or career decision-making self-efficacy, or career maturity between the groups. Table 3 shows no significant difference was found between males and females on the career self efficacy variables. Since no differences were found between groups, gender, or the interaction of gender and group, we failed to reject hypotheses H1 to H4.

Although none of the hypotheses (H1 to H4) were rejected, the detailed univariate results are provided, in Tables 4 to 7, for comparative purposes with any follow-up studies. Table 8 provides gain scores for all response variables and covariates. All groups and both genders gained in career self-efficacy but there was no difference in the gains between experiential programs and ordinary maturation as represented by the control group.

As noted in Table 4, SEED (self-efficacy for educational requirements) and SEJD (self-efficacy for job duties) were

Table 4

Covariate Effects on Career Self-Efficacy Gain Scores

Gain on:	Covariate	Beta	t-value	p-value
Self-Efficacy: Ed. Req.	GPA	.05	.39	.70
	PSAT V	-.14	-.98	.33
	PSAT M	-.26	-2.02	.049*
Self-Efficacy: Job Duties	GPA	.21	1.50	.14
	PSAT V	.04	.31	.76
	PSAT M	-.37	-2.76	.01*
Career Decision Making Self-Efficacy	GPA	.17	1.16	.25
	PSAT V	-.13	-.87	.39
	PSAT M	-.16	-1.12	.27
Career Planning	GPA	-.12	-.80	.43
	PSAT V	-.05	-.32	.75
	PSAT M	.12	.82	.42
Career Exploration	GPA	.19	1.33	.19
	PSAT V	-.32	-2.24	.03*
	PSAT M	-.03	-.25	.80
Decision Making	GPA	.17	1.17	.25
	PSAT V	-.02	-.16	.88
	PSAT M	-.03	-.21	.83
World of Work	GPA	.06	.40	.69
	PSAT V	-.10	-.66	.51
	PSAT M	-.13	-.93	.36
Career Development Attitudes	GPA	06	.39	.70
	PSAT V	-.18	-1.24	.22
	PSAT M	.02	.11	.91

* $p<.05$

Table 4 continued

Covariate Effects on Career Self-Efficacy Gain Scores

Gain on:	Covariate	Beta	t-value	p-value
Career Development Knowledge	GPA	.17	1.19	.24
	PSAT V	-.08	-.53	.60
	PSAT M	-.09	-.60	.55
Career Orientation Total	GPA	.12	.84	.41
	PSAT V	-.20	-1.33	.19
	PSAT M	.00	.03	.98
Preferred Occupational Group	GPA	.17	1.20	.24
	PSAT V	.17	1.20	.24
	PSAT M	-.16	-1.12	.27

* $p<.05$

Table 5

Test of Group by Gender Effects on Gains in Career Self-Efficacy

All F-tests with (2,57) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Self-Efficacy: Ed. Req.	172.2	877.0	.20	.82
Self-Efficacy: Job Duties	997.2	1297.8	.77	.47
Career Decision Making S-E	247.7	1114.4	.22	.80
Career Planning	87.9	206.4	.43	.66
Career Exploration	39.2	143.8	.27	.76
Decision Making	60.7	156.4	.39	.68
World of Work	56.9	28.1	2.02	.14
Career Development Attitude	1.3	183.6	.01	.99

*p<.05

Table 5 continued

Test of Group by Gender Effects on Gains in Self-Efficacy

All F-tests with (2,57) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Career Development Knowledge	54.3	53.3	1.02	.37
Career Orientation	6.6	109.2	.06	.94
Preferred Occupational Field	34.4	122.3	.28	.76

*p<.05

Table 6

Test of Gender Effect on Gains in Career Self-Efficacy

All F-tests with (1,57) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Self-Efficacy Ed. Req.	117.24	876.95	.13	.72
Self-Efficacy Job Duties	21.95	1297.81	.02	.90
Career Decision-Making S-E	629.43	1114.38	.56	.46
Career Planning	1208.17	206.40	5.85	.02*
Career Exploration	475.68	143.83	3.31	.07
Decision Making	124.46	156.43	.80	.38
World of Work	14.41	28.11	.51	.48
Career Development Attitude	1271.60	183.63	6.92	.01*
Career Development Knowledge	16.56	53.33	.31	.38
Career Orientation Total	301.25	109.23	2.76	.10

*p<.05

Table 6 continued

Test of Gender Effect on Gains in Career Self-Efficacy

All F-tests with (1,57) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Preferred Occupational Field	254.65	122.28	2.08	.15

*p<.05

Table 7

Test of Group Effect on Gains in Career Self-Efficacy

All F-tests with (2,57) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Self-Efficacy: Ed. Req.	4336.84	876.95	4.95	.01*
Self-Efficacy: Job Duties	837.57	1297.81	.65	.53
Career Decison-Making Self-Efficacy	648.95	1114.38	.58	.56
Career Planning	158.91	206.40	.77	.47
Career Exploration	6.81	143.83	.05	.95
Decision Making	8.52	156.43	.05	.95
World of Work	84.10	28.11	2.99	.06
Career Development Attitude	93.09	183.63	.51	.61
Career Development Knowledge	45.19	53.33	.85	.43
Career Development Total	103.95	109.23	.95	.39
Preferred Occupational Field	195.19	122.28	1.60	.21

*p<.05

Table 8

Averages and Standard Errors

for Response Variables and Covariates

Variable	Mean	Standard Error	Cases
GPA	3.56	0.04	93
PSAT V	55.36	0.79	93
PSAT M	67.66	0.73	92
Self-Efficacy: Ed. Req.	9.35	3.18	92
Self-Efficacy: Job Duties	8.17	3.91	84
Career Decision Making S-E	1.12	5.02	92
Career Planning Gain	6.20	1.45	93
Career Exploration Gain	-1.88	1.40	93
Decision Making Gain	3.95	1.20	93
World of Work Gain	1.17	0.60	93
Career Development Attitude Gain	2.91	1.46	93
Career Development Knowledge Gain	2.89	0.75	93

Table 8 continued

Averages and Standard Errors

for Response Variables and Covariates

Variable	Mean	Standard Error	Cases
Career Orientation Total Gain	3.13	1.09	93
Preferred Occupational Field	-0.33	1.98	76

negatively related to PSAT math scores, and PSAT verbal scores were also negatively related to CE (career exploration) scores.

The gender effects for CPGAIN (career planning gain) and CDAGAIN (career development attitude gain) are plotted in detail in Table 9. It is obvious that the mentorship program males had significantly less career planning (CP) or career development attitude (CDA) gain than the control group males, while there were no significant differences among females. The consistently lower scores resulted not in an interaction, but in a significant group effect.

