

Running head: A WOMAN'S CHOICE OF A MALE-DOMINATED MAJOR

**Factors that Influence a Woman's Choice  
to Remain in or to Leave a Male-dominated Major**

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### Abstract

Grounded theory methods of Strauss and Corbin (1990) and multidimensional scaling techniques (Kruskal & Wish, 1991) were used in this investigation to study the factors that influence a woman's choice to remain in or to leave a male-dominated major (Zuckerman, 1981). Focus group interviews were conducted with 62 sophomore women who had originally chosen male-dominated majors as freshmen to gain insight into the meanings and motivations of the student decisions. The participants responded to a 25-item survey which yielded a three dimension solution with five clusters in the multidimensional scaling analysis.

Five themes emerged from the focus groups as factors influencing a woman's choice to remain in or to leave a male-dominated major: (a) self confidence and refuse to lose attitude; (b) interest in the field; (c) career goals, jobs, and money; (d) ability and experience in the field; and (e) the desire to make a difference. The three dimensions were (a) time of experience, (b) motivation, and (c) career rewards. The five clusters were: (a) pre-college experiences, (b) college experiences, (c) career rewards, (d) self-confidence, and (e) self-fulfillment.

The findings are consistent with current literature; however, the use of the multidimensional procedure goes further and helps to explain some of the motivations of the students and challenges some of the beliefs that persons in the practice of student affairs profess about woman and chilly climate. The study extends knowledge about how women deal with their chilly environment.

## Acknowledgements

“burning with curiosity, she ran across the field after it, and was just in time to see it pop down a large rabbit-hole under the hedge. In another moment down went Alice after it, never once considering how in the world she was to get out again.”  
Lewis Carroll

Just as Alice jumped in the rabbit hole without ever once considering how in the world she was to get out, so I began this doctoral program. Unlike Alice, it did not turn out to be a dream. It turned out to be a dream come true. Fortunately, there were many supportive and loving people who were with me every step of the way. Dad's advise was very true. He used to tell me that God would give us the people to help us when we needed them. People just miraculously seemed to appear when I needed them.

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## Chapter 1

## Introduction

Women's lives have undergone tumultuous changes within the last thirty years. Although they have made many gains in educational opportunities and work situations, the majority of women lag far behind men in wealth, power, and opportunity according to a 1991 United Nations publication entitled The World's Women. Another United Nations report (1991) states that although they make up half of the population of the world and perform two-thirds of the work of the world, women receive only one-tenth of the world income and own less than one-hundredth of world property. Equality continues to elude women (Keller, 1997).

In this country, hundreds of years of historical and psychological barriers have led to continued unequal participation into the full spirit of American life. No doubt these barriers to equal participation have played major roles. However, women have traditionally thwarted their own progress as well (Henry, 1994). What women say they want, what they believe, and how they act upon those belief systems have been described as sounding like American opera singers performing in a foreign tongue, knowing the words but not beginning to translate the meaning (Henry, 1994).

There is no conspiracy which holds women back. Equality for women is not commonly opposed by most men (Kluegel & Smith, 1986). Although 94% of women report equal pay is important to them, the majority do not support feminist positions nor do they vote for women candidates who are trying to change the system. However, the more education they have, the more women feel the inequalities at home, at work, and in society in general (Cohen, 1988).

Equality is neither a nebulous nor a complicated concept. It simply means an opportunity to reach one's fullest potential, translated into decent wages, respect both at home and at work, and parity in making decisions (Henry, 1994).

Inequality for women means far less income earnings over their lifetime. The medium income earnings for a woman with a college degree is \$26,000 while men comparatively make \$39,000. Over a career, a woman would earn \$420,000 less (Faludi, 1991). Women have made gains in equality in pay to 72 cents for every dollar a man earned

in 1994 (Bianchi & Spain, 1997). The Ms Foundation Women's Voices Project (1992) attributed the women's gains to the lost income of the men during the eighties' recessionary times.

Women now earn more than half of the baccalaureate degrees which are awarded. More women have been elected to Congress than ever before (Bianchi & Spain, 1997). African American women made important gains in wages during the last decade (Tanenbaum, 1995). But, more women are poor. The U. S. Bureau of the Census shows thirty-six percent of female-headed households fall below the poverty level. Compare that with 7% of married-couple households and 17% with male-headed households (Willens, 1995).

Education and training for employment have been linked to the path out of poverty and toward self-sufficiency for women. Vocational training programs in drafting and other male-dominated careers are cited as promise for women breaking free from poverty's stubborn grip (Willens, 1995).

Self-esteem appears to play a significant role in the choices women make in college majors, careers, and personal decisions (Resnick, Fauble, & Osipow, 1970; Wigent, 1974). Vocational choice for women with higher self-esteem gives women the opportunity to choose male-dominated college majors with greater self-assuredness and greater resistance to many of society's self-imposed barriers to achievement and financial success.

Both the "glass ceiling" and the "sticky floor," invisible barriers to promotion, place the majority of working women in jobs that society considers important but lacking in decent pay and in any hope for advancement (Noble, B. 1992). The "token woman" (Constantinople, 1982; Constantinople, A., Cornelius, R., & Gray, J. 1988; Kanter, 1977a, 1977b) and the chilly climate (Hall & Sandler, 1982) are factors which present barriers to top management and professional careers. Undervalued services are the rule for pay equity rather than market factors (Gilbert, 1985; Gray, 1993; Hochschild, 1989; Terrell, 1992).

Title IX of the Education Amendments of 1972 which prohibits discrimination in education has opened wider doors for women. Women now make up 30% of medical school students. Women are now fully half of law school students (Henry, 1994).

Women have fared less well in science and engineering. Women now make up 44% of the work force, 49% of the professional and occupational jobs, and only 15% of the scientific, technical, and engineering jobs (Lane, 1988). Only 14% of freshmen women arrive at college intending to major in science, while 40% of men choose to do so (Kahle, 1988). There appears to be a misfit about the purpose and nature of women undergraduates in mathematics and science between the learned expectations of women entering those fields and the expectations of their male peers and faculty (Seymour, 1995).

Gender is reported to have an important effect on the choice of major (Jacobs, 1986). Traditionally, men have chosen majors in mathematics and science fields such as engineering, while women have chosen teaching, nursing, and social work careers. Social pressures have channeled men and women into different career directions (Solomon, 1985). Schools as social institutions reinforce gender-appropriate behavior, interests, and occupations (Kelly, 1985; Lee, Marks, & Byrd, 1994; Parker, 1995). About 70 percent of students who major in physics, chemistry, and computer science are male. Eighty-five percent of students receiving bachelors degrees in engineering are male. Although women are the majority, about 53 percent of students today, they are still not as likely to enter nor graduate from a traditionally male-dominated major (Ransom, 1990; Snyder & Hoffman, 1992; Touchton, Davis, & Makosky, 1991).

Self-esteem has been linked to educational experiences and career aspirations of both men and women. Recent data reveal a gender gap in self-esteem that increases dramatically in the teen years, through the college experience, and into adulthood. More boys than girls enter adolescence with high self-esteem and many more men than women leave adolescence with high self-esteem. Women arrive at engineering schools with lower self-confidence than men (McIlwee & Robinson, 1992). The declining self-esteem for women affects their academic confidence, aspirations, and choice of college major (American Association of University Women, 1992). Despite the fact that many of the women compete and succeed in demanding technical curricula, they continue to lack self-confidence as college students (McIlwee & Robinson, 1992). Self-esteem also affects a student's ability to pick up and forge ahead after suffering a set-back such as a bad grade or an unenthusiastic remark from

an admired professor. Lack of self-confidence is linked to persistency among college women in science, mathematics, and engineering majors (McIlwee & Robinson, 1992).

There appear to be many reasons women are not successful in mathematics and science majors. An inclination away from competition, perceived difficulty of the subject matter, lack of self-confidence, self doubts, fear of failure, and mathematics anxiety, all coupled with an unfriendly masculine culture, contribute to women's lack of success (Peltz, 1990; Tobias, 1978; 1990; Ware, Steckler, & Leserman, 1985). Learned helplessness and egotism in past-failure performance also offer additional explanations for lack of women's success in technological fields of study (Dweck & Reppucci, 1973; Frieze, 1978; Hagan & Medway, 1989).

It is important for both men and women to achieve their highest potentials, aspirations, and dreams. The college experience affords those opportunities to students. Self-affirmation appears to be linked to the successful fulfillment of those ambitions (American Association of University Women, 1992; Orenstein, 1994). Problems occur when some students are not able to fulfill their ambitions and are less willing to take on the challenges of male-dominated majors and careers, thus sacrificing economic as well as personal accomplishments. Many women appear destined to leave a college major linked to mathematics and science, thereby foregoing the opportunities for monetary as well as personal rewards that those college majors could provide. For the past two decades it has been known that many women arrive at college with clear, ambitious goals for college majors and careers. However, as time passes, women tend to lower their educational aspirations as well as professional ambitions (Holland & Eisenhart, 1990; Jacobs, 1986; Lettman, 1981; Sadker & Sadker, 1994; Schnabel, 1993; Vollmer, 1983). Women leave male-dominated majors due to lack of self-affirmation (Schnabel, 1993). Individuals with lower levels of self-esteem are not as certain of career plans and are not as likely to enter or remain in a male-dominated major (Lettman, 1981).

Women choosing a male-dominated major such as engineering technology or drafting are less certain about their majors than women choosing traditional majors (Brodsky, 1989). Women's expectations for an engineering technology major may not be realistic when they are admitted into the program. And, even if they have chosen a male-

dominated major such as engineering or computer science, graduation is not a sure bet. Women leave the programs and change to more traditional majors (Holland & Eisenhart, 1990; Jacobs, 1986; Lettman, 1981; Schnabel, 1993; Vollmer, 1983). More than one-third of women enrolled in engineering or physical science majors leave those majors (Davis, et al., 1996).

### Statement of the Problem

The phenomenon of women in male-dominated majors is a complicated issue. Researchers have been exploring this phenomenon since Alice Rossi first questioned the small numbers of women in science in 1965. Rossi fueled the gender debate, and it has continued to date. Current research leads to some understanding of students and their choice of college major, but it offers limited insight into all of the factors which lead women to their choice of a major or the satisfaction to remain within that major or to leave for another science-related or traditional major. There is some evidence that self-esteem or self-affirmation influences the choice of major. The Brown University study (1980) found that college women had lower aspirations and lower academic self-esteem than men. However, there are many other factors of influence. Becker (1990) reported that pre-college experience in mathematics and science have consequences for subsequent college experiences for women. Classroom environment, faculty behaviors, peer relations, performance pressures, role expectations, and curriculum content were variables Schnabel (1993) found as influencing a women's decision to remain in that major. Of particular concern is the plight of women who leave male-dominated majors more often than men leave those same majors (Sadker & Sadker, 1994).

There is a need to reframe the “problem of women” in science, mathematics, and engineering (Seymour, 1995). Seymour recommends either the institution needs to be changed to a friendlier learning environment which supports women's' learning styles of interaction or changing the focus of women to teach them how to survive in the environment. Many of the problems of women in science, mathematics, and engineering have been identified (Kanter, 1977a, 1977b; McIlwee & Robinson, 1996); Seymour, 1995, Tobias, 1990). More research is needed to shed light on women's' expectations of college and career (Davis et al., 1996). There is also a need to evaluate the many programs that have

been put in place to increase the numbers of women in science to determine which strategies work best to create equitable opportunities for them (Rosser & Davis, 1996).

The purpose of this study, then, is to ascertain what factors influence a woman's choice of a non-traditional, male-dominated major. The study also will address the factors associated with the satisfaction to remain in that choice of major or to leave that major if she is dissatisfied with the choice. However, this study will not be limited to a certain number of variables, but will explore and investigate data obtained in interviews with students about their motivations, experiences, and decisions to chose male-dominated majors based on grounded theory methodology (Strauss & Corbin, 1990).

If they are to compete successfully in the global marketplace and to reach equity with men in employment opportunities and salaries, women will not only have to choose more male-dominated careers, but they will have to persist in those majors. Women are now competing in law and medicine on a more equitable basis. Engineering and computer science majors will enable women to compete in those careers and reap the financial rewards as well. This study will provide answers to questions concerning access to male-dominated majors and factors associated with the decision to leave those male-dominated majors for the security of other science and mathematics-related or for traditional majors.

#### Research Questions

Using both qualitative and quantitative data-collection techniques, a set of questions were used to guide the investigation instead of using testable hypotheses. The primary questions used to conduct this investigation were:

- (1) What are the factors associated with a woman's choice of a male-dominated, male-dominated major?
- (2) What are the meanings, experiences, and motivations that influence the decision to choose a traditional or a male-dominated major?
- (3) How do women describe their decisions and motivations to remain in or to leave a male-dominated major if they are dissatisfied?
- (4) What are the experiences deemed important by the participants of this study for students' choices of male-dominated majors in the future?

#### Significance of the Study

The approaching twenty-first century is increasing the need for students to be ready to compete in a global marketplace. There will be a critical need for students to be trained in mathematics, science, and technological fields. Traditionally, men have been more successful than women in these fields of study (Solomon, 1985). All persons with such skills will be needed, however, to prepare for the careers of the future. Engineering and science fields will continue to recruit and admit women to their programs (Brodsky, 1989). More research will be needed to determine what programs are successful, not only in attracting young women, but in graduating women for technological careers.

Engineering has moved inside into analytical skills, small scale design, and computer work and is no longer a rugged, mechanical, outdoor activity; these changes make it more attractive to women as a career choice (Hacker, 1983; Salembier, 1971). However, recognition of engineering as a career choice is not sufficient. Research is needed to understand the conflict-structural perspective of women in male-dominated fields (McIlwee & Robinson, 1992). It will require studying students' choices of college majors and their perceptions of their relationships to the college major, the college, its culture, and its people.

As politicians and policy makers reinvent government, downsize programs, and propose changes to government programs such as social welfare, efforts will be made to encourage young women to seek new career opportunities to support themselves and their families with job training and educational endeavors. More and more young women will be given job training and college opportunities with a time frame to finish their education and get out of the public welfare system. Such job training and education will need to provide increased job opportunities with adequate wages. Careers in male-dominated fields can create many of those opportunities for women.

Colleges and universities are being called upon every year to reduce budgets, do more with less, show more accountability, increase retention rates, and operate more competitively in the marketplace. Tuition and fee increases for students are rapidly replacing state funding. Accountability, enrollment management marketing strategies, withdrawal rates, and graduation rates have become the markers of institutional effectiveness. Students, parents, and lawmakers are becoming more astute in their demands for accountability toward graduation. Students are seeking access to advising, career planning, and other strategies

which assist them in completing their curricula in a timely, successful manner. Students who wander aimlessly through several curricula before finding their way are depleting family as well as public resources. Dollars need not be lost because men and, in particular, women lose their way and drop out of male-dominated majors. Identifying factors which increase or decrease successful completion through a college major will assist educational leaders in their goal of providing successful student outcomes (Astin, 1993; Astin, Green, & Korn, 1985; Astin, 1990).

As they become more aware of their opportunities to make changes in their lives and seek new means of equality in careers, as well as financial and personal rewards, women may seek new avenues of growth, including the choice of male-dominated majors in agriculture, engineering, and computer and information services.

This study can provide new insight leading to an increased awareness and understanding of male-dominated majors for women. Listening to the experiences of the women students will increase knowledge and provide the means to assist these women students in developing new paradigms for successful graduation regardless of their majors.

#### Definition of Terms

For the purpose of this study, operational terms are defined as follows:

Non-traditional or male-dominated major. A major traditionally dominated by one gender; the ratio of two-thirds to one-third sex ratio in a college major (Zuckerman, 1981). For women in a male-dominated major, the student ratio would be one-third women to two-thirds men. Male-dominated major will be used in this study.

Self-esteem (Self-affirmation). How a person views his or her performance in areas deemed important and how a person believes he or she is perceived by significant others (Harter, 1990).

#### Assumptions

It is assumed that the choice of a college major is made with the expectation of career choice.

#### Delimitations of the Study

1. This study focuses on women students' choices of male-dominated majors in a rural state research university in Virginia.

2. The study is further focused on the decision to remain in the male-dominated major or to leave if dissatisfied with the choice.
3. Questions explored with students about their experiences, motivations, and decisions in their career aspirations and satisfaction with that choice of college major were based on hypotheses from Schnabel (1993), impressions that were observed by the researcher over several years of working with college students in academic advising and counseling, and factors stated by adult women as motivations for choices of major, career aspirations, and decisions to remain in the major or to leave the major.

#### Limitations of the Study

The generalizations of the findings presented in this study may be subject to the following limitations:

1. The population for this study was limited to sophomore women enrolled in a state research university in rural Virginia during the Spring, 1996, term who had originally chosen male-dominated majors as entering freshmen in the fall of 1994.
2. The criteria used for the selection included:
  - students willing to participate in the study
  - numbers of students enrolled in the specific majors considered to be male-dominated for women according to the ratio used by Zuckerman (1981): (a) agriculture, (b) architecture, and (c) arts & sciences, (d) business, (e) education, and (f) engineering.
3. There are no guidelines in conducting ethnographic research to specify when to stop searching for negative cases to conclude the research project (Glaser & Strauss (1967)).
4. Some of the potential students in the population sample were away from campus participating in the co-op program.
5. Students who were not currently enrolled in the university were not invited to participate in the study. Some students had left the major and/or the university during their freshman year.

## Chapter 2

### Review of Related Research

The literature concerning choices of male-dominated majors comes from a wide range of sources. This study will organize the literature on the subject into eight areas: (a) choice of college major; (b) influence of self-esteem or self-concept; (c) societal role expectations through choice of college major; (d) gender differences; (e) women's choices of male-dominated majors in mathematics, science, and engineering; (f) barriers to science, mathematics, and engineering; (g) the choice to leave; and (h) the need for research.

#### Choice of College Major

One of the most difficult and far-reaching decisions that college students must make is that of a choice of college major. This life-marker event is particularly important because of the influence that it has on the career choice and the transition to adulthood (Chickering, 1969). Pascarella and Terenzini (1991) found the college career choice to be the single best predictor of what occupation the student actually entered. Finding an occupation which is socially acceptable and personally expressive is one of the developmental tasks associated with college student development (Erikson, 1963; Waterman, 1982).

For the first time in their lives, many college students are experiencing their first taste of independence. Making a choice of college major is unsettling and difficult for them. Many students do not have the necessary decision-making skills to make life-long choices (McClaran & Sarris, 1985).

There are several career development theories of why people choose certain occupations. The trait and factor theory maintains that people choose jobs with demands that are consistent with their personality traits (Brown, 1990). Personality traits such as interests and aptitude play an important role in this theory. Holland's 1963 theory of careers, which expands the trait and factor theory to include the work environment as an important factor to be consistent with one of six personality traits, has five important concepts: consistency, differentiation, identity, congruence, and calculus. Based on the assumption that vocational interests are one aspect of personality, Holland's theory of careers then expounds that the description of one's vocational interest is also a description of one's personality. People are

trying to satisfy their intrinsic personality needs (Bordin, 1943, 1990; Roe, 1956; Roe & Lunneborg, 1990).

Describing the developmental stages of career choices that occur throughout the lifespan, Super (1953; 1990) explains the evolution of career choice rather than the decision-making itself. The developmental tasks for each stage are described. Super also highlights the importance of self-concept. The early research of Super (1957) was criticized because he described the homemaking role as primary in his seven career paths for women. Zytowski's theory, too, was criticized for making homemaking and work mutually exclusive (Vetter, 1973). Hansen (1978) came under criticism for his assumption that women who had a high career commitment were odd or deviant.

The inadequacies of career development theory for women have been documented (Brooks, 1990). Three approaches to develop adequate career development theories for women have been made. Hackett and Betz (1981) have applied Bandura's self-efficacy theory to the career development of women. Bandura (1982) stated that people avoid activities that exceed their coping capabilities and perform those activities of which they judge themselves to be capable. Thus, Hackett and Betz make the proposal that women possess lower and weaker career-related self-efficacy expectations which explains restricted ranges of careers and under-utilization of women's abilities. Although women who possessed strong self-efficacy expectations and assertiveness were found to be more related to a willingness to engage in non-traditional careers, the majority of women continue to be willing to engage only in traditional career occupations.

Fear of success was a related factor in a woman's unwillingness to engage in a non-traditional career (Nevill & Schlecker, 1988). Bandura (1986) went further to identify four sources of information which include performance accomplishments, vicarious experiences, verbal persuasion/encouragement from others, and physiological or emotional arousal which influence self-efficacy expectations. Performance accomplishments and vicarious experiences were thought to exert the most influence. Observing another woman in a career role, for example, would be a powerful influence for a woman's career development. Talented women lack role models as they make crucial life-role planning decisions (Arnold, 1995). Self-efficacy theories have been used to provide explanations for the continued

underrepresentation of women in male-dominated careers, particularly in the sciences, engineering, and mathematics, as well as the serious underrepresentation of women's talents and abilities in career pursuits (Farmer, 1976; Fitzgerald & Crites, 1980; Humphreys, 1982; National Science Foundation, 1982; Phafflin, 1984).

Astin (1984) and Gottfredson (1981) have both created comprehensive theories of career development which are applicable to both women and men. Of particular interest to this study is the social learning theory of career decision making (Krumboltz, 1979; Mitchell & Krumboltz, 1990). Persons are more likely to learn and use the task approach skills of career decision making if they receive positive reinforcement for learning and using the skills, or if they have a role model and receive positive reinforcement for using the career decision making skills. Experiences which reward such behaviors are often included in successful intervention strategies for women. An example of an intervention strategy would be asking a successful woman in a male-dominated career to share her experiences with a woman learning career decision making skills.

The inability to decide on an occupational identity is disturbing to individual young people (Erikson, 1963). As they mature and development occurs, students will experience growth toward identity formation (Chickering, 1969; Chickering & Reisser, 1993). Senior students are more likely to resolve their identity crisis than are freshmen students (Waterman, Geary, & Waterman, 1974). However, many students never experience an identity crisis and do not consider alternative goals and beliefs (Waterman et al., 1974; Waterman & Waterman, 1970). Such students are hindered by lack of growth in their intellectual, social, and emotional development since decision-making skills used by students are influenced by ego identity in the developmental process (Marcia, 1966; 1967; Waterman & Waterman, 1970).

#### Influence of Self-Esteem or Self-Concept

Self-esteem is the evaluation that individuals make of themselves. Maintaining that evaluation of themselves is inherent in self-esteem. Self-esteem further exerts an approving or disapproving attitude about one's self as well as the scope to which one believes himself/herself to be capable, successful, significant, and worthy. It is a personal judgment of worthiness (Coopersmith, 1967). James (1890) described self-esteem as the ratio of one's

successes to pretensions. James was referring to successes as accomplishments and to pretensions as outward appearances. According to this notion, self-esteem would be measured by accomplishments mediated by outward appearances.

Self-concept or identity is the self or person one feels he or she is (Chickering, 1969; Chickering & Reisser, 1993). Insight or accuracy of self-perception is an important construct of self-esteem.

Self-esteem is the ability to think about as well as the confidence to deal with life's challenges and to react to those challenges in an appropriate and successful manner, allowing people to live better as well as to feel better about their lives (Brandon, 1994). Interpersonal competence and self-identification are other ways to describe the identity of self or self-esteem (Loeffler & Fiedler, 1979). The higher a person's self-esteem, the better equipped he or she is to pick up after a fall or disappointment and to begin again. Self-esteem is essential for self-fulfillment and self-actualization (Brandon, 1994). Jahoda (1958) included self-acceptance and a sense of identity, growth, integration, autonomy, freedom of distortion from reality because of one's personal awareness, and environmental mastery or adequacy of interpersonal relations as his criterion for positive mental health. The sense of self is achieved through a life-long struggle to an integrated self (Jung, 1959). Individual happiness and dignity also are ultimately involved in self-esteem (Dickstein, 1977).

During college, students increase in ego identity status and self-confidence and conceptual levels (Chickering, 1969; Chickering & Reisser, 1993). During the same period of student development, identity concerns become issues for crisis and/or resolution (Waterman, 1982). Identity development becomes especially crucial in the choice of vocational plans. Parrish (1988) reported that undergraduate students who had been taught more effective ways to act took more responsibility for their lives and adopted significantly higher self-concepts. Parrish's study suggested that self-concepts can be influenced by intentional curriculum enhancement through college student development programming. Programs which are designed to increase the confidence of young women through curriculum innovations have been instrumental in providing access to male-dominated careers for women (Loeffler & Fiedler, 1979).

Vocational choice is thought to be the implementation of a person's self-concept (Super, Starishevsky, Matlin, & Jordon, 1963). Persons with high self-esteem are more likely to implement their self-concept in their vocational choice. High self-esteem persons appear to take into consideration the opportunity to satisfy their internal needs and are more intrinsically motivated and more resistant to societal influences in their career choices (Lettman, 1981).

Self-esteem is a personality variable which has been thought to influence vocational choice (Holland, 1963; Super, 1953). Research from Ghiselli (1963) and Saunders (1965) support self-esteem as a moderator variable in the vocational choice.

Lettman (1981) and Fannin (1977), however, did not find self-esteem to be significant in their studies of vocational choice. Lettman felt his method of measuring the variable was inadequate and that further study would be necessary to assess accurately self-esteem as a significant variable in the choice of a college major. Moreover, he was concerned about the small sample size, the unequal number of subjects in each group, and the mood of the students as contributing factors to the self-esteem variable.

Korman (1967) found that individuals with high self-esteem were more likely to choose occupations requiring high abilities than were individuals with low self-esteem. Thus, individuals with low self-esteem would be more likely to avoid a demanding occupation and favor a less-challenging and more comfortable occupation. Later, Korman (1969) supported his hypothesis that self-esteem is a moderator variable in vocational choice by indicating that individuals with high self-esteem are more likely to seek a career for self-fulfillment than are individuals with low self-esteem. Persons with high self-esteem would be more interested in satisfying their work needs.

Persons with high self-esteem were more certain of their career plans than were low self-esteem persons (Resnick, Fauble, & Osipow, 1970; Wigent, 1974). Although they differed little on self-esteem and self-confidence in her study, Zuckerman (1985) reported men seeing themselves as being higher in mathematics/science ability, in leadership and in public-speaking ability, and in coping and self-sufficiency abilities. The men also predicted their future careers would be a higher priority than time for themselves. The men also reported preferences for career involvement when their children would be very young.

Women preferred less work involvement while their children were very young. Maracek and Frasch (1977) found that women anticipated a career with less commitment and with a shorter portion of their lives. The majority of women surveyed have stated that it is too difficult to manage professional work and family and child responsibilities (Morgan, 1992; Rossi, 1965).

