

ABSTRACT

CANNON, SHARON MCMILLEN. Supporting First-Year College Women in Math, Science, and Related Majors: A Career Development Intervention. (Under the direction of Siu-Man Raymond Ting.)

Nationally, college women in the early 1990s were dropping out of science, math and engineering majors at a rate of 70% compared to a male dropout rate of 61%. At elite schools, 54% of women left those majors compared to 39% of the men (Seymour & Hewitt, 1997.) The current study explored whether women students with interests in majoring in math and science who were enrolled in a first-year intervention course with a career development emphasis would score higher on post-test measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring in math and science who were in a no-treatment control group. Also explored was whether the women would be more likely to persist in their intended major and career choices than women with similar interests who were in a no-treatment control group. Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994, 1996) provided a theoretical framework for the intervention.

The participants in the treatment group ($n = 11$) did not exhibit significantly different changes from pretest to posttest than the control group ($n = 11$). Participants completed the Career Decision Self-Efficacy Scale-Short Form (Betz, Klein, & Taylor, 1996), the Career Aspiration Scale (O'Brien, 1992), the Coping with Barriers Scale (Luzzo & McWhirter, 2001), and the Attitudes Toward Multiple Role Planning Scales (Weitzman & Fitzgerald, 1996). Course evaluation feedback indicated satisfaction with the course. Limitations to the study, recommendations for further study, and implications for counselors are described. Researchers are encouraged to continue to explore possible moderating and mediating

variables in order to investigate the complexities of retaining college women in math and science-related majors.

**SUPPORTING FIRST-YEAR COLLEGE WOMEN
IN MATH, SCIENCE, AND RELATED MAJORS:
A CAREER DEVELOPMENT INTERVENTION**

by
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Chair of Advisory Committee

DEDICATION

This research is dedicated
to
Jeff and Lauren Cannon
for their love, patience, and support.

BIOGRAPHY

Sharon McMillen Cannon

Sharon McMillen Cannon grew up in Odessa, Texas, and Crawfordsville, Indiana. She earned her A.B. in 1981 from Washington University in St. Louis with majors in psychology and English and her M.Ed. in 1986 from the University of Florida in Counselor Education within the Student Personnel in Higher Education track.

Sharon served as Dean of Students at Meredith College from 1995-1999 before leaving to work on her doctorate. She returned to Meredith in 2003 to work part-time as a disability counselor and a Career Center intern while working on her dissertation. Prior to coming to Meredith, Sharon was Director of Leadership and Orientation Programs at Greensboro College and an Area Director in University Housing at UNC-Chapel Hill. Before earning her M.Ed., Sharon was an Assistant Director of Admissions at Austin College and a social worker for people with visual-impairments in West Palm Beach, Florida.

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Sharon and her husband, Jeff, currently live in Durham, North Carolina, with their daughter, Lauren.

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CHAPTER ONE

INTRODUCTION

Background

Young women's grades in math and science are often better on average than those of young men through the high school years (Seymour, 1999). In the last couple of decades, young women have received more encouragement to take math and science courses prior to college. As a result, the gender gap in science and math achievement has narrowed considerably (Phillips, 1998) but has not disappeared (Hanson, 1996). Researchers, educators, and policy makers have documented well the evidence of the persisting gender gap (Ginorio, 1995; Hanson, 1996; Phillips, 1998; Seymour & Hewitt, 1997; Thom, 2001).

Retention of potential female scientists, mathematicians, and engineers becomes complicated during the undergraduate years. Young women tend to begin college study of science, math, and technology with career goals that are less well defined than those of young men (Seymour, 1999). The Wellesley Pathways for Women in the Sciences project identified the first undergraduate year as a significant time when women disproportionately abandon plans to major in science (Civian & Brett, 1997, as cited in Thom, 2001). Nationally, young women in the early 1990s were dropping out of science, math and engineering majors at a rate of 70% compared to a male dropout rate of 61%. At elite schools, 54% of women left those majors compared to 39% of the men (Seymour & Hewitt, 1997).

Proportions of undergraduate women who successfully complete degrees in science, math, and technology vary with the field of study (Thom, 2001). In 1996, undergraduate women earned 53% of biology degrees, 19% of physics degrees, 46% of mathematics and

statistics degrees, 28% of computer science degrees, and 18% of engineering degrees (National Science Foundation, 2000, as cited in Thom, 2001). One hypothesis explaining women's choices suggests that women are attracted to fields like biology and medicine which they perceive to be helping and people-oriented fields and that they avoid technical fields like physics and engineering that they perceive to be thing-oriented (Thom). A discouraging fact is that when computer science was a relatively new field in 1984, women earned 37% of undergraduate degrees; in 1999, they earned fewer than 20% (Thom). The hypothesis for the decline is that over time boys began to dominate the use of computers in classrooms and homes, and girls began to perceive that computers were not for them (National Council for Research on Women, 1999, as cited in Thom).

Lubinski, Benbow, Shea, Eftekhari-Sanjani, and Halvorson (2001) discovered that top male and female graduate students in science and math had many similarities in their backgrounds including having had their interest in math and science stimulated by a special person and having participated in special programs. Lubinski et al. (2001) compared the backgrounds of the top graduate students to a group of mathematically precocious youth they have tracked since age 13 for 20 years. Interestingly, the females from the group of mathematically precocious youth were much less likely to have participated in special programs than the mathematically precocious males or the graduate students. In Benbow, Lubinski, Shea, and Eftekhari-Sanjani's (2000) study of the mathematically precocious youth, the women were more likely to have gone into careers that were not math or science related. One wonders whether more of these women who demonstrated early precocious math talent might have entered a math or science field if they had received more mentoring and had participated in more programs to encourage their talent.

Need for the Study

There have been a number of research studies on gender differences in interests and choices regarding science, math, and related majors and occupations (e.g., Betz & Hackett, 1983; Eccles, 1994; Hackett, 1985; Trusty, 2002). There also have been a number of career interventions created to support women interested in science, math, and engineering (e.g., Farrant & Miller, 1993; Fidler, Young, & Hein, 2000; Smith, Stroup, & Coffman, 1975; Thom, 2001). However, few researchers have focused on empirically testing the effects of career interventions for women interested in math and science related majors and careers.

There is recent research indicating that using a self-efficacy approach in an intervention is helpful. While not specifically targeted for women, Luzzo, Hasper, Albert, Bibby, and Martinelli (1999) found that participants with undecided majors who received a math/science self-efficacy intervention reported higher math/science course self-efficacy and greater interest in math/science related careers. Recent research (Sullivan & Mahalik, 2000) found that women in a career self-efficacy treatment condition improved significantly more than a control group on career decision-making self-efficacy and vocational exploration and commitment. Betz and Shifano (2000) designed a seven-hour intervention focused on increasing college women's realistic self-efficacy through building, repairing, and construction activities. Self-efficacy expectations of college women with respect to the Realistic interest theme of Holland's theory were significantly increased. Changes in interests and occupational self-efficacy were not found. Because of the degree of change in Realistic confidence from the brief treatment, the authors optimistically recommended a more elaborate and longer term intervention to help increase women's confidence in interest

themes traditionally viewed as male and suggested that such interventions could be useful in facilitating women's pursuit of scientific and technical fields.

Purpose of the Study

The purpose of this study was to investigate whether or not participation in a first-year experience course with career development components would result in women's retention in their intended area of college study (math, science, or related major). The study investigated the effect of the career enrichment program in the course on the participants' career aspirations, attitudes toward multiple role planning, career self-efficacy, and coping with barriers efficacy. The study also investigated whether mother's work history, math ability, and/or family income were related to retention outcomes in the intended major and outcomes on the career measures.

Theoretical Framework Underlying the Study

Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994, 1996) is based on Bandura's (1986) social cognitive theory. "SCCT highlights the interplay of social cognitive variables (such as self-efficacy) with other key person, contextual, and experiential/learning factors, such as gender, culture, support systems, and barriers" in the self-regulation of behavior (Lent et al., 1996, p. 416). SCCT proposes that background contextual variables (e.g., socioeconomic status and personality variables) exert an influence on career self-efficacy, which in turn influence careers interests and goals. In the absence of environmental barriers and in the presence of environmental support, interests translate into positive academic and career goals and behaviors. Because SCCT takes into consideration the impact of environmental barriers and support, Lent and colleagues suggested that SCCT might be used to guide inquiry on the career development of women (Lent, Brown, &

Hackett, 2000). SCCT has become one of the most studied theories in career development (Swanson & Gore, 2000). In particular, the theory has been used as a framework in many studies about relationships among social cognitive constructs and career outcomes in the math and science realm (Swanson & Gore, 2000).

Goals for the Design of the Intervention

The goals developed for guidance in the design of the intervention were: (1) To provide academic success skills for math, science, and related majors to women during their first year of college; (2) To help women in their current adjustment to college life; (3) To support college retention of women interested in math, science, or related majors; (4) To teach women about gender-related issues in higher education; (5) To expose women to career development theories; and (6) To expose women to multiple-role planning (Weitzman, 1994).

Research Hypotheses

The investigator hypothesized that women students with interests in majoring in math and science who were enrolled in a first-year intervention course would score higher on posttest measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring in math and science who were in a no-treatment control group.

Also, the author hypothesized that women students with interests in majoring in math and science who were enrolled in the first-year intervention course would be more likely to persist in their intended major and career field than women with similar interests who were in a no-treatment control group.

Definition of Terms

For the purposes of this study, the following definitions are offered:

Social Cognitive Career Theory (SCCT): SCCT evolved from Bandura's (1986) general social cognitive theory. "SCCT highlights the interplay of social cognitive variables (such as self-efficacy) with other key person, contextual, and experiential/learning factors, such as gender, culture, support systems, and barriers" in the self-regulation of behavior (Lent et al., 1996, p. 416).

Self-efficacy: People's beliefs they hold about their capabilities.

Outcome expectations: Personal beliefs about the consequences or outcomes of performing particular behaviors.

Goals: The determination to engage in a particular activity or to effect a particular future outcome.

Basic Assumption

It was assumed that the research participants would answer self-report items honestly and to the best of their ability.

Basic Limitations

Because a college population was used, results may not be generalizable to non-college populations. Because participants were students at a women's college, results may not be generalizable to coeducational colleges and universities. Random assignment of participants to treatment and control conditions was not possible in the present study; therefore, the possibility of sampling error was increased. The method of measurement for this study was the collection of data from participants both before and after the intervention took place by means of the same instrument. This pretest-posttest design allowed for the

possibility that practice effects, resulting from participants taking a familiar instrument during the posttest phase, may have occurred.

Summary

Consideration of the impact of environmental barriers and support and hypotheses about the relationship between interest and self-efficacy suggests that SCCT can be a useful framework for inquiry on the career development of women (Lent et al., 2000). This study was designed to test SCCT as a framework for career interventions with women college students interested in math and science-related majors.

CHAPTER TWO

LITERATURE REVIEW

In the context of a limited but growing body of literature on career interventions for college women with interests in math, science, and related majors, there is a need to demonstrate empirically what types of interventions might provide the needed support for retaining women interested nontraditional career fields. Social cognitive career theory (SCCT; Lent et al., 1994, 1996) is proposed as a framework for developing effective interventions. Reviewed is the history of career development including the theories that emerged in the 1980s and 1990s in response to a need to create career theories relevant to women's lives. Support for using SCCT as a theoretical framework for the study is described. Finally, the author describes relevant literature on career interventions and other related literature.

Brief Overview and History of Career Development

In the early 1900s, Frank Parsons advanced the first conceptual framework for career decision-making when he identified three factors needed for career choice: having an understanding of self, having knowledge of careers, and using these two factors to determine a good match between person and career (Brown, Brooks, & Associates, 1996). This idea of person-environment fit became a basis for many of the career theories that followed (Osipow, 1990). Early theorists created assessments for traits like aptitudes, achievements, interests, values, and personality in order to effectively match people with jobs (Sharf, 1997).

In the 1950s and 1960s, there was a flurry of research on career development that resulted in the creation of eight new theories of career choice and development (Isaacson & Brown, 2000). Of those theories, Super's (1957) theory of career choice and development,

Holland's (1959) theory of vocational choice, and Lofquist and Dawis' (1969) theory of work adjustment have continued to evolve and are considered to be among the most viable theories today (Brown et al., 1996). Roe's (1956) needs-theory approach to career choice emphasized early childhood experiences and was rooted in Maslow's theories of needs and personality. While her theory generated research and is often included in texts on career development, "it never became a major force in influencing practice" (p. 3, Brown et al.). The most significant theory of the 1970s and one that continues to be relevant today was that of Krumboltz and colleagues (Krumboltz, Mitchell, & Jones, 1976). They were the first to apply Bandura's (1971) social learning theory to career counseling.

In the 1980s, many researchers began to criticize theories of career development that had been developed by European American males. Critics (e.g., H. S. Astin, 1984; Hackett & Betz, 1981) asserted that dominant career theories had been developed with European American males in mind and did not effectively describe the career development of women. What resulted in the 1980s and 1990s was that a number of theories were created with women's development in mind. Those theories include: Gottfredson's (1981, 1996) theory of circumscription and compromise, Hackett and Betz's (1981) self-efficacy approach to the career development of women, H. S. Astin's (1984) sociopsychological model of career choice and work behavior, Farmer's (1985) model of career and achievement motivation, and Eccles et al. (1994) model of achievement-related choices. Of the theories developed with women in mind, Gottfredson's theory has received the most attention in reviews of major career counseling theories (e.g., Brown et al., 1996; Isaacson & Brown, 2000; Swanson & Gore, 2000). Hackett and Betz's (1981) self-efficacy approach has had an influential impact

on career development research and also is mentioned prominently in some reviews of theories (e.g., Sharf, 1997).

Other prominent theories of the 1980s and 1990s include: Brown's (1996) values-based, holistic model of career and life-role choices and satisfaction, Lent et al.'s (1995) SCCT, Peterson, Sampson, Reardon, and Lenz's (1996) cognitive information processing approach to career problem solving and decision making, Tiedeman and Miller-Tiedeman's (1984) individualistic perspective on career decision making, and Young, Valach, and Collin's (1996) contextual explanation of career (Brown et al., 1996). Of the newer theories, Lent et al.'s (1995) SCCT has had the most significant impact on recent research in career development (Swanson & Gore, 2000).

Theories Related to Career Development Issues of Women

Research over the past thirty years has demonstrated that one of the important factors affecting career development is gender (Betz & Fitzgerald, 1987). Extensive reviews of the research data on career development have documented gender differences in both process and outcomes (e.g., Betz & Fitzgerald, 1987; Fitzgerald & Crites, 1980). Betz and Fitzgerald (1987) identified four categories of variables that are particularly important in studying the career development of women: individual (e.g., self-esteem), background (e.g., female role models), educational (e.g., continuation in mathematics studies), and adult lifestyle (e.g., number of children). Researchers of women's career development have identified both internal and external barriers associated with women's career development. Studies have found that young women have lower career aspirations than young men (Betz, 1994; Betz & Fitzgerald, 1987) and perceive significantly more career-related barriers than young men

(Luzzo & McWhirter, 2001). College women often underestimate their potential for educational and career success (Betz, Heesacker, & Shuttleworth, 1990).

Many of the traditional career theories which were developed by white males of European descent (e.g., Holland, 1959; Super, 1957) have been criticized as being most useful for white males and not as useful for women, people of color, and people from lower socioeconomic levels (Johnson-Bailey & Tisdell, 1998). Some theories, including Super's (Super, Savickas, & Super, 1996) theory of career development, have been revised to better incorporate women's development but continue to be criticized for failing to address how gendered social constructions impact women's development (Johnson-Bailey & Tisdell).