The results for groups (program type) also produced a univariate significant result for response variable SEEDGAIN (self-efficacy for educational requirements gain score) as noted in Table 10. The control students barely improved at all, mentor students improved substantially, and the school-based laboratory students improved remarkably.

Test of Hypothesis H5

Hypothesis 5 (H5) states that there will be no significant difference between the groups in the perceived characteristics of the participants nor in the experiential/quality characteristics of the programs as measured by the student and mentor instruments. H5 was tested

Table 9

Career Planning and Career Development Attitude Gain Results for Univariate Group by Gender Interaction

	Males		Females	
Variable	Mean	St. Error	Mean	St. Error
Career Planning Gain				
Mentor	2.5	2.6	5.8	2.9
School Based	5.5	3.1	8.3	6.1
Control	8.4	2.8	6.9	3.7
Career Development Gain				
Mentor	- 0.7	2.5	2.4	3.6
School Based	1.9	2.9	1.7	5.3
Control	5.5	3.2	5.6	3.7

Table 10

Univariate Result for Group Effect on Self-Efficacy Educational Requirements Scale Gain Score

Group	Mean	Standard Error	Number of cases
Mentor	7.1	4.8	33
School-Based	22.6	7.4	27
Control	0.5	3.9	32
Total	9.3	3.2	92

and rejected with the summary results reported in Table 11. We report only Hotellings T-squared statistic since all achieved significant levels were within .01 for the multiple response tests (Pillais, Wilks and Hotellings). Tables 12 to 16, display the detailed univariate results.

Table 11 shows that the covariates were predictors of some of the factors on the student and mentor instruments. While there were no significant gender or group/gender interaction effects, there was a difference in group effect on some gain scores. The covariate effects for the student/mentor perception variables are plotted in Table 12. Three variables, which were part of the mentor instrument, were related to covariates as predictors: student ability, scientific/technical application and quantitative nature and enjoyment of the experience. The mentor perception of student ability was positively correlated with the PSAT verbal score but negatively correlated with the PSAT math score. In addition, the scientific/technical application of the experience was predicted by the students' achievement measure (GPA), while the mentor perception of the quantitative application and enjoyment of the project was positively correlated with the PSAT verbal score. Also in Table 12, the student perception of the enjoyment and scientific relevance of the experience was negatively related to the PSAT math scores. Tables 13 and 14 provide univariate results for

Table 11

Hotelling Tests of Model Effects

Effect	Value	Approx. F	Hypoth. d.f.	Error d.f.	p-value
Covariates	1.01	1.76	21	110	.03*
Grp. X Gend.	0.27	1.46	7	38	.21
Gender	0.07	0.40	7	38	.90
Group	0.83	4.49	7	38	.00*

*p<.05

Table 12

Test of Covariate Effects on

Student/Mentor Perceptions Scores

Factor	Covariate	Beta	t-value	p-value
Mentor Character-istics	GPA	-.29	-1.86	.07
	PSAT V	.16	.98	.33
	PSAT M	-.27	-1.82	.08
Experience	GPA	-.05	-.32	.75
	PSAT V	.20	1.19	.24
	PSAT M	-.31	-2.00	.05*
Application	GPA	-.03	-.19	.85
	PSAT V	.20	1.27	.21
	PSAT M	-.40	-2.72	.01*
Student Ability	GPA	.09	.56	.58
	PSAT V	.37	2.34	.02*
	PSAT M	-.31	-2.13	.04*
Science or Technical Application	GPA	.39	2.62	.01*
	PSAT V	.22	1.43	.16
	PSAT M	-.26	-1.84	.07
Quantitative Methods	GPA	.18	1.19	.24
	PSAT V	.41	2.68	.01*
	PSAT M	-.16	-1.17	.25
Time Spent With Student	GPA	.30	1.86	.07
	PSAT V	.01	.06	.96
	PSAT M	-.19	-1.26	.21

* $p<.05$

Table 13

Test of Group by Gender Effects on Student/Mentor Perception Scores

All F-tests with (1,44) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Mentor Character-istics	850.16	181.31	4.69	.04*
Experience	.20	44.59	.00	.95
Application	27.98	8.74	3.20	.08
Student Ability	121.28	107.10	1.13	.29
Sci/Tech Appl.	.01	1.50	.01	.94
Quantitative	.04	1.36	.03	.87
Time Spent With Student	24291.73	8411.09	2.89	.10

* $p<.05$

Table 14

Test of Gender Effect on Student/Mentor Perception Scores

All F-tests with (1,44) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Mentor Characteristics	196.34	181.31	1.08	.30
Experience	47.86	44.59	1.07	.31
Application	8.29	8.74	.95	.34
Student Ability	.55	107.10	.01	.94
Sci/Tech Experience	.35	1.50	.23	.63
Quantitative Methods	.05	1.36	.04	.85
Time Spent With Student	6836.06	8411.09	.81	.37

*p<.05

gender by group interaction and gender effect although there were no significant effects.

The students' group made a difference in two responses: mentor/supervisor characteristics and in the nature of the experience. As detailed in Table 15, there was a difference in the groups on mentor characteristics, scientific nature of the experience and the relevance of the application. Table 16 provides the means and standard errors for the response variables.

In Table 16, the differences are plotted for the two project groups. With a total possible score of 84 points on "mentor characteristics", a "real" difference of ten points was noted between the groups. Questions related to this variable concerned the mentor's ability to guide in a clear and understandable way, to encourage creativity and independence, and to relate well to young people. While students in both groups were above the mid-score, the mentorship group was more positive on this factor than were students in the school-based group.