Women have often been viewed as being less capable and competent than men. Women's self-perceptions have been hampered by these views from others. The choice of a male-dominated major for women has traditionally been seen as inappropriate. Women have not been reinforced for this type of choice (Sadker & Sadker, 1994). Women with higher self-esteem have been found to have more androgynous and masculine characteristics (Jones & Lamke, 1985). Individuals with feminine characteristics have been found to have significantly lower levels of self-esteem (Jones & Lamke, 1985; Spence, Helmreich, & Stapp, 1975). Ware and Dill (1986) reported marked differences between the self-confidence of male and female science students. Women have less confidence than men do in their ability to do science (Strenta, et al., 1993).

#### Societal Role Expectations through Choice of College Major

The choice of major has been associated with gender appropriateness and occupational choice (Strange & Rea, 1983; Ware, Steckler, & Leserman, 1985). Increasingly more women are entering male-dominated fields of engineering and criminal justice while men are entering nursing and other health-related occupations. Majors traditionally dominated by men are called male-dominated majors. One is said to be in a male-dominated major when the ratio is two-thirds to one-third sex ratio of students reported to be enrolled in a major by college records (Zuckerman, 1981).

Occupational choice has not always been a high priority for women (Schenkel & Marcia, 1972). Career planning was once thought to be only be a way station on the way to the goal of marriage (Douvan & Adelson, 1966). Women were more likely to report career plans to work less hours when they had small children (Zuckerman, 1985). Horner (1968) recognized the need to frame women's occupational planning more broadly to include total life planning rather than specific job title planning.

Low self-esteem and identity diffusion have been the consequences of the socialization process that dictates that girls suppress or do not learn the assertive behaviors which are associated with high levels of self-esteem in males and females (Orlofsky, 1977). More androgynous sex role behaviors would allow individuals to have less restricted and less rigid patterns of behavior (Bem, 1975). Societal expectations can be especially detrimental to women's choices of male-dominated majors (Peng & Jaffe, 1979).

### Gender Differences

The majority of men and women continue to be enrolled in gender-segregated fields (Astin, 1993). Women also are more likely to be enrolled in male-dominated majors when they start college rather than when they graduate. Women also tend to lower their career aspirations as they continue through college (Dunlop & Canale, 1988). Women report that their overall satisfaction in college is influenced far more than men's by personal relationships and informal encounters and meetings with advisors and faculty (Light, 1990). Tobias proposed that capable women do not enter science degree majors because of their narrow content in the syllabi of science majors, the emphasis on individual competition, and the lack of opportunities for an interactive style of learning. These traditional aspects of science pedagogy are more disadvantageous to women than to men (Rosser, 1990).

Gender bias and gender differences dominate the current literature focus. Women lose self-esteem as adolescents which they never seem to regain (AAUW, 1992). Despite the fact that more women than men enroll in college, more women earn master's degrees, and success in general for women has risen in the last twenty years, women still tend to major in lower-paying fields and earn little more with a college degree than a man with a high school diploma (Touchton, Davis, & Makosky, 1991; Sadker & Sadker, 1994). There is some evidence, however, that degree of loan debt influences students to choose college majors with higher earning power (St. John, 1994). Hence, women in greater debt would be more likely to choose a higher-paying career. Both men and women continue to pay a price for the inequities that our society imposes upon them.

Gender studies have revealed that educational outcomes vary by gender. Contributing significantly to the prediction of career aspirations are gender and academic degree level (Dunlap & Canale, 1988). Astin (1993) found that educational outcomes vary

by gender in the choice of major as well as in educational attainment, cognitive development, psychological well-being, personality development, and occupational attainment. In her study of cognitive development in women, Baxter-Magolda (1992) found that men are consistently more active in the learning process than women. Men also are consistently more objective about knowledge while women are more subjective and focused on relationships.

### Women's Choices of Male-dominated Majors

Women's choices of majors in mathematics, science, and engineering have baffled researchers for years because of the underrepresentation of women in these areas (Brush, 1991; Daffin, 1937; Lips, 1992; Rossi, 1965b; Schieinger, 1989; Seymour, 1995). Only 10% of natural scientists and less than 1% of engineers were women in 1960. In 1985, women received about 15% of all baccalaureate degrees in engineering with about 16.5% of freshmen engineering enrollment (Ellis, 1986). Clearly, women choose science, mathematics, and engineering majors because they are good at science and mathematics (Ellis & Eng, 1991). Ironically, problem-solving women are unlikely to choose a scientific career due to the prevailing cultural expectations, but they are excellent prospects as scientists for research into the physical sciences (Bar-Haim & Wilkes, 1989).

### Barriers to Science, Mathematics, and Engineering

Barriers to participation in mathematics, science, and engineering fields include resentment from male colleagues, discouragement from parents to their daughters, and lack of skills and characteristics for science careers (Morgan, 1992). Other researchers identified the barriers that women face in pursuing engineering careers as isolation, competition, low self-confidence, child and family issues, lack of role models, and insufficient financial resources (Brainard, 1992). Social forces such as low peer support and faculty support contribute to women's performance in these majors (Daniels, 1988; Landis, 1988) and may contribute to the extent women value achievement in such areas (Eccles, 1987; Eccles & Jacobs, 1986). Conflicting demands of family and work present barriers for women to demanding professional career fields (Morgan, 1992).

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and the lack of opportunities for an interactive style of learning. These traditional aspects of science pedagogy are more disadvantageous to women than to men (Rosser, 1990).

With such perceived barriers, it is not difficult to understand the phenomenon of the number of women in such careers dropping (Lane, 1990). Nor is it unclear why the number of women who plan careers in engineering and physical sciences also has dropped (LeBold, 1987). One-third of those women planning to major in physical science or engineering do not complete those majors (Astin et al., 1988).

Lips (1984; 1988; 1992) described female disconnection or personal alienation from the subject matter as barriers to mathematics, science, and engineering programs. Since their academic record is usually equal to or better than those of men, women may have self views that do not include any affirmation of interest or endorsement in science and mathematics. Perhaps women would be well served with policies that focus upon awakening or reawakening their abilities and interests in mathematics and science. Changing the paradigm from an inclination toward mathematics and science to a likely career in those areas could be a critical piece in solving the under-representation problem for women.

Studies have indicated that schooling in mathematics and science discourages and disadvantages women in career aspirations (Kahle, 1996). Women are not only under-represented in mathematics, science, and engineering majors, but they also take fewer high school classes in mathematics and science to prepare them for such courses (Becker, 1990; Benbow, 1988; Feingold, 1988; Zeidner, 1990). Achievement and aptitude overlap too much to explain such under-representation (Hyde, Fenema, & Lamon, 1990; Kimball, 1989).

The National Science Board recommends women, Blacks, and Hispanics to be a largely untapped pool to increase the scientific work force of the nation in the future. A shortage of as many as 560,000 scientists and engineers will occur over the next twenty years (Conciatore, 1989; McDonnell, Oakes & Shavelson, 1989; National Science Board, 1986; Task Force, 1989). The Task Force on Women, Minorities, and the Handicapped in Science and Technology (1989) further recommends partnerships between two- and four-year institutions to ensure the success of women and minorities in engineering programs. Such linkages have proven successful in Glendale Community College and Occidental

College where all 30 students paired in the study went on to complete baccalaureate degrees (Alexander, 1989; Devarics, 1989).

### The Choice to Leave

The distribution of women and men by fields or majors is not clearly understood (Zuckerman, 1991). Women leave science and engineering fields not only to switch to other mathematics and science fields, but also to majors outside of these areas (Seymour, 1995). Talent is definitely being diverted to other majors (Davis et al., 1996).

Chilly climates for women studying mathematics, sciences, and engineering do not facilitate their retention and achievement (Sandler & Hall, 1987; Brainard, 1990). However, there is no reassurance that increasing numbers of women alone will improve the learning environment. Women are less likely to complete their degrees in science and engineering than men (Davis et al., 1996). Negative treatment and gender neutrality were found to be measures of "chilly climate" for women in engineering education programs at institutions participating in the SUCCEED Program (Hirschfeld & Majumdar, 1996).

Students who choose to leave science, mathematics, and engineering majors vary little from students who stay. Switchers and nonswitchers are likely to complain about the same things, but switchers would be more likely to switch because of peer pressure and interest in pursuing a career which offered more humanitarian or personal satisfaction. Few women leave because of bad grades (Hewitt & Seymour, 1991; 1992; Seymour, 1995; Seymour & Hewitt, 1994; Ware, Steckler, & Leserman, 1985).

Some researchers suggest that low peer and faculty support and other such social forces contribute to performance differences between men and women (Daniels, 1988; Freeman, 1979; Landis, 1988; McIlwee & Robinson, 1992; Schnabel, 1993) and may result from the extent to which women value achievement in mathematics, science, and engineering (Eccles, 1987; Eccles & Jacobs, 1986).

Peers are the single most potent source of influence on growth and development during the college years (Astin, 1993). For women in male-dominated majors, their peer group is predominantly male. And, surrounded by males who make them feel unwelcome, less capable, and with open hostility, women often find this situation to be devastating. However, male peer behavior was not a cause for women to leave science (Seymour &

Hewitt, 1994). Social isolation and lack of satisfactory interactions with faculty have been associated with students who leave the university (Brozovsky, 1996).

Many of the deterrents to active participation in the fields are subtle, but recent research has begun to shed some light on persistence of women in these fields. Persistence rates are significantly lower for women in science, mathematics, and engineering majors (Seymour, 1995). Blacks and women are less likely to obtain degrees in engineering, mathematics, and computer science than whites and males (Pugh, Hand, & Prather, 1987). Research has shown that there is no difference in persistence rates where the performance scores of men and women in science, mathematics, and engineering are the same. Despite good academic performances, women reported experiencing diminished self-esteem, self-confidence, and career ambitions. These same women reported feelings of alienation or depression which played a critical role in their decisions to leave these majors (Ginorio et al., 1993; Strenta et al., 1993). These findings are consistent with Arnold's (1987) study which found that self-esteem and career aspirations of high-ability high school seniors decreased for women by their sophomore year. During the same time frame, the self-esteem and career aspirations of their male peers increased.

Seymour and Hewitt (1994) report women switched majors due to another major offering greater intrinsic interest or educational experience, becoming "turned off to science," poor teaching by faculty, and feeling overwhelmed by pace and load that the curriculum demanded. These young women enrolled in college with less clear views of what they wanted out of college. Their parents were more likely to support career changes than were parents of male students. Women were also more likely to permit themselves to change than were men and were more likely to be supported by family and friends in their decisions to change than were men. Men were as likely to be affected by the "freshmen weed out" as women. Women were more likely to ask for help, however, and to ask for that help earlier than men. Negative experiences with faculty in overt as well as subtle ways influenced the women to feel unwelcome and to desire to leave the majors. A common response of the women in reaction to dealing with the constant attacks on their self-confidence was to appear as plain and neutral as possible in order to appear invisible, to be just "one of the guys." Seymour and Hewitt explained the behavior and counter behavior of the men and

women in a conceptual framework as the collision of two very different social systems, with the male social system being inherently more powerful than the female social system. The women went from good feelings about high performances in high school, good SAT scores, and encouragement from teachers, family, and friends to feelings of isolation, insecurity, intimidation, and wondering if they were good enough to continue (Widnall, 1988). Their lack of contact with other women in their field made it difficult for these young women to make sense of their new experience and discomfort. The experience of the “challenge” which is accepted so easily by men was new and obscure to the women. They were not used to having to “prove” themselves all of the time. The women felt they needed faculty who cared about them, advised them on the quality of their work, gave encouragement or chided them when necessary, and supported them through difficult times. Since withholding personal counsel or encouragement from freshmen until they have been through the weed-out process appears to be a moral imperative with science, mathematics, and engineering faculty, it is not likely that women or men will be engaged in a personal faculty-student pedagogical relationship (Hewitt & Seymour, 1994). Women, particularly, have not been taught not to take such rejection personally. Failing to encourage women can have the same effect as discrimination for women (Freeman, 1979; McIlwee & Robinson, 1992). The professors who did not welcome the women were unable to disregard their achievements, even though many of them did it grudgingly (McIlwee & Robinson, 1992).

Tinto's (1987, 1993) Model of Institutional Departure supports the theory that positive academic and social integration supports persistence within the institution. Experiences which reinforce the goals of the students and strengthen students' commitments to the institution contribute to the chances for student success. Otherwise, the negative social and academic experiences such as negative faculty interaction enhance the likelihood of the student's departure before graduation. Classroom learning is mediated by what happens outside the classroom (ACPA, 1994).

#### Need for Research

Although the experience of women students in male-dominated majors has been widely studied, most of the studies have focused on quantitative methods and have focused on the initial choices of the students entering these majors. Rea and Strange (1983) report a

general pattern of incongruence for students in cross-gender majors that seemed to be more of a female phenomenon. Males in female-dominated majors appeared to be as satisfied as females in those majors. They hypothesize that females' expectations to experience difficulties in proving themselves capable in addition to their doubts about their choices in male-dominated fields may be well-founded. They attribute the "novelty" effect being positive for men and negative for women to the unusual amount of attention and interest which occurs with these students. In other words, do men thrive on the attention and women do not? They begged further study for more conclusive results.

Women tend to lower their educational aspirations during college and leave those majors which are considered male-dominated (Holland & Eisenhart, 1990; Jacobs, 1986; Lettman, 1981; Schnabel, 1993; Vollmer, 1983; Seymour & Hewitt, 1994). Schnabel (1993) identified six categories which influenced the female student's affirmation of self, leading to the decision to leave the male-dominated field: (a) classroom environment, (b) faculty behaviors, (c) peer relations, (d) performance pressures, (e) role expectations, and (f) curriculum content. Self-affirmation through supportive environments during the college experience was found to be an important variable (Lips, 1984, 1988, 1992). There was also some evidence to support the theory that modest aging for women as they mature in college may be a factor in the decision to leave or stay in a college major.

As gender boundaries blur, it is important to gain new knowledge about how individual male or female students make informed career decisions and profit from the experience of their educational choices. Exploring the motivations and career aspirations and decisions of students enrolled in male-dominated majors can provide new knowledge which can lead to greater understanding of the student who is planning his/her educational and career goals for successful experiences in the college environment. Making informed choices and having access to all majors will lead to greater personal and financial success for all students. More importantly, knowledge gained in this study can help us understand how women make choices and act upon those choices. The persistence of occupational segregation is disturbing. Information gained in this study will enable advisors, counselors, faculty, and other university officials interested in student development to design strategies to assist in that decision making in a planned, supportive environment. The research project

was designed to help in understanding women's choices of majors so that they may proceed in whatever field they choose. Knowing that they can be successful and participate as equals with the men in their fields, women may begin to level the playing field and change the status quo of unequal participation. Some of the barriers to success may be reduced or removed.

## Chapter 3

### Methods of Research

This chapter describes the study design, the population, the instrumentation, the procedures for data collection, and the methods for analyzing the data.

The design of the study was an exploratory investigation of the factors associated with student career aspirations, women's choices of male-dominated majors, and satisfaction with those majors. The investigation was exploratory and interpretive in nature, and many of the assumptions of factors associated with women students' choices of majors and career aspirations, including self-esteem, were used to construct the survey. Sophomore women enrolled full-time for the Spring, 1996, semester at Virginia Polytechnic Institute and State University who as freshmen had initially majored in specific agriculture, architecture, arts and sciences, business, education, and engineering majors were included in the study. These specific majors were considered to be male-dominated using Zuckerman's (1981) ratio of two-thirds to one-third sex ratio of students in a given major. In this case, the ratio for women in male-dominated majors was one-third women to two-thirds men. Sophomore women students who had chosen male-dominated majors as entering freshmen were mailed a questionnaire to inquire if they were willing to participate in the study. The questionnaire is included in Appendix A.

Initially, two focus groups were conducted to collect data for the development of the interview protocol. One protocol-setting focus group consisted of successful career women, the majority of whom were members of a professional higher education group, the Virginia Identification Program (VIP) for the Advancement of Women in Higher Education Administration. The VIP women were selected to participate in the protocol-setting group for their proximity to Blacksburg. The second protocol-setting focus group consisted of women graduate students who were enrolled for Spring, 1996, semester in a Gender and Work class at Virginia Polytechnic Institute and State University. Based on the shared experiences of both groups of women, the questions for the interview protocol and the interview guide were developed for use with the sophomore women student focus groups (McCracken, 1988). The Interview Guide and the Interview Protocol are included in Appendix B and C.

Sixty-two sophomore women students who agreed to participate in the study were interviewed in eleven focus group sessions of two to eleven students each to ascertain what

factors were involved in their selection of a male-dominated major and their experiences with their choices to remain in or to leave the male-dominated major. An analysis of the data collected from interviews with students pursuing male-dominated majors was made to explore the factors and establish conceptual categories of the data.

### Use of Focus Groups

Focus group (Fern, 1982; 1983; Krueger, 1994; Levy, 1979; Morgan, 1988) explorations were used to obtain experiences in choice and pursuit as well as the decision to leave or remain in a male-dominated major. Focus groups have been used successfully in qualitative research to study ideas in group context, allowing a researcher to observe a large amount of interaction on a given topic in a limited amount of time (Morgan, 1988). Participant constructs gave meaning and definition to the investigation being conducted (LeCompte & Preissle, 1994).

Focus groups have several distinguishing characteristics involving a group of similar people who provide data of a qualitative nature about a particular subject. The groups needed to be small enough for everyone to have an opportunity to participate freely and large enough to give a diversified opinion. Krueger (1994) recommended five to seven persons be included in each focus group. However, experience of the researcher both as a group leader as well as a focus group participant allowed her to include more participants for a total of two to eleven participants in each group. A series of group interviews was necessary since one group may not have been responsive or may have yielded extraordinary data which would not be typical of other group interviews with the same mix of diversity. Student availability was the key factor in the make-up of the focus group sessions.

### Population Sample

Sophomore women students who had originally chosen male-dominated majors as entering freshmen were chosen from the sophomore class at Virginia Polytechnic Institute and State University. The majors considered male-dominated for Virginia Polytechnic Institute and State University were:

*Agriculture:* Agriculture Technology, Crop and Soil Sciences, Animal and Poultry Science

*Architecture:* Building Construction, Industrial Design, Landscape Architecture

*Arts and Sciences:* Computer Science, Economics, History, Philosophy, Physics

*Business:* Economics

*Education:* Secondary Education Technology

*Engineering:* Aerospace, Civil, Chemical, Computer, Electrical, Engineering Science, Industrial and Systems, Mechanical, Mining, Materials and Science, Ocean

History is a male-dominated major at Virginia Polytechnic Institute and State University. The history of the college as a male-only institution with a military corps of cadets coupled with the college's expertise and interest in Civil War history helps to explain this phenomenon.

Students who returned the survey and indicated their willingness to participate in the investigation were invited to one of eleven focus group interviews. At the time of the invitation to participate, it was not known precisely how many focus groups would be needed to obtain sufficient data to establish patterns of responses and categories of data. However, ten groups appeared to be an appropriate number to gain the necessary information. The students were randomly assigned to groups according to their availability to participate in a focus group at a particular time. Each participant was given \$10 as an incentive to participate. Students were also given food as an incentive to participate.

#### Multivariate Analysis

A short survey (see Appendix D) was administered to the focus group participants at the end of each session. Participants were asked to respond to the importance of factors relating to the choice of male-dominated majors. The results of the survey were analyzed using Multidimensional Scaling (hereinafter abbreviated to MDS). MDS is a family of models in which information from a set of data is represented by a set of points in space. For example, the relationship between a set of (n) variables contained in a correlation matrix can be spatially represented by showing each variable as a point, placing the points in such a way that the distances between the points reproduce the numerical values of the correlation coefficients. Thereby, a picture is reproduced which is a visual representation of the data in (n-1) dimensions (Colon, 1982; Everitt, 1974; Krusal & Wish, 1991; Shepard, Romney, & Nerlove, 1972). The MDS technique used the numerical values to produce a "map" of the student responses in a reduced set of dimensions (Kruskal & Wish, 1991; Shepherd, 1962). The MDS data analysis was done through ALSCAL (Young, Takane, & Lewyjkyj, 1977) in SAS. This produces a matrix where the rows are the original variables and the columns are the reduced dimensions. The cells

are the coordinates of the rows which give their position as a point in the reduced space. Based on the coordinates or points in the reduced space, items were clustered based on Ward's hierarchical clustering procedure. Ward's method, which uses a minimum variance criteria, joins clusters with a small number of observations and tends to produce clusters with roughly the same number of observations. This method of hierarchy assumes multivariate normal mixture, equal spherical covariance matrices, and equal sampling probabilities. The Ward method is also very sensitive to outliers (Milligan, 1980; Ward, 1963).

A three-dimensional model was obtained for the survey data. The model was used to develop clusters of similar responses from the students about their pursuit of male-dominated majors, satisfaction with those majors, and career aspirations.

The use of both qualitative and quantitative research methods strengthened the research design (Krueger, 1994). The researcher was able to triangulate the data from the literature, the focus group interviews, and the survey data to check the consistency of the findings and to make recommendations to the university for further investigation (Denzin, 1978).

#### Procedures for Data Collection

The study was conducted during the Spring, 1996, semester. Sophomore women were recruited early in the semester using a questionnaire sent to sophomore women who had originally chosen a male-dominated major in agriculture, architecture, arts and sciences, business, education or engineering as entering freshmen. Students who had returned the questionnaire indicating their willingness to participate were then contacted to set up appointments for the group interviews. Contacts were made by telephone, electronic mail, and mail. Eleven groups of two to eleven sophomore women were then interviewed with the protocol established from the protocol-setting focus group material. (See Appendix B for the Interview Protocol.) Students were given the opportunity in each focus group to tell the researcher what factors were associated with their choice of male-dominated majors and what factors led to their remaining in those male-dominated majors or choosing to leave the male-dominated major for a traditional major. As the focus groups were held, the researcher analyzed the data from the groups to ascertain conceptual categories or themes of responses. Additional focus groups were conducted until there were no new negative cases (Glaser & Strauss, 1967). Negative cases meant no new responses were emerging. Seeing and hearing multiple instances of the same

responses led the researcher to conclude that a reasonable data response had been obtained and the focus group sessions were discontinued (Miles & Huberman, 1984).

### Focus Group Interviews

Focus group interviews were held for the purpose of finding answers to the research questions of variables associated with the choice of male-dominated majors and the decision to remain in or to leave those majors if dissatisfied and to discover new questions as the research project was conducted (Jacob, 1987). During the group interviews, the women students were encouraged to tell their own stories in their own words on their own terms. This method gave the researcher a glimpse into the world of the participants, allowing for an opportunity to step into that world if only for a short period of time. Entrance was gained to glance into the total social and cultural context of the sophomore women being interviewed (McCracken, 1988). Questions were asked to ascertain what factors are associated with women choosing a male-dominated major and what factors are associated with the satisfaction to remain in or to leave that male-dominated major if they were dissatisfied with the choice. Each group interview lasted for about an hour and a half as the researcher explored the complicated worlds of the women students who spoke of their experiences with career aspirations and their choices of male-dominated majors. Questions were asked to verify student experiences and choices, exploring the extent of the women students' satisfaction or dissatisfaction with their choice of major. Probing, open-ended questions, and prompting strategies were used to get clarification from the participants as they told their own stories (McCracken, 1988).

The researcher gave a brief introduction to the research project at the beginning of each focus group. Each student was asked to sign a consent form to participate in the study. The interview protocol questions were placed on posters around the wall. Each student in the group was given a stack of 3 by 5 cards with a marker. Students were then asked to write their responses to the set of questions contained in the interview protocol. After they had written their responses on 3 by 5 cards, the students were asked to write their responses to each question on the appropriate poster. Questions were explored one at a time until all of the protocol questions were explored. Students were encouraged to give as many responses as they wished. Then the students were asked to share their experiences relating to the responses. The researcher used probing questions such as "What does this mean?" and "Tell me about that response" to elicit

additional data from the participants. Each student was given several opportunities to express her thoughts and experiences. A final invitation was given to students to make sure that none of their experiences were unnoted and that each response was given a place on an appropriate poster. The focus group inquiries were conducted until theoretical saturation was achieved (Glaser & Strauss, 1967). Strauss and Corbin (1990) concluded that theoretical saturation is completed when there is no new data forthcoming from the group, the paradigm elements are accounted for, and the relationships among the categories are validated and well-established. At the end of each focus group session, the participants were asked to complete a 25-item survey (see Appendix D) responding to the importance of 25 factors relating to the choice of male-dominated majors. Students were allowed to eat their food.

Each focus group interview was tape-recorded. Transcriptions were made of each recorded focus group interview by a paid transcriptionist. The transcriptions of the focus group interviews provided a paper copy of each focus group interview to give additional credibility to the data collection process. For example, the student comment was “When I was in junior high school there was a consulting engineering counselor representative who came to recruit high school students for engineering degrees, and they really, really played up the money aspect of it.” This comment was coded to the High Income category of responses. Another example of coding procedures was a comment from a student: “Oh, there are so many opportunities for women engineers. And they’re putting so many more; women are taking engineering classes. The field is so wide open.” This comment was coded in the Career Opportunities category of responses.

The researcher used the constant comparative analysis method borrowed from Glaser and Strauss (1967) to develop the themes from the focus group interviews.

The Interview Protocol was constructed using the following questions:

1. Describe the factors associated with a woman's choice of a non-traditional, male-dominated major. (A non-traditional major for women is a major in which men outnumber women with a ratio of two to one.)
2. Describe the meanings, experiences, and motivations which influenced your choice of a male-dominated major.
3. Describe the factors which influenced your decisions and motivations to remain in or to leave that male-dominated major.

4. What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major.

Additional questions were used to probe for other factors which were important in the women's choices to remain in or to leave their male-dominated majors. The probing questions were:

Can you describe an example of that?

Was this an isolated experience or do you think other students have had this experience?

What about this experience makes it especially significant for you?

Did this decision affect your career aspirations?

Was this a negative or positive experience?

What would you have done differently?

What would you recommend to other students who are considering this major?

As the information became redundant, the interviewer sought closure to the group. It was anticipated that each group would last not longer than two hours.

At the conclusion of each session, students were asked to complete a brief survey (see Appendix D). The survey was constructed which consisted of the following items: participation in advanced classes, confidence in their ability, support from family, relevant enrichment activities, teacher/counselor recommendations, internships and practicum experiences, summer jobs in the male-dominated field, mentoring or shadowing experience, female role models, faculty support, effective advising, positive campus climate, participation in professional groups, computer experience, social support, career opportunities, same-major roommate, familiarity with terminology, peer support, media influence, desire to make a difference, easy to make good grades, high school related career activities, high income, and changing majors would take too much time. Students were asked to rate the items on a Likert-type scale, giving higher rating to experiences which would be beneficial to women enrolling in male-dominated majors. Students were asked to rate their likeliness of receiving a degree in the major, working in the major, and recommending the major to other women.