Gottfredson's Theory of Circumscription and Compromise

Gottfredson (1981) proposed that during early socialization individuals go through a process of circumscription that involves eliminating some occupations as acceptable career options. She proposed that children limit their career options through a developmental process where gender role, social valuation and social class, and interests are considered. She proposed four stages of development in this process. In stage one, children who are three to five are oriented to size and power and classify occupations in simple ways. In stage two, children at ages six to eight rule out occupations perceived to be at odds with gender roles. In the next stage when children are nine to thirteen, awareness of social status and one's abilities contribute to circumscription. In the last stage, adolescents understand more complex information and begin to think of careers that seem congruent to their personal sense of self. At this stage, a process of compromise begins when preferred career options are eliminated because of perceived barriers. According to her theory, gender role is crystallized by the age of 8, and after that children and adults will not consider careers that

are inconsistent with gender role expectations. Because gender roles are so tied to identity, Gottfredson (1981) theorized that when forced to make compromises on career choice, women and men both would compromise on interest and prestige before compromising by choosing a career inconsistent with gender roles. However, Leung and Harmon (1990) found that although preferences for gender roles and prestige began in early childhood, during the teen years these preferences changed. Gottfredson's (1981) predictions regarding compromise were not supported. Also, Betz and Fitzgerald (1987) reviewed the literature on the career development of women and found that gender role socialization is probably more complicated than Gottfredson's theory describes.

Results from the research literature influenced Gottfredson (1996) to modify how people compromise regarding interest, prestige, and gender roles. She indicated that when needing to make small compromises, individuals give the highest priority to interests, followed by prestige and then gender roles. When making moderate compromises, people begin to value prestige more. Finally, when making large compromises, interests are sacrificed first and gender roles become the last thing to compromise. In the only study of Gottfredson's revised thinking on compromise, Blanchard and Lichtenberg (2003) found only partial support. Regarding small compromises, women followed the model but men didn't. Regarding moderate compromises, participants valued gender roles and prestige almost equally over interests. Regarding large compromises, interests were sacrificed first and prestige and gender roles were valued almost equally. Blanchard and Lichtenberg recommended further study of Gottfredson's revised ideas on compromise. Overall, Gottfredson's model has not generated a great deal of research and that is partially attributed to the difficulty in testing the theory (Swanson & Gore, 2000). Like other developmental

models, Gottfredson's model may be an oversimplification of career development. What has been valuable about her theory is her explication of the importance of gender role and social class socialization during early childhood regarding career development. A limitation is that her theory does not go beyond adolescence to address issues in adult career development such as career change, combining family and career, and retirement. Swanson and Gore (2000) have recommended that Gottfredson's concepts be converged with SCCT.

Hackett and Betz's Self-Efficacy Theory of Career Decision Making

In groundbreaking research, Hackett and Betz (1981) were the first to hypothesize that self-efficacy theory might be useful in understanding the career behavior of women. Hackett and Betz's thinking was influenced by the social learning theory of Bandura (1977), later relabeled as social cognitive theory (1986). Bandura (1977) defined self-efficacy expectations as beliefs about one's ability to successfully perform a particular behavior. Bandura (1986) hypothesized that individuals' behaviors are a function of the interplay between belief systems and the environment. According to Bandura (1986), self-efficacy expectations are acquired primarily through performance accomplishments, vicarious learning, verbal persuasion, and one's physiological state of arousal. These sources of efficacy information interact to affect performance judgments that, in turn, influence action and behavior. Hackett and Betz developed the Occupational Self-Efficacy Scale and measured the difference between men and women's self-efficacy expectations regarding careers traditionally held by men and women. Women had higher self-efficacy expectations than men for occupations traditionally held by women and lower self-efficacy expectations than men for occupations traditionally held by men. The researchers suggested that these gender differences were the result of how women and men are socialized. They suggested

that socialization experiences lead to men and women having different self-efficacy expectations regarding careers that are nontraditional for their gender and ultimately lead to men and women limiting their perceived career options. In particular, Betz and Hackett noted that women's self-efficacy regarding math ability predicted avoidance of math-related occupations, even when they were not actually deficient in math skills.

Hackett and Betz's (1981) study stimulated a body of research that supported links between self-efficacy and career behavior (e.g., Betz & Hackett, 1983; Lent, Brown, & Larkin, 1984, 1986). In a review of the self-efficacy research that followed Hackett and Betz's (1981) initial study of self-efficacy in the career domain, Lent and Hackett (1987) suggested that research relating to career self-efficacy be expanded to study measurement of the self-efficacy construct, to study more diverse populations and a wider variety of tasks, and to include experimental designs and career interventions. To promote the use of self-efficacy theory in practice, Betz (1992) outlined strategies for counseling. She suggested counselors could help women enter nontraditional fields by explaining gender socialization, having clients observe role models in nontraditional fields, encouraging persistence in tackling math and science assignments, and reducing anxiety regarding taking math and science courses. One limitation of the theory is that self-efficacy cannot totally explain career behavior. Hackett, Betz, O'Halloran, and Romac (1990) called for career self-efficacy theory to be incorporated into social learning or social cognitive models of career decision-making.

Astin's Sociopsychological Model of Career Choice

H. S. Astin's (1984) sociopsychological model of career choice and work behavior was developed when Helen Farmer issued an invitation on behalf of APA's Committee on

Women for Astin to develop a theoretical statement regarding the career development of women. Astin developed a model that addressed how both men and women's career expectations are influenced by gender socialization. Astin was influenced by Roe's (1956) needs approach and Bandura's (1977) social learning theory as used by Hackett and Betz (1981). Her model uses four major constructs: motivation, expectations, sex-role socialization, and the structure of opportunity (Astin). Her theory was guided by four principles: work behavior is intended to satisfy survival, pleasure, and contribution needs, career choices are based on perceived opportunities and their capacity to satisfy the three basic needs, career expectations are influenced by early socialization and perceptions of the structure of opportunity, and early career expectations can be modified when there are changes in the structure of opportunity (Astin). Fitzgerald and Betz (1984) criticized Astin's theory for a failure to effectively integrate prior theory and to incorporate much of the significant research on the career development of women. They also criticized her theory for perpetuating the status quo (Fitzgerald & Betz). Astin's model did not become a theory that was actively used in research or practice.

Farmer's Model of Career and Achievement Motivation

Farmer (1985) developed a model of career and achievement motivation that described the experiences of both women and men and addressed environmental, background, personal, and motivational factors impacted by gender role socialization. Like other theories mentioned, Bandura's (1977) social learning theory impacted her model. She hypothesized that motivational factors (educational and occupational aspiration, mastery motivation, and career motivation) would be affected by background factors (gender, social status, school location, race, age, math and verbal ability), personal factors (academic self-

esteem, expressive and independent personality, achieving style, success attribution, values, fear of success, homemaking commitment), and environmental factors (parent support, teacher support, social support for working women). She used multiple regression and path analysis to identify relationships among the variables in the model. She found women's career motivations to be heavily influenced by competing roles and environmental factors. She reported some limitations related to sampling and the instruments she used. Her model did not receive further investigation in the literature. In her recent research, she has recommended that self-efficacy theory be used as a guide in addressing career development for women (Farmer, Rotella, Anderson, & Wardrop, 1998).

Eccles' Model of Achievement-Related Choices

Eccles (1994) developed a model that links educational, career, and other achievement-oriented choices to expectations for success and the value an individual attaches to available options. Socializers (primarily parents and teachers), gender role beliefs, stereotypes about activities, perceptions of self and tasks, and children's interpretations of experience (causal attributions and locus of control) are factors influencing expectations of success and the values one attaches to options. Like Gottfredson, Eccles believes that gender role stereotypes have an early and strong influence on children's perceptions of which careers are viable options.

Eccles (1994) effectively identified several conclusions supported in the literature on the effect of gender role socialization on career choice. First, she noted that gender role socialization may lead women and men to have different core personal values. Second, gender role socialization may lead women and men to place different values on different goals. Third, gender role socialization can influence the definition one has of success.

Fourth, men are more likely to be devoted to one particular goal while women tend to value several goals simultaneously. Fifth, there are patterns indicating that men are more likely to rate family and occupation as equally important while women are more likely to rate family as more important than occupation. Finally, gender role socialization can impact the educational and vocational options and opportunities of men and women.

Although Eccles' model (1994) includes cultural stereotypes in the cultural milieu effecting a person's career development, Eccles failed to discuss how gender intersects with race/ethnicity, social class, sexual orientation, and disability in the career development of women. Just as women have criticized career theory models for having been developed on the experiences of men, women theorists on career development sometimes forget to investigate the diversity of women's experiences in developing alternative models. Samples in most career development research including that cited by Eccles tend to include mostly middle class European American college women. Little empirical work has been generated to assess Eccles' model (Battle & Wigfield, 2003.)

Social Cognitive Career Theory

Lent, Brown, and Hackett were all involved in research that applied Bandura's (1977, 1986) concept of self-efficacy to the career domain before joining together to propose SCCT. Lent et al. (1994) presented SCCT as an attempt at theory integration that was based on Bandura's (1986) social cognitive theory. They indicated that while SCCT was tied to prior translations of Bandura's (1977) social learning to career theory (e.g., Krumboltz et al.'s social learning theory of career decision making, 1976; Hackett & Betz, 1981), SCCT was distinct from these other two theories. SCCT emphasizes three social cognitive mechanisms that are relevant to career development: self-efficacy beliefs, outcome expectations, and

goals (Lent et al.). Individuals are more likely to pursue and be successful in occupations for which they have high self-efficacy (Lent et al.). Also, people are more likely to pursue occupations that they believe will result in positive outcomes such as gainful employment, self-satisfaction, and admiration (Lent et al.). Finally, people who set goals to guide their behavior are able to increase the likelihood of positive outcomes (Lent et al.). It is in the importance placed on self-efficacy and goal-setting that one can see a departure from the social learning career theory of Krumboltz and colleagues (1976). The SCCT theorists maintain that people do more than respond to environmental and personal influences; they also shape their own behavior through activities such as goal-setting.

SCCT proposes that background contextual variables (e.g., socioeconomic status and personality variables) exert an influence on career self-efficacy, which in turn influence careers interests and goals. In the absence of environmental barriers and in the presence of environmental support, interests translate into positive academic and career goals and behaviors. Because SCCT takes into consideration the impact of environmental barriers and support, Lent et al. suggested that SCCT might be used to guide inquiry on the career development of women and racial/ethnic minorities (Lent, Brown, & Hackett, 2000). In fact, SCCT has become a widely used theoretical framework for studying career development for women and for different racial/ethnic groups (Swanson & Gore, 2000). Lent and Brown (1996) suggested that strengthening support systems and eliminating barriers may be most effective ways to help women and racial/ethnic minorities with career persistence.

Support for Social Cognitive Career Theory

Research on self-efficacy

The early empirical support for some of the constructs used in social cognitive career theory came about as a result of research generated by Hackett and Betz's (1981) proposal that self-efficacy theory (Bandura, 1977) might be useful in understanding career behavior.

Lent, Brown, and colleagues were among the early researchers examining the relationships between self-efficacy and vocational choices and interests. Studies examining the academic performance of students with high and low self-efficacy revealed that students who reported higher self-efficacy earned higher grades and persisted in science and engineering fields (Lent, Brown, & Larkin, 1984, 1986). An examination of the relationship of self-efficacy to vocational interests in science and engineering students demonstrated significant and positive relationships between self-efficacy and vocational interests (Lent, Larkin, & Brown, 1989). A study of the relationship between the four hypothesized sources of self-efficacy information (i.e., performance accomplishments, vicarious learning, verbal persuasion, and emotional arousal) to mathematics self-efficacy found that these sources were significant predictors of gender differences in mathematics self-efficacy (Lent, Lopez, & Bieschke, 1991). In a review of the career development literature on self-efficacy that followed Hackett and Betz' (1981) research, Lent and Hackett (1987) concluded that self-efficacy is predictive of important aspects of career entry behavior such as college-major choices and academic performance. A meta-analysis of 39 studies demonstrated positive and significant relationships of self-efficacy beliefs to academic performance and persistence (Multon, Brown, & Lent, 1991).

Once SCCT theory was proposed, self-efficacy was studied as an important construct in the theory. In a meta-analysis of 60 studies examining the relationship between self-efficacy and interests, results demonstrated that self-efficacy and interests are independent constructs that correlate moderately (Rottinghaus, Larson, & Borgen, 2003).

Research on Other SCCT Constructs

The study of outcome expectations, goals, and supports and barriers has received much less attention in SCCT related research the construct of self-efficacy. Such research is more recent, less extensive, and more mixed than the research on self-efficacy. Continuing with their interest in the choice of math and science as academic options, Lent and colleagues extended their work in a study examining self-efficacy, coping self-efficacy, outcome expectations, interests, goals, and perceived contextual supports and barriers in the choice of math and science majors (Lent et al., 2001). Self-efficacy and outcome expectations were predictive of interests and academic choices. In general, perceived barriers and supports were weakly related to choice. Higher coping efficacy was associated with a lower perception of barriers, a higher perception of supports, and higher math course self-efficacy. The researchers mentioned that a limitation of the study was that the sample included students who overall perceived barriers to be low and supports to be high. The mean math SAT scores were relatively high (approaching 600).

Support for the relation of outcome expectations to self-efficacy, interest formation, academic choices, career indecision, intentions, and goal setting has come from Betz and Voyten (1997), Diegelman and Subich (2001), Fouad and Smith (1996), and Lent et al. (2001). Betz and Voyten suggested that addressing distorted or inaccurate outcome

expectations might be an effective intervention technique. Individuals may prematurely foreclose possible career paths if they perceive barriers or negative outcomes.

SCCT Research on Women

SCCT has become a frequently used framework for studying the career development of women. For example, researchers exploring the SCCT model of explaining career development have examined the roles that career aspirations (Flores & O'Brien, 2002; Nauta, Epperson, & Kahn, 1998), feminist attitudes (Flores & O'Brien, 2002), perceived career and educational barriers (Flores & O'Brien, 2002; Luzzo & McWhirter, 2001), coping with perceived career and educational barriers (Luzzo & McWhirter, 2001), and career self-efficacy (Flores & O'Brien, 2002; O'Brien, Friedman, Tipton, & Linn, 2000) play in women's career development.

Using social-cognitive theory as a framework, Nauta et al. (1998) found that ability, self-efficacy, positivity of role model influence, and role conflict influenced higher levels of career aspirations among two groups of women: students in mathematics, physical science, and engineering majors and students in biological science majors. However, in contrast to the women in math, physical science, and engineering majors, the relationships between ability and self-efficacy and between positivity of role-model influence and self-efficacy were significantly lower for women in the biological sciences group.

In a longitudinal study of young women's career development (O'Brien et al., 2000), there was some concern that there were no changes in the women regarding their levels of career self-efficacy from the senior year in high school to five years later. The researchers expected college to provide experiences that would build confidence, increase aspirations, and broaden career choices. They found college to have a null effect on women's career

development. The women in the study who demonstrated career self-efficacy were more likely to aspire to leadership positions and further education. The finding by O'Brien et al. (2000) that career self-efficacy influences aspirations is consistent with SCCT.

Although Lent et al. (1994, 1996) posit that perceived barriers help shape experiences leading to career interests and choices, the study of barriers has received much less attention in SCCT related research than constructs like self-efficacy. Using a measure of perceived educational and career-related barriers and coping efficacy, Luzzo and McWhirter (2001) found that women and ethnic minorities in college anticipated significantly more career-related barriers than did men and European American students, respectively. Luzzo and McWhirter recommended creating career interventions for students likely to encounter barriers.