The second significant difference between the groups was found in the students' perception of the scientific relevance and motivation of the learning experience. This factor, with a total possible score of 49 points, inquired about the scientific/quantitative application of the experience and the

Table 15

Test of Group Effect on Student/Mentor Perception Scores

All F-tests with (1,44) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Mentor Character-istics	1131.56	181.3	6.24	.02*
Experience	646.33	44.59	14.49	.00*
Application	35.69	8.74	4.08	.049*
Student Ability	87.29	107.10	.82	.37
Sci/Tech Application	.43	1.50	.29	.59
Quantitative Methods	1.40	1.36	1.03	.32
Time Spent With Student	2771.55	8411.09	.33	.57

* $p<.05$

Table 16

Averages and Standard Errors for Response Variables

Variable	Mean	Standard Error	Cases	Sign.
Mentor Characteristics	65.97	2.11	59	*
Mentor Grp.	70.97	2.28	32	
School Grp.	60.11	3.44	27	
Experience	27.29	0.94	58	*
Mentor Grp.	30.19	1.13	31	
School Grp.	23.96	1.30	27	
Application	19.69	0.40	59	*
Mentor Grp.	20.47	0.45	32	
School Grp.	18.78	0.65	27	
Student Ability	48.02	1.50	53	
Mentor Grp.	48.77	1.92	30	
Student Grp.	47.04	2.41	23	
Sci/Tech Application	5.53	0.18	53	
Mentor Grp.	5.53	0.22	30	
School Grp.	5.52	0.30	23	

*p<.05

Table 16 continued

Averages and Standard Errors for Response Variables

Variable	Mean	Standard Error	Cases	Sign.
Quantitative Methods	5.28	0.16	60	
Mentor Grp.	5.09	0.22	33	
School Grp.	5.52	0.25	27	
Time Spent With Students	74.43	11.62	60	
Mentor Grp.	67.63	10.50	33	
School Grp.	82.74	22.64	27	

*p<.05

motivation of the student in project choice. Again a real difference was noted between the groups; the mentorship group scored significantly higher on scientific application and motivation than did the school-based group. While the average response for the school-based group on this factor was "adequate" (4 out of 7), the mentor group rated this factor "above average" (5 out of 7).

Finally, the students' perception of the application and enjoyment of the experience varied between the groups. While not a "real" difference, it was a statistical difference. With a total of 42 points possible, the mentor group ranked about "adequate" while the school-based group came in just below "adequate" on this response.

Hypothesis 5 (H5) was rejected concluding that there is a difference between the groups on student/mentor perceptions and covariate prerequisites of ability and achievement.

Test of Hypothesis H6

Hypothesis 6 (H6) states that there will be no real difference between the groups on personality characteristics as measured by the Myers-Briggs Type Indicator, or intellectual ability as measured by scores on the Preliminary Scholastic Aptitude Test or achievement as measured by grade point average.

Table 17 notes the sixteen Myers-Briggs types and the distribution by groups as well as the total number of types across all groups. The predominant types in this distribution of students were the INFP and the ENFP personality types, with the largest clustering in the mentorship and the control groups. The literature (Myers & McCaulley, 1985) suggests that personality characteristics as measured by the Myers-Briggs Type Indicator might be used to place students in the most appropriate of program. In support of this hypothesis (H6), a MANOVA was performed for achievement (GPA,PSAT), and self-efficacy measures (CPGAIN through CDMSESGAIN) by group and each of the four Myers-Briggs preference factors (EI, NS, JP, and TF).

Hotellings T-squared statistic is reported in Table 18. Only one significant result was found for Myers-Briggs Indicator type between groups, groups by types or in terms of prerequisite achievement or ability. While the judging-perceiving (JP) factor showed a significant difference in certain gain scores and perceived characteristics of the project variables univariate results did not support this finding. The detailed univariate results are presented in Table 19. The detailed means and standard deviations for all the response variables are reported in Table 20.

Table 17

Myers-Briggs Type Indicator Scores by Group

Type	Number in Groups Mentor	School-Based	Control	Total
ISTJ	2	1	2	5
ISTP	1	2	0	3
ISFJ	1	0	2	3
ISFP	0	3	1	4
INFJ	1	3	2	6
INFP	9	3	6	18
INTJ	1	3	4	8
INTP	1	2	1	4
ESTP	1	0	1	2
ESFP	0	0	1	1
ESTJ	1	0	1	2
ESFJ	0	3	2	5
ENFP	9	4	10	23
ENFJ	1	2	0	3
ENTP	4	0	1	5
ENTJ	0	1	0	1

Table 18

Hotelling Tests of Model Effects

Effect	Value	Approx. F	Hypoth. d.f.	Error d.f.	p-value
Covariates	27.91	1.77	42.00	8.00	.20
TF X Group	7.66	2.19	14.00	4.00	.23
JP X Group	3.49	1.00	14.00	4.00	.56
EI X Group	3.01	.86	14.00	4.00	.63
NS X Group	5.01	1.43	14.00	4.00	.40
TF	1.64	.47	14.00	4.00	.87
JP	25.67	7.34	14.00	4.00	.03*
NS	5.32	1.52	14.00	4.00	.37
EI	2.63	.75	14.00	4.00	.69

* $p<.05$

Table 19

Test of Group Effects on Gains in Career Self-Efficacy and Student/Mentor Perception Scores

All F-tests with (1,17) degrees of freedom

Variable	Mean Sq.	Error Mean Sq.	F	p-value
Mentor Characteristics	1168.30	196.59	5.94	.03*
World of Work Gain	98.58	19.85	4.97	.04*
Career Decision Making Self-Efficacy Gain	6174.13	1244.15	4.96	.04*

* $p<.05$

Table 20

Means and Standard Deviations for Response Variables by Judging/Perceiving Personality Type

Variable	Judging Mean	S.D.	N	Perceiving Mean	S.D.	N	P
Mentor Characteristic	64.26	18.65	19	66.78	15.06	40	.35
Experience	26.21	6.58	19	27.82	7.48	39	.43
Application	19.74	3.18	19	19.68	3.11	40	.94
Student Ability	52.00	8.41	15	46.45	11.48	38	.44
Scientific Application	6.07	.80	15	5.32	1.42	38	.47
Quantitative Methods	5.68	1.00	19	5.10	1.36	41	.45
Time Spent With Student	64.16	57.12	19	79.20	102.06	41	.44
Career Planning Gain	8.74	10.76	31	4.94	15.30	62	.58
Career Exploration Gain	-1.68	12.32	31	-1.98	14.21	62	.59
Decision Making Gain	3.23	11.97	31	4.31	11.36	62	.21

*p<.05

Table 20 (continued)

Means and Standard Deviations of Response Variables

By Judging/Perceiving Personality Type

Variable	Judging Mean	Judging S.D.	Judging N	Perceiving Mean	Perceiving S.D.	Perceiving N	P
World of Work Gain	.00	4.84	31	1.76	6.13	62	.38
Career Development Attitude Gain	4.61	12.29	31	2.06	14.93	62	.99
Career Development Knowledge Gain	1.61	7.22	31	3.53	7.17	62	.15
Career Orientation Gain	3.71	8.78	31	2.84	11.30	62	.47
Potential Occupation Gain	0.38	9.60	26	-0.70	20.2	50	.68
Self-Efficacy for Ed. Req. Gain	7.00	22.31	31	10.54	34.05	61	.94
Self-Efficacy for Job Duties Gain	11.74	37.88	27	6.74	35.02	57	.98
Career Decision Making S-E Gain	-0.35	73.3	31	1.85	28.74	61	.74

*p<.05

Hypothesis 6 (H6) was rejected for JP personality preference; there is a difference, but not in general, between the groups in the judging/perceiving characteristic of the Myers-Briggs Personality Type Indicator.