After the students completed the survey, they received their incentives for participating in the project. The student signed to receive their cash incentive. The interviews were concluded.

### Methods for Analyzing the Data

As each focus group session was completed, the researcher then began the process of synthesizing the data into recurrent themes or patterns. These themes were considered the conceptual categories (Strauss & Corbin, 1990). The researcher reviewed the written expressions of the students from the cards and posters, listened to the tapes of the focus group interviews, read the transcriptions, noted the similarity in responses, and established a theme for each of the response categories (McCracken, 1988).

The researcher tallied all of the student responses into a frequency count matrix. The student responses were then classified into themes for each group of responses that were similar. As focus group interview data were coded into the meaningful themes, it was possible to keep it faithful to a systematic and precise set of procedures based on research questions (Strauss & Corbin, 1990). The criteria for a category or theme was set to keep all similar responses into a meaningful expression of a student response. Since the investigation with qualitative data was exploratory, the exact manner in which the investigator was to travel from data to observations to conclusions in the data analysis was not known prior to the investigation. The objective of the analysis, then, was to ascertain the categories and relationships that form the participants' experiences in male-dominated major choices and career aspirations (McCracken, 1988).

The researcher invited the original VIP women who served as the initial focus group to come together again to review and refine the data. Three of the four members of the original VIP group in addition to three campus administrators participated in the VIP II group to reach consensus, provide recommendations, and to make decisions concerning the data in a Delphic-like group process. Delphic groups have been used successfully with people who are experts or have knowledge in finding possible solutions (Krueger, 1994).

The researcher was able to triangulate the data from the three areas of research--the literature review, the focus groups, and the survey--to make some inferences with reference to advising women students in male-dominated majors. Retention efforts and student outcomes assessment personnel were then able to gain valuable information concerning student success or lack of success in male-dominated majors.

### Summary

The design of the study was an exploratory investigation using focus groups interview and survey data. The population for the study was sophomore women students enrolled for spring semester at a rural state university who had originally chosen specific agriculture, architecture, arts and sciences, business, education, and engineering majors and their choices to remain in or to leave the male-dominated major. The investigation began with two protocol-establishing focus groups to ascertain questions to be included in the group interview protocol with the students. In a series of eleven focus group interviews, the participating sophomore women shared their career aspirations, experiences and motivations in choosing college majors and their decisions to remain in or to leave a male-dominated major. Experiences in choices of male-dominated majors and decisions to remain in those majors if dissatisfied with the choice were explored in focus group interviews. At the end of each focus group interview, a short survey was administered to each participant asking for opinions regarding experiences related to the choice of a male-dominated major. The collected focus group interview data were analyzed for themes or categories of choices in career aspirations following the research methods of Levy, (1979), Krueger (1994), Strauss and Corbin (1990) and others. The survey data were then plotted on a graph using MDS (Colon, 1982; Krusal & Wish, 1991; Shepard, 1962; Shepard, Romney, & Nerlove, 1972). MDS gave the researcher a three-dimensional picture of the data instead of an inference (Young & Hamer, 1987). Visual inspection of the graphs greatly aided in the interpretations of the student responses. Slowly spinning the visual data led to additional theoretical-type insight on the part of the researcher (Johnson & Wichern, 1992) concerning the success or lack of success for women in male-dominated majors. A Delphic-like group (VIP II) was invited to review and to refine the data. The researcher used the profile of the student interview responses, survey data responses and a review of the literature to triangulate the research data into meaningful recommendations and connotations from the research project (Kruskal & Wish, 1991). The data containing the student accounts of their own experience were seen in a new light epitomizing the theoretical debate embodying career aspirations, choice of college majors, and satisfaction with the choice of a male-dominated major.

## Chapter 4

### Findings

Information in this chapter is divided into three parts. Part 1 describes the focus interview groups, the general observations of the researcher for each of the focus interview groups, and the responses to the four research questions. The student responses to the research questions are discussed. A chart listing frequency counts for the responses to each of the interview questions is presented. The responses are then collapsed into themes and later to clusters of related responses to items. The clusters were identified in the MDS procedure administered to the survey data. The analysis of the multivariate procedure using MDS for the survey data is detailed in Part 2. The data are refined in Part 3 using the results of a Delphic-type group of professional women.

#### Part 1

##### Description of Focus Interview Groups

During the spring semester of 1996, a questionnaire was mailed to 149 sophomore women at Virginia Polytechnic Institute and State University who had originally chosen a male-dominated major as entering freshmen in the fall semester of 1994. It should be noted that students who had left the major and/or the university during the freshmen year were not available to be included in this survey. Students were asked to return the questionnaire if they were willing to participate in a focus group interview. Two weeks later, a post-card reminder was mailed to the students who had not responded. Ninety-eight students or 65.7% returned the questionnaire indicating their willingness to attend a focus group session. Each student was then invited to come to Squires Hall on one of several specific dates to participate in a session. Students were allowed to participate in any session which fit their class schedule. Invitations were issued by e-mail or telephone with a follow-up letter by mail. A total of 62 students participated in eleven groups. Fifteen of the 62 students had left the original major with 47 students either remaining in the original or another male-dominated major which is consistent with Astin, Korn, Sax, and Mahoney (1994) in which some women switch to other male-dominated majors. An average of five students participated in each group with two being the lowest number of participants in a group and 11 being the highest number of group participants. Table 1 shows the number of participants in each group. There were no new responses after the fifth focus group interview, but the researcher held six additional

groups to increase the numbers of participants who, in addition to the focus group interview, completed a short 25-item survey (see Appendix D).

#### Focus Group Interview 1

The six participants in group one had decided to remain in the major. They were determined to persevere and they “refused to lose.” The women were focused, animated, and vocal. They quickly engaged in lively discussions and were expressive in their views.

#### Focus Group Interview 2

Group 2 members were very reflective. They were introspective and thoughtful about their decisions. Only one had chosen to leave, but others had considered the possibility. They appeared to realize their vulnerability in the classes, but were seeking the respect of fellow students and professors.

#### Focus Group Interview 3

Group 3 was in transition. The researcher could observe students making decisions that day. One of the students had made a decision that very day, based on insight gained in a self-expression pottery class. She was positive she had made the right decision to leave the male-dominated major. There were several expressions of “If I stay....” Only two of the students were very sure they were staying. One woman was sure she was going to be an astronaut and another quite emphatic that she would become an engineer.

#### Focus Group Interview 4

One woman in Group 4 was known to the researcher. The discussion was enriched with many examples of the students' experiences in the male-dominated majors. One woman told of a supportive professor and how he had accepted her different ways of thinking and increased her self-confidence. Although they had struggled their first year, these women were determined to stay and prove that they could do it. One woman did recommend that “all engineering professors should be made to read this study since Tech is a big school and cannot get by with much discrimination.” She felt that the university would not be allowed to discriminate against the women students without being accused of violating federal laws.

#### Focus Group Interview 5

Group 5 participants were very definite in their choices. Those remaining were adamant about staying and those leaving were adamant about leaving. The two students who were leaving

Table 1

Number of Participants in Each Focus Group Interview

Group	Remainers	Leavers	Total
1	6	0	6
2	7	1	8
3	5	2	7
4	3	0	3
5	2	2	4
6	5	3	8
7	7	4	11
8	5	1	6
9	2	0	2
10	1	2	3
11	4	0	4
Total	47	15	62

talked about not leaving because of grades. One woman stated a female professor encouraged her to stay, and the other woman did not get along with her advisor. Both left because they did not like it; it was not worth their effort. All participants were vocal and had good communication skills. One student expressed some parental “encouragement” to stay in the major, telling her “there’s always Education when she failed a test,” meaning that he would be disappointed with her if she did not complete an engineering degree. Education as a major was not held in high esteem by her father.

#### Focus Group Interview 6

The women in Group 6 were intense in thought and emotion. They were challenged with the notion of a focus group centered on their thoughts and feelings about their choice of major. The five women remaining were serious and enthusiastic about their ambitions and goals. The women who had chosen to leave were equally serious about career choices, but confident they had made good decisions about leaving the original major. One woman wrote at the end of the group, “I found this very enlightening to hear the thoughts of other women in technical fields.” One woman tended to dominate the conversation, but yielded when gently prodded by the researcher to let others express their views. One woman had limited social interaction skills. She told the group that her parents had warned her to stay away from boys. She answered all of the questions with “stay away from boys” answers. The other group members were amused at first, but they quickly realized she was socially inexperienced and did not make fun of her nor treat her poorly. They rolled their eyes at times and were uncomfortable at other times, but they were kind and pleasant to her. At the end of the group, the women quickly left the room, which was in contrast to the other groups of women who stayed to talk and socialize with each other.

#### Focus Group Interview 7

Group 7 was informal. The caterer brought the food early and the students ate during the group instead of at the end of the group. The group articulated its choices and motivations clearly and enthusiastically. Seven women were remaining in the male-dominated major, and four were leaving. One woman was determined to become an astronaut. Engineering was the means to get her to her career goal. Others were just as determined to become engineers. One of the leavers described her motivations for leaving as “insipid professors and students.” The other woman who had left the male-dominated major agreed with the description.

### Focus Group Interview 8

Five of the women in Group 8 were remaining in the male-dominated major. Only one woman had chosen to leave. Two women in this group expressed blatant harassment and discrimination in vivid details. Both had complained and had received administrative help in resolving the issues. The two women encouraged other women to report harassment and discrimination, believing there would be support from the Engineering Dean and others in the College of Engineering. The unpleasant experiences had made the two women wiser and more competent in dealing with such instances. Both of the women remained in the male-dominated major.

### Focus Group Interview 9

Group 9 consisted of two women. There were no other women who could meet at that particular time for a group. The researcher decided to proceed with the group since the two were enthusiastic about participating. There was more time for each of the two women to share experiences and motivations. The group tended to become a moderator-participant format rather than the researcher model in a focus group (Morgan, 1988), one of the pitfalls of focus group inquiry. The two women were contemplating daily their decisions to stay in the major. Both admitted that they had daily thoughts of leaving the major. One of the women had difficulty with computers. She had limited computer experience and wished she had taken computer classes in high school. Frustration with computers was one of the factors in her decision to stay or leave the major.

### Focus Group Interview 10

Group 10 had three participants. One of the three was remaining in the male-dominated major. For the other two, lack of girlfriends and friends in general was their motivations for leaving. The two leavers had 3.7 and 3.9 GPAs and were not leaving because of grades. They thought they were not being challenged. Nothing was "hard" for them in the major; they just found life difficult without friends.

### Focus Group Interview 11

The four women in this group as well as the researcher were weary at this point in the semester. There were two weeks left until exams. The excitement, however, of being two weeks of away from the end of the year and being half way through engineering was noteworthy. The

four women were all remaining and were all happy to have made it that far. These four women appeared to be mature in thoughts and actions.

In summary, the eleven focus groups were successful in eliciting articulate and seemingly honest answers from the women students. Students were enthusiastic about their participation in the groups and expressed a desire to continue the groups. The researcher was able to use her many years of counseling experience to draw out additional information and clarification from the students. Consistent with the findings of Arnold (1995), these women had high achievement and abilities; they could have chosen any field that they wished to pursue.

### Discovering Themes

A number of factors associated with the choice of a male-dominated major and the decision to remain in or to leave the major were discovered during the literature review. However, the researcher used the exploratory nature of this study to guide the decision to let the participants list factors from their own experiences.

During the focus group interviews, the participants were asked to list the factors associated with their choice of a male-dominated major as well as the factors related to their decision to remain in or to leave the study. The participants listed the factors on 3x5 note cards. The cards for each focus group interview were then used to list all factors for each of their three questions:

Question 1: Describe the factors associated with a woman's choice of a male-dominated major.

Question 2: Thinking of your own experience, describe the meanings and motivations which influenced your choice of a male-dominated major.

Question 3: Describe the factors which influenced your decision to remain in or to leave that male-dominated major.

Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?

The researcher used the cards, the tapes, and the transcripts to make a list of all responses to all three questions. The list (see Appendix E) was the first grouping of the responses and was used as a report to the Office of Outcomes Assessment which provided funds for the research project. The responses were reviewed, compared, and collapsed to give the first grouping of

significant themes for the student responses. The researcher listed each different response as a theme. A frequency count of themes was completed. Table 4.2 displays the responses to each of the four research questions. A theme was counted when a student mentioned a response for the first time.

### Discussion of Responses

*Question 1: Describe the factors associated with a woman's choice of a male-dominated major.*

The women overwhelmingly reported **interest in the field** as the most frequent response. There were a total of 44 responses of **interest in the field**. The students felt one should do what one enjoys and what one wants to do “regardless of the obstacles.” Many of the women spoke of how much they enjoyed the major and their desire to make a career out of it. Some were “curious,” some reported being “intrigued,” but all of them stated that women chose male-dominated fields because of their interest in the field. Interest in technology was described by one woman when asked by the researcher about what interested her in the field. Others agreed that technology, logical reasoning, computers, problem-solving, math, and science were the key interests. None of the women thought that women chose male-dominated fields just because the majors were male-dominated. In fact, most reported not realizing that their choice of major was a male-dominated field. Several of the women reported being interested in a male-dominated career such as engineering at a very early age.

**Career goals, jobs, and income** were the second most frequently used responses. Every group except Group 1 listed **career goals, job opportunities, and income** as important factors in the choice of a male-dominated major. When asked to describe these factors, the students talked about good job opportunities, companies being interested in hiring more females, and reported better chances of getting high-income jobs. Money was a big factor to these young women. The women also reported that family members encouraged them to go where the money is. There was evidence that the material wealth or money influence of decision making toward male-dominated majors was high. One woman stated she did not want her children to grow up in poverty. Another, reacting to the present corporate culture of downsizing, said she needed a career which would allow her choices if she were let go from a job at any early age as her father had been just prior to her coming to college.

Table 2  
 Frequency of Factor Responses by Group

Factors	Frequency of Responses in Each Group											Total
	1	2	3	4	5	6	7	8	9	10	11	
<i>Question 1: Describe the factors associated with a woman's choice of a male-dominated major.</i>												
Interest in the field	2	5	4	2	5	5	10	5	1	3	2	44
Career Goals, Jobs, \$\$\$		6	2	1	5	4	11	2	1	4	2	38
Challenge, Determination, & Perseverance	5	5	2	6	1	4	3	1		1	4	32
Ability and experience in the field	2	6			6	4	2	3	1			24
Self-Confidence	1	8	1	1		2		6		1	1	21
Desire to make a difference	2			3	1	1	1		1			9
<i>Question 2: Thinking of your own experience, describe the meanings and motivations which influenced your choice of a male-dominated major.</i>												
High school experiences	3	5	2	7	4	6	2	6	3	2	2	42
Challenge/career/job opportunities/\$\$\$\$	2	4	8	3	5	9	1	5	1	1	2	41
Family Influences	4	6	2	2	3	7	1	4		1	1	31
Personal strengths	6	7	3	2	4	4	1	2				29
Dreams of becoming engineer	1		8		1	4		2		3	3	22
Desire to make a difference	1	1	4	2	4		1				1	14

Table 2, *continued*

Factors	<u>Frequency of Responses in Each Group</u>											Total
	1	2	3	4	5	6	7	8	9	10	11	
<i>Question 3: Describe the factors which influenced your decision to remain in or to leave that male-dominated major.</i>												
<i>Students Remaining in the Major</i>												
Enjoyment of major/field	5	3	2	2	3	4	5	3	1		4	32
Prove I can do it	2	3		4	1	2	5	2	1	1	4	25
Support from family/friends	1	4	1	2	1	2	2	1	1			15
Ability to do the work successfully	2	1	1		1	1	1	3				10
Helpful professors/advisors	2	1	1		1			1	1			7
\$\$\$\$\$	1	3				1			1			6
Desire to make a difference	1							1				2
Extra time to change					2							2
<i>Students Leaving the Major</i>												
Frustration/intimidation/tired of having to prove myself		2	4		3	3	9	3		2		26
In it for wrong reasons/didn't enjoy/didn't have personality		1	5		1	5	5			3	1	21
Intimidation from professors/other students					1	2		1				4
Grades/extra time to change majors		1				1	1			1		4

Table 2, *continued*

Factors	Frequency of Responses in Each Group											Total
	1	2	3	4	5	6	7	8	9	10	11	
<i>Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?</i>												
High confidence-building experiences	2	4	2	4		13	9	7	1	2	6	50
Experiences that require perseverance, determination and quality of effort	2	9	3	3		5	11	5		2	8	48
Exposure to "male" interests/ability to relate to men	5	5	3	1	2	1	2	2		1	6	28
Assertiveness training	1			2		7	7	3		3	1	24
Communication skills	1	1	1	2	1	3	4	2		3	2	20
Strong background in science, math & computers	4	2			1	2	1	2	2	1	2	17
Good role models/learn to network			3		4	2	1		3	1	2	16
Obtain good career information	1	2	2	1	4	1	2			1	2	16
Seek support from friends, family, and others		2		2	3	1	3	1				12

Note. It was not possible to separate remainers and leavers into homogeneous focus groups because of the student schedules.

The overwhelming tone of the responses in **challenge, determination, and perseverance** responses was a “refuse to lose” attitude. Thirty-two responses were in this category, but the tone was forceful enough to make this the dominant theme in the focus group interviews. One woman explained it, “I am too stubborn; It is not going to get me.” There was a challenge theme as well. Students reported having to work harder to achieve equal recognition with the men. The women also recognized the need to persevere to achieve their goals in a male-dominated field.

**Ability and experience in the field** responses were noted as some sort of ability or talent to perform successfully in the male-dominated major. One woman noted, however, that these are all factors which go toward deciding to enter any major, male-dominated or not. Knowledge, proficiency, and success in classes were frequently mentioned when the students were describing what they meant by ability and experience.

**Self-confidence** was mentioned in 21 responses. By self-confidence, the students meant independence, motivation, discipline, desire to prove one's self, determination, confident of your ability to succeed in that major, being comfortable with one's self, and “confident enough in who you are to pursue your interests.” Students also went further to explain that this was an opportunity to do very well and if you did not, it might be blamed on your being female. Ability to accept criticism, to face prejudices, and to tolerate a high level of discomfort were also mentioned as facets of self-confidence. In other words, students felt a strong, secure personality that does not discourage easily was essential.

**Desire to make a difference** was listed by nine students as a factor in woman's decision to choose to male-dominated major. One of the students stated that you would get to make useful things when you grow up. Other students reported that they would like to design solutions to everyday and no-so-everyday problems. Another student wanted to be part of a global as well as a local issue problem-solving situation. Usefulness as well as giving back to society were the supporting themes in these responses.

*Question 2: Thinking of your own experience, describe the meanings and motivations which influenced your choice of a male-dominated major.*

**High school experiences** were noted in 42 of the responses to Question 2. High school

classes in math, science, and computer programming were frequently mentioned. Advanced placement courses were cited as motivating factors. Enrichment activities such as engineering and computer camps, internships, research activities, magnet school experiences, and work experiences were listed as having influenced decisions to choose a male-dominated major. Teachers and counselors were mentioned as persons who suggested and encouraged careers for these women. Others said their parents' careers had greatly influenced their choices.

Forty-one responses to Question 2 were related **to challenge, career and job opportunities, and opportunities to make high incomes.** "I was always told I could do whatever I put my mind to regardless of gender," was the response of one of the women, but many echoed the same idea throughout the group. Prestige, pride, and the opportunity to break stereotypes were also expressed by the participants. "I have three brothers, and I want to do the same thing they do. I was never treated any differently from them. My father believed I would be an excellent engineer." Others stated that parents wanted them to have a "practical" major to be able to get a good job.

**Family influences** were stated by 31 women as factors which influenced their decisions to choose a male-dominated major. Engineering tended to run in the families of these women. Many of them reported that fathers, brothers, and sometimes, mothers were engineers. "My parents loved it when I said I wanted to do engineering" was a common response. "Women in my life were always very strong so I had a lot of support," stated one woman. Many also thought engineering was expected of them. One woman said she received her father's encouragement and "expectations." When asked what that meant, she stated that her father encouraged her, but he also expected her to become an engineer. They also stated that they thought their parents would be very disappointed if engineering was no longer their major. Some of the women reported being in competition with a brother in engineering; "I wanted it too," was a common reaction.

**Personal strengths** were listed by 29 women as motivating factors to choose a male-dominated major. Good math and science skills were the personal skills most often mentioned. Enjoying working with computers and being able to program computers were also high priorities on the personal strengths list. Problem-solving skills and understanding concepts were important to these women. "Respect for and liking the laws and organization of math and science" were skills noted by one participant. "I want to learn how to manipulate hard and software," stated

another woman in the study. One woman noted that at the end of high school, she reflected on the subjects which she was good at, and what she enjoyed was math, physics, and science, which pointed her in the direction of engineering. The women also stated that they needed a challenging field so that they would not be bored.

**Dreams of becoming an engineer** were reported by 22 women in the study. Many of the women reported that they could remember that they wanted to become an engineer in the early elementary grades. "My fascination with it describes all of my motivations," stated one woman. "It's what I always wanted to do," said another woman. "This is the only major I ever wanted since high school. I went to Governor's School, and I got past wanting to be a trauma surgeon because it didn't fit the lifestyle I wanted." "I chose engineering," stated a participant. She added, "It was my only interest, and I didn't plan on allowing anything to stand in my way."

**Desire to make a difference** was listed in 14 responses to Question 2. "This will give me a chance to make a contribution to the state of the world and living conditions of people, flora, and fauna," stated one of the women. Another woman stated she enjoyed science concepts and thought patterns, and she thought she could make more of a difference with an engineering degree. Several of the woman had chosen environmental engineering to make a difference in the environment. "After seeing a woman engineer head a team for a project I did with the Navy Research Lab, I was sure that engineering was for me and that I could make a difference," explained one woman.

*Question 3: Describe the factors which influenced your decision to remain in or to leave that male-dominated major.*

Responses from students remaining in the field:

The most frequent response to the question from those women remaining in the major was **enjoyment of the major or field**. Thirty-two women gave these responses. The students described their experience as a "great challenge and experience." "I love my department....I like it...I love math and science" were common answers. "I stay because of my passion for it. It doesn't bother me that there is not a 50/50 ratio." The students reported that no other major got them excited. "I'm staying even though some of my classes are beyond me...because I like the department a lot." The women reported being motivated to continue to learn more in their major classes.

**Prove I can do it** was given as a response by 25 of the students. The women were adamant in their refusal to lose. These remaining students really want to prove to themselves more than to parents, mentors, or friends that they can do it and be successful in their male-dominated majors. They admitted to being stubborn enough to accomplish their goals. One woman expressed her sentiment as “personal satisfaction to get through a tough curriculum and do well.” Another said, “I will not let anyone tell me what I am and am not capable of, especially because I am female. Only I know what I can do.” “I’m learning valuable life skills, I’m being challenged, and I don’t want to give that up,” reported another woman. When asked what she meant by valuable life skills, she added that life skills were the relationships to how one lives one’s life.

**Support from family and friends** was given as a response from 15 of the women. The supporting relationships for these women were their reasons for staying in the male-dominated major. Some of the women had found female friends outside of the major. “I made some engineering buddies both male and female to share experiences with, study with, [and] complain with.” I made many good male friends--now don’t get the wrong idea.” These women who were remaining had peers, family, and some professors who helped them in times of distress. Having male friends appeared to be a positive influence since many of the women reported that many or most of their friends were male. Parental support was evident, also. “My parents were encouraging and didn’t push too hard.” Others reported, “Friends encouraged me to stick it out.”

**Ability to do the work successfully** was the response given by 10 students. Other students seemed to take this statement for granted. These students were self-selected in very restricted academic areas which would explain their assumption that a student had to have the ability to do the work or she would not be in the major.

**Helpful professors and advisors** was the response given by seven of the participants. The students who made these choices had experienced positive encounters with professors and advisors. “I enjoy my classes and my professors,” stated one woman. “Great staff. Helpful professors, advisors, and teaching assistants. I love my department,” added another woman. “The women in high positions in the [engineering] department have been helpful. They didn’t really motivate me to stay, but rather they helped reassure me that what I was doing was right.” “It showed me the world can be fair,” explained another student. “I had a very nice and supportive

advisor,” was another comment. “My EF (Engineering Fundamentals) teacher promised engineering wouldn’t be as much of a weed out [of unqualified candidates] after the first year,” said another student who was remaining in the major. It should be noted here that two of the women remaining in the male-dominated majors had experienced severe harassment from professors and colleagues. It is interesting to note that they remained in the major. Both stated they had received support and assistance immediately following the incidents. One woman said administration officials helped her, particularly a woman in an administrative role. The other woman said her experience occurred in a work environment for a cooperative experience. Supervisors quickly dealt with the offending colleague.

Six responses were in the **money** and income category with the remaining students. They were staying for the money they could earn. Similar to the responses in Questions 1 and 2, these women admitted to a materialistic reason for deciding to remain in their male-dominated major. These students thought they would be successful quickly and quickly make a lot of money.

Two of the responses to question 3 about motivations to remain in the major were about a **desire to make a difference**. The students’ desires to make a contribution were expressed in phrases such as “I can see myself doing ChE (Chemical Engineering) for the next 30-35 years and can face the continuous challenges, and I desire to remain in a field that would help solve problems that society and industry face today through design.” Another woman commented, “The job in the end will satisfy all of the hard work. I’ve learned the importance of engineering.”

Two of the women who were remaining in the major were not staying because they were satisfied with the major. They were remaining because it would take **extra time to change majors**. One woman commented that she was going to change majors, but she did not when she learned it would require another year to graduate. Another woman stayed because she had received in-state tuition for tuition this year and she would have to pay additional tuition in another state for an extra year if she transferred.

Responses from students leaving the field:

**Frustration, intimidation, and tired of having to prove myself** were the most common responses to Question 3. Twenty-six responses were in this category. Students described being intimidated, less motivated, tired, and feeling that they did not want that stress for the rest of their lives. “I also became tired of always having to prove myself,” the woman stated. Many students

talked about being overwhelmed and under too much pressure. The atmosphere was very competitive and too much work for too little rewards. One student described how she felt like a cog. Another student described her experience, "I did not enjoy the classes, ...kind of like torture. I was bored and began being very apathetic toward my grades...considering that grades are very important to me, that was a sign that something was wrong." Another woman said she was tired of putting up with the teachers, particularly her academic advisor, telling her that women did not belong in this field. "And, since I wasn't happy in this major, I didn't want to deal with their hassling me. I just couldn't see me doing this for the rest of my life," she commented further. Added to the frustration and hassle was the fact that most of these women were number 1 or 2 in their high school classes, and now everyone here was from that selective group. Several students reported that much of their frustration came from computers. Either they were not prepared for computer work or just did not like computers. One student told of her frustration with orientation and the explanation with computer experience. During orientation, she had been told not to worry if she was inexperienced with computers. She would be taught how to use them and would learn in class. "Well, when I got here, someone brought this computer box and set it down in my room and left. The guys down the hall helped me unpack it and hook it up. I didn't even know how to turn it on. When class started, I was behind from day one because the most of the other students already knew how to program." She asked that the researcher please tell the orientation person to tell the students the truth that they would need to know how to use computers.