Flores and O'Brien (2002) used SCCT as a framework in a study of the career development of Mexican American adolescent women. "Partial support of the model was evidenced as nontraditional career self-efficacy, parental support, barriers, acculturation, and feminist attitudes predicted career choice prestige. Acculturation, feminist attitudes, and nontraditional career self-efficacy predicted career choice traditionality. Feminist attitudes and parental support predicted career aspiration" (p. 14). However, the researchers did not find relationships between background contextual variables (i.e., acculturation level, feminist attitudes, mother's educational level, and mother's traditionality) and nontraditional career self-efficacy. Nontraditional career interests did not impact any of the outcome variables in the study. The study confirmed some of the explanatory power of SCCT but raised questions regarding the limitations of the model in studying Mexican American adolescent females.

Study Related to SCCT

Farmer and colleagues have contributed to the understanding of gender differences in women and men regarding math, science, and technology careers (Farmer et al., 1998). They provide support for using self-efficacy theory in designing interventions for women.

Analyzing longitudinal data collected in 1980 when participants were in high school and in 1990 when participants were young adults, Farmer and colleagues found that women over time had lowered their career aspirations (Farmer et al.). Also, they found that having Realistic career aspiration types in high school predicted a science, math, or technology career for young men but did not for young women (Farmer et al.). Interviews conducted with 105 of the science, math, and technology participants in the longitudinal study suggested that two of the deterrents for women considering math, science, and technology careers were the number of years required for training in the field and believing the careers in the field were incompatible with child rearing (except for nursing) (Farmer et al.). Gender differences were found in the occupational prestige of science, math, and technology occupations and majors, controlling for high school mathematics grades. Men in the study were 18.7 times more likely than the women to be in high prestige careers and/or majors in math, science, and technology. Gender differences also were found for Holland's Realistic and Social interest types only when Realistic and Social was the first letter in the code and not when they were the second or third letter. In light of their findings, Farmer et al. recommended that counselors use all orderings of clients' top three Holland interest codes to examine occupation possibilities and to help young clients to think ahead and brainstorm ways to achieve what they perceive to be competing goals (e.g., going to graduate school and marrying/having children). They also suggested young women would benefit from hearing

employers in high prestige math, science, and technology fields talk about flexible work arrangements they are willing to make for women with young children (Farmer et al.). Also, Farmer and colleagues recommended using self-efficacy theory as a basis for facilitating the development of Realistic and Investigative interests as well as in designing programs to increase women's self-efficacy (Farmer et al.).

Summary of Support

SCCT is one of the most widely studied career theories in recent literature (Swanson & Gore, 2000). In particular, self-efficacy research influenced the development of the theory and continues to be one of the most studied constructs of the theory. Self-efficacy and SCCT research has provided strong evidence for the relationship between self-efficacy and academic/career performance, persistence, choices and interests (e.g., Multon et al., 1991; Rottinghaus et al., 2003). The research on career self-efficacy and related constructs used in SCCT have been theory building studies that employ correlations and path analyses to explain the relationship between career constructs and career behaviors. To date few experimental studies have been conducted, and few studies have involved career interventions. SCCT offers a promising framework for examining career interventions with women interested in math, science, and related majors. Research investigating college students with math, science, and related interests (Lent et al., 1984, 1986; Lent et al., 1989; Lent et al., 1991; Nauta, Epperson, & Kahn, 1998) has demonstrated significant and positive relationships between self-efficacy and vocational interests. SCCT identifies additional factors such as the structure of opportunity and environmental constraints and perceived barriers that have been useful in examining the career development of women (e.g., Flores & O'Brien, 2002; Luzzo & McWhirter, 2001; Nauta, Epperson, & Kahn, 1998).

Implications for Career Interventions and Career Counseling

The early literature on self-efficacy and social cognitive career theory has been focused on theory development and developing measures for constructs. There have been some good efforts to promote the use of SCCT in career counseling practice (Brown & Lent, 1996; Chartrand & Rose, 1996; Hackett & Byars, 1996; Lent et al., 1996; Morrow, Gore, & Campbell, 1996; O'Brien & Heppner, 1996). Hackett and Byars described how SCCT is useful in illustrating the interplay between cognitive barriers and contextual factors in the career development of African American women. Using SCCT as a framework, Morrow et al. examined the impact of societal influences on the career choices and self-efficacy of lesbian women and gay men. Chartrand and Rose made recommendations for using SCCT for people with limited access to opportunities and presented a career intervention program for adult female criminal offenders. O'Brien and Heppner extended SCCT to the training of career counselors. What is notable about these articles is that they illustrate using SCCT in populations often overlooked in career development literature.

Brown and Lent (1996) described how to help clients identify possible careers that they may have eliminated on the basis of inaccurate self-efficacy perceptions and outcome expectations. Techniques for comparing need and aptitude data with interest data using assessment instruments and card sorts were described to help clients identify foreclosed options (Brown & Lent, 1996). Examples were given for how to help clients identify and cope with possible career barriers (Brown & Lent, 1996). Finally, methods for helping modify self-efficacy beliefs were shared (Brown & Lent, 1996). A detailed description of an intervention with a fictional client provided further information on applying SCCT to career

counseling (Lent et al., 1996). Overall, SCCT theory has generated guidelines useful in translating theory into practice.

The following section describes career interventions targeting self-efficacy and other sociocognitive variables and career interventions for women that provide future directions for designing career interventions for women interested in math and science fields.

Career Intervention Models

In a literature review of career development interventions for women, Gavin (1994) found only five in the literature published since 1980. Gavin found many methodological flaws in the five studies she reviewed and recommended that future interventions evaluate measurable objectives and pay more attention to employing standard research methods that would help establish the validity of the findings (e.g., randomly assigning participants to treatment groups and using reliable and valid instruments for assessing outcomes). Gavin also recommended that future studies of interventions for women should be anchored in the most current theoretical literature on women's career development.

Since Gavin's review only a few more interventions for women have been published in the literature, but those published have been stronger methodologically and have been grounded in theories relevant to women's career development. Regarding the many programs and interventions that have been designed in the past two decades to encourage the progress of women in math, science, and technology, few have been empirically tested. Recent interventions that use self-efficacy theory and/or SCCT as a framework and recent meta-analyses of career interventions offer useful recommendations in the design of future career interventions for women interested in math, science, and related careers (Brown & Krane, 2000).

In this section, an overview of the literature on career interventions for women interested in math, science, and related careers is presented. Given the lack of empirically studied interventions of this nature, interventions that use self-efficacy theory and/or SCCT as a framework are explored for their usefulness in creating future interventions. Finally, helpful guidelines from meta-analyses of career intervention literature are offered.

One of the earliest interventions is described by Smith, Stroup, & Coffman (1975). They conducted a six-hour career workshop intervention for high school senior women with ACT scores of 27 or higher in natural sciences and mathematics. They also described a concurrent workshop for parents of the women and a follow-up home course of study available to participants in the workshop. Results comparing the experimental group (participants in the workshop) and a control group are not published.

Matyas and Dix (1992) describe examples of intervention programs for women in science and engineering but with little or no data on the success of these programs. Two consecutive issues of *Initiatives* were devoted to describing interventions and initiatives to promote gender equity in math and science (Farrant & Miller, 1993). Among the programs described were the Purdue Women in Engineering Program, the Dartmouth Women in Science Project, the University of Washington Women In Engineering Initiative, and Brooklyn College's Eureka program for its commuter population. While many of the programs described had been evaluated none had been tested experimentally. Thoms (2001) briefly describes a number of programs with good outcomes but with no experimental data. For example, at Smith College, which launched the Picker Program in Engineering and Technology in 1999, women with science and math-related degrees make up 25 to 30% of each graduating class.

Project SUPER at Douglass College (women's college of Rutgers University) is the most thoroughly described intervention in the literature (Fisler, Young, & Hein, 2000). Project SUPER is a comprehensive program for first-year college women who want to study math, science, or engineering. The program includes a special early orientation program, an introduction to research course in the first year, and a first-year summer internship. While not officially a part of Project SUPER, Rutgers also has a residence hall for women majoring in science and math. Participants were interviewed and surveyed in their third and fourth years in college. Students participating in the program were more likely than nonparticipants to major in math, science, and engineering. Participants indicated that the research and mentoring experiences in the program helped them make informed academic and career decisions. Because of the lack of control in the study, one cannot say that the positive outcomes directly resulted from the intervention, but the study does affirm that the program had a positive impact on the participants. One of the recommendations coming out of the project is that future interventions should address issues of combining family and career.

Overall authors describing the interventions for women interested in math, science, and related majors mention the importance and need for role models (faculty, women currently in careers, and examples from history), mentors, and courses that give women real experiences and chances to build self-confidence as well as gender and science courses and women in science workshops. The authors also discuss the need to discuss dual career couples and issues of balancing careers and family.

Regarding self-efficacy and other sociocognitive interventions, Hackett and colleagues (Campbell & Hackett, 1986; Hackett et al., 1990; Hackett & Campbell, 1987) paved the way when they conducted analog studies to examine the influence of performance

on self-efficacy. After finding evidence that performance did influence self-efficacy expectations, Lent and Hackett (1987) recommended that researchers design experimental career interventions that measure changes in career self-efficacy.

Foss and Slaney (1986) studied whether watching a career development videotape (“Women: Choices and Changes”) would impact women’s career decidedness, traditionality of career choices and choices for hypothetical daughters, and career decision-making self-efficacy. Increases were found for career decision making self-efficacy and career decidedness. The women in the study chose more nontraditional careers for themselves and their hypothetical daughters after watching the videotape. Speight, Rosenthal, Jones, and Gastenveld (1995) also provided evidence that interventions can increase self-efficacy in the career domain. Their study was designed to increase medical career self-efficacy for ninth grade students by incorporating Bandura’s (1977) four primary sources of information that impact self-efficacy (vicarious learning, performance accomplishments, verbal persuasion, emotional arousal) into the intervention (Medcamp). They found significant gains on three measures of self-efficacy. A concern with both of these studies is that they lacked control groups.

In a controlled study of career self-efficacy, Luzzo, Funk, and Strang (1996) examined the effects of a videotaped career intervention on career decision-making self-efficacy for college students who were assessed to have either an internal or external locus of control. One half of the participants in each locus of control group were randomly assigned to one of two conditions: an attributional retraining or no-training (control) treatment. Participants in the attributional retraining condition viewed an 8-minute videotape that used

verbal persuasion. Career decision-making self-efficacy increased for participants with external locus of control and did not increase for participants with internal locus of control.

While not specifically targeted for women, Luzzo, Hasper, Albert, Bibby, and Martinelli (1999) incorporated two of the primary sources of information described by Bandura (1977) (performance accomplishment and vicarious learning experiences) into an intervention and measured their effects on the math/science self-efficacy and career interests, goals, and actions of career undecided college students. Participants were randomly assigned to one of four conditions: no treatment, vicarious-learning treatment, performance-accomplishment treatment, and combined vicarious-learning and performance-accomplishment treatment. The participants who received the vicarious learning treatment viewed a 15-minute video of two graduates who began undecided on their majors but who majored in math- and science-related fields after successful experiences. They did not use any verbal persuasion. The participants who received the performance accomplishment treatment completed math series tasks developed by Hackett et al. (1990). Participants in the combined vicarious learning/performance accomplishment treatment were exposed to the previously described treatments in a counterbalanced order. Participants in the control condition attended a 30-minute orientation to the university's career center. In immediate posttest measures, the vicarious learning intervention did not result in significant changes in math self-efficacy or any of the measures of career choice, goals, and actions. The participants who received the performance accomplishment intervention resulted significant increases in math self-efficacy with immediate posttest measures but no significant increases in other measures. In posttest measures taken 4 weeks after treatment, the math/science career interests of the participants who received the combined performance accomplishment

and vicarious learning treatment had significantly higher scores than the other three treatment groups. The measures 4 weeks later also indicated significant changes for the performance accomplishment only treatment in math self-efficacy, math/science career interests, and the math/science relatedness of courses in which they were planning to enroll. The investigators stated that the results suggest a temporal lag in change that Bandura (1986) hypothesized and that further investigation of this lag should be explored within SCCT research.

Betz and Shifano (2000) designed a seven-hour intervention focused on increasing college women's realistic self-efficacy through building, repairing, and construction activities. Because Bandura (1977) says that self-efficacy is influenced by four primary sources of information, Betz and Shifano incorporated the four sources into their intervention. The instructors demonstrated tasks (vicarious learning), they ensured successful completion of activities (performance accomplishments), they encouraged and supported participants (verbal persuasion), and they took breaks where they used applause and verbal praise and relaxation techniques to manage anxiety (emotional arousal). Self-efficacy expectations (Realistic confidence from the Skills Confidence Inventory) of college women with respect to the Realistic domain of Holland's theory were significantly increased. Changes in interest and occupational self-efficacy were not found. Because of the degree of change in Realistic confidence from the brief treatment, the authors optimistically recommended a more elaborate and longer term intervention to help increase women's confidence in domains traditionally viewed as male and suggested that such interventions could be useful in facilitating women's pursuit of scientific and technical fields.

In a study of social-cognitive variables, McWhirter, Rasheed, and Crothers (2000) investigated the effects of a high school career education class on career decision-making

self-efficacy, vocational skills self-efficacy, perceived educational barriers, outcome expectations, educational plans, and career expectations. Post- and follow-up testing indicated increases among participants in career decision-making self-efficacy, vocational skills self-efficacy, and outcome expectations. There were no changes in perceived educational barriers. Acknowledging that their own study had the limitations of a nonrandomized design, the authors concluded that because the role of perceived barriers in career decision-making is less clearly articulated in SCCT than other variables, the role of perceived barriers in career choice needs continued study.

Sullivan and Mahalik (2000) investigated whether or not a career group intervention would increase career decision-making self-efficacy and vocational exploration and commitment in college women. Bandura's (1977) four primary sources of information that impact self-efficacy (vicarious learning, performance accomplishments, verbal persuasion, emotional arousal) were incorporated into the intervention. Women in the treatment group improved on career decision-making self-efficacy and vocational exploration and commitment.

Peng (2000) compared two group counseling approaches and a control group in an intervention study to see what treatment might be more effective in enhancing confidence in planning careers by undecided Taiwanese college women. Ten students received a cognitive restructuring intervention based on Bandura's theory (1977) and self-efficacy literature. Ten received training in career decision-making skills. The 10 participants in the control group participated in sessions that did not deal with the content of career development. Before and after the 8 session interventions, participants completed the Career Confidence Scale (CCS, Pickering, Calliotte, & McAuliffe, 1992, as cited in Peng, 2000). The students participating

in the cognitive restructuring intervention scored significantly higher on the CCS. Given the small number of participants and that the participants were women of Asian culture, Peng (2000) recommended similar research with larger samples of American women.

Dawes, Horan, and Hackett (2000) studied the effects of a technology education program on the technical/scientific self-efficacy and career interests of seventh and eighth grade students. Students were randomly assigned to experimental and control conditions. Because of course scheduling constraints, half of the experimental students were treated in the first quarter and the other half in the second quarter. Half of the control participants participated in art instruction the first quarter; the other half participated in art the second quarter. A technology education teacher administered the experimental treatment for 50 minutes each school day for seven weeks. The treatment was a commercially published technology education program (Herlihy & Co., 1992, as cited in Dawes et al., 2000) that was reported to have “a number of components comparable to what might be derived from self-efficacy theory (p. 90). Students completed three of twenty-one available modules in scientific fields over a 7-week period. Those components were hands-on performance accomplishments for specific tasks (approximately 10 activities per module). The treatment participants did not register changes on the outcome measures. The authors did not assign students to the modules based on prior self-efficacy and interest and speculated on whether paying closer attention to those variables in such an intervention might be warranted.