Unhypothesized Findings

Responses on the mentor perception instrument "amount of time spent with student" scale, as detailed in Table 21, indicated the mentors spent almost two and a half times as much time with the females as the males while the school-based supervisors spent twice as much time with the males as the females. Table 22 illustrates graphically this interaction.

Summary

In Chapter 4, the findings of the study have been presented. Hypotheses 1 through 4 (H1 to H4) were not rejected: all groups and genders gained about equally in career self-efficacy. There was no difference in the gains between experiential programs and ordinary maturation as represented by the control group.

Hypothesis 5 (H5) was rejected: there is a significant difference in the mentor and school-based groups and in the prerequisite achievement and ability covariates on the

Table 21

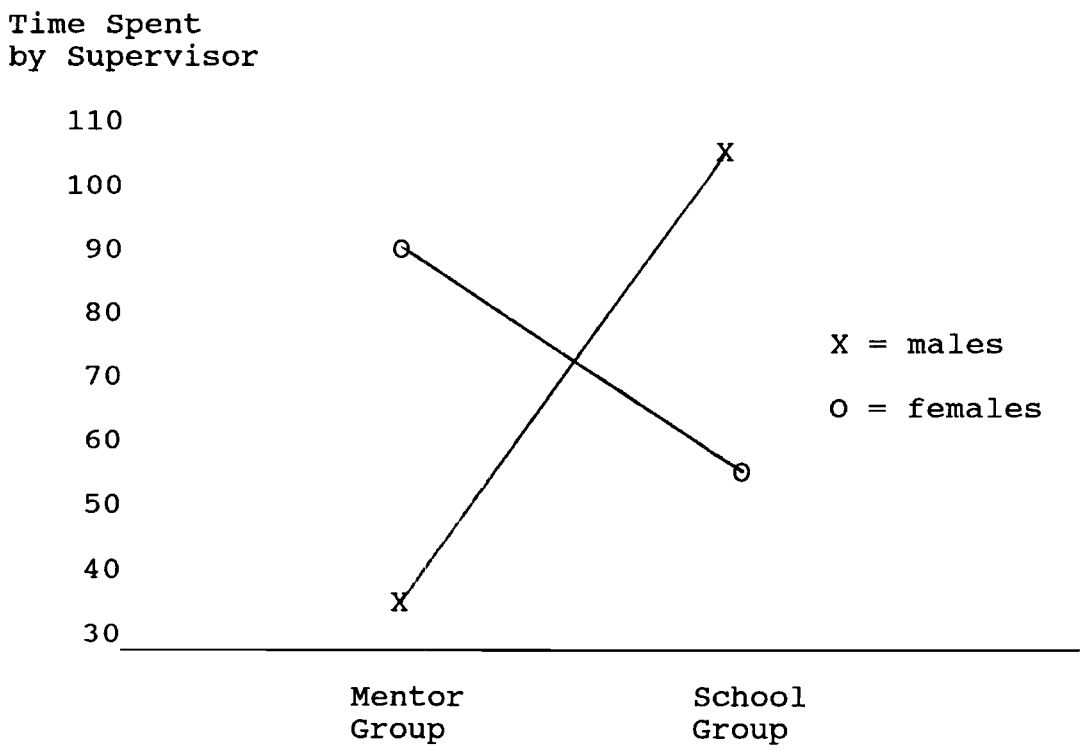
Univariate Result for Gender Effect on Amount of Time Spent with Student Scale Score

Gender	Mean	Standard Error	No.of Cases
Mentor Group			
Males	36.38	7.0	13
Females	87.95	15.0	20
School Based Group			
Males	104.13	39.7	15
Females	56.00	8.3	12

Table 22

Gender by Group Interaction of

Amount of Time Spent with Student Scale Score



student/mentor perception variables. The student perception variables of "mentor characteristics", "perception of the experience" and "application of the experience" differed between groups with the mentor group scoring significantly higher than the school-based group on these variables. PSAT math scores were correlated with the "experience", "application" and "student ability" variables, while PSAT verbal scores were related to the "student ability" and "quantitative methods" factors. Achievement as measured by grade point average was also related to the "scientific or technical application" variable.

Hypothesis 6 (H6) was rejected. There is a difference in the groups on the judging/perceiving (JP) characteristic of the Myers-Briggs Personality Type Indicator.

Other findings indicated that mentors spent more than twice as much time with females as they did with males; school-based supervisors spent twice as much time with male students as they did with female students.

CHAPTER V

Conclusions and Recommendations

Introduction

In the last two decades, women have gradually entered a number of occupations that have been considered traditionally male. However in 1986, women accounted for only 15 percent of all the employed scientists and engineers (National Science Foundation, 1987). With a growing need for more professionals in these fields, increased attention has been focused on women's career development.

Bandura's self-efficacy theory, a behavioral model, attributed changes in fearful and avoidant behavior in phobics to increased levels of self-efficacy expectations (Bandura, 1977, 1982). Advanced by Hackett and Betz (1981) as a possible mediating factor in understanding women's career development, and underrepresentation in traditionally male fields, their findings indicated significant gender differences in self-efficacy with regard to career choice.

Investigating the application of Bandura's self-efficacy theory to further the understanding of career indecision,

Taylor and Betz (1983) developed an instrument designed to measure career decision-making self-efficacy.

A review of the literature indicated very few studies on the direct application of Bandura's theory or on counseling interventions which measured changes in these self-efficacy variables. Following up on Bandura's findings that performance-based programs offered the greatest promise for increasing self-efficacy levels, the researcher considered studying the effect of two experiential programs on the career development variables mentioned above.

The purpose of the study was to determine whether there was any difference in career choice self-efficacy, career decision-making self-efficacy or career maturity after participating in either experiential program: a community-based mentorship program or a school-based research program. Since the selective population of very bright students was drawn from a specialized high school for mathematics, science and technology, the study controlled for ability and achievement through the use of covariates.

In addition the study investigated the student and mentor/supervisor perceptions of the quality and enjoyment of the experience, the quantitative application, the time involved and ways to improve the programs. It also compared the students in the groups in relation to personality differences.