Twenty-one students reported they left the male-dominated major because they felt they were **in it for the wrong reasons, they didn't enjoy it, or they didn't have the personality for it**. One student commented, "I couldn't imagine doing something I disliked for the rest of my life." Several students told of their dislike for computers. One said, "I don't want to go blind looking at a computer terminal." Another student said, "Will I be working at that job for the rest of my life or is a family important to me?" One woman said, "math got dry and boring the more I learned." "I was not willing to take a bunch of classes I would hate in order to get to the fun mechanical stuff," another related. One student felt she was in it for the wrong reasons and that she did not have the personality or thought processes for it. When asked what was the usual definition of a wrong reason, the answer was usually money. They were in it for the money, and it just was not worth it. One student said the negative attitudes were more from male students

rather than teachers. "However," she stated, "both participated." One student said she felt as if she were always asking the wrong question. Grades were the reason for some students leaving, but not for the majority of those leaving. "I had a 3.0 GPA and didn't get along with my advisor. It was a white male thing." "I had a 3.6 GPA and could see that it was not what I wanted to do....just something I did not enjoy," stated another. Some of the other students in the focus group interviews were quite surprised to learn that some of the students who had left the male-dominated majors had higher GPAs than the students still enrolled in the male-dominated majors.

Four students felt they were leaving the major due to **intimidation from professors/other students**. "I felt the teachers were rude and cold," stated one student. Another response was, "Most of the professors I had were not very helpful, and I did not care for what they were teaching."

Four students gave the response that **grades or extra time required to change** majors was their motivation for leaving the major. Grades were a significant reason for these few students, but overall, students leaving the male-dominated majors reported that their GPAs were 3.0 and above. The effort required for the GPA seemed to be more of a factor to leave rather than the end result of the GPA. Students who left the male-dominated major reported that it just was not worth the effort.

*Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?*

Fifty of the participants thought **high confidence-building experiences** were important experiences for a woman to have prior to considering a male-dominated major. Students described these experiences as perseverance, ability to deal with chauvinism, and ability to ask for help when needed, even if regarded as a "clueless female." Other responses to this theme included confidence in her ability, "strong in her decision in order not to get discouraged," independence and ability to study on one's own, and high tolerance level for failure. Additional students responded with the ability to "be prepared to have everyone/everybody trying to knock you down...very few people want you to succeed," and the ability to talk with professors about learning opportunities. Students responded with other comments such as the ability to seek the support that is out there for women....it's out there ...you just have to seek it, and ability to deal

with failure....you will fail something...just deal with it, ability to seek out other females, and any other experience that gives a woman self-pride and respect. One woman summed up her thoughts, "Stand up for yourself when someone tells you that you don't belong in that major." Another woman said, "A women will have experiences that may knock her down mentally and emotionally so that it is necessary that she, herself, must be the one to comfort herself and pick herself back up."

**Experiences that require perseverance, determination, and quality of effort** were responses given by 48 of the women in the focus group interviews. Students described their meanings as activities such as "independence, determination, being able to challenge yourself, drive, and being prepared deal with competitiveness." "Refuse to lose is the best advice I can give," stated a participant. "Design in small successes," stated another woman. When asked to elaborate on that thought, the woman said, "You don't always have to go for the gold. Take the small successes on the way."

Twenty-eight of the responses to Question 4 were relating to experiences that lead to **exposure to "guy" interests and ability to relate to "guys."** Comfort level around males in their classes was of high interest to the women in the groups. One woman said, "Women who are considering male-dominated majors need exposure to what are considered traditional male interests: computers, competitions, and design groups." Prior experience of working with men in groups was very helpful for her. Another participant suggested that women should learn to feel comfortable in a room full of males and recognize that both males and females have strengths and weaknesses and that their minds work differently. "Learn to be comfortable with yourself and who you are....you will not always be taken seriously by men in the field," stated a woman. "And don't single yourself out as a female among males...you are just another student, struggling with different facts just like everyone else." Several of the women suggested that there will be extensive interactions with guys, and that it helped if they "kind of understand where the "guys" are coming from in certain situations. Men have difficulty in male-dominated majors, too. "Women should start trying to talk to guys on a professional level early on....not just on a social level"

**Assertiveness training** was recommended by 24 of the women who participated.

Speaking up, asking for help, standing up for one's self, and finding the support systems were all suggested by the women as ways to enhance one's ability to deal with a male-dominated major. The students who were assertive appeared to be dealing with the problems they were facing. "If a woman is shy, she should definitely take an assertive class," was the advice. "She should learn to work with and deal with men. Many of them [men] are raised to believe that a man is always right or has some sort of upper hand on the woman, particularly in this area of the country." Another woman thought that "a woman should learn to deal with men who believe the woman's place is in the home and who believe that men are always right and superior to women."

Twenty students gave **communication skills** as significant experiences for women to have as they enroll or consider male-dominated majors. Ability to ask questions, seek help, and relate to men were valued skills

Women should have a **strong background in science, math, and computers**. In addition to an intensive study of math and science, women need to know computers and programming skills. They recommended that women considering engineering or another male-dominated field be told in orientation or sooner that they will need to know how to use a computer and that programming skills would be very helpful. The women also suggested that they be allowed to purchase their computers prior to the beginning of fall semester to take advantage of learning how to use them.

The use of **good role models and ability to network** received 16 responses. Students who had good role models spoke enthusiastically about the positive effects of those persons. Science teachers, females in the major field, and female engineers were some of the role models students had found. Networking with their mentors and other females in the field was seen by the women as a good way to learn to talk with both male and female professionals in their field and to find others interested in their fields of study. Having people to answer their questions was an important resource for the women.

**Obtain good career information** was given as a response by 16 women. The students thought that good career information was necessary to have correct information about the majors and to know what to expect from that major and what one could look forward to in the career. Not all women had experienced good career information. Television and other media often give a glamorous view of careers, and some students said that they might have chosen other fields if the

career information had been more informative. Several of the women recommended that information about careers be given to prospective students so that better decisions could be made prior to the start of a college career.

Twelve of the students gave the response that students should **seek support from family, friends and others** to assist them in their pursuit of a male-dominated major. Asking for help and support was recommended by many others, also.

## Part 2

One of the engaging aspects of this study was to analyze the survey completed by the focus group participants by using a Multidimensional Scaling (MDS) technique as a non-parametric alternative to Factor Analysis. The MDS procedure reconstructed the distances between the responses in space to produce five clusters in a three-dimensional space. The three underlying constructs are dimensions which represent exclusivity with either/or belief categories. If a student agreed with the belief at one end of a dimension, then she was excluded from another category of beliefs at the other extreme. The factors are presented as dimensions in space.

### Multidimensional Scaling

People have been classified into types since ancient cultures. Frequent characteristics for classifying people have been gender, race, physical and behavioral characteristics, personality types, and political ties. Many scholars in higher education have developed typologies of college students based on personality, interests, values, and behavior (Astin, 1993; Clark & Trow, 1966; Holland, 1966, 1973; Katchadourian & Boli, 1985; Newcomb, Keonig, Flacks & Warwick, 1967; Schumer & Stanfield, 1966; Warren, 1966). Distinguishing the similar from the dissimilar is the method by which all real knowledge is sought, according to Linnaeus' General Plantarum, first published in 1737 (as cited in Everitt, 1974).

In this study, classifying the student responses by similarities was done to search for natural groupings of like items for the survey data (Everitt, 1974). The survey, which was given to the focus group participants, was used to investigate the factors deemed important experiences for women considering or enrolled in a male-dominated major. There were 25 items in the survey in addition to measures of major, which included original major and current major as well as measures of intent, which included the intent to remain in the original major or to leave the original major. A Likert-type scale was used to measure the likelihood of a student to agree with

the survey item. The means and frequencies of the survey items are presented in Table 3. Pearson Product Moment Corrections were computed (see Appendix F). MDS and cluster analysis were used to interpret the items for Table 3.

MDS computes the best way to reconstruct the pair-wise distances between the items of the survey while simplifying the relationship between the items (Hair, Anderson, Tatham, & Grabrowsky, 1984). The procedure is used to obtain a simplified distance matrix between the entities, or groups of items on the survey or scale following common procedures (Everitt, 1974). Pearson product moment correlation coefficients were computed between the 24 variables in the survey for the measurement of similarity, and these correlations were converted to distances between the items (see Table 3). The distances represent a 24 dimension space which was reduced to a three-dimensional space using MDS. Based on the reduced distance, the items were formed into five scales or clusters.

Ward (1963) recommends a minimum-variance method in which the distance between two clusters is the ANOVA sum of squares between the two clusters computed over all the variables. This method was used since it tends to join clusters with a small number of observations and is strongly biased to producing clusters with roughly the same number of observations. The method is very sensitive to outliers (Milligan, 1980). The correlations (see Appendix F) were computed to measure a standardized similarity between items. These similarities ( $r$ ) were converted to distances ( $d$ ) based on  $d = (1-r)$  where the largest difference is 2 and the smallest is zero. Because of the lack of confidence in the interval nature of this index, the distances between pairs of items were ranked for each row and these rankings were used in the Multidimensional Scaling procedure. The results of the MDS technique indicate the appropriateness of a three dimension solution. Table 4 presents the stress values which were used for the three dimension solution which was the best fit for the data. The decision to use the three dimension solution was confirmed by the ability to interpret the dimensions. Each Dimension is described in terms of the loadings of the original items (see Table 5).

Kruskal's stress values (see Note), as represented in Table 4, indicated that the three-dimensional solution was the best fit. The stress for the three-dimensional solution was .24686 and the squared correlation (RSQ) of the original distances and the reconstructed distances was 0.804. This decision was based on the changes in stress where the range from 3 dimensions to 2

dimensions (.09977) was much larger than the change from 5 dimensions to 4 dimensions

Table 3

Frequencies, Percentages, & Means of Survey Items for Experiences Considered Important for Women in Male-Dominated Majors

	ITEM	R L	Disagree	Disagree	Undecided	Agree	Agree	Mean
			Very Strongly				Very Strongly	
1	AP CLASSES	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
		L	0	0	0	3 (20%)	12 (80%)	4.8
2	CONFIDENCE	R	0	0	0	3 (6%)	44 (94%)	4.9
		L	0	0	0	3 (20%)	12 (80%)	4.8
3	FAMILY SUPPORT	R	0	1 (2%)	2 (4%)	14 (30%)	30 (64%)	4.5
		L	0	2 (13%)	0	6 (40%)	7 (47%)	4.2
4	ENRICH ACTIVITIES	R	0	4 (9%)	9 (19%)	16 (34%)	18 (38%)	4.0
		L	0	1 (7%)	2 (13%)	8 (53%)	4 (27%)	4.0
5	TEACHER RECOMMENDATION	R	1 (2%)	7 (15%)	8 (17%)	25 (53%)	6 (13%)	3.6
		L	0	3 (20%)	2 (13%)	9 (60%)	1 (7%)	3.5
6	INTERNSHIPS	R	0	4 (9%)	7 (15%)	18 (38%)	18 (38%)	4.1
		L	0	0	2 (13%)	8 (53%)	5 (33.3%)	4.2
7	SUMMER JOBS	R	0	7 (15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
		L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
8	MENTORING	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
		L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
9	FEMALE ROLE MODELS	R	0	4 (9%)	8 (17%)	17 (36%)	18 (38%)	4.0
		L	0	0	0	9 (60%)	6 (40%)	4.4
10	FACULTY SUPPORT	R	0	1 (2.1%)	4 (8.5%)	21 (44.7%)	21 (44.7%)	4.3
		L	0	0	5 (33.3%)	5 (33.3%)	5 (33.3%)	4.0
11	EFFECTIVE ADVISING	R	0	1 (2.1%)	8 (17%)	19 (40.4%)	19 (40.4%)	4.2
		L	0	0	1 (7%)	12 (80%)	2 (13%)	4.1
12	POSITIVE CLIMATE	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
		L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
13	PROFESSIONAL GROUPS	R	1 (2%)	7 (15%)	10 (21%)	23 (49%)	6 (13%)	3.6
		L	0	2 (13%)	6 (40%)	4 (27%)	3 (20%)	3.5
14	COMPUTERS	R	0	3 (6%)	4 (9%)	14 (30%)	26 (55%)	4.5
		L	0	1 (7%)	0	4 (27%)	10 (66%)	4.5
15	PEER SUPPORT	R	0	4 (8.5%)	1 (2.1%)	20 (42.5%)	22 (46.8%)	4.3
		L	0	0	1 (7%)	4 (27%)	10 (66%)	4.6
16	CAREER OPPORTUNITIES	R	2 (4%)	4 (8.5%)	12(25.5%)	15 (32%)	14 (30%)	3.7
		L	0	4 (27%)	3 (20%)	5 (33%)	3 (20%)	3.5
17	SAME MAJOR ROOMMATE	R	3 (6%)	20 (43%)	6 (13%)	9 (19%)	9 (19%)	3.0
		L	1 (7%)	6 (40%)	4 (26.6%)	4 (26.6%)	0	2.7

Frequencies, Percentages, & Means of Survey Items for Experiences Considered Important for Women in Male-Dominated Majors, *continued*

ITEM		R	Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
18	TERMINOLOGY	R	0	4 (9%)	11 (23%)	26 (55.3%)	6 (12.7%)	3.7
		L	0	3 (20%)	3 (20%)	7 (47%)	2 (13%)	3.5
19	SOCIAL SUPPORT	R	2 (4%)	8 (17%)	7 (15%)	17 (36%)	13 (28%)	3.2
		L	0	1 (7%)	5 (33%)	6 (40%)	3 (20%)	3.7
20	MEDIA INFLUENCE	R	5 (11%)	19 (40%)	16 (34%)	7 (15%)	0	2.5
		L	0	8 (53%)	5 (33%)	1 (7%)	1 (7%)	2.7
21	CONTRIBUTE TO SOCIETY	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
		L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7
22	EASY GRADES	R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
		L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1
23	H.S. CAREER ACTIVITIES	R	1 (2%)	7 (15%)	8 (17%)	20 (43%)	11 (23%)	3.7
		L	0	1 (7%)	1 (7%)	8 (53%)	5 (33%)	4.1
24	HIGH INCOME	R	4 (9%)	12(25.5%)	12(25.5%)	18 (38%)	1 (2%)	3.0
		L	0	5 (33%)	5 (33%)	4 (27%)	1 (7%)	3.1
Crit 1	CONFIDENT DEGREE	R	0	1 (2%)	0	5 (11%)	41 (87%)	4.9
		L	1 (7%)	0	0	2 (13%)	12 (80%)	4.6
Crit 2	CONFIDENT JOB	R	0	2 (4%)	7 (15%)	12 (26%)	26 (55%)	4.3
		L	0	1 (7%)	0	6 (40%)	8 (53%)	4.4
Crit 3	LIKELY RECOMMEND	R	1 (2%)	3 (6%)	10 (21%)	12 (26%)	21 (45%)	4.0
		L	5 (33%)	3 (20%)	6 (40%)	0	1 (7%)	2.3

Note. N = 62    R =Remaining(47)    L =Leaving(15)

Table 4  
S-Stress and R Square Statistics for 1-5 Dimensions

Statistics	Dimension				
	5	4	3	2	1
Stress	.13488	.18983	.24686	.34663	.54223
R Square	.927	.879	.804	.681	.412

(.05495) and from 4 dimensions to 3 dimensions (.05703). The stress for the three-dimensional solution was .24686 and the squared correlation (RSQ) with the original distances and the reconstructed distances was 0.804.

The item loadings for the three dimensions are shown in Table 5. Dimensions are primarily based on the items with the highest loadings with the intent to identify the characteristic which best differentiates between those items with the high positive loadings versus those items with the highest negative loadings. Those students with beliefs at the highest weights at the end of each dimension think those items are the most important while students with beliefs at the lowest end of the dimension think those items are the most important. It is important to point out the exclusivity of beliefs since students who believe one thing are excluded from another belief.

Using the three dimensions, the items were clustered as shown in Figure 1. The results of the cluster analysis on the three dimensions are shown in Figure 2 and Figure 3. The five final clusters were used based on the change in the Between Sum of Squares relative to the Within Sum of Squares, the relative number of items in the clusters, and the interprobability of the results. The items, identified with the other items in their cluster, are shown based on their dimension weights.

Figure 2 compares Dimension I-Time of Experience and Dimension II-Motivation. There is a single cluster of items at each extreme of the dimensions except for the negative end of the Dimension II-Motivation. Those who consider both Self-fulfillment and Career Rewards to be more important would tend to have a very negative score on this dimension. Figure 3 compares Dimension I-Time of Experience and Dimension III-Career Rewards. This comparison shows that Dimension III separates Career Rewards from the other two clusters of Self-confidence and Self-fulfillment.

Note. Kruskal's Stress Formula:

$$\text{STRESS} = \left[ \frac{\sum_j \sum_k (d_{jk} - \hat{d}_{jk})^2}{\sum_j \sum_k d_{jk}^2} \right]^{1/2}, \text{ where the } d\text{'s are distances in the underlying metric space, and the } \hat{d}\text{'s are}$$

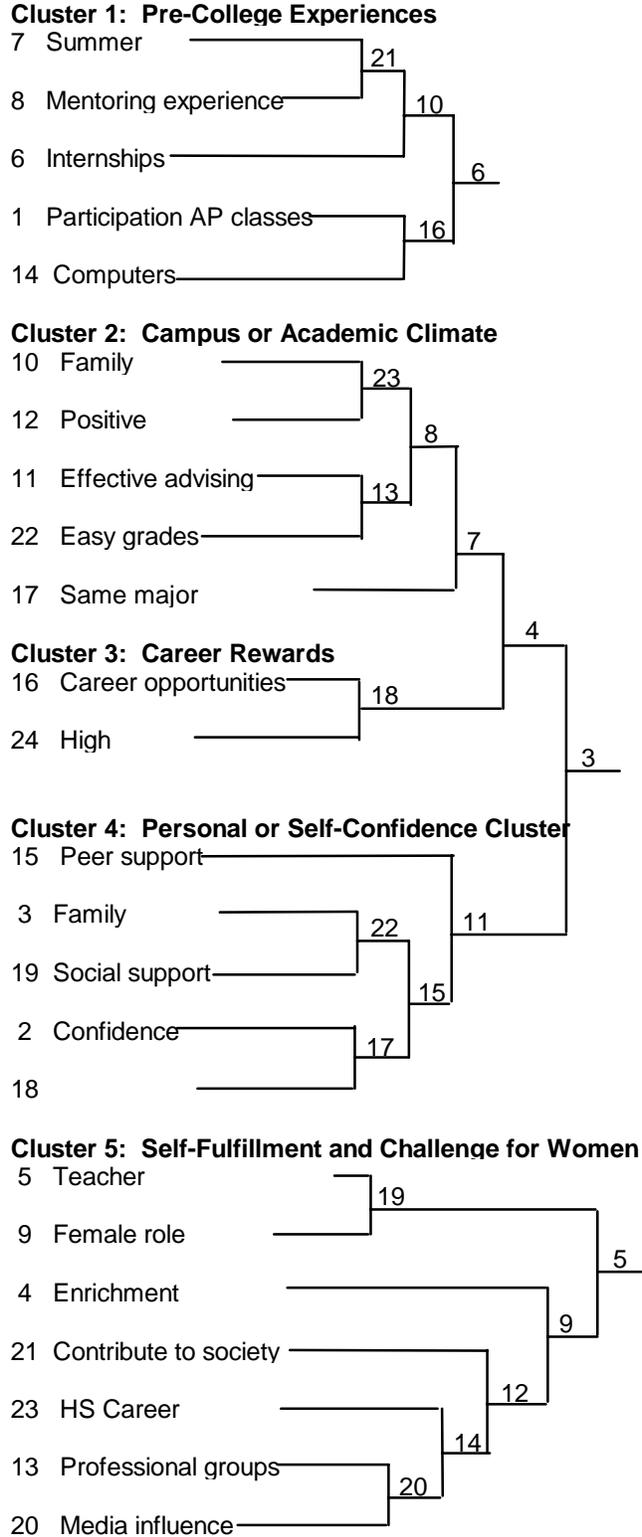
related to proximities data by a nonincreasing monotonic function. Another STRESS formula has now been incorporated as the standard form, which differs only in the normalization factor in the denominator (under the radical). It is normalized by dividing by  $\sum_j \sum_k (d_{jk} - \bar{d})^2$  rather than  $\sum_j \sum_k d_{jk}^2$ , where  $\bar{d}$  is the mean of the  $d_{jk}$ 's (Davies & Coxon, 1982).

Table 5

Multidimensional Scaling Stimulus Coordinates

Stimulus Item	Item	Dimension		
		Time of Experience	Motivation	Career Rewards
Participation AP classes	1	1.6806	1.20	1.0710
Confidence	2	-.6627	1.5980	-0.0683
Family support	3	-1.1128	1.0593	-0.46
Enrichment Activities	4	0.3267	-1.22	0.4870
Teacher Recommend.	5	-0.1009	-0.1475	-1.4917
Internships	6	1.8251	0.3126	-0.6280
Summer jobs	7	1.7270	0.4554	0.7232
Mentors	8	1.7325	0.1932	0.4627
Female role models	9	-0.0771	-0.7307	-1.3814
Faculty Support	10	-1.6580	0.1447	-0.34
Effective Advising	11	-1.4705	-0.8720	-0.1958
Positive Climate	12	-1.4896	0.2604	-0.3492
Profess. Groups	13	0.5745	-0.9727	-0.1443
Computers	14	0.9565	1.5379	0.9395
Peer Support	15	-0.0832	0.8876	-1.0883
Career Opportunity	16	-0.2568	-1.1383	1.9250
Same major Roommate	17	-1.6050*	0.4283	1.3788
Terminology	18	-0.2998	1.0768	-0.4022
Social Support	19	-0.8328	1.1604	-0.5328
Media Influence	20	0.5519	-1.4404	-0.4251
Contribution to Society	21	0.40	-1.2854	-1.2321
Easy Grades	22	-1.1487	-1.2452	0.6496
HS Career Activities	23	0.9540	-0.6878	-0.64
High Income	24	0.0626	-0.5746	1.7756

Note. \*Item 25 was not reported in the Cluster Model because it was the only one related to factors of time to graduate.



The numbers indicate the sequence of clustering steps where 23 is the first step which represents 23 groups; the next step (22) represents 22 groups, etc.