In a pre-experimental design that didn't involve a control or comparison group, Diegelman and Subich (2001) used verbal persuasion to raise outcome expectancies for getting a psychology degree. A sample of nonpsychology majors participated in a 25-minute presentation that highlighted positive outcomes associated with obtaining a psychology

degree. Outcome expectations for an undergraduate psychology degree related positively and significantly to posttest interests in that degree. Overall, the study found significant positive relations between self-efficacy, outcome expectations, interest, and pursuit intention. Enhancement of outcome expectations was not related to change in self-efficacy. These results support the independent functioning of self-efficacy and outcome expectations as posited in SCCT. The intervention was limited in that it did not have a control group and did not measure long-term effects. The implication regarding outcome expectations is that intervening in outcome expectations may be helpful in helping clients identify aspects of careers which may be important to them but for which they might be unaware.

Self-efficacy and SCCT related interventions to date have provided evidence that self-efficacy can be increased through an intervention (e.g., Betz & Shifano, 2000; Foss & Slaney, 1986; Speight et al., 1995; Sullivan & Mahalik, 2000). Studies also indicate the usefulness of incorporating Bandura's (1977) four primary sources of information that impact self-efficacy (vicarious learning, performance accomplishments, verbal persuasion, emotional arousal) into interventions (e.g., Betz & Shifano, 2000; Speight et al., 1995; Sullivan & Mahalik, 2000). There is recent evidence that outcome expectations can be increased through an intervention (Diegelman & Subich, 2001). The usefulness of addressing perceived barriers and coping with barriers in an intervention is not clear (McWhirter et al., 2000).

From meta-analyses on career interventions, Brown and Krane (2000) conclude that the effectiveness of career interventions can be improved by ensuring that five components are included: "written exercises, individualized interpretation and feedback, information on the world of work, modeling, and building support" (p. 745). Effective written exercises

(e.g., journals, logs, and workbooks) help clients establish career goals and gain accurate information about themselves and occupations (Brown & Krane). Effective individualized feedback can include interpretations of test information as well as feedback on career decision-making strategies and goals (Brown & Krane). Information about the world of work can come from counselors, computers, and readings. What is important is that the information is nonstereotypic, accurate, and up-to-date (Brown & Krane). Effective modeling exposes clients to videos, speakers, and mentors and can include appropriate self-disclosure from a counselor (Brown & Krane). Finally, it is important to assist clients in building support networks in order to help them overcome potential career-limiting influences (Brown & Krane). Potential resources for building support are family, friends, faculty, self-help groups, professional organizations, career classes, and mentors. No intervention studies have included all five of these components (Brown & Krane).

Acknowledging the dearth of research on interventions for women and underrepresented groups, Brown and Krane (2000) suggest that the effects of modeling can be maximized by providing models similar to clients who can describe how they struggled and succeeded in making career decisions. Although barrier identification and coping strategies do not account for much of the variance in career intervention outcomes in meta-analyses, Brown and Krane (2000) believe that may be because people who face barriers are not represented well in the research. They believe “it may be found that an explicit focus on barriers, along with preventive and coping strategies, may account for more variance in the career intervention outcomes of women, minorities, and gays than for other people” (p. 755). Finally, they suggest that it may help women to include planning regarding multiple role conflicts in goal-setting components of career interventions (Brown & Krane).

Recommendations for career interventions by Brown and Krane are consistent with SCCT recommendations for practice (Lent et al., 1996).

Related Research Influencing the Intervention

In surveying the literature on the career development of women, the psychological development of women, the effects of the college environment on women, the development of college students, and first year experience courses, the author was influenced by related research while thinking about the intervention. Related literature influencing the intervention is presented.

Regarding the career development of women, research on women's attitudes toward multiple role planning (Weitzman, 1994) seems related to goal-setting and coping with barriers as presented in SCCT. Because women often find juggling multiple roles to result in stress and conflict, Weitzman hypothesized that approaching a multiple role lifestyle with more thought and planning might minimize the frustrations in such a lifestyle. Grounded in Crites' (1978, as cited by Weitzman) career maturity model, Weitzman conducted an investigation of attitudes toward multiple role planning that resulted in the development of an assessment instrument (Attitudes Toward Multiple Role Planning; ATMRP; 1996). The scales provide a useful assessment to use in research examining how women negotiate career and family issues. Given SCCT's propositions about how goal-setting fits into career development and given suggestions from authors (e.g., Fidler et al., 2000) who created interventions for college women interested in math, science, and related careers, it seems that it would be helpful for women to engage in multiple role planning during an intervention as a part of their goal-setting. Peng's (2000) successful cognitive restructuring intervention

included “helping female students formulate realistic family and life-planning goals” (p. 670).

Barnett, Gareis, James, and Steele (2003) found that college seniors whose mothers worked outside the home were less concerned about potential difficulties balancing career and marriage than seniors who had stay-at-home mothers. Seniors who planned to delay marriage and childbearing also were less concerned about potential conflicts in juggling marriage and career. The current study examined whether the mother’s work history was correlated with a woman’s attitudes toward multiple role planning.

The author studied the work of several theorists on the development of women before designing the intervention for women. The work of Belenky, Clinchy, Goldberger, and Tarule (1986) provided guidance in structuring classroom experiences. Belenky et al. began an analysis of women’s development using Perry’s scheme but found that the thinking of the women they interviewed did not fit into Perry’s categories. They developed a classification system that grouped women’s perspectives on knowing into five categories of development. They also described two types of knowing: separate (an orientation toward impersonal rules) and connected (an orientation toward relationships). They believed that connected knowing comes more easily to women and that:

“Educators can help women develop their own authentic voices if they emphasize connection over separation, understanding and acceptance over assessment, and collaboration over debate; if instead of imposing their own expectations and arbitrary requirements, they encourage students to evolve their own patterns of work based on the problems they are pursuing.” (Belenky et al., 1986, p. 229)

The work of Belenky et al. (1986) suggests that women may need confirmation of their capability to think intelligently, a community that supports and accepts them and doesn't oppress and patronize them, and teaching that helps them "give birth to their own ideas" (Belenky et al., p. 217) as prerequisite conditions for intellectual growth. Belenky et al. suggested that presentations that involve collaboration might work better for women than debate and conflict in helping students move into multiplicity as a way of thinking. Also, they said "the connected class constructs truth not through conflict but through 'consensus'" (p. 223) and shared experience.

The author also examined literature on the development of college students. Pascarelli and Terenzini's (1991) review of the literature on college students indicated that most studies measuring ego development found entering college students to be characterized by conformity to social rules and a need to belong to a group. Superficial niceness and attention to appearance are used to get along with the group. Entering students commonly stereotype others. Typically self-awareness in relation to the group increases during the first year of college. Both the person's thinking and inner life become more complex. The person begins to develop long-term self-evaluated goals and a sense of responsibility for others. The students own standards gradually begin to become more important than the group's rules. This type of knowledge can be useful for an instructor in understanding classroom dynamics.

Also of concern in the retention of women in math, science, and technology majors is the impact of the overall college environment. Hall and Sandler (1982, 1984) have described colleges as being inhospitable to women for a variety of reasons. Among the problems they mentioned are that faculty call on men more than women in the classroom, both faculty and students denigrate women's intellectual abilities, and the academic environment is a male-

dominated culture which discriminates against women and reinforces gender stereotypes about women. They suggested that this “chilly climate” has a negative impact on the self-confidence of women, and hence, on their success during and after college.

Unlike coeducational institutions, women’s colleges have been successful in creating a college climate that results in women’s increased self-esteem, in their satisfaction with their education during and after college, and in their achievement after college (A. W. Astin, 1977; Smith, 1990; Smith et al., 1995; Tidball, 1980; Wolf-Wendel, 1998). Among the factors most frequently cited as contributing to these positive outcomes are more opportunities to interact with female role models, to participate in academic, extracurricular, and leadership development activities, and to participate in classroom interactions (Miller-Bernal, 1993, 2000; Smith, 1990; Smith et al., 1995; Tidball, 1980; Whitt, 1994). Trice (1994) determined that women’s colleges are more likely to use teaching approaches like dividing course material into smaller units and testing frequently (methods that have been demonstrated to provide high course success for students). She surmised that these teaching methods might lead to self-efficacy behavioral accomplishment and might help explain the success of women who attend women’s colleges. The research on factors in women’s colleges that seem to contribute to positive outcomes can be useful in designing interventions to promote positive outcomes for women at all institutions.

Finally, because the career intervention in the current study was contained within a first-year experience course, it was important to examine the research on first-year experience courses and gender. Research by the National Resource Center has shown that first-year experience courses increase retention and grade point averages for freshmen (Fidler, 1992). Upcraft and Gardner (1989) provide information for creating a first-year

experience course, describe what contemporary first-year students are like, and examine how various student development programs and services can impact first-year students. While there is a chapter on the needs of first-year women in Upcraft and Gardner's book (1989), there is only one research article examining the relationship of gender in students' development during a coeducational first-year orientation course. Blackhurst (1995) examined gender differences in a freshman seminar on three of Chickering's (1969, 1993) vectors (developing purpose, mature relationships, and autonomy). Chickering developed a theory of college student development widely used by student development practitioners. Like other researchers (Straub & Rodgers, 1986; Taub, 1995), Blackhurst found that there are differences in men and women's development during college. She found:

“Further exploration of the relationship between the development of autonomy and the development of mature relationships in women is needed. This study suggests that women may begin to develop on the autonomy task before entering college and before beginning development on the mature relationships task. During the first semester of college, however, autonomy scores for the women in this study decreased significantly. It is possible that the decrease in women's autonomy scores was simply a consequence of increased attention to relationship concerns . . . It is also possible that there are elements in the college environment that are not conducive to—and in fact discourage—the development of autonomy in first-year women. Given this possibility, there is a need to examine campus climates for barriers to women's autonomy and to implement programs designed to promote the development of autonomy in women. The results of this study suggest that simply providing female role models and mentors is not enough to offset those factors that may be negatively

affecting female students' autonomy development. Rather, both male and female freshman seminar instructors need training in methods of facilitating and supporting autonomy development in women." (p. 78)

Blackhurst's concerns about the development of autonomy in first-year women is similar to the findings of Loevinger et al. (1985) in a study of ego development in college students. Just as researchers before them had found, the women arrived at college with a slightly higher ego development score than the men (with an average score slightly higher than that of Loevinger's "Conscientious" stage). By the end of the senior year, the men had made greater gains than the women, and the women registered a loss. Among the explanations the researchers considered for this loss was "that for some significant fraction of students, particularly women, college is a regressive experience" (p. 960). They went on to question whether the environment on college campuses faced by "starry-eyed" new students provides "optimal conditions for personal growth" (p. 961).

It makes sense that an intervention course be designed with a broad understanding of contextual factors impacting college women.

Conclusion

The author designed a first-year experience course for women as a career intervention to facilitate the retention of women interested in science, math, and related majors. SCCT provided the framework for the intervention. Related theory, career interventions, related information about the development of women and college students, and factors that have led to the success of women at women's colleges were explored in the development of the intervention.

CHAPTER THREE

METHOD

Participants

The participants were 24 first-year college women drawn from a population of first-year students at a women's college in the Southeast. The college had a fall 2003 enrollment of 2000 undergraduates. In fall 2003, 332 traditional-aged students entered as first-year students. The college also enrolls nontraditional-aged students whose demographics are not included here. Of the new first-year students, 86% were in-state students and 14% were out-of-state students. Of the new first-year students, 281 identified themselves as European-American, 14 as African-American, 11 as Hispanic-American, 4 as Asian-American/Pacific Islander, and 2 as non-resident aliens. Another 19 did not identify their race/ethnicity.

Participants were first-semester, first-year students interested in majoring in math, science, or technology. The pool of participants was drawn from students with math and science-related interests who had SAT math scores 500 or higher and who had high school math and science grades of B or higher. Of the students who returned forms to participate in early registration and completed the item of intended major, 49 indicated an interest in math and science. Twenty-nine of those had a math SAT score of 500 or higher. Only students with SAT math scores over 500 were selected because it did not seem appropriate to expose students who lacked math skills to an intervention to promote retention in math, science, and related majors. Combined SAT scores of the participants ranged from 910 to 1360. The middle 50% range of SATs for new first-year students at the college was 950 to 1120.

The investigator asked participants to sign release forms (Appendix B) in order to gain access to SAT scores, high school, and first-semester college grades. SAT scores and

grades also were requested on a self-report demographic form. Students were assigned by the director of academic advising at the college to the sections of the course based on meeting their total course requests. The math SAT scores and high school math and science grades of the participants in the two groups were matched as much as possible. While ethnic diversity was desired in the sample, after measures to screen participants based on math SAT scores and high school math grades and after meeting the student's total course requests, ethnic diversity in the sample was not achieved.

Twelve participated in an experimental first-year experience course, and 11 completed it. An additional same-size group of first-year college women from the same college interested in majoring in math, science, or technology was recruited to participate in a no-treatment control group, and eleven completed posttest measures. The treatment group consisted of ten European-Americans and one African-American. The control group was made up of 11 European-Americans. At pre-test, 2 participants in each group were 17 years of age with the remainder in each group being 18. At posttest, the treatment group had eight who were 18 and three who were 19. In the control group, all were 18 years of age at posttest. Participants in the course received one-hour of elective credit.

Permission to include the students in the study was granted by the North Carolina State University Institutional Review Board for the Use of Human Subjects in Research, and the human subjects review board at the college in the study. Students involved in the study received and signed informed consent forms (Appendix A). Parental informed consent was obtained for any first year students under 18 years of age. Participants were able to withdraw from the study at any time. Personal data obtained in the study was treated confidentially, data was stored securely, and no oral or written information links participants to the study.

Research Hypotheses

The investigator hypothesized that women students with interests in majoring in math and science who were enrolled in a first-year intervention course would score higher on posttest measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring in math and science who were in a no-treatment control group.

Also, the author hypothesized that women students with interests in majoring in math and science who were enrolled in the first-year intervention course would be more likely to persist in their intended major and career field than women with similar interests who were in a no-treatment control group.

Design

The design is pretest-posttest control group quasi-experimental with a no-treatment control condition. The independent variable is a career development intervention for first-year college women interested in majoring in math, science, or technology. The dependent variables are career aspirations, attitudes toward multiple role planning, coping with career and educational barriers, career self-efficacy, and retention in intended major. Final variables analyzed were whether math SAT scores, verbal SAT scores, mother's work history, and/or family income of the participant influenced the outcomes.

Outcome Measures

Career Aspirations

The Career Aspiration Scale (CAS; O'Brien, 1992; Appendix C) contains 10 items that assess participants' goals and plans within their career field. Example items include "I hope to become a leader in my career field" and "I do not plan on devoting energy to getting

promoted in the organization or business I am working in.” Participants indicate whether the items apply to them by using a 5-point scale ranging from *not at all true of me* (0) to *very true of me* (4). Scale scores are derived by calculating the mean score for the items. High scores indicate strong aspirations in one’s career plans.

Internal consistency of the CAS has been reported as .76 (O’Brien & Fassinger, 1993) with female high school students, .80 (Nauta, Epperson, & Kahn, 1998) with female undergraduate students, and .61 with high school seniors (Flores & O’Brien, 2002).