In the quasi-experimental study, using two treatment groups and a control group, subjects were pretested using the Career Decision-Making Self-Efficacy Scale, the Career Development Inventory and the Self-Efficacy For Technical/Scientific Fields Scale with PSAT scores and grade point averages used as covariates of achievement and ability. Personality characteristics were measured using the Myers-Briggs Type Indicator.

Over the next four months, students participated in one of three groups: a school-based experiential program, a community-based mentorship experience, or a control group. Upon completion of the programs, students were retested using the same instruments and gain scores recorded. A student perception instrument and a mentor/supervisor validation assessment were piloted to investigate the scientific application and the participants' perceptions of the experience. These instruments were administered to subjects at the conclusion of the experiential programs. The data was analyzed using multivariate analysis of variance (MANOVA) with PSAT scores and grade point averages serving as covariates. Analyses were tested for statistical significance at the $p<.05$ probability level.

The findings of the study were as follows:

- Although all groups gained in career self-efficacy, there was no difference in gain scores between the experimental programs and ordinary maturation.
- Students in the mentorship program felt more positive about their mentor, the scientific or technical nature of the experience, and the application and enjoyment of the program than did the school-based group.
- High student verbal ability and achievement were related to greater mentor/teacher appreciation of the student ability, as well as the scientific nature and enjoyment of the experience.
- Students with greater ability in mathematics perceived the relevance and scientific application of the experience less positively.
- The groups differed generally on the judging/ perceiving characteristic of the Myers-Briggs Personality Indicator scale.
- Mentors spent over twice as much time helping females as they did with males; whereas, school-based teachers spent twice as much time with males.

Conclusions Based on the Hypotheses

The first two research questions asked if the mentorship or the school-based research programs were successful in raising the career choice self-efficacy, the career decision-making self-efficacy or the career maturity of the students. The findings showed that while all groups and both genders gained in career self-efficacy and maturity, there was no major gain difference from the two programs as compared to the control group or natural maturation. It could be that investigating eleven career development measures proved to be too numerous to detect differences between the groups.

The third research question inquired if there was a significant gain difference in the career development variables between the treatment groups. Again, no significant differences were found between the groups on these variables. Minor differences were noted which included gains in SEED (self-efficacy for educational requirements) with the control group barely improving, the mentor group improving substantially, and the school-based group improving remarkably. Implications of these findings could be that students who participated in either "hands-on" research program grew in their perceived capability to fulfill the educational requirements of math/science careers. These results are in contrast to the findings of Weiner (1985) who

compared groups of gifted students with and without mentors in relation to growth in career maturity. In that study, students with mentors scored significantly higher on career development variables.

A relationship was noted between PSAT math scores and self-efficacy for SEED well as SEJD (self-efficacy for job duties). This finding confirmed Betz and Hackett's (1983) results that mathematics self-efficacy expectations were related to the choice of science-based careers. A relationship between PSAT verbal scores and career exploration was also evident which validate the results of Kelly and Colangelo (1990) who found higher levels of career maturity associated with high academic ability.

In answering research question number four, "Are there gender differences in career choice self-efficacy, career decision-making self-efficacy or career maturity between the groups?" no major differences were found in gender gain scores between the groups or from maturation. These findings agree with Lent, Brown and Larkin (1984, 1986, 1987) who did not find gender differences in career self-efficacy for a population of college students majoring in technical or scientific career fields. Since these students were all generally interested in mathematics, science and technology fields, this may explain why gender differences in self-efficacy expectations were minimal.

While no significant gender differences were found, minor differences were noted in CPGAIN (career planning gain) and CDAGAIN (career development gain) with the males in both groups gaining less than through ordinary maturation, while there were no significant differences among females regardless of group. These results are in direct contrast to the findings of Cesarano-Delacruz (1985) who found that males scored significantly higher on the Career Planning (CP) and the Career Development Attitude (CDA) scales.

The fifth hypothesis was concerned with differences between the groups in the perceptions of both students and supervisors/mentors regarding their supervisor/mentor or mentoree and the quality, quantitative nature, enjoyment and application of the experience. The mentorship students felt more positive about the openness, ability, understanding and creativity of their mentor than did the school-based students. The mentorship group also felt the quality and quantitative nature as well as the enjoyment of the experience surpassed that of the school-based group. Students with higher mathematical ability perceived the experience as less scientific or technical in nature, and less applicable to their career goals.

In contrast, there were no noticeable differences between the groups of teachers and mentors regarding their perception of the quality and quantitative nature of the experience.

However, high verbal ability students were perceived more favorably by both the teachers and mentors. They also regarded projects designed by high achieving students as more scientific or technical in nature.

The sixth hypothesis asked about differences between the groups in personality characteristics, ability or achievement. On the judging/perceiving characteristic there was a general difference between the groups, but no difference was noted in specific factors. In examining the mean grade point average for the groups, they range from 3.5 for the mentor group, to 3.6 for the school-based to 3.5 for the control group. Similarly, the verbal and mathematics ability scores were within two points for all groups. One could conclude that the groups were almost identical in ability and achievement.

Other Conclusions

Responses on the mentor perception instrument indicated mentors spent almost two and a half times as much time with female students than with male subjects while the school-based teachers spent twice as much time with males than with females. Possible explanations of this finding are that 1) mentors in the business/scientific community are more acutely aware, than are teachers, of the need to nurture future female scientists, engineers and mathematicians, and that 2) teachers

in the school-setting validated previous educational studies which found that male students received more time and attention from teachers than did females (Sadker & Sadker, 1988).

Included in the mentor/supervisor and student instruments were response sections for comments on the programs. Overall, the mentors were generally more pleased with the project than were the school-based supervisors. Both groups cited the need for greater student technical preparation, students more able to work independently, and more time to work with students.

When asked what they liked about the project, mentors most often cited the opportunity to establish a relationship with an enthusiastic young person and share a common scientific experience with them. They also offered the following suggestions to improve the program: 1) more coordination between the mentor and the school, 2) more student technical preparation, 3) more extended time periods (a minimum of three hours three times a week), 4) clearly defined mutual goals, and 5) more independent and committed students.

Some of the comments offered by the teachers concerning the school-based program were: 1) students needed more technical preparation, 2) students needed to be more committed to research, 3) some of the testing equipment was not available, 4) students needed to start their projects sooner

than the fall of senior year, and 5) more time was needed to spend with each student. Perhaps the mentors were more satisfied with the experience because they were teaching on a one-to-one basis whereas the teachers were helping several students at one time. It is also probable that more advanced, up-to-date equipment was more available in the settings outside of the school.