Figure 1. Model of Sequence for Joining Clusters Together

Dimension II – MOTIVATION: Self-Fulfillment to Self-Confidence

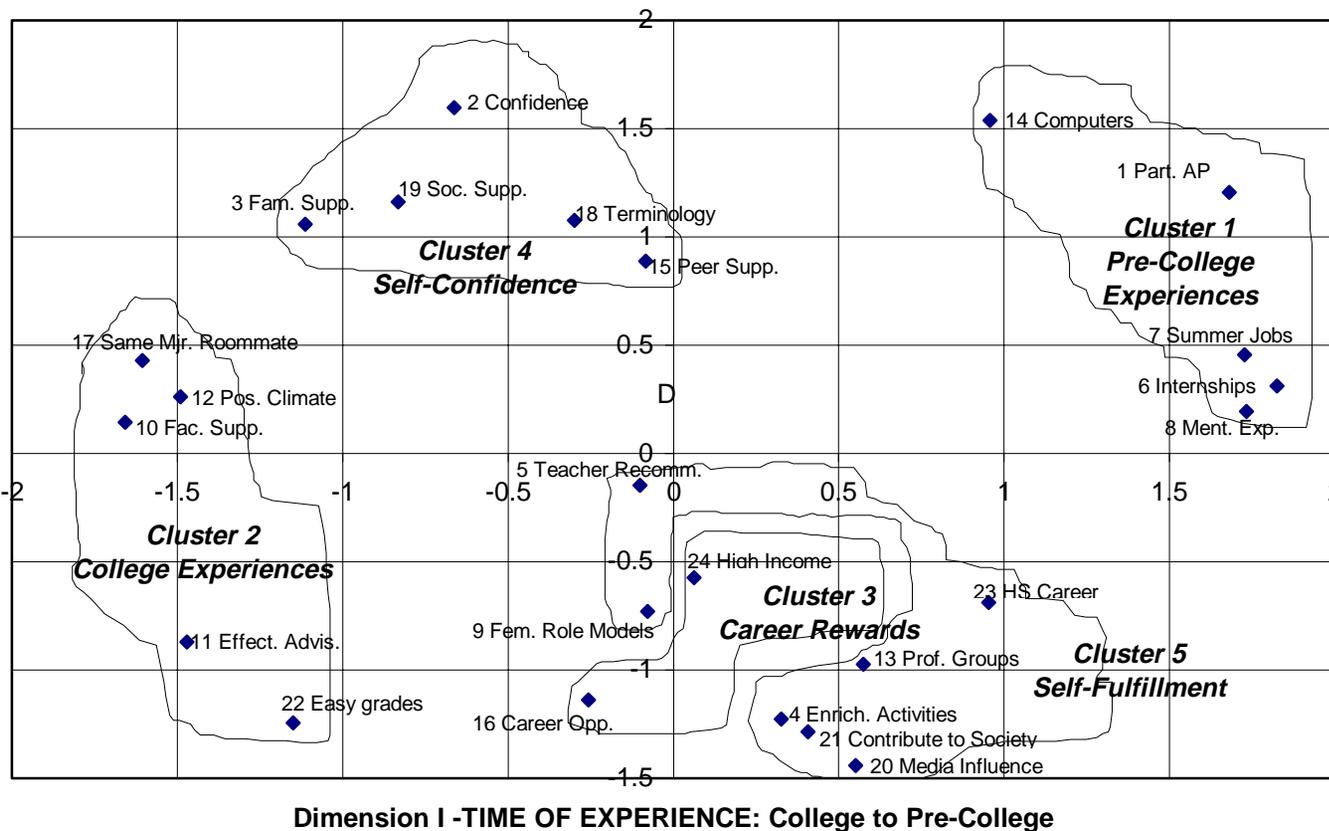


Figure 2. Stimulus Coordinates: Dimension I (x) vs. Dimension II (y)

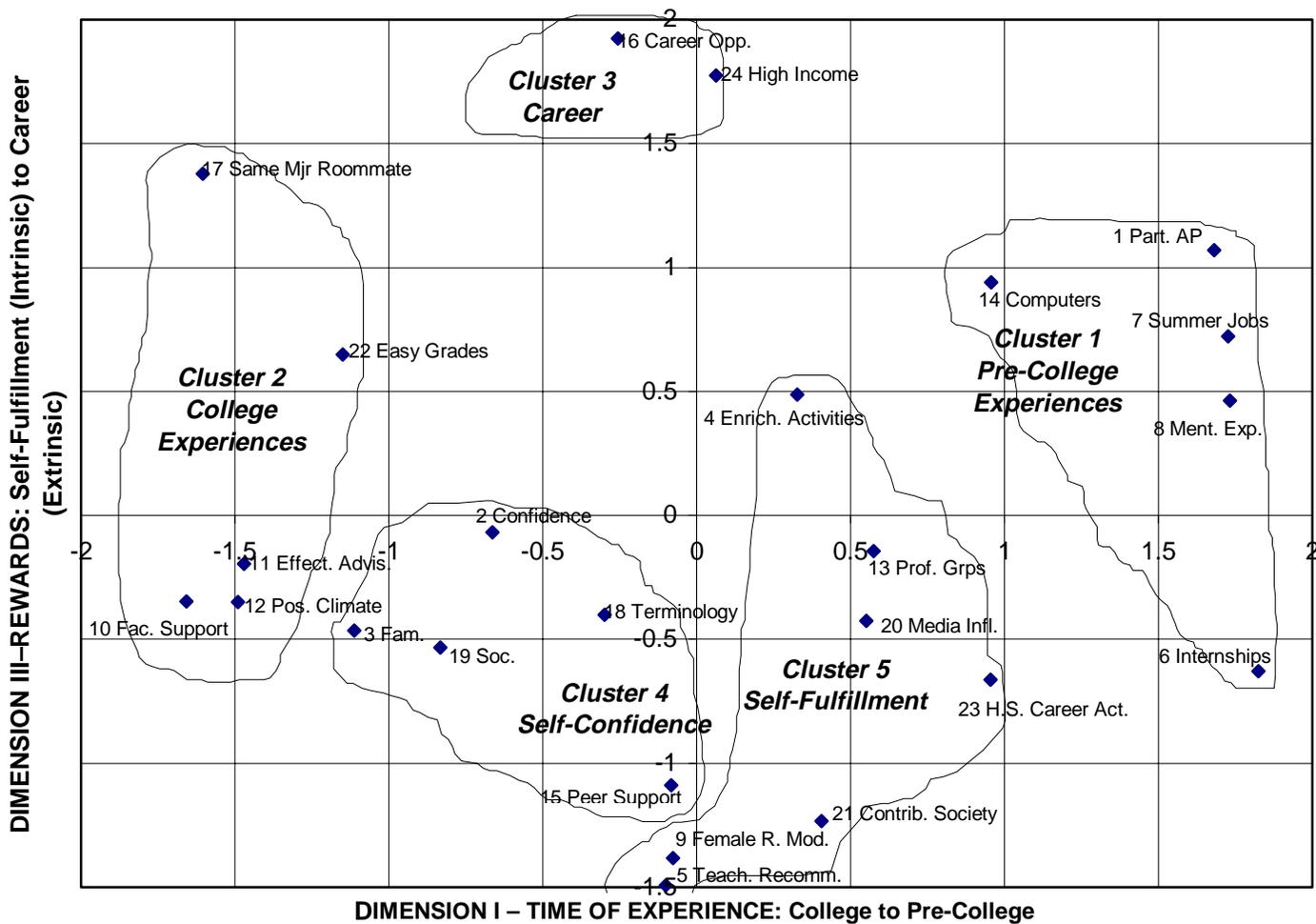


Figure 3. Stimulus Coordinates: Dimension I (x) vs. Dimension III (y)

Dimension I-Time of Experience best explains the pair-wise distance across items. These items account for the largest variance between the beliefs about experiences considered to be beneficial to women choosing to remain in or to leave a male-dominated major. Items with the most positive loadings for Dimension I-Time of Experience are Internships/Item 6 (1.83), Mentoring/Item 8 (1.73), Summer Jobs/Item 7 (1.73), and Advanced Placement Classes/Item 1 (1.68). Items with the most negative loadings included Faculty Support/Item 10 (-1.66), Same Major Roommate/Item 17 (-1.61), Positive Climate/Item 12 (1.49), and Effective Advising/Item 11 (-1.47). Those responses with the most positive loadings on Dimension I-Time of Experience reflected student beliefs that pre-college experiences such as internships, mentoring, summer jobs, and advanced placement classes were positive experiences for women choosing to enroll in male-dominated majors. Those responses for the group with the most negative loadings reflected student beliefs about college experiences that faculty support, same major roommate, positive climate, and effective advising were more important experiences for students choosing to enroll in male-dominated majors.

A possible explanation of these groupings of items along Dimension I-Time of Experience is the respondents' direct influence of pre-college career experiences compared to their limited or negative academic experiences in their college situation. The positive real-world experiences of the students contrasted to their theoretical or academic experiences may help to explain the groupings. Another explanation for the placement of the items along Dimension I-Time of Experience may include students' idealistic goals being compromised by the realistic side of the educational experiences. Their care-free, happy, and supportive environments from high school days may be being replaced with the isolation, insecurity, and self doubts that some college women experience (Widnall, 1988). The social learning theory of Krumboltz (1979) and Bandura (1982, 1986) may help to explain the college experiences dimensions. Having learned from the positive pre-college experiences in social settings such as internships, mentors, summer jobs, and advanced placement classes, the students may now find that their social supports are missing in the academic environment where the atmosphere is quite chilly for women (Sadker & Sadker, 1994; Sandler & Hall, 1987; Schnabel, 1993).

Items with the most positive loadings on Dimension II-Motivation were: Confidence/Item 2 (1.60), and Computer Experience/Item 14 (1.54). Items with the most negative loadings were

Media Influence/Item 20 (-1.44), Contribution to Society/Item 21 (-1.29), Easy Grades/Item 22 (-1.24), and Enrichment Activities/Item 4 (-1.22). Respondents at the positive end tended to believe that confidence and computer experience were beneficial experiences for a student to have. Students at the negative extreme of Dimension II-Motivation tended to believe that media influence, contribution to society, easy grades, and enrichment activities were more important as beneficial experiences for women in male-dominated majors to have.

Along Dimension III-Rewards, three items had substantial loadings: Career Opportunity/Item 16 (1.93), High Income/Item 24 (1.78), and Same Major Roommate/Item 17(1.38). Three items had substantial negative loadings: Teacher Recommendations/Item 5 (-1.49), Female Role Models/Item 9 (-1.38), and Contribution to Society/Item 21(-1.23). On Dimension III-Rewards, those respondents with the highest positive loadings tended to believe that career opportunities, high income, and having a roommate in the same major were important considerations for students choosing male-dominated majors. Those responses with the highest negative loadings represented student beliefs that teacher recommendations, female role models, and a making a contribution to society were important experiences for students considering or enrolling in male-dominated majors. One possible explanation for these negative groupings of responses is the lack of integration of academic and social experiences (Tinto, 1975; 1985; 1987; 1993). Students were very interested in making high incomes as soon as they graduate. Making a contribution to society was a lower priority than making a lot of money. Women tend to be poorer and making money is important to them because of their insufficient resources (Brainard, 1992).

In summary, Dimension I-Time of Experience reflects the time of the student experiences which range from college to pre-college experiences. College experiences were described as effective advising, same major roommate, easy grades, positive climate, and faculty support. Pre-college experiences were described as advanced placement classes, computer experience, summer jobs, internships, and mentoring experiences. Dimension II-Motivation included a range of experiences from self-fulfillment to self-confidence. Experiences of self-fulfillment included high school career activities, terminology, enrichment activities, media influences, and making a contribution to society. Self-confidence experiences included confidence, terminology, peer support, family support, and social support. Dimension III-Rewards included a range of

experiences from self-fulfillment or intrinsic rewards to career or extrinsic rewards. Self-fulfillment experiences were described as teacher recommendation, enrichment activities, female role models, making a contribution to society, high school career activities, and media influence. Career rewards included high income and career opportunities.

### Part 3

#### Refining the Data

In an effort to refine the data from the focus groups, the literature review, and the student survey, the researcher invited the original VIP women's group that served as one of the initial protocol-setting focus group (hereinafter known as the VIP II Group) to come together again to review and refine the data. Three of the four members of the original VIP Group in addition to three campus administrators participated in the VIP II Group to reach consensus, to provide recommendations, and to make decisions concerning the data in a Delphic-like group process. Delphic groups have been used successfully with people who are experts or have knowledge in finding possible solutions (Krueger, 1994). These six professional women have comprehensive backgrounds in the issues related to the study. The Interview Guide and Protocol are included in Appendix G and H, respectively.

Although there were risks to external validity and the process involved extra time and work for the researcher, the use of a Delphic-like group added closure to the grounded theory methodology used in the investigation.

For each of the four research questions, the following protocol was used in the VIP II group. The researcher gave a short review of the summary data from the student focus groups, the literature review, and the student survey. The Summary of Findings was given to each participant prior to the group in a spread-sheet format (see Appendix I). The group participants were given a short period of time to review their notes and the summary data. The participant discussion was centered around three categories: (a) themes that might be missing from the list given to them for this group; (b) themes that should not have been included in the information for this group; and (c) the most important themes. The group was then asked about the meaning of the most important themes and what, if anything, the university should do the findings.

#### Discussion of the Questions and Answers

*Question 1: Describe the factors associated with a woman's choice of a male-dominated major.*

The participants commented that family influences and role models were included by the students as responses in Question 2, but not in Question 1. The discussion centered around the fact that Question 2 was more personal, and, therefore, may have struck more of a personal chord than the global response to Question 1. One participant commented that these students may have thought that their experience was not common to all—almost as if the normal experience would not apply to them as in a monochromatic cultural experience which is typically linear, scheduled, and ordered, whereas a polychromatic culture was be more individualist and less ordered.

The participants felt very strongly that the student responses were the most valuable contributions to the study, and therefore, none should be excluded. They commented that the researcher should take intensity of responses into consideration, however, since she would know what experiences cut deeply into their motivations for remaining in or for leaving the male-dominated major.

The researcher shared with the group the intensity of the “refuse to lose” experience in the Challenge, Determination, and Perseverance theme. Another theme which received intensive discussion in the student focus groups, according to the researcher, was self-confidence. The students had shared their feelings that students wishing to be successful in a male-dominated major must have self-confidence to begin again after they failed a test or had a discouraging incident.

The participants listed the most important themes: the overwhelming importance of high school and home experience; and personality traits of self-confidence, perseverance, and “refuse to lose.”

*Question 2: Describe the meanings, experiences, and motivations which influenced your choice of a male-dominated major.*

The participants outlined the most important themes as: dreams of becoming engineer, contribution to society, and pre-college experiences.

“Dreams of becoming an engineer” was discussed. The group members felt that Contribution to society should be considered with this theme since the two themes were related. Many of the students had responded that their motivation for choosing a male-dominated major, according to the researcher, were to design solutions to everyday and not-so-everyday problems. Participants asked for clarification on the contribution to society theme about the motivations of

the students. The researcher was asked if the motivation appeared to be making a contribution to the community in a philanthropic way or as a bridge-builder. The researcher reported that the students were very aware of the potential lucrative income from engineering professions, but they reported they were more interested in the "bridge-building" type of contribution.

Pre-college experiences were very influential and merited discussion among the participants. The discussion centered around student experiences such as mentoring, internships, summer jobs, and other opportunities available to students. The influences of family were cited as being important by the participants.

*Question 3: Describe the factors which influenced your decisions and motivations to remain in or to leave that male-dominated major.*

The group did not choose to include additional themes. However, one participant suggested that Gary Downey's research at Virginia Polytechnic Institute and State University might be considered if additional information is needed.

At this point, the participants recommended the following themes be collapsed into broader, more comprehensive themes: challenge, determination, and perseverance and self-confidence into a self-confidence/refuse to lose theme; high school experiences and family influences into a pre-college experiences theme. Therefore, the most important themes would then become: (a) self-confidence/refuse to lose, (b) pre-college experiences; (c) frustration, intimidation, tired of having to prove myself; and (d) intimidation from professors, other students

. The group proceeded to discuss why some students chose to leave. One idea which emerged from the discussion was that the students may have found a way to meet their needs without harassment by switching to another major. The researcher shared a view that perhaps the students had moved to another level of intellectual development and were making decisions based on a new way of thinking (Belenky, et al, 1986; Gilligan, 1988; Kohlberg, 1981, 1984; Perry, 1981). However, she did point out that additional research would be needed to investigate that possibility. Another participant shared the research of Douglas Heath of Haverford College (1974; 1977; 1978) about students in honors programs: music and math show up early in the areas of intellectual development, and other fields may be equally strong but just emerge later.

The group discussed the issues involved in chilly climate and low faculty support for some students. They agreed with the literature that failure to encourage can have the same effect

as discrimination for women (Freeman, 1979). One administrator spoke of remarks from campus officials about the relative degree completion success rates to incoming students in that major. These remarks, even though factual, could be interpreted as particularly unsupportive of women students.

*Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?*

The group chose pre-college experiences as the most important theme for Question 4. The participants discussed the issue of computer use, experience, and information given to students about the necessity of knowing how to use computers. The researcher shared the student responses of students being given inaccurate information about the need to be computer literate. The engineering faculty member who participated in the group acknowledged the fact that students are given inaccurate information, but that she had been unsuccessful in trying to change the focus of orientation with her colleagues. She did inform the group about logistics confronting the engineering department of purchasing, negotiating computer prices for the university, and trying not to provide obsolete computers by purchasing them too far in advance of fall semester. Many students had requested the researcher share their concerns about getting the computer in a box when the semester starts and not knowing what to do with it.

The group consensus for the most important themes of the entire study included three themes: (a) self-confidence/refuse to lose—high confidence-building activities which promote the ability to survive the bumps along the way; (b) pre-college experiences and opportunities—including guidance and support from family members; and (c) interest and ability in the field.

The members of the groups concluded that the bumps or obstacles which a woman experiences when choosing a male-dominated field can be made smoother by high confidence-building activities, experiences that promote resilience in the women, and experiences that teach self-nurturing.

The VIP II group concluded with the following recommendations for the university:

1. Conduct a longitudinal study to provide information about all of the students' choice for choosing a male-dominated major and reasons for remaining or leaving the male-dominated study. This study was a small sample and did not include any students who had dropped out of the major and/or the university during their freshman year. It

should include investigation of the point at which the decision to remain in or to leave the male-dominated major is made.

2. Conduct a workshop for high school counselors to “Meet an Engineer” Inform them about engineering as a major and what engineers do. Give them examples for advanced placement classes. For example, explain why Advanced Computer classes would be more beneficial for engineering students than would Advanced Biology which most of the engineering students take now as high school students. Workshops would be helpful for Upward Bound students as well as elementary, junior, and high school students.
3. Recruit with a “You can change to world” theme, using opportunities for contributions to society as a carrot.
4. Provide support groups for women—Women in Engineering groups, etc.
5. Conduct an orientation for women to include mentoring experiences, role-playing what intimidation and harassment look and feel like, and coping strategies.
6. Avoid the stereotypic mind-set of engineering as a profession which has a reputation as the proverbial “chosen few” metaphor.
7. Train faculty in diversity.
8. Support the infiltration of women in administrative positions
9. Gain support from men in administrative and faculty positions who have daughters and are likely to see them discriminated against.

## Chapter 5

### Findings, Conclusions, Implications and Recommendations

This chapter will present an overview of the study, a summary of the findings, conclusions based on the findings, implications for this investigation, and recommendations for practice.

#### An Overview of the Study

The purpose of the study was to gain meaning and insight into the factors that influence a woman's choice to remain in or to leave a male-dominated major. Male-dominated majors were chosen using Zuckerman's (1981) ratio of two-thirds to one-third of men to women students in a major. Majors which were considered male-dominated at Virginia Polytechnic Institute and State University were specific programs in agriculture, architecture, arts and sciences, business, education, and engineering. Overwhelmingly, in this investigation, engineering was the most common male-dominated major.

To accomplish this investigation, eleven focus groups were conducted during the Spring, 1996, semester with sixty-two sophomore women at Virginia Polytechnic Institute and State University who had originally chosen a male-dominated major as freshmen in the Fall, 1995, semester.

Initially, the researcher used two focus groups to set the protocol for the student focus groups. The researcher invited a group of successful career women who were members of a professional higher education group, the Virginia Identification Program (VIP) for the Advancement of Women in Higher Education Administration, to participate in the first group. The second protocol-setting group was a Gender and Work graduate class at Virginia Polytechnic Institute and State University. Based on the shared experiences of members of both groups, the protocol was developed to use in the focus groups interviews with students. An average of five to six women participated in each student focus group. During the focus group interviews, the women were asked to describe the factors that influenced their choices of male-dominated majors and the meanings and experiences which influenced their decisions to remain in or to leave the male-dominated majors. The women enthusiastically participated in the exploration. At the end of each focus group, each participant was asked to complete a 25-item survey (see Appendix D)

of experiences that they deemed important for a woman if she was considering or enrolling in a male-dominated major.

Student responses from the focus groups were tape-recorded, transcribed, and analyzed. A frequency chart of student responses was constructed, and the researcher organized the student responses into themes or categories based on grounded theory methods (Glaser & Strauss, 1967). After the data were analyzed, the researcher invited the VIP group to review and refine the data in a Delphic-like (Kreuger, 1994) group (VIP II). The VIP II group was able to refine the data by collapsing categories of responses into distinct, major themes. The group chose the three most important themes of the study: (a) self-confidence and a persisting attitude of refusing to lose; (b) pre-college experiences and opportunities; and (c) interest and ability in the field.

Using the information from the focus group interviews to bridge the gap with the multidimensional scaling technique added value to the study. Confirmation of the student responses added both flavor and validity to the Delphic group. The experts wanted confirmation and anecdotal information from the focus group responses as they reached conclusions and sought closure to the study.

The survey data were tabulated and used in a Multidimensional Scaling (MDS) procedure to provide additional meaning to this investigation. Normally, mathematical formulas are not administered to this type of qualitative data gleaned from focus group interviews. However, the MDS technique was used in this case to determine how closely the items in the survey were related in a cluster procedure. This allowed the researcher to get a glimpse into the thought processes of the students. A three-dimension solution with five clusters best fitted the survey data. The five clusters of the three dimensions were plotted and yielded new insights and information to help explain the motivations and thought processes of the students as they made choices to remain in or to leave their male-dominated majors.

### Summary of Findings

The summary of the findings of the investigation includes the themes from the focus group interviews and data produced from the administration of the Multidimensional Scaling (MDS) procedure. Five themes emerged from the analysis of the data discovered in the focus group interviews: (a) self-confidence and a refuse-to-lose attitude; (b) interest in the field; (c) career goals, jobs, money; (d) ability and experience in the field; and (e) the desire to make a

difference. The researcher, integrating the refinement data of the VIP II Group with the data from the investigation, designated the three most important themes as (a) self-confidence and a refuse-to-lose attitude; (b) interest in the field; and (c) career goals, jobs, and money.

The discussion of the findings will be presented from the MDS procedure point of view because it leads to a greater understanding of the student decisions and motivations underpinning those decisions as factors to remain in or to leave the male-dominated major.

Research Questions Revisited:

Question 1: Describe the factors associated with a woman's choice of a male-dominated major.

Five themes emerged from the triangulation of data discovered in the investigation: (a) **self-confidence/refuse to lose**, (b) **interest in the field**, (c) **career goals, jobs, and money**, (d) **ability and experience in the field**, and (e) **desire to make a difference**.

Question 2: Describe the meanings, experiences, and motivations which influenced your choice of a male-dominated major.

Meanings, experiences, and motivations influencing the student choices of male-dominated majors yielded five themes: (a) **pre-college experiences**, (b) **challenge/ career/job opportunities/\$\$**, (c) **personal strengths**, (d) **dreams of becoming engineer**, and (e) **desire to make a difference**.

Question 3: Describe the factors which influenced your decisions and motivations to remain in or to leave that male-dominated major.

Women who were remaining in the major listed seven themes as factors which influenced their decision to remain in the male-dominated major: (a) **enjoyment of the field/major**, (b) **refuse to lose/prove I can do it**, (c) **support from family/friends**, (d) **ability to do the work successfully**, (e) **helpful professors/advisors**, (f) **\$\$\$**, and (g) **desire to make a difference**.

Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?

There were nine themes to the student responses of experiences deemed important for a student to have as she considers a male-dominated major: (a) **high confidence-building experiences**, (b) **experiences that require perseverance, determination, & quality of effort**, (c) **exposure to male interests/ability to relate to men**, (d) **assertiveness**

**training/communication skills, (e) strong background in science/math/computers, (f) good role models/learn to network, (g) obtain good career information, and (h) seek support from friends/family/others.**

Five themes emerged from the triangulation of data discovered in the investigation from the focus groups, the literature review, and the multidimensional scaling technique: (a) **self-confidence/refuse to lose**, (b) **interest in the field**, (c) **career goals/ jobs/ \$\$\$**, (d) **ability and experience in the field**, and (e) **desire to make a difference**.

Analysis of the information gained in the MDS technique provided the researcher with a visual picture of the survey data with five clusters on a three-dimensional solution. The three dimensions were (a) Time of Experience, (b) Motivation, and (c) Career Rewards. The five clusters, or groups of items which were found to be closely related to a similar theme, were:

1. Pre-College Experiences which included (a) participation in advanced classes, (b) summer jobs, (c) mentoring experiences, (d) computers, and (e) internships.
2. College Experiences which included (a) same major roommate, (b) easy grades, (c) effective advising, (d) positive climate, and (e) faculty support.
3. Career Rewards which included career opportunities and high income.
4. Self-confidence which included (a) confidence, (b) family support, (c) social support, (d) terminology, and (e) peer support.
5. Self-fulfillment which included (a) enrichment activities, (b) professional groups, (c) contribution to society, (d) female role models, (e) teacher recommendations, (f) media influences, and (g) high school career activities.

Time of Experience was the overlying factor in the clusters presented in Dimension I. The survey questioned students about the importance of their experiences prior to coming to college and then after enrolling in college. Dimension II was Motivation, and it captured the factors relating to self-fulfillment and self-confidence. The third dimension was named Rewards, and it measured student factors of career rewards from the intrinsic rewards, self-fulfillment, to the extrinsic rewards, career rewards.

To be sure, the students thought that their pre-college experiences of advanced placement classes, summer jobs in the field, internships, mentoring experiences, and computer experience were the most important experiences they could have had prior to enrolling in male-dominated

majors. These findings support the social learning theory of Bandura (1982) and Krumboltz (1979) in which reinforcement from high school activities and encouragement from family appeared to serve the women even in a chilly environment. With such a supportive background, students were more likely to learn and use their skills with positive reinforcement and encouragement from others. Family and friends served as “balcony people” (Heatherly, 1984) for these women, providing support and encouragement and cheering them on to successful outcomes. The importance of peer support upholds the findings of Astin (1993b) that peers are the most potent influence on growth and development during the college years.

There was some support for Tinto's Model of Institution Departure in which students who are able to integrate their academic and social experiences persisted at a higher rate at the institution. The students who had chosen to remain in the original male-dominated major appeared to be doing a better job of integrating their social and academic experiences. Students who were not remaining in their original majors appeared to lack the integration of social support into their new environment.

The students believed that college experiences of positive climate, faculty support, same major roommate, effective advising, and easy grades were not the important factors in their choices to major in a male-dominated field. These findings challenge the current literature of which has placed more importance on faculty support and chilly climate issues and less emphasis on the student's reaction to those chilly conditions (Hirschfeld & Majumdar, 1996; Ginorio et al.; Schnabel, 1993; Seymour & Hewitt, 1994; Strenta et al., 1993). While the clusters do help explain the student thoughts on their experiences, it is important to remember that the students had only been in college a year and a half, and, during that time, many of their experiences had been negative in the academic setting. Their positive, idealistic memories of high school experiences appeared to be clashing with their real-life college experiences. These confrontations could have compromised those idealistic goals and images of what college would be like. These findings do tend to support Widnall's (1988) conclusions that some women students have negative experiences of isolation, self-doubts, and insecurities.

Self-confidence emerged as a defining cluster in Dimension II-Motivation. High confidence-building activities, in addition to family support, social support, familiarity with terminology in the field, and peer support, were grouped together to get the self-confidence

cluster. On the negative end of the scale, self-fulfillment experiences such as teacher recommendation, enrichment activities, female role models, making a contribution to society, high school career activities, and media influence were seen as positive experiences but less important factors by those emphasizing self-confidence. Also, Cluster 1-Pre-college Experiences, as discussed earlier, ranked high on the Motivation scale while Cluster 3-Career Rewards such as career opportunities, female role models, were not deemed very important by the students who developed self-confidence before coming to college.

The present data are supportive of the self-confidence link to majors as shown in the literature (Brown, 1990; Tickling, 1969; Coppersmith, 1967; Hacked & Beets, 1981; Holland, 1961, 1963, 1973; Koran, 1967, 1969; Letterman, 1981; Super, 1953, 1957, 1990). There was a definite link to persistence and the determined attitude of the students which agrees with the challenge theory of Hewitt and Seymour (1991) that women have to prove themselves. Students were adamant about their refusing to lose. The researcher noted that this was the most intense feeling expressed during the focus groups as well. While admitting to being too stubborn to lose, the students described their beliefs as “wanting to prove themselves to parents, mentors, and friends that they can do it and be successful in their male-dominated majors.” One student said it best: “I will not let anyone tell me what I am and am not capable of, especially because I am female.” Whatever they told themselves they could do, the women seemed to be able to do. Dimension II-Motivation supports this persistence position by describing the range of experience in motivation from Self-fulfillment to the highest level of Self-confidence. What is missing in the current study as well as the current literature is how to instill that strategy for resistance and determined attitude in the students.

Dimension III-Career Rewards gives meaning to the choices that the students made. Career opportunities and high income were the reasons given by some of the students for choosing to enroll in a male-dominated major. While some of the students voiced intrinsic reasons for being in the majors as making the world a better place, or as a desire to make a difference, the other competing goals appeared to be extrinsic ones to have high incomes. This research did reflect the findings that the intrinsic factor was important in the ego development of students as they move through the college years (Marcia, 1966, 1967; Waterman, 1982; Waterman & Waterman, 1970). Perhaps the students had begun to think in terms of intrinsic

motivations, but their development had not yet begun to include actions based on those thoughts. This, too, is consistent with the abundant evidence that college students make changes in altruism, humanitarianism, and civic responsibilities as well as social conscience while in college (Astin, 1972, 1977; Chickering, 1974; Marks, 1990; McLaughlin & Smart, 1987; Pace, 1972, 1974; Pascarella, Ethington, & Smart, 1988; Pascarella, 1988; Pascarella, Smart, & Braxton, 1986; Peterson, 1968; Thistlethwaite, 1973).