Convergent validity for the CAS has been supported by relations with multiple role self-efficacy, career decision-making self-efficacy, and career salience (O’Brien, Gray, Tourajdi, & Eigenbrode, 1996). Discriminant validity has been demonstrated through the absence of relations between the CAS and social desirability, as well as a negative relation between the CAS and a measure of the relative importance of career versus family (O’Brien et al., 1996).

Attitudes Toward Multiple Role Planning

The ATMRP scales (Weitzman & Fitzgerald, 1996; Appendix D) use 50 five-point Likert items (10 items per scale) to assess the degree of realism-unrealism in individual’s attitudes toward multiple roles. The ATMRP consists of five scales Knowledge/Certainty (the degree of knowledge and certainty a woman has about planning for multiple roles), Commitment to Multiple Roles (commitment to a multiple role lifestyle), Independence (independence in planning and decision-making), Involvement (degree of involvement in multiple role planning and perceived immediacy of the need to plan), and Flexibility/Compromise (flexibility in planning). High scores reflect more realistic attitudes toward multiple role planning.

The fifth scale (Flexibility/Compromise) has not demonstrated sufficient reliability and validity and was not used in this study. Therefore, the 10 questions representing the fifth scale were removed from the instrument. The first four scales have demonstrated strong internal consistency, with alpha coefficients ranging from the high .70s to the mid .80s (Weitzman, 1994; Weitzman & Fitzgerald, 1996). Test-retest coefficients over a 2-week interval ranged from .62 to .90. Preliminary validity analyses indicated that scores on the ATMRP scales increased with educational level (i.e., high school, undergraduate, and graduate) and differed in terms of the type of work-family plans young women were developing (i.e. higher scores for compatible plans than for incompatible plans; Weitzman, 1994; Weitzman & Fitzgerald, 1996).

Coping with Career and Educational Barriers

The Coping with Barriers Scale (Luzzo & McWhirter, 2001; Appendix E) was created as a companion piece to a modified Perceptions of Barriers Scale (POB; Luzzo & McWhirter, 2001) designed for use with college students. The scale contains 27 items and measures the degree to which a person possesses confidence in coping with perceived barriers to career and educational aspirations. The measure parallels most of the items on the modified Perceptions of Barriers Scale (Luzzo & McWhirter). Likert-type item responses range from highly confident (5) to not at all confident (1). Higher scores indicate greater confidence in one's ability to overcome barriers (i.e., coping efficacy). McWhirter (2003) reports alpha reliability coefficients of .95 for the total scale (n=292). Test-retest reliability over a 2-month period yielded .58 (n=55) for the total scale (McWhirter, 2003). The last four items of the combined measure (items 61-64) are used for rough validity estimates.

Career Decision Self-efficacy

The short form of Career Decision Self-Efficacy scale (CDMSE-SF; Betz, Klein, & Taylor, 1996) was used to measure career self-efficacy. The CDMSE is a 25-item measure. Respondents rate their degree of confidence that they could complete 25 tasks along a five-point Likert-type scale. Example items include “Successfully manage the job interview process” and “Find out about the average yearly earnings of people in an occupation.” Response options range from *no confidence at all* (1 points) to *complete confidence* (5 points). Higher scores reflect higher career decision-making self-efficacy.

Estimates of internal consistency ranged from .73 to .83 for the subscales and .94 for the total score (Betz et al., 1996), and from .95 to .97 (Gloria & Hird, 1999). In a sample of community college students (n=233), Luzzo (1993) reported a 6-week test-retest reliability coefficient of .83. McWhirter, Rasheed, and Crothers (2000) reported a Cronbach’s alpha of .95 with high school sophomores. Strong reliability and validity evidence, based largely on college samples, is summarized in Betz et al. (1996) and Betz and Luzzo (1996). For example, construct validity for the CDMSE-SF has been supported by relationships with career indecision and fear of commitment (Betz et al., 1996; Serling & Betz, 1990).

Demographic Information

A demographic questionnaire (Appendix F) asked for self-report on race/ethnicity, family income, intended college major, future career goal, mother’s work history, verbal and math SAT scores, and high school math and science grades.

Retention in Intended Major

Students were asked to self-report intended major at the beginning and end of the fall semester and again mid-way through the spring semester.

Treatment Group Evaluation Measure

At the end of the course, students completed the standard course and instructor evaluation used for all classes at the college (Appendix G). Students rated the content of the course, the instructor of the course, and the course in general using a Likert scale. Response options range from *poor* (1 point) to *excellent* (5 points). Higher scores reflect higher satisfaction with the course or instructor. Students also were asked two open-ended questions: “What aspects of this course did you find to be particularly valuable?” and “What aspects of this course do you think need to be improved and what suggestions would you make to improve them?”

An analysis was conducted to determine whether or not the experimental FYE course differed significantly from regular FYE courses on the course evaluation.

Procedure

The intervention took place during the 15-week fall academic semester of 2003. The week prior to the fall semester, the investigator recruited by phone incoming students for the treatment and control groups who were identified by the director of academic advising at the college as having an interest in math, science, or related majors as well as math SAT and math/science high school grades that met the screening criteria. Students who requested to take a First Year Experience (FYE) course were assigned by the director of academic advising at the institution to the FYE course if they were available for the time slot. Other academic schedule requests prevented participation of some individuals who met the criteria of having SAT math scores of 500 or higher and high school math and science grades of B or higher. Students who agreed to participate in the control group were matched as much as possible on demographic and academic information to the students in the treatment group.

Students met with the investigator to sign informed consent forms (Appendix A) and release forms for SAT scores and grades (Appendix B) at the first class meeting of the course.

Students were informed that participation in the research study would include filling out assessment instruments at the beginning and end of the semester and providing information at a midpoint in the spring semester. During appointments with the investigator during the first week of classes, control group participants received the same information as the experimental group and completed informed consent forms and release forms for SAT scores and grades.

The facilitator of the course received training by the experimenter in presenting the course materials and lectures but did not know the details of the study in order to avoid experimenter bias.

Data Collection

An introduction to the course took place in the first meeting of the experimental group. Members of the experimental group signed informed consent at that time. Pretesting on the career measures also took place during the first meeting. The order of presenting the measures was counter-balanced to reduce the threat of test interaction. Posttesting on the career measures took place in the last meeting of the class. Pretests and posttests were administered in a group setting by the investigator in the classroom where the course was taught each week. One member of the experimental group was not present at the first FYE class and met by appointment with the investigator in the Career Center to complete her assessment instruments. At posttest, two members of the experimental group were not present and met by appointment with the investigator to complete the assessment instruments.

Control condition participants received pretesting and posttesting on the career measures the same weeks as the students in the experimental condition. Control group members signed informed consent at their first testing with the investigator. Control group members were tested by appointment in the Career Center when it was discovered that it would be difficult to test everyone at once. As with the experimental group, the order of presenting the measures was counter-balanced to reduce the threat of test interaction. One member of the control group was ill during assessment at the end of the fall semester. She completed testing during the first week back at school in January.

All participants were contacted by e-mail and phone for further posttesting mid-way through the spring semester. This testing included the two self-efficacy measures (Coping with Barriers Scales & CDMSE) and was completed to determine whether there might be a temporal lag regarding self-efficacy as Bandura (1986) and Luzzo et al. (1999) suggest. At that time students also were asked the current status of their academic major and career choice plans. For this final posttesting only, a drawing for a \$50 gift certificate was advertised in the e-mail recruitment. Any participant who completed the final assessment was eligible for a drawing for the gift certificate. Control and experimental participants were tested by appointment in the Career Center. Ten control group members completed the final assessment and one e-mailed to say she was studying abroad for the semester. She was given the opportunity to complete the instruments by e-mail, but she did not respond to that opportunity. Seven experimental group members completed the final assessment. One had an unlisted phone and e-mail and could not be located. The three remaining experimental group members were given an opportunity to respond to the instruments by e-mail. They did not follow through.

Intervention

The intervention was designed as a one-credit hour, semester-long (15-week) first year experience course meeting once a week for 80 minutes each week. Two course sessions had to be cancelled: one for weather and one because of instructor illness. The class sessions were composed of both didactic and experiential activities and discussions. The intervention was designed based on literature on career interventions and used SCCT (Lent et al., 1994, 1996) as a framework. A course syllabus and lesson plans for each week described assignments and content of each class meeting. Appendix H is the syllabus for the first year experience course and includes a course description, overall course objectives, and an outline of the course. Appendix I is a plan of the lessons with objectives and procedures outlined for each week. As in previous interventions intended to foster self-efficacy (e.g., Betz & Shifano, 2000; Sullivan & Mahalik, 2000), Bandura's (1977) four primary sources of information that impact self-efficacy (vicarious learning, performance accomplishments, verbal persuasion, emotional arousal) were incorporated into the intervention. Included in the intervention were experiences designed to address issues of career aspirations for women, self-efficacy, outcome expectations, multiple role planning, coping with perceived career barriers, and feminism.

Vicarious learning came from experiences with mentors like the female math professor teaching the class and the teaching assistant (a sophomore biology major), and a project that involved obtaining biographical information on a woman mathematician or scientist. Barr and Birke (1997) who interviewed 40 women from a range of adult education courses and self-help groups found several themes to explore in transforming science education. They recommended rooting science in women's experiences and making science

relevant by teaching the history of women in science. Women in the class taught each other when they shared PowerPoint presentations of their biographical information on a woman mathematician or scientist. Based on the thinking of Belenky et al. (1986), the women in math and science PowerPoint project was a collaborative assignment. Peng's (2000) successful cognitive restructuring intervention with Taiwanese women included having students interview individuals working in their fields of interest. A similar assignment was included in the current intervention.

Performance accomplishment was included in a hands-on workshop where the students took apart a computer one week and put it back together the next week. This exercise echoed the Realistic experiences that Betz and Shifano (2000) used in their intervention. Further performance accomplishment involved completing class assignments and exercises related to career development. Additional performance accomplishments were built into the community service project portion of the class. The community service project was postponed until exam week and took place after assessment of the students.

Emotional arousal was addressed through instruction by a guest speaker on time management and stress management techniques. The stress management portion of the class emphasized cognitive restructuring techniques such as positive self-statements. A study comparing two career counseling treatments (cognitive restructuring vs. career decision-making skills) found that cognitive restructuring was more effective in enhancing the career confidence of the participants (Peng, 2000). Students were challenged by the instructor to use these techniques throughout the semester. Also, a portion of each class was devoted to allowing the students to discuss in the class stress and time management issues they were experiencing.

Verbal persuasion and support was a component of the panels and experiences with the instructor and course assistant. Another construct in SCCT that is considered to be important regarding career choice is outcome expectancies. Verbal persuasion has been shown to impact outcome expectations as well as self-efficacy for a major/career (Diegelman & Subich, 2001). Guest panelists were asked to highlight the skills that make math and science majors highly employable, inform the students of the wide variety of employment opportunities available, and express satisfaction regarding math and science related careers.

Another part of the curriculum was to assist women in their thinking about multiple role planning. A panel discussion with women scientists and mathematicians about how they've juggled roles was included in the intervention. Goal-setting is one of the factors considered in SCCT but not studied within previous SCCT research. Peng's (2000) successful cognitive restructuring intervention included "helping female students formulate realistic family and life-planning goals" (p. 670). The multiple role planning activities were designed to foster awareness of external career barriers and how to cope with them. Based on suggestions that interventions should foster an awareness of external career barriers and internal career barriers, class readings and discussions touched on those topics (Luzzo & McWhirter, 2001).

Finally, as Brown and Krane (2000) suggested, the five components of effective career interventions were included in this class: "written exercises, individualized interpretation and feedback, information on the world of work, modeling, and building support" (p. 745). Journals, a paper on an informational interview with a woman mathematician or scientist, a paper on women of science and math, and exercises from the career textbook were among the written exercises. Instructor responses to journal writings

and a Strong Interest Inventory interpretation meeting with a Career Center counselor provided individual feedback. Readings, class discussions, and panels provided information on the world of work. The instructor, course assistant, and panel members provided modeling. Students gained support from the instructor and fellow students in the class and learned from class readings and attending a student organizational meeting.

Teaching Approach

Typically, those teaching career and first-year experience seminars employ some developmentally sound methods of teaching. The course in the current study was designed to have experiential components and a small teacher/student ratio. Journals, role plays, debates, and discussions involved students in the subject matter. The instructor provided the students frequent opportunities to demonstrate an understanding of the subject matter and timely feedback.

Assumptions about ego development levels of the students entering the course and about women's development from Belenky et al. (1986) indicated that the instructor should be trained to begin the class teaching in a very concrete way and increase the abstract nature of teaching and of topics as the semester progressed.

It was important to think about the students' level of development in designing the curriculum. For example, when asking a first-year student to write in a journal there should be some guidance about what to write to avoid ending up with superficial entries or outpourings of emotion that do not demonstrate integration of course material into the students' thinking. Students turned in five journal entries. In Loevinger's theory (Loevinger et al., 1985), ego development involves mastering, integrating, and applying meaning to experiences in order to understand oneself and others. One way the students were assisted in

integrating course material and making meaning of their course experience was to write reflections in a journal. The instructor read the journals and kept information in the journals confidential. Having occasionally used journals in previous teaching experiences with first-year students, there are some things the author has learned. Students turned in journal entries throughout the semester so that they wouldn't wait until the last minute to catch-up and write all of the entries due at once. Therefore, students kept a loose-leaf journal on notebook paper and turned in five entries at times spaced throughout the semester. The instructor gave frequent feedback (challenge and support) in journal comments. In the beginning of the course, support was the more frequent type of feedback and as the semester unfolded the students increasingly received challenging feedback. Entries were returned with comments from the instructor each time. The instructor's comments "supported and challenged" the thinking reflected in the journal writings.

The instructor benefited from being able to assess through reading the journals throughout the semester how students were responding to course material and how they were developing personally in their first semester at college. The author's experience with first-year students is that they need concrete ideas about what to write about in the beginning of the semester (this observation is congruent with the level of development where most would be upon entering college.) Therefore, journal entries were structured to respond to course material. As the semester progressed, the instructor made the assignments a little more flexible to encourage more self-reflection and self-disclosure about how a course topic impacted them personally. Also, at the end of each entry, the instructor had the students write as much as they wanted about how they were feeling about their first semester in college and/or the course material.

Because women seem to learn best in a supportive environment (Belenky et al., 1986), the instructor provided challenge primarily through increasingly more complex and controversial topics. Occasional guest speakers and panels were made up of effective female role models, including faculty, staff, other students, and professionals. Students had assignments requiring their participation in a career center orientation meeting, a scavenger hunt, a community service project, and a student organization meeting. These assignments were designed to encourage students' involvement in activities outside of the classroom. While the instructor was always present, guest speakers were used to teach course material for week 4 (note taking, studying, reading comprehension, and test-taking strategies), for week 5 (time management/stress management), and weeks 7 and 8 (computer workshops). Guest panelists were used week 2 (exploring resources) and week 12 (multiple role planning and dual careers).

Textbooks and Readings

Two textbooks were used in the intervention. This might seem like a lot for a one-credit class, but the students were not asked to read both books in their entirety. The career textbook chosen (see Appendix H) devotes a small section to gender issues related to work. The second text (see Appendix H) is one that addresses gender issues on campus and includes a small section on gender and work. Both books are easy to read, insightful, mildly challenging, and very supportive in helping students think about relevant issues. They are full of resources that will be useful to the students beyond the scope of the class.