Similarly students in the mentor group were twice as satisfied with the experience than the school-based group. These findings agreed with those of Gladstone (1987) who noted mentors exhibited characteristics of openness, patience, and concern; they provide an atmosphere in which mentorees grow in independence, self-confidence and work related values. Comments on ways to improve the program from students in the mentorship included a need for clearer expectations, more personal attention, and the need to spend more time developing projects.

While the students in the school-based group were moderately pleased, they cited difficulty in obtaining the teacher's individual attention, getting bogged down in selecting a project, the meed for more advanced testing equipment, and not enough time to complete the project.

Possible explanations would be similar to those for the mentors. Mentorship students met with their mentors individually in a relatively well equipped setting; school-

based students complained they needed more attention from their teachers and more guidance in designing a project.

Limitations

The study was limited by instrumentation and the population under consideration. Instrumentation designed to study self-efficacy was very limited; while the literature yielded several studies on the construct, the researchers used modifications of the original Betz and Hackett (1981) instrument to study career choice self-efficacy. The instrument used (SEED and SEJD), which was developed by Lent, Brown and Larkin (1984), was modified from the Betz and Hackett model to include occupations in which students majoring in scientific or mathematical fields would be interested. While used in several studies by Lent et al. (1984, 1986, 1987, 1989a, 1989b), the small sample populations they used were all undergraduate engineering students.

The instrument used to measure career decision-making self-efficacy (CDMSES) had initially been found by Taylor and Betz (1983) to be domain specific. However, findings by Robbins (1985) indicated the instrument might be measuring a more general self-efficacy construct rather than decision-making. These conflicting results imply that the two

instruments may have measured the same general self-efficacy construct.

A further limitation of the study was the population under consideration. Generally high achievers, the students were already motivated toward considering mathematics, science or technology fields after attending this specialized school for three years. The homogeneity of the population may have contributed to the difficulty in discriminating gain in the career development variables.

Recommendations

The conclusions of this study resulted in the following recommendations:

1. While no differences were found in the career self-efficacy factors with this population of high achieving students, detailed data has been provided for future researchers to consider in later studies. The lack of discernable differences could have been as a result of too many variables under consideration. In the future, it is recommended that the study be replicated using only one dependent variable, the career choice self-efficacy construct.

2. In the population used for this study, both males and females were demonstrated high achievers, generally interested in mathematics, science and technology fields. Since the

literature confirms that career patterns are developed in the early high school years (Post-Kammer & Smith, 1985), more research is needed with a diverse ability population of high school students who are not as goal and achievement oriented, who might offer a greater variety of interests among students. Perhaps a more diverse population would demonstrate a significant difference between genders on career self-efficacy variables.

3. In this study, subjects were randomly chosen from self-selected programs. In future studies, it is recommended that the students be randomly assigned to programs which would strengthen the design of the study. Students could also be assigned to opposite groups that what they had selected. Would there be any detrimental effects?

4. The programs under consideration were originally intended to enable the students to learn techniques of designing and conducting "good" research. Because the context for the learning experience was laboratory settings either in the school or in the community, this researcher assumed that a secondary benefit would be an increase in self-efficacy expectations for scientific or mathematical careers. In the future, it is recommended similar programs be studied which clearly are designed to increase career choice self-efficacy.

5. The differences found in the judging/perceiving personality characteristics between the groups could be used

as a counseling intervention. Counselors could use the Myers-Briggs Type Indicator scale to help students pre-select a program in which they would be most satisfied. Counselors could also match students with mentors who have similar Myers-Briggs profiles which would enhance the enjoyment of the experience of both mentoree and mentor.

6. Since the mentorship program was more favorably received by both students and mentors, it is recommended that the program be expanded to include at least half the seniors who are involved in laboratory research projects.

The following recommendations are offered to future researchers in their study of the career self-efficacy variable.

1. More attention must be paid to measuring issues which include strengthening the validity of self-efficacy measures. Three measures are currently available: one to measure self-efficacy for mathematics (Hackett & Betz, 1984), another designed to measure career decision-making self-efficacy (Taylor & Betz, 1983), and an instrument assessing perceived ability to success in a variety of different academic majors or career fields (Lent, et al., 1984). While reliability measures are available, there is a need for further convergent and discriminate validity to distinguish career self-efficacy from other constructs.

2. The mentorship and the school-based research programs which were examined in this study were both performance attainment interventions which could prove to be valuable counseling strategies to raise self-efficacy levels of females who might not be considering mathematics, science or technologically related fields. Self-efficacy theory could provide a rich source of ideas for counselors to design new treatment strategies based on the other three sources of self-efficacy information: vicarious experiences, verbal persuasion and anxiety reduction. Designing studies which investigate the effectiveness of theory-based interventions or a combination of interventions, could prove to be a valuable area of further investigation for the counseling profession.

3. Another area for future consideration would be to investigate how self-efficacy based interventions might affect perceived expectations of ability in other areas beyond career choice or career decision-making. Do increasing levels of self-efficacy transfer to different behavioral tasks beyond the specific domain under consideration?

4. It is suggested that counselors replicate this study using special populations. Another need we are facing is to increase the numbers of minorities who are considering careers in mathematics, science and engineering. Further studies should investigate effective counseling interventions which increase the self-efficacy of racial and ethnic minorities, of

the disabled, and of populations other than high school and college students as well as females.

5. This study was conducted over a period of four months. Longitudinal designs would be valuable to document how career self-efficacy develops and changes over time. It would also be interesting to follow sample populations from elementary school through junior high and high school on to college and into the workplace to investigate changes in career expectations, interests and occupational choices. It is well documented that we are loosing students interested in mathematics, science and engineering at an alarming rate (National Science Foundation, 1987) beginning in the sophomore year in high school through the senior year in college to other less rigorous fields. Longitudinal studies should investigate changes in self-efficacy levels during those critical decision-making points in a young person's educational career; perhaps elementary school years are not too early to affect self-efficacy changes. Additional information might indicate counseling interventions which could prevent this loss of talent in the fields of mathematics, science and engineering.

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Appendix A

Letter to the Reader

Permission was obtained by the researcher to use the Career Decision-Making Self-Efficacy Scale from Dr. Nancy Betz and the Self-Efficacy for Educational Requirements/Job Duties from Dr. Robert Lent. If the reader is interested in using these instruments, written permission should be obtained from:

Dr. Nancy Betz
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East Lansing, Michigan 48824

THE CAREER DECISION-MAKING SELF-EFFICACY SCALE

The Career Decision-Making Self-Efficacy scale asks you about behaviors relevant to career choices. You are asked questions in the areas of self-appraisal, gathering occupational information, goal selection, making plans for the future, and problem solving. The results of this scale will help you in your career decision-making process.