On the Career Rewards-Dimension III scale, self-confidence and self-fulfillment experiences were definitely not as important experiences for the women at the positive end of this dimension as were the career rewards. Students often reflected that they were opting for better career opportunities for women, since women had traditionally been underrepresented in these fields which supported the findings of Brush (1991), Conciatore (1989), Daffin (1937), Farmer (1976), Fitzgerald & Crites (1980), Humphreys (1982), Lips (1992), McDonnell et al. (1989), National Science Board (1986), National Science Foundation (1982), Phafflin (1984), Rossi (1965), Schiebinger (1989), Seymour (1995). Their views supported prior research (Brainard, 1992) that women have not had high-paying careers in the past and have experienced insufficient financial resources. Many students related stories about their mothers being poor due to divorce or corporate down-sizing for their fathers.

### Conclusions

Several conclusions were drawn from this study. The study confirmed that existing literature can be depended upon to provide information about women in male-dominated majors. This subject has been widely studied for many years. This investigation served to support the findings of that research. These findings about college women and their choices of changing majors generally agree with the conclusions reached by Menges (1988) in which he reported in a study of generalizations about changes in human behavior: "some do, some don't; the differences aren't very great; and, it's more complicated than that" (p.276).

However, this study, utilizing the MDS procedure, goes further in helping to explain some of the motivations and meanings of the student experiences and to challenge some of the beliefs that persons in the practice of student affairs profess about the chilly environment in which students find themselves. It extends our knowledge of what is important about the chilly environment and may change how professionals might deal with the environment. How students

react to the chilly environment may be the most important finding here about the motivations and beliefs of the students.

The use of the Delphic group was innovative in this type of investigation. Using experts to refine the data and reach conclusions and solutions appeared to be worthwhile to strengthen the recommendations and conclusions of the project. However, there are some risks involved in the use of Delphic groups. External validity may be challenged, the investigation does take longer, and the group may wish additional research to be conducted. However, the use of experts in this investigation did indeed prove worthwhile and helpful for the resulting recommendations the group provided.

The majority of these women were succeeding. Driven by a desire to succeed, courage to take risks, discipline, determination, and perseverance, the women were excited about their majors, intended to get their degrees, and intended to seek careers in their fields. The women were challenged, courageous, and highly motivated.

The climate, as indicated by earlier research, is indeed chilly. What appears to be more salient than the chilly climate, however, was how the students were managing the chilly environment. Many students were overcoming harassment and intimidation to pursue their dreams of being engineers and the condition itself.

There were five basic sources which support female success in a male-dominated major. Self-confidence and perseverance appear to be the most important personal strengths that a student needed for enrolling in a male-dominated major. The students appeared to have a built-in protection against outside, tormenting actions of male peers and professors.

During the focus groups, the student listed their pre-college experiences as more important to their success as students than their experiences at the college. Important experiences were high school science fairs, engineering camps, internships, summer jobs in fields related to engineering, and advanced placement classes.

Students were extrinsically motivated by the career rewards of money and job opportunities. Although they frequently gave responses relating to making the world a better place, making money and having good career opportunities was at the top of their chart for motivation.

Students would benefit from better and more accurate career information. Given good information, they can succeed and do well. The students did not come to college with accurate knowledge of the engineering field and the careers available in the field.

Support from family and friends is crucial to the students' survival in these majors. Students could benefit from knowing self-nurturing skills such as how to seek support from friends and family.

The students in the study appeared to be able to do anything that they told themselves they could do. The researcher was reminded many times during the study of an informal conversation at a NASPA Conference several years ago with Dr. Elizabeth Whitt, a well-known student affairs professor. Dr. Whitt (personal communication, March 29, 1992) stated, "In all of my research with women, telling them 'You can do it' seems to be the most important thing you can do for them."

The researcher was impressed with the intensity and emotionally-charged, persistent attitude of "refusing to lose" which was expressed by the students who were remaining the major. Their pervasive ability to deal with the "bumps" along the way made them appear to be less vulnerable to the intimidation and frustration that the leaving students described. From the researcher's point of view, that appears to be the most salient characteristic of this study. Students may be better served if the paradigm were changed from a prevention of "chilly climate" model, which is certainly a worthy and perhaps idealistic goal, to a teaching model with survival, coping, and self-nursing, self-confidence skills.

### Implications of the Study

The Multidimensional Scaling technique, a statistical procedure which produced a mathematical expression of each factor, was used to group the items by clusters in relationship to each other. This method, which is not ordinarily used with this line of investigation, added new insights and meanings to data which seemed to be getting redundant with earlier work on the topic. The MDS procedure gets at the motivation and thought processes for student choices rather than just recording the responses of the students.

Some of the clusters and their accompanying themes were much more powerful explainers than others. Some of the factors always believed to be important or as the most powerful, such as chilly climate, are not thought to hold such importance in this investigation.

The students in the investigation appeared to have been inoculated against the harassment, the intimidation, the bad experiences of failing their first test, and the inferior treatment they had received. Inoculation theory (Duryea,1984) has been studied with students to resist pressure toward alcohol. Perhaps this theory could be used to explain why the remaining students were resisting all of the pressures to leave the major. And, better still, this theory could provide the model for teaching those students who were leaving due to chilly climate and low faculty and peer support better methods of resistance. Further research appears to be warranted to gain additional insight into the resistance abilities of these successful students. It would be important to include students who had left the university or the major since they may have been the students who could not take the harassment.

Additional research using a combination of the MDS technique as well as the traditional qualitative methods could push the limits of providing data which is not only refreshed, but sophisticated and powerful, to explain the motivations and choices of students. The study should not only be replicated, but should be extended to other environments, other majors, and all types of students. This investigation appears to be only the tip of the iceberg in extending our current knowledge and creating new knowledge about students and their choices of majors.

#### Recommendations for Practice

What do these findings and conclusions say to practitioners in the field? Suggestions will be made to the customer or student, to those who would advise students, to those who would provide the learning environment for the student, and to those scholars who will conduct future research in the field.

#### To the Woman Considering a Male-Dominated Major

1. Become computer literate. Knowledge of computers and computer programming are essential to student success in engineering.
2. Take all of the mathematics, science, and computer classes that are available in high school.
3. Take advantage of all of the enrichment activities that are available in high school such as summer camps in engineering and computers, science fairs, summer jobs in related fields, internships, and mentoring programs.
4. Obtain realistic career information.

5. Participate in clubs and professional groups such as "Women in Engineering."
6. Seek out women in engineering careers as role models.
7. Participate in leadership activities, communication skill-building activities, assertiveness training, and other activities to increase self-confidence.
8. Take advantage of learning opportunities which promote teamwork.
9. Develop male friends to increase your comfort level around men.
10. Seek support from family, friends, teachers, and mentors.
11. Develop skills which will help you bounce back after a disappointing grade or a discouraging encounter with a professor.
12. Learn to design for success in small steps. (You don't have to always go for the gold.)
13. Enroll with a "Refuse to Lose" attitude.

#### To Those Who Would Advise Students

1. Give students accurate information. The students in the study recommended that advisors **please** tell students that they would need to know how to use computers.
2. Help women explore their motivations for choosing the major. Several of the students felt they had made choices for the wrong reasons, mainly money.
3. Encourage women by saying to them, "You can do it."
4. Recognize that failure to encourage women can have the same results as discrimination to them.
5. Encourage women to become involved in professional groups.
6. Encourage women to get to know each other.

#### To Those Who Would Provide the Learning Environment

##### Engineering Department

1. Conduct a workshop for high school counselors to "Meet an Engineer." Inform them about engineering as a major and what engineers do.
2. Recruit women to engineering with a "You Can Change the World" theme.
3. Provide sharing opportunities and career forums for women in engineering.
4. Integrate professional engineering group activities into student programming.

5. Conduct an orientation for women to include mentoring experiences, role-playing what intimidation and harassment look and feel like, and give them coping strategies. It might inoculate the students against some of the "chilly climate" that takes place.
6. Provide an environment in which students could develop their own Survival 101 Manual. It could be sponsored by a club or organization.
7. Allow students to purchase their computers prior to the beginning of fall term.

#### University Administrators

1. Conduct a longitudinal study to investigate the factors involved in women choosing to remain or to leave a male-dominated major. This study was limited to a small sample of 62 sophomore women. A further exploration should include all freshmen to pinpoint the point of decision to remain or stay in the major or in the university. Any further research project should include those students who leave immediately after beginning a male-dominated major since those students were not available for this research project.
2. Train faculty in diversity.
3. Support women in administrative positions.
4. Recognize that programming which supports women in male-dominated majors may also support other minorities on campus.
5. Intervene promptly when there is a problem with harassment.
6. Develop a risk survey to identify the students at risk of dropping out of the university or the major.

#### To Those Scholars Who Would Conduct Future Research

1. Should you choose to replicate the study, women's participation in athletics would be an possible indicator for building self-esteem.
2. Plan an intervention such as a "Survival Manual" and test it on the students for results.
3. Evaluate the use of the Multidimensional Scaling procedure and Delphic group used in this investigation. Both appeared to be a powerful tools to begin investigating the student thought processes. Delphic groups, in particular, bring closure while reaching conclusions in the study.

4. Design further research studies to investigate the students during their freshmen year.
5. Design a follow-up study to determine if the findings from this study are indicative of all of the women engineering students.
6. Replicate all three facets of this research project. The use of focus groups, multidimensional scaling, and Delphic groups was methodology not common to previous investigations. Since the technique appeared to further explain student choices, it may be a technique to be recommended to other investigations of this type.

This methodology has proved to be worthwhile in extending knowledge, getting critical information from the students in the focus group interviews, using experts in the Delphic-like group, and using multidimensional scaling with ethnographic research data. The investigation was strengthened by the use of multivariate analysis of the data. An advantage of using the multidimensional scaling technique over factor analysis-type techniques is that the procedure retains some of the most interesting cases such as outliers and low frequency data cells, and thus it enriches the interpretative quality of the analysis.

This investigation was important because it added new information about students and their choices of leaving or remaining in male-dominated majors. Overall, the study found the majority of these students were successful in their male-dominated majors. The students appeared to be fulfilling their dreams of becoming engineers, astronauts, and scientists. Gaining insight into the students' thinking about their experiences and ways of dealing with their frustrations and "bumps" along the way may give university policy makers new information for planning and implementing future interventions for positive student development outcomes.

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## Appendix A

### Questionnaire

I am conducting a study of factors associated with decisions to remain in or to leave chosen major fields of study among women sophomore students at Virginia Polytechnic Institute and State University. I want to know whether you are willing to participate in the study. The study will include completion of this questionnaire by all students who agree to participate and completion of a group interview on the subject by selected volunteers. You will be asked to complete a short survey at the end of the interview. The interviews will be completed in a group setting on-campus and will require about an hour and a half of your time. No questions asked on either the questionnaire or in the interview will contain personally intrusive or offensive information and no risk is foreseen to any participant. You will receive an incentive of \$10 for your participation in the study.

If you are unwilling to participate in the study, please return the form uncompleted.

If you are willing to participate, please provide the following information:

NAME \_\_\_\_\_ Social Security # \_\_\_\_\_

Address \_\_\_\_\_

What is your current major? \_\_\_\_\_

Is your major considered a non-traditional major for you? \_\_\_\_\_

Have you changed your major? \_\_\_\_\_

If yes, what was your Original Major? \_\_\_\_\_

Male \_\_\_\_\_ Female \_\_\_\_\_ GPA \_\_\_\_\_ Phone# \_\_\_\_\_

I am willing to participate in this study. \_\_\_\_\_ To participate, I agree to come to \_\_\_\_\_ for approximately an hour and a half to participate in a group interview. The best day for me to participate is \_\_\_\_\_ and the best time is Morning \_\_\_\_\_ Afternoon \_\_\_\_\_ Evening \_\_\_\_\_. The best time to call me is between \_\_\_\_\_ and \_\_\_\_\_ at \_\_\_\_\_ (phone #).

E-mail \_\_\_\_\_

## Appendix B

### Interview Guide

Good Afternoon. Thank you for agreeing to participate in this discussion. As you know, the focus of this discussion is a woman's choice of non-traditional major. The questions that will be asked will be related to your personal experiences. I appreciate your sharing your stories and experiences with me to help future students with successful outcomes in non-traditional majors. As a student who has made these choices, you are the best person to relate your experiences.

I will be asking you how you describe your experiences in your choices of major. I hope you will be honest and candid, describing the meanings and motivations which influenced your decisions. I am particularly interested in your motivations and reasons for leaving the non-traditional major. Please feel free to ask for clarification when necessary and do not feel intimidated to disagree with other participants. There are no right or wrong answers, only your answers. I do ask that you only speak one at a time in order for everyone to be heard.

All of your answers will be protected for confidentiality. I am taping your answers for my use later in analyzing the data and clarifying your responses for accuracy. At the end of the project, all tapes and written materials will be destroyed. None of the participants will be identified in the reports from the focus group sessions.

You are required to keep confidential the information you learn from the focus group. Confidentiality of the interview material will maintain the integrity of the group and provide respect for the other participants.

I will give you questions and pause briefly for you to write your responses. I will then allow you to put your responses to each of the questions on large sheets of paper which will be placed around the room . You will then be given an opportunity to share your responses and experiences with the group. Do you have any questions?

Let us begin with introductions. We will now proceed with signing a consent form. The first question is . . .

## Appendix C

### Interview Protocol

#### **Questions**

1. Describe the factors associated with a woman's choice of a non-traditional, male-dominated major. (A non-traditional major for women is a major in which men outnumber women with a ratio of two to one.)
2. Describe the meanings, experiences, and motivations which influenced your choice of a non-traditional major.
3. Describe the factors which influenced your decisions and motivations to leave that non-traditional major.
4. What are the significant experiences that you would deem important for a student to have as she considers a non-traditional major?

#### Probe Questions

Can you describe an example of that?

Was this an isolated experience or do you think other students have had this experience?

What about this experience makes it especially significant for you?

Did this decision affect your career aspirations?

Was this a negative or positive experience?

What would you have done differently?

What would you recommend to other students who are considering this major?

#### **Closure**

As the information becomes redundant, the interviewer will bring closure to the group. It is anticipated that each group will last not longer than two hours.

#### **Survey**

At the conclusion of the session, students will be asked to complete a brief 25-item survey. Students will then receive their incentives for participating in the project. The student will sign to receive their cash incentive. The interview will be concluded.

## Appendix D

## Survey

I would like to thank you for participating in this study. Here are some examples of experiences which might be beneficial to women considering or already enrolled in a male-dominated major. Please indicate how important you think each activity is for such a woman to experience in order to make an appropriate career choice. Please respond in terms of your own personal experience.

4 Very beneficial

3 Beneficial

2 Somewhat beneficial

1 Not beneficial

\_\_\_\_\_ Participation in AP/advanced classes

\_\_\_\_\_ Confidence in their ability

\_\_\_\_\_ Support from family (parents, siblings)

\_\_\_\_\_ Relevant enrichment activities (space camp, engineering camp, computer camp, leadership, etc.)

\_\_\_\_\_ Teacher/counselor recommendations

\_\_\_\_\_ Internships, practicum experiences

\_\_\_\_\_ Summer jobs in the male-dominated field

\_\_\_\_\_ Mentoring or shadowing experience with person in a male-dominated field of choice

\_\_\_\_\_ Female role models/faculty

\_\_\_\_\_ Faculty support, interaction, and encouragement

\_\_\_\_\_ Effective and realistic advising/career counseling

\_\_\_\_\_ Positive campus climate for women

\_\_\_\_\_ Participation in professional groups such as "Women in Science"

\_\_\_\_\_ Experience with computer, lab equipment

\_\_\_\_\_ Support from friends and peers

\_\_\_\_\_ Career opportunities are better in male-dominated field

\_\_\_\_\_ Roommate in same or closely-related major

Appendix D. Survey, *continued*

- \_\_\_\_\_ Familiarity with terminology that people in field use
- \_\_\_\_\_ Close personal friend in the field/social support
- \_\_\_\_\_ Career influence in the media (LA Law, etc.)
- \_\_\_\_\_ Desire to make a contribution to society
- \_\_\_\_\_ Fairly easy to make good grades with reasonable effort
- \_\_\_\_\_ Participation in high school career-related classes, clubs, and activities
- \_\_\_\_\_ Ability to be successful quickly (high income)
- \_\_\_\_\_ Would change majors but would lose too much time

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Original Major \_\_\_\_\_

Current Major \_\_\_\_\_

On a scale of 1-4, with 4 being very likely and 1 not likely, please rate the following:

- \_\_\_\_\_ Confident of getting a degree in this major
- \_\_\_\_\_ Confident of working in a job in this major
- \_\_\_\_\_ Recommend that someone such as yourself start out in your original major

Comments: (Anything else you would like to say.)

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Appendix E  
Summary Report

**Focus Group Analysis Summary  
for Student Groups**

**Factors Which Influence A Woman's Choice  
to Remain in or to Leave a Male-dominated Major**

**Gail S. Catron**

**May 27, 1996**

Appendix E, Summary Report, *continued***Focus Group Analysis Summary for Student Groups****Factors Which Influence A Woman's Choice  
to Remain in or to Leave a Male-dominated Major**

Eleven focus group interviews were conducted during the Spring, 1996 Term with 63 Virginia Polytechnic Institute and State University sophomore women who had chosen a male-dominated major\* in the fall of their freshmen year.

The factors articulated by the sophomore women emanated from discussion of four questions:

1. Describe the factors associated with a woman's choice of a male-dominated major.
2. Thinking about your own experience, describe the meanings and motivations which influenced your choice of a male-dominated major.
3. Describe the factors which influenced your decision to remain in or to leave a male-dominated major.
4. What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major.

Data from these questions are presented on the following pages. The responses to each questions were reviewed, compared, and collapsed to give the significant themes for the student responses. These data may be used to provide information to improve student outcomes for retention of women students in male-dominated majors.

Question 1 - Describe the factors associated with a woman's choice of a male-dominated major.**Ability & Experience in the Field**

Interest in technology  
Ability or talent in the major area

**Interest in the Field**

Intrigue/curiosity with field  
Love of the field  
Wanted to be an engineer since 3rd grade

Appendix E, Summary Report, *continued*

**Career Goals, Jobs, \$\$\$\$\$**

Good job opportunity  
Ability to make \$\$\$\$\$/prestige

**Self-Confidence**

Secure with personality and intelligence  
Confident in ability to succeed in that major

**Desire to Make a Difference**

Ability to design solutions to everyday and no-so-everyday problems  
Problem-solving abilities  
Opportunity to make a difference

**Challenge, Determination, Perseverance**

Challenge, desire to prove myself  
To do better than the guys  
"Refuse to lose!" Attitude  
Rebel against stereotypes

Question 2 - Thinking of your own experience, describe the meanings and motivations which influenced your choice of a male-dominated major.

**Dreams of Becoming Engineer**

Someone told me I could do it so I did  
Desire to learn  
Fascination and intrigue with field  
I've wanted to be in the field since 3rd grade

**High School Experiences**

Intense study of math and science naturally drew me to engineering  
Like of computers  
Wanted to know how things work  
Internship as Mechanical Engineer  
Pushed very hard by teachers and counselors  
After seeing a woman engineer head a team for a project I did with the Navy Research Lab, I was sure Engineering was for me  
Working in a water treatment program

Appendix E, Summary Report, *continued*

**Personal Strengths**

Good at math and problem solving  
Ability in the major  
Liked concept of making things that would work  
Was always told I could do whatever I put my mind to regardless of gender  
Enjoyed science, concepts, and thought patterns

**Family Influences**

Father (engineer) thought I would be an excellent engineer  
Have 3 brothers; do the same thing they do; was never treated differently from them  
Women in my life were always strong so I had a lot of support  
Engineering runs in the family  
Father's encouragement and "encouragement" (expectation)

**Challenge/Career Opportunities/\$\$\$\$\$**

Job security/advantage of being female  
To break a tradition/stereotypes  
Job availability  
Was told it was a prestigious field  
\$\$\$\$\$  
High salaries

**Desire to Make a Difference**

Opportunity to apply personal interests in ecology, conservation, person & group relationships & management to a single career  
Chance to contribute to state of world & living conditions of people, flora, & fauna  
Not just do research  
Be part of global & local issues/problem solving initiate change

Question 3- Describe the factors which influenced your decision to remain in or to leave that male-dominated major.

**STUDENTS REMAINING IN MALE-DOMINATED MAJOR**

**Ability to Do the Work Successfully**

Relative success  
"Holding my own" in classes  
Won't give up if it only gets a little bit harder  
Motivated to continue learning even more

Appendix E, Summary Report, *continued*

**Enjoyment of the Major**

- Great challenge and experience
- Love my department
- Enjoyment of course material
- Stay because of my passion for it
- Enjoy companionship & shared experiences with others in field

**Prove I Can Do It**

- "Refuse to lose!" Attitude
- Unwilling to let men prove they are better
- Dedication to prove equality
- Personal satisfaction to get through a tough curriculum & do well

**\$\$\$\$\$**

- Money! A good motivator
- Security in finding a job/\$\$
- Stability once I graduate

**Helpful Professors/Advisors**

- Great staff
- Helpful professors, advisors, & teaching assistants
- Women in high positions
- Help & support from Advisor

**Support from Family & Friends**

- Parents, especially Dad
- Engineering "buddies", both male & female
- Made friends outside of engineering classes
- Positive "real world" experience with supportive engineers
- Parents were supportive & didn't push too hard

**Desire to Make a Difference**

- I can face the continuous challenges for the next 30-35 years
- Help solve problems that society & industry face today
- Job in end will satisfy all the hard work

Appendix E, Summary Report, *continued*

**STUDENTS LEAVING THE MALE-DOMINATED MAJOR**

**Frustration, Intimidation, Tired of Having to Prove Myself**

Frustrated, tired, knew I didn't want that stress for the rest of my life  
Frustration  
Intimidated—feel my voice has no weight (philosophy major)  
Overwhelmed  
Too competitive, too much pressure  
Too much work for too little rewards  
Kind of like torture  
Tired of hearing (particularly from my Advisor) that I didn't belong in this field  
Didn't want to deal with their hassling me  
Frustration of being #1 in high school and everyone else being a #1 when I got to college

**In It for the Wrong Reasons**

I hate computers  
Could see that it wasn't something I wanted to do  
Didn't enjoy it  
Didn't have the personality for it  
Decided it was boring  
Not what I expected  
Felt like a "cog"  
Learned I would rather work with people  
Something I didn't enjoy (3.7 GPA)  
Didn't enjoy classes (actually got pretty good grades)

**Intimidation from Professors/Other Students**

Discouragement from professors & other classmates  
White male "thing" (3.0 GPA)—Didn't get along with professor (3.7 GPA)  
Teachers were rude, cold  
Negative attitudes from students, professors  
Felt I was always asking the wrong questions  
Tired of putting up with teachers & my advisor telling me women didn't belong in this field

**Grades, Extra Time to Change Majors**

Not as successful as I would like to be  
Changing majors requires more years  
Was going to change but it required another year to change

Appendix E, Summary Report, *continued*

Question 4—What are the significant experiences that you would seem important for a student to have as she considers a male-dominated major?