Teams of two students each chose a different woman scientist or mathematician and read biographical or autobiographical materials on that person. Because this was a one-credit class, it was decided that reading a whole biography would be too much to ask of the students

so web-based material was acceptable in completing the assignment. Students wrote a paper and presented a short collaborative PowerPoint presentation for the class describing the career development of the woman during her lifetime and the impact reading about her life had on their thinking about their own future careers.

Mentoring

Studies have shown that faculty mentors are significant to the personal development and academic achievement of first-year students (Pascarella & Terenzini, 1977; Terenzini & Wright, 1987). The instructor was trained with the idea that she would think of her role as being a mentor as well as an instructor for the women in the course. Also, the instructor began to teach the students about networking.

Training of Instructor

The instructor was an assistant professor of math who has been involved in organizing summer math camps for high school women. She received training from the researcher on career development as well as training from the person in charge of the college's first year experience program who provides training for all new first year experience instructors on facilitating discussion, teaching study skills, and other first year experience topics. Selections from a text on college teaching (Lowman, 1995) were used in the training to expand her knowledge on leading discussions.

The intervention included a peer course assistant. This is standard in first year experience courses at the college where the study was conducted. The peer course assistants for FYE receive one-hour of course credit. Before the semester began, the assistant received training with other FYE course assistants that exposed her to the concept of developmental teaching. Also, because the intervention had a goal of promoting retention in math, science,

and technology majors, the peer course assistant selected was a sophomore majoring in biology who has interpersonal and intellectual qualities suited for the role. The peer course assistant was asked to help facilitate experiential activities and to provide appropriate personal “testimonies” about the importance of the topics (like study skills). She organized a community service project for the students in the class to complete as a group. Finally, the peer assistant had good insights for the instructor about how the class was going and in assisting the students with issues outside of class.

During the semester the course was taught, the investigator conducted ongoing weekly meetings with the instructor. The investigator discussed upcoming topics and reviewed the objectives and techniques to be used in each class session.

Data Analyses

Students’ responses were summed for each instrument. Due to the size of the sample (less than 30), nonparametric inferential tests were conducted on the data (Wilcoxon Rank Sum test and Kolmogorov-Smirnov test, Blalock, 1972). An alpha level of .01 was used for each individual test. Mean scale scores for each instrument were compared. Any changes that could have occurred over the semester were identified by comparing pretest and posttest results for individual students. The mean differences in each group were also compared.

Comparisons of math SAT scores, verbal SAT scores, mother’s work history, family income level, and first semester college GPA were evaluated for potential differences between the two groups.

In order to better understand the students’ backgrounds and that relationship to the results, Spearman correlation tests were conducted to see if there were significant relationships between variables.

A Student's t-test was used to determine if the treatment group course evaluations were different than the evaluations for all FYE courses at the college.

Limitations of the Study

Because a college population was used, results may not be generalizable to non-college populations. Students at only one institution were studied. Because participants were students at a women's college, results may not be generalizable to women attending coeducational colleges and universities. All students at the college from which the population was chosen receive a laptop computer as a part of their tuition and fees at the beginning of their college experience. This would not be the experience of most students at most colleges.

It was not feasible to use a strictly randomized sample; therefore, the possibility of sampling error is increased. The sample size was small which increases the probability of a Type II error. The method of measurement for this study was the collection of data from participants both before and after the intervention took place by means of the same instrument. This pretest-posttest design allowed for the possibility that practice effects, resulting from participants taking a familiar instrument during the posttest phase, may have occurred.

CHAPTER FOUR

RESULTS

The current study was an investigation of the effectiveness of a first-year experience course designed to support women intending math and science-related majors and careers. Specifically, the study measured whether participants in the experimental course demonstrated significantly higher posttest scores in career self-efficacy, coping with barriers efficacy, career aspirations, and attitudes toward multiple role planning than those in a no-treatment control group. The study also investigated the persistence of the treatment and control groups in math and science-related majors.

At pretest, there were 12 participants in the treatment group and 12 participants in the control group. The sample at the first posttest consisted of 11 participants in the treatment group and 11 participants in the control group. The sample at the second posttest consisted of 10 members in the control group and seven members in the experimental group. At pretest and posttest, all participants completed the Career Decision Self-Efficacy Scale—Short Form (CDMSE-SF, Betz, Klein, & Taylor, 1996), the Career Aspiration Scale (O'Brien, 1992), the Coping with Barriers Scale (Luzzo & McWhirter, 2001), and the Attitudes Toward Multiple Role Planning Scales (Weitzman & Fitzgerald, 1996). Throughout the study, all questionnaires were completed thoroughly and all were usable. The resulting scale responses from the instruments were scored. The author separated scores for two portions of the Coping with Perceived Barriers scales into Coping with Educational Barriers (CBE) and Coping with Career Barriers (CBC) to see if there were any differences.

Characteristics of Participants at Pretest

At pretest, treatment and control groups were not found to be significantly different in SAT math scores, SAT verbal scores, and parental income using the Wilcoxon Rank Sum test (Table 1). However, the mean verbal and math SAT scores of the control group are slightly higher than those of the treatment group (Table 1). Prior to the dropout of one participant in each group, the initial mean math SATs were more closely matched ($N=12$, $M=567.5$ for treatment group; $N=12$, $M=579.6$ for control group). The treatment group participant who did not persist until posttest had the highest math SAT and combined SAT scores of that group. The median income of the treatment group families also was slightly lower than the control group (Table 1).

Treatment and control groups were not found to be significantly different for the percentages of mothers working before the participants were age 5 ($p=1.0000$) or for the percentages of mothers currently working ($p=.9934$) using the Kolmogorov-Smirnov test. The treatment group ($n=10$; one participant didn't know if her mother had worked before she was age 5) and control group ($n=11$) had similar percentages of their mothers working before they were age 5 (80% and 82%, respectively). While not significantly different, a higher percentage of the treatment group had mothers currently working (82%) than the control group (64%). There was no significant difference in age between the two groups at pretest (both groups had nine who were 18 years of age and two who were 17).

In pretest measures, there were no significant differences between the two groups in career aspirations, coping with barriers efficacy, attitudes toward multiple role planning, and career self-efficacy. However, the treatment group began with somewhat higher attitudes toward multiple role planning ($p=.0539$) (Table 1).

Table 1

Wilcoxon Rank Sum Test for Differences Between Groups at Pretest

<u>Variable</u>	<u>Treatment</u>		<u>Control</u>		<u>p</u>
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	
SATV	520.00	63.56	556.36	87.67	.6033
SATM	555.45	46.12	577.27	53.50	.3994
Parental Income	3.55	1.86	3.88	1.89	.6884
Pretests					
ATMRP	130.82	7.39	125.09	9.63	.0539
CAS	30.00	5.53	30.45	6.39	.3831
CDMSE	99.91	11.17	98.55	12.90	.8454
CBC	29.18	4.12	29.27	3.38	.9219
CBE	87.00	10.97	89.09	8.76	.8964

Notes: Treatment group (n=11); Control group (n=11)

ATMRP: Attitudes Toward Multiple Role Planning Scales

CAS: Career Aspiration Scale

CDMSE: Career Decision Self-Efficacy Scale

CBC: Coping with Barriers—Career

CBE: Coping with Barriers—Educational

Parental Income: 1=\$25,000, 2=\$25,000-\$49,999, 3=\$50,000-\$74,999,
 4=\$75,000-\$99,999, 5=\$100,000-\$149,999, 6=\$150,000-\$199,999,
 7=\$200,000 or more

Treatment median parental income=2; Control median parental income=3

Analysis of Hypotheses

The investigator hypothesized that women students with interests in majoring in math and science who were enrolled in a first-year intervention course would exhibit a larger change on posttest measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring

in math and science who were in a no-treatment control group. Table 2 provides the mean results and standard deviations of the results of both groups at the first posttest. Using the Wilcoxon Rank Sum test, no significant differences were found between the treatment group and the control group on attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy (Table 3). However, the women in the control group ended with somewhat higher increases in career aspirations ($p=.0574$) (Table 3).

Table 2

Results of First Posttest

<u>Variable</u>	<u>Treatment</u>		<u>Control</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
Posttests				
ATMRP	132.36	6.67	127.63	10.34
CAS	27.55	6.67	31.64	5.28
CDMSE	97.55	9.56	102.82	12.40
CBC	30.27	3.41	30.82	2.36
CBE	84.55	11.55	91.00	8.26

Notes: Treatment group (n=11); Control group (n=11)

Also, the investigator hypothesized that women students with interests in majoring in math and science who were enrolled the first-year intervention course would be more likely to persist in their intended major than women with similar interests who were in a no-treatment control group. Nine out of 11 (82%) in the treatment group retained the same academic and career interests at posttest. Ten out of 11 (91%) in the control group retained the same academic and career interests at posttest. The differences in the two groups were not significant using the Kolmogorov-Smirnov test ($p=1.0000$).

Table 3

Wilcoxon Rank Sum Tests for Differences in Score Change Between Groups on Career Assessments After Treatment

<u>Variable</u>	<u>Treatment</u>		<u>Control</u>		<u>p</u>
	<u>Mean Change</u>	<u>SD</u>	<u>Mean Change</u>	<u>SD</u>	
ATMRP	1.55	9.35	2.55	6.36	.7699
CAS	-2.45	4.63	1.18	3.82	.0574
CDMSE	-2.36	13.31	4.27	7.16	.3849
CBC	1.09	3.14	1.55	3.39	.9472
CBE	-2.45	9.31	1.91	8.94	.4387

Later in mid-spring semester (second posttest), students were asked again about their academic major and career plans. Ten out of eleven members of the control group who had taken the first posttest responded to complete the final posttest. The other one e-mailed to say she was studying in Mexico for the spring semester; she was one of the students who had already changed her major and career plans at the end of the fall semester. Seven out of eleven members of the treatment group who had taken the first posttest responded. At the second posttest, one additional member of the control group had changed her major and career goals from math and science related majors and careers and one additional member of the treatment group had changed her major and career goals from math and science.

The investigator did not make a hypothesis about end-of-semester GPA but did collect that data to better understand the two groups. While not significantly different, the control group had higher mean GPAs at the end of the fall semester (Table 4).

Table 4

Wilcoxon Rank Sum Test for Differences Between Group First-Semester GPAs

	<u>Treatment</u>		<u>Control</u>		p
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	
First-semester GPA	2.73	.69	3.18	.49	.1458

Note: Treatment group (n=11); Control group (n=11)

Exploration of Temporal Lag in Self-Efficacy

In the second post test of the two self-efficacy measures 10 out of 11 of the control group responded and 7 out of the 11 of the treatment group responded. Table 5 lists means and standard deviations for the second posttest. There were no significant differences between the groups from pretest to second posttest (Table 6) or from first posttest to second posttest (Table 6). The results do not demonstrate a temporal lag in self-efficacy (Table 6).

Table 5

Results of Second Posttest

<u>Variable</u>	<u>Treatment</u>		<u>Control</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
Posttests				
CDMSE	97.71	9.69	102.90	12.67
CBC	29.43	3.74	29.60	3.84
CBE	84.86	12.06	87.80	11.21

Notes: Treatment group (n=7); Control group (n=10)

Table 6

Wilcoxon Rank Sum Test for Differences Between Groups on Self-Efficacy Measures

<u>Variable</u>	Pretest/2 nd Posttest <u>Comparison</u>	1 st Posttest/2 nd Posttest <u>Comparison</u>
	<u>p</u>	<u>p</u>
CDMSE	.2040	1.0000
CBC	.5553	.7270
CBE	.4347	.4059

Comparison of Treatment Group Course Evaluations

Looking at the mean scores for the treatment group course evaluations and the evaluations of other FYE courses, the mean scores of the treatment FYE course are higher than the overall mean scores of the other FYE courses taught in Fall 2003 at the College. However, Student's t-test did not find significant differences between the treatment course and the other FYE courses (Table 7).

Table 7

Comparison of Course Evaluations

	<u>Treatment</u>		<u>All FYE</u>		<u>t</u>	<u>p</u>
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>		
Content of this Course	4.00	1.12	3.81	1.15	0.49	.6376
Instructor of this Course	4.56	0.53	4.43	0.96	0.66	.5293
Course in General	4.00	0.87	3.64	1.23	1.16	.2811

Notes: Treatment (n=9); All FYE (n=117)

Spearman Correlations

Significant correlation coefficients were found between SAT verbal scores and first-semester college GPA ($r = 0.49$), SAT math scores and first-semester college GPA ($r = 0.54$), and parental income and first-semester college GPA ($r = 0.48$) (Table 8).

Table 8

Spearman Correlation Coefficients

	<u>SATV</u>	<u>SATM</u>	<u>Income</u>
<u>GPA</u>	0.49*	0.54**	0.48*
<u>SATV</u>		0.62**	0.25
<u>SATM</u>			0.13

Notes: $n=22$

* $p < .05$; ** $p < .01$

CHAPTER FIVE

DISCUSSION

College women must choose a major and a career in the context of society's expectations that people fall into gender-typed vocational paths. Many jobs in math and science related fields that have been nontraditional for women provide opportunities for salary and prestige that are less likely to be available in jobs that are traditionally held by women. Unfortunately, majors in fields like math and science that historically have been considered the domain of men have poor retention rates of women. A number of researchers have been exploring how to encourage young women to enter nontraditional fields and how to retain them in those fields. There have been a number of research studies on gender differences in interests and choices regarding science, math, and related major and occupations (e.g., Betz & Hackett, 1983; Eccles, 1994; Hackett, 1985; Trusty, 2002). There also have been a number of career interventions created to support women interested in science, math, and engineering (e.g., Farrant & Miller, 1993; Fisler, Young, & Hein, 2000; Smith, Stroup, & Coffman, 1975; Thom, 2001). However, few researchers have focused on empirically testing the effects of career interventions for women interested in math and science related majors and careers. Empirically-tested interventions that address career issues relevant to women entering nontraditional fields are needed to fill the gap between theory and practice.

First-year experience courses have become a very common way to support the developmental needs of new students on many college campuses. In fact, over 90 percent of American colleges and universities now offer some type of first-year experience class (Laufgraben, Pica, & Swing, 2004). The current study integrated academic skills and career

development interventions into a first-year experience course designed to support women interested in math and science related majors and careers. Components of the course included having a math professor teach the course and act as a mentor/role model, having a sophomore biology major course assistant support the faculty member in facilitating the course and act as a peer role model, and having specific activities to address what are believed to be the needs of young women interested in entering nontraditional fields. Included in the intervention were experiences designed to address issues of career aspirations for women, self-efficacy, outcome expectations, multiple role planning, coping with perceived career barriers, and feminism. The women took apart and put together a computer to help build self-efficacy in an activity that men might more traditionally engage in. They read about and presented information on a successful woman in a math or science field. They interacted with a panel of woman scientists and mathematicians to learn how those women juggle multiple roles in their lives. They read and discussed issues related to gender and work. They completed an information interview with a woman in a career field in which they were interested. They also completed an interest assessment and met once with a career counselor.

The investigator hypothesized that women students with interests in majoring in math and science who were enrolled in the first-year intervention course would score higher on posttest measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring in math and science who were in a no-treatment control group. Also, the author hypothesized that women students with interests in majoring in math and science who were enrolled in the first-year intervention course would be more likely to persist in their intended major and career field

than women with similar interests who were in a no-treatment control group. The results of the study do not support the author's hypotheses.

Limitations and Confounding Variables

Limitations in the current study are related to the size of the sample and the fact that all participants were college women with fairly homogeneous backgrounds. The small group size and use of nonparametric inferential tests limit the power of the statistical analysis. A larger sample size might have elicited different results.