INSTRUCTIONS: For each question below, please indicate your degree of confidence in your ability to successfully complete each task. Indicate how confident you are on the 9-point scale.

Completely Confident	9	8	7	6	5	4	3	2	1	No Confidence

Response

1. Make a career decision and then not worry about whether it was right or wrong. _____

2. Find information about companies who employ people with college majors in English. _____

3. Come up with a strategy to deal with flunking out of college. _____

4. Go back to school to get a graduate degree after being out of school five to ten years. _____

5. Find information about educational programs in engineering. _____

6. Make a plan of your goals for the next five years. _____

7. Choose a major or career that your parents do not approve of. _____

8. Prepare a good resume. _____

9. Change occupations if you are not satisfied with the one you enter. _____

10. Choose the major you want even though the job market is declining with opportunities in this field. _____

Completely Confident	9	8	7	6	5	4	3	2	1	No Confidence

Response

11. Accurately assess your abilities. _____

12. Get letters of recommendation from your teachers. _____

13. Determine the steps to take if you are having academic trouble with an aspect of your chosen major. _____

14. Identify some reasonable major or career alternatives if you are unable to get your first choice. _____

15. Change majors if you did not like your first choice. _____

16. Figure out whether you have the ability to successfully take mathematics courses. _____

17. Figure out what you are and are not ready to sacrifice to achieve your career goals. _____

18. Find and use the career center in school. _____

19. Determine what your ideal job should be. _____

20. Select one occupation from a list of potential occupations you are considering. _____

21. Describe the job duties of the career/occupation you would like to pursue. _____

22. Successfully manage the job interview process. _____

23. Select one major from a list of potential majors you are considering. _____

24. Apply again to college after being rejected the first time. _____

25. Find information in the library about occupations you are interested in. _____

26. Find out the employment trends for an occupation in the 1990's. _____

Completely Confident 9 8 7 6 5 4 3 2 1 No Confidence

Response

27. List several majors that you are interested in. _____

28. Move to another city to get the kind of job you really would like. _____

29. Decide what you value most in an occupation. _____

30. Persistently work at your major or career goal even when you are frustrated. _____

31. Choose a career that will fit your preferred lifestyle. _____

32. Plan course work outside of your major that will help you in your future career. _____

33. Determine the academic subject you have the most ability in. _____

34. Identify the employers, firms, institutions relevant to your career possibilities. _____

35. Resist attempts of parents or friends to push you into a career or major you believe is beyond your abilities. _____

36. Determine the steps you need to take to successfully complete your chosen major. _____

37. List several occupations that you are interested in. _____

38. Choose a major or career that will suit your abilities. _____

39. Decide whether or not you will need to attend graduate or professional school to achieve your career goals. _____

40. Choose the best major for you even if it took longer to finish your college degree. _____

41. Get involved in a work experience relevant to your future goals. _____

Completely Confident	9	8	7	6	5	4	3	2	1	No Confidence

Response

42. Find information about graduate or professional schools. _____

43. Find out about the average yearly earnings of people in an occupation. _____

44. Ask a faculty member about graduate schools and job opportunities in your major. _____

45. Talk to a faculty member in a department you are considering for a major. _____

46. Define the type of lifestyle you would like to live. _____

47. Determine whether you would rather work primarily with people or with information. _____

48. Talk with a person already employed in the field you are interested in. _____

49. Choose a major or career that will fit your interests. _____

50. Choose a career in which most workers are the opposite sex. _____

SELF-EFFICACY FOR SCIENTIFIC/TECHNICAL FIELDS SCALE

Part A. INSTRUCTIONS: For each occupation listed below, please indicate whether or not you feel you could successfully complete the education and/or training required to enter the occupation -- assuming you were motivated to make your best effort. For each YES, indicate how sure you are on the 10-point scale.

Occupation	Could you successfully complete required education and/or training?		If yes, how sure are you? Completely Unsure ... Completely Sure
1. Aerospace Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
2. Agricultural Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
3. Architect	Yes	No	1 2 3 4 5 6 7 8 9 10
4. Landscape Architect	Yes	No	1 2 3 4 5 6 7 8 9 10
5. Astronomer	Yes	No	1 2 3 4 5 6 7 8 9 10
6. Chemical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
7. Chemist	Yes	No	1 2 3 4 5 6 7 8 9 10
8. Civil Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
9. Computer Scientist	Yes	No	1 2 3 4 5 6 7 8 9 10
10. Electrical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
11. Geologist	Yes	No	1 2 3 4 5 6 7 8 9 10
12. Mathematician	Yes	No	1 2 3 4 5 6 7 8 9 10
13. Mechanical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
14. Physicist	Yes	No	1 2 3 4 5 6 7 8 9 10
15. Statistician	Yes	No	1 2 3 4 5 6 7 8 9 10
16. Other _____ (Please Specify)	Yes	No	1 2 3 4 5 6 7 8 9 10

PART B. INSTRUCTIONS: For each occupation listed below, please indicate whether or not you feel you could successfully perform the job duties of that occupation, assuming you had the necessary education/training and that you were motivated to do your best. For each YES, indicate how sure you are on the 10-point scale.

Occupation	Could you successfully complete the job duties?		If yes, how sure are you? Completely Unsure ... Completely Sure
1. Aerospace Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
2. Agricultural Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
3. Architect	Yes	No	1 2 3 4 5 6 7 8 9 10
4. Landscape Architect	Yes	No	1 2 3 4 5 6 7 8 9 10
5. Astronomer	Yes	No	1 2 3 4 5 6 7 8 9 10
6. Chemical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
7. Chemist	Yes	No	1 2 3 4 5 6 7 8 9 10
8. Civil Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
9. Computer Scientist	Yes	No	1 2 3 4 5 6 7 8 9 10
10. Electrical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
11. Geologist	Yes	No	1 2 3 4 5 6 7 8 9 10
12. Mathematician	Yes	No	1 2 3 4 5 6 7 8 9 10
13. Mechanical Engineer	Yes	No	1 2 3 4 5 6 7 8 9 10
14. Physicist	Yes	No	1 2 3 4 5 6 7 8 9 10
15. Statistician	Yes	No	1 2 3 4 5 6 7 8 9 10
16. Other _____ (Please Specify)	Yes	No	1 2 3 4 5 6 7 8 9 10

SENIOR RESEARCH PROJECT QUESTIONNAIRE

Supervisor/Mentor Form

This questionnaire is being used to gather information about the senior research program in which you supervised students this year. Please answer honestly; we need to know how you really feel in order to make improvements in the future. YOUR ANSWERS WILL BE KEPT CONFIDENTIAL.