**Strong Background in Science, Math, Computers, & Communication Skills**

Strong math & science high school classes  
Classes in computers and computer programming

**High Self-Confidence Building Experiences**

Independence & ability to work independently as well as in groups  
Strong, secure personality  
Ability to deal with chauvinism, "extra-friendly" classmates  
Ability to bounce back after a failure  
Experiences that give her confidence, self-pride, respect  
Ability to comfort herself and pick herself back up  
Don't be intimidated by new things or situation  
Leadership roles  
Strong personality but still approachable & easy to get along with  
Sports, team work  
Ability to take criticism  
Ability to design in small successes (don't have to go for gold)

**Exposure to "Guy" Interests/Ability to Relate to Guys**

Exposure to computers, competitions, design groups  
Ability to feel comfortable around guys  
Not be intimidated by a majority of guys in class  
Don't be a female among males—be just one of the guys  
Need to understand where guys are coming from, too  
Be comfortable in male study group

**Good Role Models/Learning to Network**

Find people to answer your questions about the field  
Learn about challenges in field in dealing with colleagues  
Talk with other females in field  
Find Mentors—Women in Engineering Club  
Seek out mentors from research projects

Appendix E, Summary Report, *continued***Good Career Information**

Job fairs/career days to research about fields of interest  
 Talk with school advisors about work/learning experiences  
 Learn all about the major!  
 Internships  
 Research Practicums  
 Work in field during summer or high school  
 Get as much real world experience as possible  
 Know what you are getting into

**Support from Friends, Family, Others**

Support of parents, teachers, boyfriend  
 Peer support, role models  
 Networking skills  
 Backing from family & friends

**Assertiveness Training**

Learn how to ask for help  
 Ask for help even if regarded as "clueless female"  
 Don't be afraid to go to the Dept. Head if you have a problem with a professor  
 There's support for women out there—you just have to seek it  
 Take a class in assertiveness training  
 Learn to stand up for yourself  
 Be comfortable enough to speak freely around anyone

**Experiences That Require Perseverance, Determination & Quality of Effort**

Must be willing to work very hard  
 High tolerance level  
 You will fail something—just deal with it  
 Must not discourage easily  
 Persevere  
 "Refuse to Lose!" Attitude

\* Male-dominated majors, according to Zuckerman (1981) are those majors in which males outnumber females by a ratio of 2:1. The majors included:

*Agriculture:* Agriculture Technology, Crop & Soil Sciences, Poultry Science

*Architecture:* Building Construction, Industrial Design, Landscape Architecture

*Arts & Sciences:* Computer Science, Economics, History, Philosophy, Physics

*Business:* Economics

*Education:* Secondary Education Technology

*Engineering:* Aerospace, Civil, Chemical, Computer, Electrical, Engineering Science and  
 Mechanics, General, Industrial & Systems, Mechanical, Mining, Materials &  
 Science, Ocean

Appendix F

Pearson Product-Moment Correlation Coefficients for Choice of Major, Intent, and Factors Considered

Important for Women Enrolling in Male-dominated Majors

Survey Item	Intercorrelation Coefficients									
	MAJOR	ITEM 1	ITEM1	ITEM 2	ITEM 3	ITEM 4	ITEM 5	ITEM 6	ITEM 7	
MAJOR	1.000	0.037	0.028	0.149	-0.274*	0.067	0.113	-0.164	-0.149	
INTENT	0.037	1.000	0.132	-0.200	-0.188	-0.110	-0.032	0.090	0.097	
1 AP CLASSES	0.028	0.132	1.000	-0.136	-0.317*	-0.057	-0.071	0.039	0.096	
2 CONFIDENCE	-0.149	-0.200	-0.136	1.000	0.333*	-0.042	-0.030	0.110	0.003	
3 FAMILY SUPPORT	-0.274*	-0.188	-0.317*	0.333*	1.000	0.104	0.372*	0.031*	-0.009	
4 ENRICH. ACTIVITIES	0.067	-0.110	0.057	-0.042	0.104	1.000	0.152	0.273*	0.123	
5 TEACHER RECOMM.	0.113	-0.032	-0.071	0.030	0.372*	0.152	1.000	0.143	-0.021	
6 INTERNSHIPS	0.164	0.090	0.039	0.110	0.031	0.273*	0.143	1.000	0.570*	
7 SUMMER JOBS	-0.149	0.097	0.096	0.003	-0.009	0.123	-0.021	0.570*	1.000	
8 MENTOR EXPER.	-0.261*	0.092	0.014	0.071	0.003	0.108	0.045	0.468*	0.451*	
9 F. ROLE MODELS	0.078	0.220	-0.061	0.048	0.126	0.113	0.163	0.042	0.005	
10 FACULTY SUPPORT	0.144	-0.217	-0.056	0.242	0.208	0.194	0.109	-0.069	-0.088	
11 EFFECT. ADVISING	0.235	-0.135	-0.105	0.004	0.083	0.155	0.387*	-0.137	-0.078	
12 POSITIVE CLIMATE	0.070	0.038	-0.015	-0.073	0.213	0.235	0.134	-0.133	0.090	
13 PROFESS GROUPS	-0.013	0.057	-0.268*	0.082	0.097	0.301	0.196	0.263*	0.329*	
14 COMPUTERS	-0.162	0.013	0.228	0.084	0.098	0.039	0.039	0.155	0.123	
15 PEER SUPPORT	0.257*	0.150	-0.248	0.113	0.385*	0.002	0.193	0.225	0.000	
16 CAREER OPPOR.	-0.081	-0.059	-0.174	-0.005	-0.016	0.078	0.044	-0.102	-0.023	
17 SAM. MJR ROOMMATE	-0.035	-0.095	-0.195	0.046	0.156	-0.059	0.000	-0.249	.000	
18 TERMIN-OLGY	.046	-0.103	-0.004	0.107	0.193	0.078	0.084	0.179	0.197	
19 SOCIAL SUPPORT	-0.091	0.070	-0.090	0.152	0.224	0.097	0.069	0.115	0.092	
20 MEDIA INFLUENCE	-0.144	0.040	-0.017	-0.048	-0.064	-0.013	-0.119	0.209	-0.012	
21 CONTRIB. TO SOC.	-0.006	-0.158	-0.096	-0.029	0.076	0.063	0.226	0.218	0.082	
22 EASY GRADES	0.210	-0.065	-0.046	0.079	0.052	0.288*	0.043	-0.036	-0.159	
23 HS CAREER ACTIVITY	0.079	0.180	-0.051	-0.115	0.133	0.475*	0.270	0.467	0.382*	
24 HIGH INCOME	-0.133	-0.009	-0.190	-0.103	0.114	0.138	0.041	-0.057	0.229	
25 TIME	-0.060	-0.166	0.060	0.168	0.051	0.259	-0.092	-0.007	0.205	
C1 CONFIDENT DEGREE	-0.034	-0.147	0.104	-0.026	0.195	0.017	0.256	-0.087	-0.160	
C2 CONFIDENTJOB	-0.041	0.033	0.025	0.069	-0.003	0.019	0.259	0.176	0.051	
C3 LIKELY RECOMM.	0.028	-0.663	-0.099	0.142	0.045	0.153	-0.033	-0.044	-0.046	

Note. N = 62. Missing data of 5.1% is replaced by mid-point of item scale. \*Correlations greater than ± 0.25 are significantly different from 0. \*p < .05.

Pearson Product-Moment Correlation Coefficients for Choice of Major, Intent, and Factors Considered Important for Women Enrolling in Male-dominated Majors, *continued*

Survey Item		Intercorrelation Coefficients								
		ITEM 8	ITEM 9	ITEM 10	ITEM 11	ITEM 12	ITEM 13	ITEM 14	ITEM 15	ITEM 16
	MAJOR	-0.261*	0.078	0.144	0.235	0.070	-0.013	-0.162	-0.257*	-0.081
	INTENT	0.092	0.220	-0.217	-0.135	0.038	0.057	0.013	0.042	0.528
1	AP CLASSES	0.014	-0.061	-0.056	0.105	-0.015	-0.268*	0.228	-0.248	-0.174
2	CONFIDENCE	0.071	0.0478	0.242	0.004	-0.073	0.082	0.084	0.113	-0.005
3	FAMILY SUPPORT	0.003	0.126	0.208	0.083	0.213	0.097	0.098	0.385*	-0.016
4	ENRICH. ACTIVITIES	0.108	0.113	0.194	0.155	0.235	0.301	0.039	0.002	0.078
5	TEACHER RECOMM.	0.045	0.163	0.109	0.387*	0.134	0.196	0.039	0.193	0.044
6	INTERNSHIPS	0.468*	0.042	-0.069	-0.137	-0.133	0.263	0.155	0.225	-0.102
7	SUMMER JOBS	0.451	0.005	-0.088	-0.078	0.090	0.329	0.123	0.000	-0.023
8	MENTOR EXPER.	1.000	0.214	-0.123	-0.061	-0.015	0.470	0.076	0.310	0.063
9	F. ROLE MODELS	0.214	1.000	0.351	0.345*	0.170	0.361*	-0.023	0.034	0.013
10	FACULTY SUPPORT	-0.123	0.351	1.000	0.261	0.200	0.136	0.017	0.068	-0.021
11	EFFECT. ADVISING	-0.061	0.345	0.252*	1.000	0.474*	0.180	-0.058	0.017	0.134
12	POSITIVE CLIMATE	-0.015	0.170	0.200	0.474*	1.000	0.156	-0.077	0.200	-0.081
13	PROFESS. GROUPS	0.469*	0.361*	0.136	0.180	0.156	1.000	-0.199	0.218	0.145
14	COMPUTERS	0.076	-0.023	0.017	-0.058	-0.077	-0.199	1.000	0.061	-0.063
15	PEER SUPPORT	0.310*	0.034	0.068	0.017	0.200	0.218	0.061	1.000	-0.137
16	CAREER OPPS.	0.063	0.013	-0.021	0.134	-0.081	0.145	-0.062	-0.137	1.000
17	SAM. MJR ROOMMATE	-0.108	-0.047	0.235	0.074	0.221	0.029	-0.147	-0.016	0.120
18	CAREER TERM.	0.174	0.240	0.283*	0.240	0.332*	0.243	0.142	0.320*	-0.078
19	SOCIAL SUPPORT	-0.034	0.080	0.213	0.055	0.139	0.111	0.054	0.177	-0.191
20	MEDIA INFLUENCE	0.190	0.209	0.136	0.002	0.047	0.270	-0.225	0.167	0.065
21	CONTRIB. TO SOC.	-0.116	0.198	0.050	0.095	-0.048	0.148	-0.195	0.072	-0.060
22	EASY GRADES	-0.311*	0.017	0.379	0.089	-0.023	0.014	0.017	0.074	0.063
23	HS CAREER ACTIVITIES	0.331*	0.302*	0.163	0.111	0.069	0.385*	0.183	0.121	-0.130
24	HIGH INCOME	0.130	-0.057	0.017	-0.004	0.072	0.193	0.127	0.086	0.475*
25	TIME TO CHANGE	0.076	0.011	0.147	0.196	0.203	0.180	0.161	0.019	0.175
C1	CONF. DEGREE	-0.162	-0.142	-0.091	-0.083	-0.083	0.000	-0.047	0.087	0.044
C2	CONF. JOB	0.067	0.026	-0.072	-0.047	-0.177	0.028	0.036	-0.035	-0.038
C3	LIKELY RECOMM.	-0.167	-0.202	0.139	0.109	-0.002	-0.058	-0.105	-0.141	0.002

Note. N = 62. Missing data of 5.1% is replaced by mid-point of item scale. \*Correlations greater than ± 0.25 are significantly different from 0. \*p < .05.

Pearson Product-Moment Correlation Coefficients for Choice of Major, Intent, and Factors Considered Important for Women Enrolling in Male Dominated Majors, *continued*

Survey Item		Intercorrelation Coefficients								
		ITEM 17	ITEM 18	ITEM 19	ITEM 20	ITEM 21	ITEM 22	ITEM 23	ITEM 24	ITEM 25
	MAJOR	-0.035	0.046	-0.091	-0.144	-0.006	0.209	-0.080	-0.133	-0.060
	INTENT	-0.095	-0.103	0.070	0.040	-0.158	-0.065	0.180	-0.009	-0.166
1	AP CLASSES	-0.195	-0.004	-0.090	-0.017	-0.096	-0.046	-0.051	-0.190	0.060
2	CONFIDENCE	0.046	0.107	0.152	-0.048	-0.029	0.079	-0.115	-0.103	0.168
	FAMILY SUPPORT	0.156	0.193	0.224	-0.064	0.076	0.052	0.133	0.114	0.051
4	ENRICH. ACTIVITIES	-0.059	0.078	0.097	-0.013	0.063	0.288*	0.475*	0.138	0.259
5	TEACHER RECOMM.	0.000	0.084	0.069	-0.119	0.226	0.042	0.270*	0.041	-0.092
6	INTERNSHIPS	-0.249	0.179	0.115	0.209	0.218	-0.036	0.467*	-0.057	-0.007
7	SUMMER JOBS	0.000	0.197	0.092	0.012	0.082	-0.159	0.382*	0.229	0.205
8	MENTOR EXPER.	-0.108	0.174	-0.034	0.190	-0.116	-0.311*	0.331*	0.130	0.076
9	F. ROLE MODELS	-0.047	0.240	0.080	0.209	0.198	0.017	0.302	-0.057	0.011
10	FACULTY SUPPORT	0.235	0.283*	0.213	0.136	0.050	0.379*	0.163	0.017	0.147
11	EFFECT. ADVISING	0.074	0.240	0.055	0.001	0.095	0.089	0.111	-0.004	0.196
12	POSITIVE CLIMATE	0.221	0.332	0.139	0.047	-0.048	-0.023	0.069	0.072	0.203
13	PROFESS. GROUPS	0.029	0.243	0.111	0.270	0.148	0.014	0.385*	0.193	0.180
14	COMPUTERS	-0.147	0.142	0.054	-0.225	-0.195	0.017	0.183	0.127	0.161
15	PEER SUPPORT	-0.016	0.320*	0.177	0.167	0.072	0.074	0.121	0.086	0.019
16	CAREER OPPOR.	0.120	-0.078	-0.191	0.065	-0.060	0.063	-0.130	0.475	0.175
17	SAM. MJR ROOMMATE	1.000	0.191	0.440*	-0.016	-0.150	0.026	-0.160	0.201	0.190
18	TERMINOLOGY	0.191	1.000	0.298*	0.029	-0.055	0.064	0.080	0.006	0.231
19	SOCIAL SUPPORT	0.440*	0.298*	1.000	0.163	0.055	0.005	0.133	0.020	0.224
20	MEDIA INFLUENCE	-0.016	0.029	0.163	1.000	0.243	0.150	0.231	0.120	0.095
21	CONTRIB. TO SOC.	-0.150	-0.055	0.055	0.243	1.000	0.226	0.230	-0.016	-0.130
22	EASY GRADES	0.026	0.064	0.005	0.150	0.226	1.000	0.214	0.134	0.061
23	HS CAR. ACTIVITIES	-0.160	0.080	0.133	0.231	0.230	0.214	1.000	0.129	-0.081
24	HIGH INCOME	0.201	0.006	0.020	0.120	-0.016	0.134	0.129	1.000	0.239
25	TIME	0.190	0.231	0.224	0.095	-0.130	0.061	-0.081	0.239	1.000
C1	CONFIDENT DEGREE	-0.079	-0.182	-0.058	-0.095	0.206	0.193	-0.155	-0.065	-0.162
C2	CONFIDENT JOB	-0.282*	-0.303*	-0.185	0.068	0.263	0.114	0.224	0.012	-0.228
C3	LIKELY RECOMM.	-0.111	-0.080	-0.172	0.164	0.374*	0.221	0.029	0.088	0.095

Note. N = 62. Missing data of 5.1% is replaced by mid-point of item scale. \*Correlations greater than ± 0.25 are significantly different from 0. \*p < .05.

Pearson Product-Moment Correlation Coefficients for Choice, Intent, and Factors Considered Important for Women Enrolling in Male Dominated Majors, *continued*

Survey Item		Intercorrelation Coefficients		
		CRIT1	CRIT2	CRIT3
	MAJOR	-0.034	-0.041	0.028
	INTENT	-0.147	0.033	-0.663*
1	AP CLASSES	0.104	0.025	-0.099
2	CONFIDENCE	-0.027	0.069	0.142
3	FAMILY SUPPORT	0.195	-0.003	0.045
4	ENRICHMENT ACTIVITIES	0.017	0.019	0.153
5	TEACHER RECOMMEND	0.256*	0.259*	-0.033
6	INTERNSHIPS	-0.087	0.176	-0.044
7	SUMMER JOBS	-0.160	0.051	-0.046
8	MENTOR EXPERIENCE	-0.162	0.067	-0.167
9	FEMALE ROLE MODELS	-0.142	0.026	-0.202
10	FACULTY SUPPORT	-0.091	-0.072	0.139
11	EFFECTIVE ADVISING	-0.083	-0.047	0.108
12	POSITIVE CLIMATE	-0.083	-0.177	-0.002
13	PROFESSIONAL GROUPS	0.000	0.028	-0.058
14	COMPUTERS	-0.047	0.036	-0.105
15	PEER SUPPORT	0.087	-0.035	-0.141
16	CAREER OPPORTUNITY	0.044	-0.038	0.002
17	SAME MAJOR ROOMMATE	-0.079	-0.282*	-0.111
18	TERMINOLOGY	-0.182	-0.303	-0.080
19	SOCIAL SUPPORT	-0.059	-0.185	-0.172
20	MEDIA INFLUENCE	-0.095	0.068	0.164
21	CONTRIBUTE TO SOCIETY	0.206	0.263	0.374*
22	EASY GRADES	0.193	0.114	0.221
23	HS CAREER ACTIVITIES	-0.155	0.224	0.029
24	HIGH INCOME	-0.065	0.012	0.087
25	TIME TO CHANGE	-0.162	-0.228	0.095
C1	CONFIDENT DEGREE	1.000	0.516	0.088
C2	CONFIDENT JOB	0.516	1.000	0.132
C3	LIKELY RECOMMEND	0.888	0.132	1.000

Note. N = 62. Missing data of 5.1% is replaced by mid-point of item scale. \*Correlations greater than ± 0.25 are significantly different from 0. \*p < .05.

## Appendix G

INTERVIEW GUIDE FOR VIP II  
PROFESSIONAL WOMEN'S GROUP FOR DATA INTEGRATION

Good morning. Thank you for agreeing to participate in this discussion. I appreciate your willingness to assist me in integrating the data from the research study. For those of you who have returned to help a second time, I want you to know how helpful the first protocol-setting group was to the entire project. That is one of the reasons you were asked to assist again. Each of you were specially chosen because your expertise adds value to the study.

This study investigated the factors that influence a woman's choice to remain in or to leave a male-dominated major. In the spring of 1996, I interviewed 62 sophomore women in 11 focus groups who had enrolled in a male-dominated major as freshmen in the fall of 1994. Forty-seven of the women were remaining in the male-dominated major, and 15 women had chosen to leave a male-dominated major. Questions were asked to verify student experiences and choices, exploring the extent of the women students' satisfaction or dissatisfaction with their choice of major. At the end of each focus group, a short survey of 25 questions was administered to the group participants. The summary you received contains a summary of themes or categories of the student responses, the corresponding citations from the literature review, and a summary of the survey results. The survey items are directly related to Question 4 concerning experiences that the participants would deem to be beneficial to women considering or already enrolled in a male-dominated major. The survey items are also linked to the first three questions.

Let us begin with introductions. Most of you already know each other . . . (Welcome, Review of Study and Introductions: 10 Minutes)

## Appendix H

### INTERVIEW PROTOCOL

**QUESTION 1:** Describe the factors associated with a woman's choice of a male-dominated major.

Short Review of Summary: Focus Group Themes, Literature Review, Survey Items (5 minutes)

Give group participants time to review their notes and the summary data (8 minutes).

Discussion of the data from Question 1. (10 minutes)

Are there other themes that are not represented in Gail's List?

Are there themes in Gail's List that should not be included?

What are the most important themes?

**QUESTION 2:** Describe the meanings, experiences, and motivations which influenced your choice of a male-dominated major.

Short Review of Summary: Focus Group Themes, Literature Review, Survey Items (5 minutes)

Give group participants time to review their notes and the summary data (8 minutes).

Discussion of the data from Question 2. (10 minutes)

Are there other themes that are not represented in Gail's List?

Are there themes in Gail's List that should not be included?

What are the most important themes?

**QUESTION 3:** Describe the factors which influenced your decisions and motivations to remain in or to leave that male-dominated major.

Short Review of Summary: Focus Group Themes, Literature Review, Survey Items (5 minutes)

Give group participants time to review their notes and the summary data (8 minutes).

Discussion of the data from Question 3. (10 minutes)

Appendix H, INTERVIEW PROTOCOL, *continued*

Are there other themes that are not represented in Gail's List?

Are there themes in Gail's List that should not be included?

What are the most important themes?

**QUESTION 4:** What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major.

Short Review of Summary: Focus Group Themes, Literature Review, Survey Items (5 minutes)

Give group participants time to review their notes and the summary data (8 minutes).

Discussion of the data from Question 4. (10 minutes)

Are there other themes that are not represented in Gail's List?

Are there themes in Gail's List that should not be included?

What are the most important themes?

**GROUP CONSENSUS:** (15-18 minutes)

To provide group consensus and closure, the following questions will be discussed.

What are the most important themes of the entire study?

What do you consider the top three themes and why?

So What? What does it mean?

What should the university do about the findings?

Appendix I  
Summary of Findings

**Question 1: Describe the factors associated with a woman's choice of a male-dominated major.**

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Interest in the field (44)	<i>Brown</i> : trait-factor-personality; <i>Holland</i> : consistent with personality; <i>Chickering</i> : ego development theory <i>Ellis &amp; Eng</i> : chose these fields because they are good at science and math	1–AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
Career Goals; Jobs, \$\$\$ (38)	<i>Bandura</i> : self-efficacy–performance accomplishments tied to goals; <i>Brush, Daffin, Lips, Rossi, Schiebinger, Seymour</i> : under-representation of women <i>St. John</i> : degree of debt load linked to higher-paying career <i>Conciatore, McDonnell, Oakes and Shavelson, National Science Board</i> : opportunities for women <i>Lettman</i> : Internal career rewards <i>Bandura</i> : lower career expectations related to self-efficacy theory <i>Brainard</i> : insufficient financial resources	16–Career opportunities	R	2 (4%)	4 (8.5%)	12(25.5%)	15 (32%)	14 (30%)	3.7
			L	0	4 (27%)	3 (20%)	5 (33%)	3 (20%)	3.5
		24–High income	R	4 (9%)	12 (25.5%)	12 (25.5%)	18 (38%)	1 (2%)	3.0
			L	0	5 (33%)	5 (33%)	4 (27%)	1 (7%)	3.1
Challenge, Determination, Perseverance (32)	<i>Chickering</i> : ego development, intellectual, social and emotional development with emphasis on individual competition <i>Astin</i> : 1/3 do not complete plans to major in physical science or engineering <i>Hewitt &amp; Seymour</i> : challenge “prove” themselves	1–AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2–Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		21–Contribute to society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7

*R* = Remaining; *L* = Leaving

Number in parentheses represents the number of student responses in the Focus Groups.

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Ability and Experience in the field (24)	<i>Eccles</i> : achieve in math/science AP classes	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Ellis</i> : women good in science and math	4-Enrichment activities	R	0	4 (9%)	9 (19%)	16 (34%)	18 (38%)	4.0
			L	0	1 (7%)	2 (13%)	8 (53%)	4 (27%)	4.0
	<i>Bandura</i> : Accomplishments	5-Teacher recommend.	R	1 (2%)	7 (15%)	8 (17%)	25 (53%)	6 (13%)	3.6
			L	0	3 (20%)	2 (13%)	9 (60%)	1 (7%)	3.5
	<i>Widnall</i> : High performance in high school, good SAT scores, encouragement from teachers	6-Internships	R	0	4 (9%)	7 (15%)	18 (38%)	18 (38%)	4.1
			L	0	0	2 (13%)	8 (53%)	5 (33.3%)	4.2
	<i>Lips</i> : Women are not affirmed for their abilities, even though academic record usually equal to or better than men	7-Summer jobs	R	0	7(15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
	<i>Hewitt and Seymour; Wane et al.</i> : Few women leave because of grades	18-Terminology	R	0	4 (9%)	11 (23%)	26 (55.3%)	6 (12.7%)	3.7
			L	0	3 (20%)	3 (20%)	7 (47%)	2 (13%)	3.5
	22-Easy grades		R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
			L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1
23-HS career activities		R	1 (2%)	7 (15%)	8 (17%)	20 (43%)	11 (23%)	3.7	
		L	0	1 (7%)	1 (7%)	8 (53%)	5 (33%)	4.1	

Appendix H, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Self-confidence (21)	<p><i>Super</i>: vocational choice is implementation of self-concept;  <i>Lettman</i>: high self-esteem/persons satisfy intrinsic needs through career;  <i>Holland; Super</i>: self-esteem is moderator variable in vocational choice;  <i>Korman</i>: individual with high self-esteem more likely to choose careers requiring high abilities;  <i>Resnick, Fauble et al.</i>: more confident of career plans  <i>Jones and Lamke</i>: high self-esteem individuals have more androgynous and masculine characteristics;  <i>Strenta</i>: women less confident to do science;  <i>Wane &amp; Dill</i>: marked differences in self confidence of male and female science students;  <i>Bandura</i>: coping abilities, fear of success;  <i>Coopersmith</i>: interpersonal competence;  <i>Hackett &amp; Betz</i>: strong self efficacy expectations and assertiveness</p>	2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Desire to make a difference (9)	<i>Holland</i> : personality types; <i>Brown</i> : trait-factor personality <i>Borden</i> ; <i>Roe</i> ; <i>Roe &amp; Lunneborg</i> : Satisfying intrinsic personality needs; <i>Hackett &amp; Betz</i> : strong self-efficacy expectations; <i>Marcia</i> ; <i>Waterman &amp; Waterman</i> : ego identity in developmental process; <i>Lettman</i> : high self-esteem linked to satisfying internal needs and intrinsic motivations <i>Hewitt &amp; Seymour</i> : leavers likely to leave for more humanitarian or personal satisfaction	21-Contribute to Society	R L	1 (2%) 0	3 (6%) 1 (7%)	5 (11%) 5 (33%)	24 (51%) 7 (47%)	14 (30%) 2 (13%)	4.0 3.7

Appendix I, Summary of Findings, *continued***Question 2: Thinking of your own experiences, describe the meaning and motivations which influence your choice of a male-dominated major.**

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
High school experience (42)	<i>Bandura</i> : performance accomplishments include vicarious experiences and encouragement from others; <i>Arnold</i> : role models; <i>Krumboltz</i> : social learning theory/positive reinforcement; <i>Chickering &amp; others</i> : identity formation; <i>Brandon</i> : self-esteem <i>Loeffler &amp; Fiedler</i> : interpersonal competence and self identification	1–AP classes	R	0		2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0		0	3 (20%)	12 (80%)	4.8
		4–Enrichment activities	R	0		9 (19%)	16 (34%)	18 (38%)	4.0
			L	0		2 (13%)	8 (53%)	4 (27%)	4.0
		5–Teacher recommend.	R	1 (2%)		8 (17%)	25 (53%)	6 (13%)	3.6
			L	0		2 (13%)	9 (60%)	1 (7%)	3.5
		6–Internships	R	0		7 (15%)	18 (38%)	18 (38%)	4.1
			L	0		2 (13%)	8 (53%)	5 (33.3%)	4.2
		7–Summer jobs	R	0		8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0		3 (20%)	9 (60%)	3 (20%)	4.0
		9–Female role models	R	0		8 (17%)	17 (36%)	18 (38%)	4.0
			L	0		0	9 (60%)	6 (40%)	4.4
		22–Easy grades	R	3 (6%)		13 (28%)	17 (36%)	6 (13%)	3.3
			L	0		4 (27%)	6 (40%)	0	3.1
23–HS career activities	R	1 (2%)		8 (17%)	20 (43%)	11 (23%)	3.7		
	L	0		1 (7%)	8 (53%)	5 (33%)	4.1		

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean		
Challenges, career/job opportunities, \$\$\$ (41)	<i>Bandura</i> : self-efficacy– performance accomplishments tied to goals; <i>Brush, Daffin, Lips, Resci, Schieinger, Seymour</i> : under- representation of women <i>St. John</i> : degree of debt load to higher-paying career <i>Conciatore, McDonnell, Oakes and Shavelson</i> , National Science Board: opportunities for women <i>Lettman</i> : Internal career rewards <i>Bandura</i> : lower career expectations related to self- efficacy theory <i>Brainard</i> : insufficient \$ resources <i>Chickering</i> : ego development, intellectual, social and emotional development with emphasis on individual competition <i>Astin</i> : 1/3 do not complete plans to major in physical science or engineering <i>Hewitt and Seymour</i> : challenge “prove” themselves	1–AP Classes	R L	0 0	0 0	2 (4.3%) 0	18 (38.3%) 3 (20%)	27 (57.4%) 12 (80%)	4.6 4.8		
		2–Confidence	R L	0 0	0 0	0 0	3 (6%) 3 (20%)	44 (94%) 12 (80%)	4.9 4.8		
		16–Career opportunities	R L	2 (4%) 0	4 (8.5%) 4 (27%)	12 (25.5%) 3 (20%)	15 (32%) 5 (33%)	14 (30%) 3 (20%)	3.7 3.5		
		21–Contribute to society	R L	1 (2%) 0	3 (6%) 1 (7%)	5 (11%) 5 (33%)	24 (51%) 7 (47%)	14 (30%) 2 (13%)	4.0 3.7		
		24–High income	R L	4 (9%) 0	12 (25.5%) 5 (33%)	12 (25.5%) 5 (33%)	18 (38%) 4 (27%)	1 (2%) 1 (7%)	3.0 3.1		
		Family Influences (31)	<i>Krumboltz/Bandura</i> : Social learning theory, person more likely to learn & use skills with positive reinforcement; encouragement from others; <i>Sadler &amp; Sadler</i> : negative reinforcement; <i>Peng &amp; Jaffe</i> : societal expectations <i>Morgan</i> : family discouragement; <i>Seymour &amp; Hewitt</i> : Support from family	3–Family support	R L	0 0	1 (2%) 2 (13%)	2 (4%) 0	14 (30%) 6 (40%)	30 (64%) 7 (47%)	4.5 4.2