Another limitation is related to the selection process and testing process. Students who had indicated a desire to take a First Year Experience course, whose course selections did not interfere with the time slot for the experimental FYE course, and who met the criteria for interest in a math or science major, minimum Math SAT score and math and science high school grades were tentatively assigned to the class. Students were contacted by the investigator who invited them to participate in the study. No student declined. Students in the treatment group were tested in their course classroom at the beginning and end of the fall semester. Students with no interest in an FYE course who met the criteria were contacted for the control group. Some declined. Those who agreed to participate had to make an effort to come to the Career Center for testing each time. There was a high attrition rate with the treatment group at the final posttest with a smaller percentage of those in the treatment group following through on the second posttest. The attrition rate may be related to the differing testing environments for the two groups. It is possible that because the treatment group had been assessed in the course classroom for the pretest and first posttest (requiring little additional effort on their part) that some were less committed to continuing with the study when they had to make an effort to participate in a second posttest.

One possible confounding variable may be related to the lack of sensitivity of the scales of the assessment instruments used to measure constructs and development in the study. All four of the instruments used to measure dependent variables had five-point Likert-type scales. Differences between the treatment group and the control group may not have been demonstrated due to the lack of sensitivity of the instruments. When answers and scores for groups being compared are clustered at similar points on a scale, it is possible that differences are not evident because the possible spread of scores is restricted (Heppner, 1998). A number of the participants at pretest and posttest had answers clustered in the “4” and “5” choices of the CDMSE--SF and the “A” and “B” choices of the Coping with Perceived Barriers Scales. With answers clustered at the upper limits, there may have been a limit or “ceiling effect” of the amount of change that the measures of the dependent variables could detect for many of the participants (Heppner, 1998). The original longer CDMSE created by Taylor and Betz (1983) incorporates a nine-point scale that might be more useful than the CDMSE—SF in detecting developmental changes. Increasing the width of the scales of the other instruments might make it easier to detect changes in those instruments as well.

Another possible confounding variable is related to the investigator learning after the posttest that three of the women in the control group were in the Honor’s Program. Activities in the Honor’s Program are designed to encourage women in their academic studies. It is likely that Honor’s Program activities supported those few women in the control group in a similar manner to the First Year Experience program thus confounding the results.

The class section on Women and Work had to be cancelled due to instructor illness. While the content of course sessions including the “Gender on Campus” discussion and the

multiple role planning panel addressed career barriers, the students in the class did not receive the entire intervention designed to assist students with coping with perceived career and educational barriers. The average scores of both groups on coping with barriers were relatively high and remained so at the end of the semester. Attending a small college with small classes and personal interaction with faculty may have contributed to both groups self-efficacy regarding coping with educational barriers. The instructor of the treatment group reported to the investigator that the students who spoke during discussions did not think that women faced significant career and educational barriers due to gender in current times. Being at a women's college, they would have been less likely to have faced and understood what career and educational barriers exist for women. Also, while the control group did not receive the benefits of listening to women talk about juggling multiple roles, they may have received benefits inherent in attending a women's college (i.e., high interaction with female role models in and out of the classroom).

Both groups benefited from a large percent of the faculty at the college being women. In fall 2003, 91 of the 137 full-time teaching faculty were women (66.4%), 98 of the 140 part-time faculty were women (70.0%), and 189 of the 277 total faculty were women (68.2%). Any of the women in both groups would have benefited from having women faculty as role models in their math and science courses. To learn more about the exposure the students in the study had with women faculty, the investigator asked the students during the middle of the spring semester to indicate how many of their math and science courses were taught by women. The seven women from the treatment group who participated in the second post-test indicated as a group that 11 of the 23 (48%) science and math courses they had taken were taught by women. The 10 women from the control group who participated in

the second posttest indicated as a group that 23 of the 50 (46%) math and science courses they had taken were taught by women.

Any of the women in both groups could have benefited from male-free math and science courses. After the second posttest, the investigator debriefed the women who had participated in the study. An anecdotal finding after the debriefing was that many of the women told the investigator that they would have disliked being in science and math classrooms with male students.

It also should be noted that retention in the science and math majors thus far for both groups was strong. In addition to possible benefits the women might have received from the small class sizes, male-free classes, personal attention given at a small college, and the role modeling given by women faculty, they may have benefited from teaching techniques. Trice (1994) determined that women's colleges are more likely to use teaching approaches like dividing course material into smaller units and testing frequently (methods that have been demonstrated to provide high course success for students). She surmised that these teaching methods might lead to self-efficacy behavioral accomplishment and might help explain the success of women who attend women's colleges.

The intervention was conducted during the first semester in college while the women were adjusting to new academic expectations. The instructor of the course observed that some of the students were demonstrating poor study habits not only in other classes but in the FYE class as well. Because the class was not test-oriented and was not considered as important as the other classes, she questioned whether all of the students were completing the assigned reading. Therefore, all of the participants in the course may not have received the full benefit of the course.

Research by the National Resource Center has shown that first-year programs increase college retention and grade point averages for freshmen (Fidler, 1992). Few researchers, however, have examined the developmental impact of first-year courses. McAdams and Foster (1998) suggested that a year-long course is probably needed to foster significant gains in development. Perhaps a year-long course and study would have a stronger impact. Also, semester-long FYE courses vary from institution to institution in the number of credit hours given for a class with some colleges giving as many as three-credit hours. The course in the current study was a one-credit hour class meeting for an hour and twenty minutes each week. It might be that a three-credit hour class would have a stronger impact on the development of the students.

Bandura (1986) and Luzzo et al. (1999) suggest that there may be a temporal lag in self-efficacy changes. All participants received further posttesting mid-way through the spring semester on the two self-efficacy measures (Coping with Barriers Scales & CDMSE). No temporal lag in self-efficacy changes was found in the current study. This second post-test yielded a smaller number of participants in both groups. Therefore, the investigator believes that the results of the second posttest should not be generalized.

The course evaluations for the course and the instructor were higher than the overall mean scores for FYE courses and instructors. While the course did not demonstrate the changes hypothesized by the author, the results of the course evaluation indicated satisfaction with this approach to teaching a first year experience course. One student indicated on the evaluations that she liked being grouped with other math and science majors and liked that they completed some special activities that applied to them. Another student indicated that she did not like the *Gender on Campus* book. The instructor received similar verbal

feedback from other students in the class about the textbook. According to the instructor, the students in the course did not identify with feminism as a philosophy. Students specifically mentioned on the course evaluations that they liked the outside speakers who spoke on time management and careers. Course satisfaction alone may be a good reason for practitioners who develop first-year experience courses to look to this approach in designing the curriculum for a similar course.

Implications for Research

A fundamental goal of this research was to link career theory with an intervention designed to support women interested in math and science related majors and careers. In particular, Social Cognitive Career Theory (SCCT) was used to guide the development of the intervention. One of the things the author finds intriguing about SCCT is that the theory seems to provide a potential framework for examining how career barriers impact a variety of people. As in most studies of career interventions, the sample in this study was not diverse. An important future direction would be for researchers using the theory as a framework to consider how to design their interventions to include a greater diversity of people. It is recommended that this study be replicated in coeducational institutions as well as larger institutions where women might strongly benefit from the attention given in this type of course. Larger sample sizes would be available in a larger institution and would make it possible to analyze the results with parametric statistics, thus improving the power of the statistical analyses. Also, a large sample would provide a better opportunity to include more diverse participants.

Not only is it important to know how to create interventions that increase the self-efficacy of women going into traditionally male fields, but it is also important to know what

interventions are effective with people from different racial/ethnic backgrounds. Among African American women awarded doctorates in biology between 1975 and 1992, 75% took their undergraduate degrees at historically Black colleges and universities (HBCUs), notably Spelman and Bennett colleges (Thom, 2001). It could be helpful to learn what conditions at HBCUs could be translated into effective interventions at predominately White colleges and universities.

Research on career interventions also should be extended to examine issues of disability and sexual orientation. Considering the increasing numbers of students entering college with some type of disability, it may begin to make sense to ask questions about disability in demographic questionnaires. People with obvious physical disabilities and challenging learning disabilities historically have faced some of the biggest career barriers. While the passage of Americans with Disabilities Act has resulted in more people with disabilities entering college and staying in college, employment after college remains a challenge for many. One can imagine that facing big career barriers related to one's disability would impact career outcome expectations. The instructor of the course in this study shared that there were a couple of students in the course who disclosed having ADHD. We do not know how having disabilities would have impacted students in the study.

Longitudinal studies which track women's career aspirations, attitudes toward multiple role planning, career self-efficacy, and coping with barriers efficacy over their adult lifespan also are needed. Such studies could help determine (1) how women plan to juggle multiple roles and how they eventually integrate career and other roles, (2) what women's beliefs are about their ability cope with career and educational barriers and how they ultimately cope with those barriers, (3) what the relationship is between career aspirations

and eventual career achievements, and (4) what the relationship is between career self-efficacy and success in making career decisions. Longitudinal studies would provide a means for exploring the interplay of social cognitive variables (such as self-efficacy) with other important person, contextual, and experiential/learning factors, such as gender, culture, support systems, and barriers in the outcome of women's careers, particularly in nontraditional fields for women.

McAdams and Foster's (1998) research suggested that a year-long first-year experience course is probably needed to foster significant gains in development. Perhaps a year-long course would have a stronger impact. During a second semester of the course, students might be ready to adopt stronger study habits and learn more effectively from course readings and assignments designed to challenge thinking.

Because the sample size was small, the investigator limited the number of instruments used. In a larger sample, it might be interesting to investigate the student's thinking about feminism and how that impacts or relates to career aspirations and plans. The instructor of the course observed that the women speaking up in class disagreed with the feminist ideas in the book. Although, the students stated they believed in equal pay for equal work, they stated they did not identify with feminism. The sample was taken from a private college in a politically conservative state and drew students primarily from the state. It may be that in a student sample that identified with feminist thinking there might be different results. Also, within the women's college setting the student participants likely were not experiencing "the chilly climate" that has been described by researchers (Hall & Sandler, 1982, 1984). It may be that young women must have significant experiences involving sexism before feminist ideas make sense.

The Spearman correlation coefficients for the sample indicated a strong relationship between first-semester GPA and SAT scores and first-semester GPA and family income. It may be that variables such as SAT scores and family income are a stronger predictor of outcome than an intervention of this type. Possibly, an intervention of this type would be more useful in supporting women with higher SATs who are at colleges where the atmosphere is more competitive than supportive and where men dominate in classroom numbers.

Implications for Practice

When Fitzgerald and Crites (1980) reviewed the existing literature on women's careers to identify what was known and still needed to be determined about women's career behavior, they recommended that counselors who intended to provide interventions for women receive additional training. In approaching career counseling with first-year college women interested in math and science-related majors and careers, assessing career aspirations, attitudes toward multiple role planning, coping with career and educational barriers efficacy, and career self-efficacy could be beneficial in understanding the attitudes and self-efficacy of the student being assisted. While self-efficacy measures were not correlated significantly with GPA for the two groups, the investigator noted that there were individual students whose grades and self-efficacy scores were similarly low. Using SCCT as a model, understanding the client's self-efficacy in coping with perceived educational and career barriers would be an important consideration. Counselors should be creative in developing interventions that gently challenge current attitudes that students have about nontraditional fields and provide support to help them persist in those fields.

In the present study, students in the treatment group discussed gender inequities and read a textbook on gender issues called *Gender on Campus*. The instructor of the course observed that the students did not identify with feminism and one student specifically commented on disliking the book on the course evaluation. Practitioners desiring to tackle gender inequities as was done in the course described in this study may want to read an account that Williams (2004) gives of her experiences teaching undergraduate women about feminism and leadership. She describes how her students typically come in to her classes associating feminism with negative connotations.

“Postadolescent women—and by this I mean most of my students, who are straddling that liminal space between being teenagers and becoming adults—seem especially concerned that such extreme behaviors and opinions will relegate them to the fringes of the social pods in which they seek membership. They struggle with calling themselves ‘women’ instead of ‘girls,’ so it has begun to seem a bit importunate of me to even broach the more heady matters of institutional sexism, glass ceilings, and wage inequities. Which is not to say I don’t do this, I just do it differently that I used to...” (Williams, 2004, 19-20.)

Williams effectively describes how she uses a service learning component in her course, “Women and Leadership,” to give women experiences that provide a context for understanding feminism. Overall, William’s article is an effective discussion addressing where many undergraduate women are developmentally with the concept of feminism. The investigator would suggest practitioners wanting to address gender issues in career and first-year courses read William’s essay and plan experiential learning experiences that will provide students an opportunity to understand gender-based career issues.

Conclusion

In the current study, an intervention model for supporting first-year college women with interests in math and science-related majors was tested. The study investigated whether participants in an experimental version of a first year experience course would demonstrate more significant positive differences in posttest measures of career aspirations, attitudes toward multiple role planning, coping with barriers efficacy, and career self-efficacy than women with interests in majoring in math and science who were in a no-treatment control group. The study also investigated whether women students with interests in majoring in math and science who were enrolled in the first-year intervention course would be more likely to persist in their intended major and career field than women with similar interests who were in a no-treatment control group. Although there were no differences found between the group receiving the intervention and the control group, studies testing interventions should continue.

The concept of studying field interventions of college women interested in math and science majors is worthy of further consideration and investigation. The Wellesley Pathways for Women in the Sciences project identified the first undergraduate year as a significant time when women disproportionately abandon plans to major in science (Civian & Brett, 1997, as cited in Thom, 2001). There have been a number of career interventions created to support women interested in science, math, and engineering (e.g., Farrant & Miller, 1993; Fisler, Young, & Hein, 2000; Smith, Stroup, & Coffman, 1975; Thom, 2001). However, few researchers have focused on empirically testing the effects of career interventions for women interested in math and science related majors and careers. Knowing what types of efforts are effective in helping retain first-year women with nontraditional majors will help colleges

support women in entering higher paying and higher prestige nontraditional fields. At the very least, the experimental course in the current study received favorable evaluations by the students and offers a model for practitioners to implement. Future research endeavors with this model using larger sample sizes and parametric statistics might elicit different results. A course of this type is likely to be more effective in a coeducational college setting where women experience the challenges of being in classroom settings where men dominate the science and math fields and where women role models are more difficult to find. The women in the experimental and control groups of this study were students at a women's college, an environment many researchers regard to be a more supportive for women than coeducational colleges (A. W. Astin, 1977; Miller-Bernal, 1993, 2000; Smith, 1990; Smith et al., 1995; Tidball, 1980; Whitt, 1994; Wolf-Wendel, 1998). The participants did not have men in their math and science classrooms. Almost half of the participants' math and science courses were taught by women. In most coeducational colleges, students are likely to have a smaller percentage of their courses taught by women. Women in a school of engineering may benefit most from such an intervention. Within mathematics and science fields, engineering trails behind nearly every other profession in the participation of women (Thom, 2001).

In general, research in this area is critically needed. We need more information about why women are less likely than men to persist in math and science-related careers and majors and how we can support and retain women with interests in entering these fields.

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Appendix A

North Carolina State University Informed Consent Form

I am a graduate student in the department of Educational Research and Leadership and Counselor Education at North Carolina State University. I am conducting a study on the career development of first-year college women interested in math, science, or related careers. I am under the supervision of Dr. Siu Man Ting. You are invited to participate.

Participants involved in this study will participate in a first-year experience course and complete five career development scales plus brief demographic information concerning age, race/ethnicity, family income, high school math and science grades, SAT scores, future career goals, current math and science courses, and mother's work experience. The information in the study is confidential, data will be stored securely, and no oral or written information would link you to the study.