Please complete a form for each student. Thank you for your participation.

1. Name of laboratory or firm: _____

2. Name of student: _____

3. Describe briefly the project completed by the student:

_____

_____

_____

_____

Circle the response that best describes how you feel about each question or statement.

4. How would you rate the available learning experience for the student in terms of:

a. Quantitative (mathematical) techniques, methods, etc.

1------2------3------4------5------6------7
very little average exceptional

b. Scientific techniques, methods, etc.

1------2------3------4------5------6------7
very little average exceptional

c. Direct application of the subject matter.

1------2------3------4------5-------6-------7
very little average exceptional

5. Was the experience enjoyable for the student?

1------2------3------4------5------6-------7
no somewhat extremely

6. Was the experience enjoyable for the mentor or supervisor?

1_____2_____3_____4_____5_____6_____7
no somewhat extremely

7. How would you rate the student's capacity to perform the project in terms of knowledge of the project's subject?

1------2-------3-------4------5-------6-------7
very poor adequate outstanding

8. How would you rate the student's enthusiasm for the project's subject?

1-------2-------3------4------5-------6-------7
very poor adequate outstanding

9. How would you rate the student's capacity to perform the project in terms of technical skills?

1------2-------3-------4-------5-------6-------7
very poor adequate outstanding

10. How would you rate the student's communication skills?

1------2------3-------4-------5-------6-------7
very poor adequate outstanding

11. Was the student able to work independently?

1-------2-------3-------4-------5-------6-------7
rarely usually always

12. How did the student socially fit into the work environment?

1-------2------3-------4-------5-------6-------7
poorly well exceptionally

13. For mentors only: How did you get involved in being a mentor?

_____

_____

14. Approximately how much time did you and other staff members spend with the student in planning, preparation, direction and execution of the project? Total number of hours _____

15. How would you improve the project experience if you could do it over again? What things did you like most about the experience? What aspects do you feel need to be improved? Be as frank as you care to be; we need to know how you really feel in order to make appropriate improvements. Write on the back or attach sheets as needed.

16. Are you willing to be contacted for further information?
_____ no, I would rather not.
_____ yes. My phone number is_____.

Code Number_____

SENIOR RESEARCH PROJECT QUESTIONNAIRE

Student Form

This questionnaire is being used to gather information about the senior research program in which you have participated this year. The results of this survey will provide us with valuable planning data. Please answer honestly; we need to know how you really feel in order to make improvements in the future. YOUR ANSWERS WILL BE KEPT CONFIDENTIAL.

School Laboratory Assignment_____

Please describe your project briefly:

Directions: Circle the responses that best answers the questions below.

Please rate your lab teacher and mentor (if applicable) on the following items:

7-----6-----5-----4-----3-----2-----1
Strongly agree — Agree — Strongly disagree

	Mentor	Lab Teacher
1. Is knowledgeable about my project	_____	_____
2. Is available and is willing to help me or answer questions when I need assistance.	_____	_____
3. Is patient and understanding.	_____	_____
4. Is enthusiastic about his/her work.	_____	_____
5. Is willing to teach me many new things.	_____	_____

	Mentor	Lab Teacher
6. Is willing to let me be independent and make my own decisions.	_____	_____
7. Tolerates my mistakes and helps me learn from them.	_____	_____
8. Is organized and gives me clear directions.	_____	_____
9. Relates well to young people.	_____	_____
10. Has guided me and created new opportunities and experiences for me.	_____	_____
11. Has given me a clear understanding of what is expected of me.	_____	_____
12. Has shown interest in me as a person and made extra efforts to see that I was happy with my project.	_____	_____

13. How would you rate the learning experience from this project in terms of:

a. Quantitative (mathematical) techniques, methods, etc.

1-----2-----3-----4-----5-----6-----7
very little average exceptional

b. Scientific or engineering techniques, methods, etc.

1-----2-----3-----4-----5-----6-----7
very little average exceptional

c. Application of the subject matter to methods, techniques, etc.(i.e. laboratory applications of biology)

1-----2-----3-----4-----5-----6-----7
very little average exceptional

d. Real world work experience.

1_____2_____3_____4_____5_____6_____7
very little average exceptional

e. Relating to others in a research environment.

1_____2_____3_____4_____5_____6_____7
very little average exceptional

14. Do you feel you were well prepared to begin research?

1-----2-----3-----4-----5-----6-----7
no somewhat yes

15. Was the environment in which you worked enjoyable?

1-----2----3-----4-----5-----6-----7
no somewhat extremely

16. I really wanted to do a school-based project.

1-----2-----3-----4-----5-----6-----7
definitely no didn't care absolutely yes

17. I really wanted to do a mentorship project outside the building.

1-----2-----3-----4-----5-----6-----7
definitely no didn't care absolutely yes

18. How strongly were the following factors involved in choosing your laboratory project?

a. Thought it would help me learn more about a career 1---2---3---4---5---6---7
not much somewhat a lot

b. Personal interest 1---2---3---4---5---6---7
not much somewhat a lot

c. Interested in writing the project up 1---2---3---4---5---6---7
not much somewhat a lot

d. Thought it could lead to a job 1---2---3---4---5---6---7
not much somewhat a lot

e. Thought it would help me decide on a career 1---2---3---4---5---6---7
not much somewhat a lot

f.Others:_____

19. Do you think your project could make an impact on the body of knowledge in the field?

1-----2-----3-----4-----5-----6-----7
not really perhaps most likely

20. Feel free to comment on any aspect of your project. Write on the back or attach sheets as needed. Be as frank as you care to be; we have to know how you really feel to make appropriate improvements.

VITA

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Education

Bachelor of Arts, in Psychology
Regis College, Weston, MA.

Master of Arts, in Counselor Education
University of Massachusetts, Boston, MA.

Doctor of Education, in Student Personnel Services
Virginia Polytechnic Institute and State Institution, Blacksburg, VA., May, 1992

Experience

Director of Student Services,
Fairfax County Public Schools,
Fairfax, VA., 1981 to present.

School Counselor
Fairfax County Public Schools,
Fairfax, VA., 1977 to 1981.

Mathematics Teacher
Fairfax County Public Schools,
Fairfax, VA., 1970 to 1977.

Mathematics Teacher
Arlington County Public Schools,
Arlington, VA., 1962 to 1963.

Mathematics Teacher
North Reading Public Schools,
North Reading, MA., 1960 to 1962.