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Personal strengths (29)	<i>Bandura</i> : personal accomplishments; <i>Arnold</i> : performance <i>Ellis &amp; Eng</i> : good at science and math <i>Lips</i> : academic record equal to or better than men; <i>Korman</i> : persons with high self-esteem more likely to choose occupation requiring high abilities	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
Dreams of becoming engineer (22)	<i>Super, Bandura, Korman</i> : relates to self-esteem, contribution to society (to make world a better place); extrinsic/intrinsic career rewards; <i>Hackett &amp; Betz</i> : self efficacy tasks	2-Confidence	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		16-Career opportunities	R	2 (4%)	4 (8.5%)	12 (25.5%)	15 (32%)	14 (30%)	3.7
			L	0	4 (27%)	3 (20%)	5 (33%)	3 (20%)	3.5
Desire to make a difference (9)	<i>Holland</i> : personality types; <i>Brown</i> : trait-factor personality <i>Borden; Roe; Roe &amp; Lunneborg</i> : Satisfying intrinsic personality needs; <i>Hackett &amp; Betz</i> : strong self-efficacy expectations; <i>Marcia; Waterman &amp; Waterman</i> : ego identity in developmental process; <i>Lettman</i> : high self-esteem linked to satisfying internal needs and intrinsic motivations <i>Hewitt &amp; Seymour</i> : leavers likely to leave for more humanitarian or personal satisfaction	21-Contribute to society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7

Appendix I, Summary of Findings, *continued*

**Question 3: Describe the factors which influenced your decision to remain in or to leave that male-dominated major.**

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Enjoyment of field/major (32)	<i>Korman</i> : high ability majors chosen by persons with high self-esteem; <i>Holland</i> : theory of vocational choice related to personality; <i>Erickson, Waterman</i> : occupation that is acceptable and personally expressive; <i>Bandura</i> : people perform those activities of which they judge themselves capable; <i>Hackett &amp; Betz</i> : strong self-efficacy skills <i>Dickstein</i> : individual happiness & dignity are involved in self-esteem; <i>Jahoda</i> : positive mental health	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		12-Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
		22-Easy grades	R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
			L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1
Prove I can do it/Refuse to Lose (25)	<i>Chickering</i> : ego development, intellectual, social and emotional development with emphasis on individual competition <i>Astin</i> : 1/3 do not complete plans to major in physical science or engineering <i>Hewitt and Seymour</i> : challenge "prove" themselves	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		21-Contribute to society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Support from family/friends (15)	<i>Krumboltz/Bandura</i> : Social learning theory, person more likely to learn & use skills with positive reinforcement; encouragement from others; <i>Sadler &amp; Sadler</i> : negative reinforcement; <i>Peng &amp; Jaffe</i> : societal expectations <i>Morgan</i> : family discouragement; <i>Seymour &amp; Hewitt</i> : Support from family <i>Tinto</i> : academic and social integration; <i>Morgan</i> : discouragement is barrier in career goals; <i>Daniels, Landis</i> : low peer support contributes to performance; <i>Brozovsky</i> : social isolation linked to leaving; <i>Astin</i> : peers = most potent influence on growth and development; <i>Seymour and Hewitt</i> : support from parents to leave; <i>Widnall</i> : supportive feelings from family friends in high school to feelings to isolation, insecurity, and self-doubt <i>Schnabel</i> : peer relations	3–Family support	R L	0 0	1 (2%) 2 (13%)	2 (4%) 0	14 (30%) 6 (40%)	30 (64%) 7 (47%)	4.5 4.2
		15–Peer support	R L	0 0	4 (8.5%) 0	1 (2.1%) 1 (7%)	20 (42.5%) 4 (27%)	22 (46.8%) 10 (66%)	4.3 4.6
		17–Same mjr roommate	R L	3 (6%) 1 (6.7%)	20 (43%) 6 (40%)	6 (13%) 4 (26.6%)	9 (19%) 4 (26.6%)	9 (19%) 0	3.0 2.7
		19–Social support	R L	2 (4%) 0	8 (17%) 1 (7%)	7 (15%) 5 (33%)	17 (36%) 6 (40%)	13 (28%) 3 (20%)	3.2 3.7

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Ability to do the work successfully (10)	<i>Eccles</i> : achieve in math/science AP classes	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Ellis</i> : women good in science and math	4-Enrichment activities	R	0	4 (9%)	9 (19%)	16 (34%)	18 (38%)	4.0
			L	0	1 (7%)	2 (13%)	8 (53%)	4 (27%)	4.0
	<i>Bandura</i> : Accomplishments	5-Teacher recommend	R	1 (2%)	7 (15%)	8 (17%)	25 (53%)	6 (13%)	3.6
			L	0	3 (20%)	2 (13%)	9 (60%)	1 (7%)	3.5
	<i>Widnall</i> : High performance in high school, good SAT scores, encouragement from teachers	6-Internships	R	0	4 (9%)	7 (15%)	18 (38%)	18 (38%)	4.1
			L	0	0	2 (13%)	8 (53%)	5 (33.3%)	4.2
	<i>Lips</i> : Women are not affirmed for their abilities, even though academic record usually equal to/better than men	7-Summer jobs	R	0	7 (15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
	<i>Hewitt and Seymour; Wane et al.</i> : Few women leave because of grades	18-Terminol.	R	0	4 (9%)	11 (23%)	26 (55.3%)	6 (12.7%)	3.7
			L	0	3 (20%)	3 (20%)	7 (47%)	2 (13%)	3.5
	22-Easy grades		R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
			L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1
23-HS career activities		R	1 (2%)	7 (15%)	8 (17%)	20 (43%)	11 (23%)	3.7	
		L	0	1 (7%)	1 (7%)	8 (53%)	5 (33%)	4.1	

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Helpful Professors, Advisors (7)	<i>Tinto</i> : positive climate; ACPA: classroom learning mediated by activities outside classroom;	8–Mentoring	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
	<i>Hewitt &amp; Seymour</i> : personal faculty-student pedagogical relationship;	10–Faculty support	R	0	1 (2.1%)	4 (8.5%)	21 (44.7%)	21 (44.7%)	4.3
			L	0	0	5 (33.3%)	5 (33.3%)	5 (33.3%)	4.0
	<i>Freeman</i> : effect of faculty rejection;	11–Effective advising	R	0	1 (2.1%)	8 (17%)	19 (40.4%)	19 (40.4%)	4.2
			L	0	0	1 (7%)	12 (80%)	2 (13%)	4.1
	<i>Mcllwee &amp; Robinson</i> : faculty relationships;	12–Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
	<i>Seymour &amp; Hewitt</i> : negative faculty;	13–Prof. Groups	R	1 (2%)	7 (15%)	10 (21%)	23 (49%)	6 (13%)	3.6
			L	0	2 (13%)	6 (40%)	4 (27%)	3 (20%)	3.5
\$\$\$ (6)	<i>Bandura</i> : self-efficacy–performance accomplishments tied to goals;	16–Career opportunities	R	2 (4%)	4 (8.5%)	12(25.5%)	15 (32%)	14 (30%)	3.7
			L	0	4 (27%)	3 (20%)	5 (33%)	3 (20%)	3.5
	<i>Brush, Daffin, Lips, Resci, Schieinger, Seymour</i> : under-representation of women	24–High income	R	4 (9%)	12 (25.5%)	12 (25.5%)	18 (38%)	1 (2%)	3.0
			L	0	5 (33%)	5 (33%)	4 (27%)	1 (7%)	3.1
<i>St. John</i> : degree of debt load to higher-paying career	<i>Conciatore, McDonnell, Oakes and Shavelson</i> , National Science Board: opportunities for women	<i>Lettman</i> : Internal career rewards	<i>Bandura</i> : lower career expectations related to self-efficacy theory	<i>Brainard</i> : insufficient financial resources					

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Desire to make a difference (2)	<i>Holland</i> : personality types; <i>Brown</i> : trait-factor personality <i>Borden</i> ; <i>Roe</i> ; <i>Roe &amp; Lunneborg</i> : Satisfying intrinsic personality needs; <i>Hackett &amp; Betz</i> : strong self-efficacy expectations; <i>Marcia</i> ; <i>Waterman &amp; Waterman</i> : ego identity in developmental process; <i>Lettman</i> : high self-esteem linked to satisfying internal needs and intrinsic motivations <i>Hewitt &amp; Seymour</i> : leavers likely to leave for more humanitarian or personal satisfaction	21-Contribute to Society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7
<b>LEAVING</b>									
Frustration, Intimidation, tired of having to prove myself (26)	<i>Chickering</i> : ego development, intellectual, social and emotional development with emphasis on individual competition <i>Astin</i> : 1/3 do not complete plans to major in physical science or engineering <i>Hewitt and Seymour</i> : challenge "prove" themselves	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		21-Contribute to society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7



Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Intimidation from professors/Peers (4)	<i>Tinto</i> : positive climate; ACPA: classroom learning mediated by activities outside classroom; <i>Hewitt &amp; Seymour</i> : personal faculty-student pedagogical relationship; <i>Freeman</i> : effect of faculty rejection; <i>McIlwee &amp; Robinson</i> : faculty relationships; <i>Seymour &amp; Hewitt</i> : negative faculty; <i>Sandler &amp; Hall</i> ; <i>Sadker &amp; Sadker</i> : chilly climate; <i>Light</i> : encounters with advisors and faculty; <i>Daniels, Freeman; Landis; McIlwee &amp; Robinson, Schnabel</i> : lower peer and faculty support; <i>Schnabel</i> : faculty behaviors <i>Freeman</i> : failure to encourage women an have same effect as discrimination; <i>Brozovsky</i> : social isolation and unsatisfactory interactions with faculty associated with leaving; <i>Hirschfield &amp; Majumdar</i> : negative treatment and gender neutrality associated with "chilly climate"	8-Mentoring	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
		10-Faculty support	R	0	1 (2.1%)	4 (8.5%)	21 (44.7%)	21 (44.7%)	4.3
			L	0	0	5 (33.3%)	5 (33.3%)	5 (33.3%)	4.0
		11-Effective advising	R	0	1 (2.1%)	8 (17%)	19 (40.4%)	19 (40.4%)	4.2
			L	0	0	1 (7%)	12 (80%)	2 (13%)	4.1
		12-Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
		13-Prof. Groups	R	1 (2%)	7 (15%)	10 (21%)	23 (49%)	6 (13%)	3.6
			L	0	2 (13%)	6 (40%)	4 (27%)	3 (20%)	3.5

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Grades/Extra time to change (4)	<i>Eccles</i> : achieve in math/science AP classes <i>Ellis</i> : women good in science and math <i>Bandura</i> : Accomplishments <i>Widnall</i> : High performance in high school, good SAT scores, encouragement from teachers <i>Lips</i> : Women are not affirmed for their abilities, even though academic record usually equal to or better than men <i>Hewitt and Seymour; Wane et al.</i> : Few women leave because of grades	1–AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		22–Easy grades	R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
			L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1

Appendix I, Summary of Findings, *continued*

**Question 4: What are the significant experiences that you would deem important for a student to have as she considers a male-dominated major?**

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
High confidence building experiences (50)	<i>Bandura</i> : Performance activities; <i>Krumboltz/Bandura</i> : Social learning theory; <i>Tobias</i> : Interactive learning activities; <i>Arnold</i> : supportive role models <i>Krumboltz</i> : positive learning experiences; <i>Mitchell &amp; Krumboltz</i> : sharing career decision-making skills <i>Parrish</i> : Intentional curriculum enhancements for self-esteem building; <i>Lettman</i> : high self-esteem persons more resistant to societal influences in career development; <i>Bem</i> : learn androgynous behaviors (leadership skills); <i>Orlofsky</i> : assertiveness skills; <i>Loeffler and Fiedler</i> : curriculum innovations; <i>Baxter/Magolda</i> : Women are more focused on relationships that learning	1–AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2–Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		8–Mentoring role models	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	7 (26.7%)	4.0
		9–Role models	R	0	4 (9%)	8 (17%)	17 (36%)	18 (38%)	4.0
			L	0	0	0	9 (60%)	6 (40%)	4.4
		12–Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Experiences that require perseverance, determination and quality of effort (48)	<i>Chickering</i> : ego development, intellectual, social and emotional development with emphasis on individual competition <i>Astin</i> : 1/3 do not complete plans to major in physical science or engineering <i>Hewitt and Seymour</i> : challenge "prove" themselves <i>Eccles</i> : achieve in math/science AP classes <i>Ellis</i> : women good in science and math <i>Bandura</i> : Accomplishments <i>Widnall</i> : High performance in high school, good SAT scores, encouragement from teachers <i>Lips</i> : Women are not affirmed for their abilities, even though academic record usually equal to/better than men <i>Hewitt and Seymour; Wane et al.</i> : Few women leave because of grades	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		4-Enrichment activities	R	0	4 (9%)	9 (19%)	16 (34%)	18 (38%)	4.0
			L	0	1 (7%)	2 (13%)	8 (53%)	4 (27%)	4.0
		5-Teacher recommend.	R	1 (2%)	7 (15%)	8 (17%)	25 (53%)	6 (13%)	3.6
			L	0	3 (20%)	2 (13%)	9 (60%)	1 (7%)	3.5
		6-Internships	R	0	4 (9%)	7 (15%)	18 (38%)	18 (38%)	4.1
			L	0	0	2 (13%)	8 (53%)	5 (33.3%)	4.2
		7-Summer jobs	R	0	7 (15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
		18-Termin.	R	0	4 (9%)	11 (23%)	26 (55.3%)	6 (12.7%)	3.7
			L	0	3 (20%)	3 (20%)	7 (47%)	2 (13%)	3.5
		21-Contribute to society	R	1 (2%)	3 (6%)	5 (11%)	24 (51%)	14 (30%)	4.0
			L	0	1 (7%)	5 (33%)	7 (47%)	2 (13%)	3.7
		22-Easy grades	R	3 (6%)	8 (17%)	13 (28%)	17 (36%)	6 (13%)	3.3
			L	0	5 (33%)	4 (27%)	6 (40%)	0	3.1
23-HS career activities	R	1 (2%)	7 (15%)	8 (17%)	20 (43%)	11 (23%)	3.7		
	L	0	1 (7%)	1 (7%)	8 (53%)	5 (33%)	4.1		

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Exposure to male interests, ability to relate to men (28)	<i>Krumboltz</i> : Positive learning experiences; <i>Tobias</i> : Interactive learning experiences; <i>Seymour, Schnabel, Sandler &amp; Hall</i> : Positive treatment by peers, faculty; <i>Bem</i> : Learn androgynous behaviors (leadership skills) <i>Seymour &amp; Hewitt</i> : Invisible treatment to "just be one of the guys"	2–Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		12–Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
Assertiveness training (24)	<i>Bandura</i> : Performance activities; <i>Krumboltz/Bandura</i> : Social learning theory; <i>Tobias</i> : Interactive learning activities; <i>Arnold</i> : supportive role models <i>Krumboltz</i> : positive learning experiences; <i>Mitchell &amp; Krumboltz</i> : sharing career decision-making skills <i>Parrish</i> : Intentional curriculum enhancements for self-esteem building; <i>Lettman</i> : high self-esteem persons more resistant to societal influences in career development; <i>Bem</i> : learn androgynous behaviors (leadership skills); <i>Orlofsky</i> : assertiveness skills; <i>Loeffler and Fiedler</i> : curriculum innovations; <i>Baxter/Magolda</i> : Women are more focused on relationships than learning	1–AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
		2–Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
		8–Mentoring role models	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
		9–Role models	R	0	4 (9%)	8 (17%)	17 (36%)	18 (38%)	4.0
			L	0	0	0	9 (60%)	6 (40%)	4.4
		10–Faculty support	R	0	1 (2.1%)	4 (8.5%)	21 (44.7%)	21 (44.7%)	4.3
			L	0	0	5 (33.3%)	5 (33.3%)	5 (33.3%)	4.0
		12–Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	27 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Communication Skills (20)	<i>Bandura</i> : Performance activities; <i>Krumboltz/Bandura</i> : Social learning theory;	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Tobias</i> : Interactive learning activities; <i>Arnold</i> : supportive role models	2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Krumboltz</i> : positive learning experiences; <i>Mitchell &amp; Krumboltz</i> : sharing career decision-making skills	6-Internships	R	0	4 (9%)	7 (15%)	18 (38%)	18 (38%)	4.1
			L	0	0	2 (13%)	8 (53%)	5 (33.3%)	4.2
	<i>Parrish</i> : Intentional curriculum enhancements for self-esteem building; <i>Lettman</i> : high self-esteem persons more resistant to societal influences	7-Summer jobs	R	0	7 (15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
	<i>Bem</i> : learn androgynous behaviors (leadership skills); <i>Orlofsky</i> : assertiveness skills;	8-Mentoring role models	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
	<i>Loeffler and Fiedler</i> : curriculum innovations; <i>Baxter/Magolda</i> : Women are more focused on relationships than learning	9-Role models	R	0	4 (9%)	8 (17%)	17 (36%)	18 (38%)	4.0
			L	0	0	0	9 (60%)	6 (40%)	4.4
	12-Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1	
		L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2	
	18-Terminology	R	0	4 (9%)	11 (23%)	26 (55.3%)	6 (12.7%)	3.7	
		L	0	3 (20%)	3 (20%)	7 (47%)	2 (13%)	3.5	
Strong background in science, math and computers (17)	<i>Lips</i> : Women's academic record	1-AP classes	R	0	0	2 (4.3%)	18 (38.3%)	27 (57.4%)	4.6
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Bandura</i> : personal accomplishments; <i>Arnold</i> : performance	2-Confidence	R	0	0	0	3 (6%)	44 (94%)	4.9
			L	0	0	0	3 (20%)	12 (80%)	4.8
	<i>Ellis &amp; Eng</i> : good at science and math <i>Lips</i> : academic record equal to or better than men; <i>Korman</i> : persons with high self-esteem more likely to choose occupation requiring high abilities	14-Computers	R	0	3 (6%)	4 (9%)	14 (30%)	26 (55%)	4.5
			L	0	1 (7%)	0	4 (27%)	10 (66%)	4.5

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Good role models/learn to network (16)	<i>Arnold</i> : Supportive role models; <i>Tinto</i> : positive climate; ACPA: classroom learning mediated by activities outside classroom; <i>Hewitt &amp; Seymour</i> : personal faculty-student pedagogical relationship; <i>Freeman</i> : effect of faculty rejection; <i>McIlwee &amp; Robinson</i> : faculty relationships; <i>Seymour &amp; Hewitt</i> : negative faculty; <i>Sandler &amp; Hall</i> ; <i>Sadker &amp; Sadker</i> : chilly climate; <i>Light</i> : encounters with advisors and faculty; <i>Daniels, Freeman; Landis; McIlwee &amp; Robinson, Schnabel</i> : lower peer and faculty support; <i>Schnabel</i> : faculty behaviors	8–Mentoring	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
		10–Faculty support	R	0	1 (2.1%)	4 (8.5%)	21 (44.7%)	21 (44.7%)	4.3
			L	0	0	5 (33.3%)	5 (33.3%)	5 (33.3%)	4.0
		11–Effective advising	R	0	1 (2.1%)	8 (17%)	19 (40.4%)	19 (40.4%)	4.2
			L	0	0	1 (7%)	12 (80%)	2 (13%)	4.1
		12–Positive climate	R	0	4 (8.5%)	5 (10.6%)	21 (44.6%)	17 (36%)	4.1
			L	0	1 (6.6%)	1 (6.6%)	7 (46.7%)	6 (40%)	4.2
		13–Professional group	R	1 (2%)	7 (15%)	10 (21%)	23 (49%)	6 (13%)	3.6
			L	0	2 (13%)	6 (40%)	4 (27%)	3 (20%)	3.5
Obtain good career information (16)	<i>McClaran</i> : Decision-making skills; <i>Arnold</i> : Observing woman in career; <i>Krumboltz</i> : Sharing career information; <i>Dunlop &amp; Canale</i> : Lower career aspirations	7–Summer jobs	R	0	7 (15%)	8 (17%)	20 (42.5%)	12 (25.5%)	3.8
			L	0	0	3 (20%)	9 (60%)	3 (20%)	4.0
		8–Mentoring	R	0	5 (11%)	10 (21%)	21 (45%)	11 (23%)	3.8
			L	0	0	4 (26.7%)	7 (46.6%)	4 (26.7%)	4.0
		11–Effective advising	R	0	1 (2.1%)	8 (17%)	19 (40.4%)	19 (40.4%)	4.2
			L	0	0	1 (7%)	12 (80%)	2 (13%)	4.1
		23–HS career activities	R	1(2%)	7 (15%)	8 (17%)	20 (43%)	11 (23%)	3.7
			L	0	1 (7%)	1 (7%)	8 (53%)	5 (33%)	4.1

Appendix I, Summary of Findings, *continued*

Focus Group	Literature Review	Survey Item		Disagree Very Strongly	Disagree	Undecided	Agree	Agree Very Strongly	Mean
Seek support from friends, family and others	<i>Krumboltz/Bandura</i> : Social learning theory, person more likely to learn & use skills with positive reinforcement; encouragement from others; <i>Sadler &amp; Sadler</i> : negative reinforcement; <i>Peng &amp; Jaffe</i> : societal expectations <i>Morgan</i> : family discouragement; <i>Seymour &amp; Hewitt</i> : Support from family <i>Tinto</i> : academic and social integration; <i>Morgan</i> : discouragement is barrier in career goals; <i>Daniels, Landis</i> : low peer support contributes to performance; <i>Brozavsky</i> : social isolation linked to leaving; <i>Astin</i> : peers = most potent influence on growth and development; <i>Seymour and Hewitt</i> : support from parents to leave; <i>Widnall</i> : supportive feelings from family friends in high school to feelings to isolation; insecurity and self-doubt <i>Schnabel</i> : peer relations	3-Family support	R L	0 0	1 (2%) 2 (13%)	2 (4%) 0	14 (30%) 6 (40%)	30 (64%) 7 (47%)	4.5 4.2
		15-Peer support	R L	0 0	4 (8.5%) 0	1 (2.1%) 1 (7%)	20 (42.5%) 4 (27%)	22 (46.8%) 10 (66%)	4.3 4.6
		17-Same maj. Roommate	R L	3 (6%) 1 (6.7%)	20 (43%) 6 (40%)	6 (13%) 4 (26.6%)	9 (19%) 4 (26.6%)	9 (19%) 0	3.0 2.7
		19-Social support	R L	2 (4%) 0	8 (17%) 1 (7%)	7 (15%) 5 (33%)	17 (36%) 6 (40%)	13 (28%) 3 (20%)	3.2 3.7

GAIL SATTERFIELD CATRON

**VITAE**

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**EDUCATION**

Ph.D. 1997 Virginia Polytechnic Institute & State University  
M. S. Radford University  
B. A. Emory & Henry College

**EXPERIENCE**

WYTHEVILLE COMMUNITY COLLEGE: Coordinator of Financial Aid

- Administer student financial aid program of \$2.1 million Implemented DIRECT LOAN & QUALITY ASSURANCE Programs
- Focus Groups, Dept. of Education, Reengineering the Application; FISAP
- VASFAA Conference Planning Committee, 1995-96  
Chair, Awareness Committee, 1996-98
- Presenter, VASFAA Fall, 1995 & Spring 1996  
NASFAA Philadelphia, 1997  
NASFAA Denver, 1996
- VCCS Peer Conference Co-Chair April, 1996

BLUEFIELD STATE COLLEGE: Coordinator of Counseling, Academic Advising, Placement (CAP Center).  
Director of Counseling and Testing.

- Supervision of counseling, academic advising, testing, multi-cultural activities, peer tutoring, work study and placement program
- Planned and implemented strategies for success for nontraditional students—PINNACLE HONOR SOCIETY and “The 30 Something? Crowd”
- Chaired North Central Association Design Committee for the college self study—received ten year accreditation
- Mentioned by North Central Evaluators, the CAP Center was a major strength and innovative program
- Served as member of Joint Academic Affairs Committee for curriculum evaluation and revision
- Administered and assisted in planning college assessment program, including student outcomes assessment for developmental classes

WYTHEVILLE COMMUNITY COLLEGE

Adjunct Faculty Psychology

**WYTHE COUNTY SCHOOLS**

- Remedial Reading and English Teacher

**ADDITIONAL EXPERIENCE**

Private Practice, Licensed Professional Counselor #971  
 Employee Assistance Programs  
 Mental Health Counselor, Twin County Community Hospital  
 Director, Social Services, Wythe County Community Hospital  
 Psychological Counselor, Blue Ridge Job Corps Center  
 Owner, Seams and Dreams  
 Counselor, Wythe County Schools

**AWARDS AND HONORS**

Honorary membership in PINNACLE National Honor Society for students for exceptional contributions to nontraditional students

Honorary membership in PHI ETA SIGMA National Honor Society for students for exceptional contributions to freshmen students.

Phi Beta Lambda Counseling Honor Society

**POLICY-MAKING AND ADVISORY BOARDS**

- Appointed by Gov. Dalton to State Board of Mental Health, Mental Retardation, and Substance Abuse; served as Vice Chair; Budget and planning review for \$30 million budget and Liaison to Community Services Boards.
- Appointed by Gov. Baililes to FACT, Family and Children's Trust Fund of Virginia; reappointed by Gov. Wilder—as Trustee for the prevention of family violence; served as Board Chair.
- Chair, Better Beginnings for Virginia's Children—statewide project for the prevention of adolescent pregnancy.
- Vice-Chair, Action for Prevention, Inc.—Virginia coalition for the prevention of mental retardation and developmental disabilities.
- Organized Mt. Rogers Community Mental Health and Mental Retardation and Substance Abuse Board for Bland, Carroll, Grayson, Smyth, and Wythe Counties and the City of Galax—coalition building for service delivery; served as Board Chair. Helped establish Virginia Association of Community Services Board.
- Helped establish Family Resource Center for abused women and children. Grant writer and Chair.
- Serve on Board of Directors of Action Alliance for Virginia's Children—statewide advocacy board for children

**PROFESSIONAL AFFILIATIONS**

Virginia Association of Student Financial Aid Administrators  
 National Association of Student Financial Aid Administrators  
 National Academic Advising Association  
 American College Personnel Association  
 Virginia College Personnel Association  
 National Association of Student Personnel Administrators  
 Virginia Counselors Association  
 Virginia Clinical Counselors Association  
 American Counselors Association  
 American Mental Health Counselors Association