Thank you for your participation.

Sincerely,

Sharon McMillen Cannon
Principal Investigator
919-403-9025

Please read the following statements and sign below if you agree to participate:

- I have read and understand the procedure described above.
- I realize that my participation in this study is voluntary.
- I understand that the information I provide is confidential and is to be used for research purposes only.
- I understand that I am free to withdraw my consent for participation in this study at any time.
- I have received a copy of this form, and I agree to participate in this research study.

Participant's Signature

Date

Investigator's Signature

Date

If you feel you have not been treated according to the descriptions on this form, or your rights as a participant in research have been violated during the course of this project, you may contact the Chairperson of the NSCU Human Subjects Committee, Matt Zingraff, at Box 7906, NCSU Campus or 919-513-1834.

Appendix B

Release Form for Grades and SATs

I am a graduate student in the department of Educational Research and Leadership and Counselor Education at North Carolina State University. I am conducting a study on the career development of first-year college women interested in math, science, or related careers. I am under the supervision of Dr. Siu Man Ting.

I am requesting permission to request your high school and first semester college grades and your SAT scores from Meredith College. The information in the study is confidential, data will be stored securely, and no oral or written information would link you to the study.

Thank you for your participation.

Sincerely,

Sharon McMillen Cannon
Principal Investigator
919-403-9025

Please read the following statements and sign below if you agree to participate:

- I have read and understand the procedure described above.
- I realize that my participation in this study is voluntary.
- I understand that the information I provide is confidential and is to be used for research purposes only.
- I understand that I am free to withdraw my consent for participation in this study at any time.
- I have received a copy of this form, and I agree to participate in this research study.

Participant's Signature

Date

Investigator's Signature

Date

If you feel you have not been treated according to the descriptions on this form, or your rights as a participant in research have been violated during the course of this project, you may contact the Chairperson of the NCSU Human Subjects Committee, Matt Zingraff, at Box 7906, NCSU Campus or 919-513-1834 and/or Dr. Jean Jackson, Vice President for Student Development at Meredith College, 760-8556.

Appendix C

Career Aspiration Scale

Karen M. O'Brien, Ph. D.

In the space next to the statement below, please circle a number from "0" (not at all true of me) to "4" (very true of me). If the statement does not apply, circle "0." Please be completely honest. Your answers are entirely confidential and will be useful only if they accurately describe you.

	Not at All True of Me 0	Slightly True of Me 1	Moderately True of Me 2	Quite a Bit True of Me 3	Very True of Me 4
1. I hope to become a leader in my career field.	0	1	2	3	4
2. When I am established in my career, I would like to manage other employees.	0	1	2	3	4
3. I would be satisfied just doing my job in a career I am interested in.	0	1	2	3	4
4. I do not plan on devoting energy to getting promoted in the organization or business I am working in.	0	1	2	3	4
5. When I am established in my career, I would like to train others.	0	1	2	3	4
6. I hope to move up through any organization or business I work in.	0	1	2	3	4
7. Once I finish the basic level of education needed for a particular job, I see no need to continue in school.	0	1	2	3	4
8. I plan on developing as an expert in my career field.	0	1	2	3	4
9. I think I would like to pursue graduate training in my occupational area of interest.	0	1	2	3	4
10. Attaining leadership status in my career is not that important to me.	0	1	2	3	4

Appendix D

Attitudes Toward Multiple Role Planning Scales™

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Many people today are considering being involved in their career at the same time that they have children. As you might imagine, managing multiple roles (e.g., combining the roles of career and family) is often challenging. The statements below ask you about your beliefs and feelings about how to best combine a career and a family. Please indicate the degree to which you agree or disagree with each statement by circling the numbers that correspond with each statement by circling the numbers that correspond with the scale:

	1	2	3	4	5
	Strongly Disagree		Unsure		Strongly Agree
1. I don't know how to plan for combining my career and my family.	1	2	3	4	5
2. I want it all, to be a parent, spouse, and career person, and I am determined to manage it all and do it well.	1	2	3	4	5
3. Other people (e.g., parents, friends) usually can suggest the best ways to manage career and family responsibilities for those they care about.	1	2	3	4	5
4. I can't seem to become very concerned about how to combine my career with my family plans.	1	2	3	4	5
5. When deciding how to manage your career and family responsibilities, it's important to come up with flexible plans.	1	2	3	4	5
6. Figuring out how to balance my career and my family confuses me because I don't feel I know enough about myself or about the stresses involved in balancing these roles.	1	2	3	4	5
7. You should choose ways of managing your career and family obligations so that you can "do it all."	1	2	3	4	5
8. I plan to look to my friends and family for suggestions about balancing my career with my parenting responsibilities.	1	2	3	4	5
9. I seldom think about the ways that I might actually combine my career and my family obligations.	1	2	3	4	5
10. I feel it is important to listen to my partner or spouse's ideas and suggestions about the best ways for me to balance my career and my family.	1	2	3	4	5
11. I can't understand how some people can be so certain about how to successfully manage career and family responsibilities.	1	2	3	4	5
12. I really want to accomplish something in my life, to have a satisfying career <u>and</u> to be a good parent.	1	2	3	4	5

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|-----|--|---|---|---|---|---|
| 13. | I don't want anybody else to tell me how to balance my career and my family responsibilities. | 1 | 2 | 3 | 4 | 5 |
| 14. | I'm not going to worry about how to combine my career with my family until I'm actually involved in both of these roles. | 1 | 2 | 3 | 4 | 5 |
| 15. | The best plans for how to balance your career with your family are those that are loosely structured (e.g., flexible instead of rigid). | 1 | 2 | 3 | 4 | 5 |
| 16. | When it comes to combining my career with my family, I can't seem to make up my mind how to do it successfully. | 1 | 2 | 3 | 4 | 5 |
| 17. | When it comes to work and family, there's no reason why people can't "have it all" (e.g., time for both work and family) if they just try hard enough. | 1 | 2 | 3 | 4 | 5 |
| 18. | Your friends or family can probably give you the best advice on ways to manage your career and your family. | 1 | 2 | 3 | 4 | 5 |
| 19. | I don't worry about managing my career and family responsibilities because I'm sure it will sort itself out sooner or later. | 1 | 2 | 3 | 4 | 5 |
| 20. | I intend to work things out with my partner or spouse when it comes to deciding on strategies for combining career and family responsibilities. | 1 | 2 | 3 | 4 | 5 |
| 21. | It's easy to be certain how to manage my future career and family obligations in ways that are realistic for me. | 1 | 2 | 3 | 4 | 5 |
| 22. | The greatest appeal of balancing my career with my family obligations is the opportunity it provides for a fulfilling life. | 1 | 2 | 3 | 4 | 5 |
| 23. | When trying to decide how to manage the demands of my career and my family, I wish someone would tell me what to do. | 1 | 2 | 3 | 4 | 5 |
| 24. | There is no point in trying to decide how to deal with the demands of a career and a family when the future is so uncertain. | 1 | 2 | 3 | 4 | 5 |
| 25. | It's very likely that the plans I'll make now for managing multiple roles will undergo some change when I actually carry them out in the future. | 1 | 2 | 3 | 4 | 5 |
| 26. | I have little or no idea of what being both a career person and a parent will be like. | 1 | 2 | 3 | 4 | 5 |
| 27. | I am committed to having a lifelong career in addition to raising a family. | 1 | 2 | 3 | 4 | 5 |
| 28. | I will make my own decisions about the type of childcare that's best for my child(ren) regardless of what my mother or friends may think is right. | 1 | 2 | 3 | 4 | 5 |

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|-----|--|---|---|---|---|---|
| 29. | Finding out who I am as a person is so important right now that it makes planning for combining a career and family seem unrealistic. | 1 | 2 | 3 | 4 | 5 |
| 30. | When thinking about how to combine a career with a family, you should consider several different strategies. | 1 | 2 | 3 | 4 | 5 |
| 31. | I don't know whether my plans for combining my career and my family will allow me to be the kind of person I want to be. | 1 | 2 | 3 | 4 | 5 |
| 32. | Having a challenging career is as important to me as being a parent. | 1 | 2 | 3 | 4 | 5 |
| 33. | I feel I should do what those I care about want me to do. | 1 | 2 | 3 | 4 | 5 |
| 34. | You shouldn't worry about trying to combine your career with your family because so much depends on things that are out of your control. | 1 | 2 | 3 | 4 | 5 |
| 35. | Even though I'm not actively combining my career with my family, I feel there is much I can learn <u>now</u> about how to manage these roles successfully. | 1 | 2 | 3 | 4 | 5 |
| 36. | I'm very clear on how to plan for combining my career and family responsibilities. | 1 | 2 | 3 | 4 | 5 |
| 37. | Having both a career and a family is worthwhile because it lets you have a satisfying life. | 1 | 2 | 3 | 4 | 5 |
| 38. | If someone would tell me how to manage my career and my family, I would feel much better. | 1 | 2 | 3 | 4 | 5 |
| 39. | I feel it's important to "take it as it comes" when it comes to planning for combining my career and my family plans. | 1 | 2 | 3 | 4 | 5 |
| 40. | There is generally only one best way to balance a career and a family. | 1 | 2 | 3 | 4 | 5 |
| 41. | I don't know whether my plans for combining my career with my family are realistic. | 1 | 2 | 3 | 4 | 5 |
| 42. | The most important aspect of balancing a career and a family is the personal pleasure that comes from doing it. | 1 | 2 | 3 | 4 | 5 |
| 43. | You can't go very far wrong by following your friend or family's advice about how to combine our career with having a family. | 1 | 2 | 3 | 4 | 5 |
| 44. | I seem to spend a lot of time these days thinking about how I will combine my family and my work responsibilities. | 1 | 2 | 3 | 4 | 5 |
| 45. | Sometimes you have to make choices about managing career and family obligations that don't reflect exactly what you want. | 1 | 2 | 3 | 4 | 5 |
| 46. | I know a lot of strategies for combining a family with a career in a way that minimizes the stress involved. | 1 | 2 | 3 | 4 | 5 |

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| 47. | I'm not going to give up anything. I really want to have both a career and a family. | 1 | 2 | 3 | 4 | 5 |
| 48. | Choosing how to best manage my career and my family is something I have to do on my own. Nobody can tell me how to do it. | 1 | 2 | 3 | 4 | 5 |
| 49. | It's very important to me to try and figure out ahead of time how I will balance my career and family responsibilities. | 1 | 2 | 3 | 4 | 5 |
| 50. | One of the really important things for me in managing multiple roles is that my partner or spouse agrees with my choices. | 1 | 2 | 3 | 4 | 5 |

Appendix E

Coping with Perceived Barriers Scale

Luzzo, D. A., & McWhirter, E. H. (2001)

COPING WITH BARRIERS

Please rate your degree of confidence that you could overcome each of the potential career barriers listed below.

	Highly Confident			Not At All Confident	
1. Discrimination due to my gender.	A	B	C	D	E
2. Discrimination due to my ethnicity.	A	B	C	D	E
3. Negative comments about my sex (insults, jokes).	A	B	C	D	E
4. Negative comments about my racial/ethnic background (insults, jokes).	A	B	C	D	E
5. Difficulty finding quality daycare.	A	B	C	D	E
6. Difficulty getting time off when my children are sick.	A	B	C	D	E
7. Difficulty finding work that allows me to spend time with my family.	A	B	C	D	E

Please rate your degree of confidence that you could overcome each of the potential educational barriers listed below.

	Highly Confident			Not At All Confident	
8. Money problems	A	B	C	D	E
9. Family problems	A	B	C	D	E
10. Not being smart enough	A	B	C	D	E
11. Negative family attitudes about college	A	B	C	D	E
12. Not fitting in at college	A	B	C	D	E
13. Lack of support from teachers	A	B	C	D	E
14. Not being prepared enough	A	B	C	D	E

15. Not knowing how to study well	A	B	C	D	E
16. Not having enough confidence	A	B	C	D	E
17. Lack of support from friends	A	B	C	D	E
18. My gender	A	B	C	D	E
19. People's attitudes about my gender	A	B	C	D	E
20. My ethnic background	A	B	C	D	E
21. People's attitudes about my ethnic background	A	B	C	D	E
22. Childcare concerns	A	B	C	D	E
23. Lack of support from my "significant other"	A	B	C	D	E
24. My desire to have children	A	B	C	D	E
25. Relationship concerns	A	B	C	D	E
26. Having to work while I go to school	A	B	C	D	E
27. Lack of role models or mentors	A	B	C	D	E
28. Lack of financial support	A	B	C	D	E

Finally, please indicate your level of agreement with the following four statements:

"In general, I think that..."	Strongly Agree		Not Sure		Strongly Disagree
29. ...there are many barriers facing me as I try to achieve my <i>educational</i> goals.	A	B	C	D	E
30. ...I will be able to overcome any barriers that stand in the way of achieving my <i>educational</i> goals.	A	B	C	D	E
31. ...there are many barriers facing me as I try to achieve my <i>career</i> goals.	A	B	C	D	E
32. ...I will be able to overcome any barriers that stand in the way of achieving my <i>career</i> goals.	A	B	C	D	E

Appendix F

Demographic Questionnaire

Age: _____

Ethnic/Racial Group (Choose One):

___ African American

___ American Indian/Native American

___ Arab American

___ Asian American

___ Multiracial (Please identify) _____

___ Chicana/Hispanic/Latina

___ Caucasian/European American (non-Hispanic)

___ Other (Please identify)

What is your best estimate of your parents' total income last year?

___ Less than \$25,000

___ \$75,000-\$99,999

___ \$200,000 or more

___ \$25,000-\$49,999

___ \$100,000-\$149,999

___ \$50,000-\$74,999

___ \$150,000-\$199,999

Intended college major: _____ Future career goal: _____

High school GPA: _____ Math SAT: _____ Verbal SAT: _____

High school math grades (list courses and grades): _____

High school science grades (list courses and grades): _____

Please list the math and science courses you are taking this semester: _____

Please describe your mother's work history:

Years worked full-time outside the home _____ Years worked part-time _____

Did your mother work outside the home before you were 5? _____

Is your mother currently working outside the home? _____ If yes, list her job _____

Appendix G

Fall 2003 Course and Instructor Evaluation

- A. The following information is to be used by the administration as part of personnel decisions.

	Poor				Excellent
1. Rate the <i>content of this course</i> .	1	2	3	4	5
2. Rate the <i>instructor</i> of this course.	1	2	3	4	5
3. Rate the <i>course in general</i> .	1	2	3	4	5

- B. The following two questions are to be used by the instructor to improve the quality and effectiveness of instruction. Please respond as objectively as possible in complete sentences.

1. What aspects of this course did you find to be particularly valuable? (Use the back if necessary.)
2. What aspects of this course do you think need to be improved and what suggestions would you like to make to improve them? (Use the back if necessary.)

Appendix H

Fall 2003 Syllabus First Year Experience Course for Students with Interests in Math, Science, and Related Fields

Class Time: Thursdays, 9:30-10:50 a.m.

Credit and Grading: One credit hour; letter grade earned

Description: This First Year Experience course is designed to facilitate a successful transition into college as well as to facilitate career decision-making for undergraduate women. Rooted within the context of a commitment to women's concerns, emphasis will be placed upon the process of academic success, individual growth, community, and lifelong learning.

Objectives:

1. To provide academic success skills to women during their first year of college.
2. To help the women in their current adjustment to college life.
3. To promote college retention of women.
4. To build a small support group for students that is facilitated by a trained faculty/staff person in which students feel comfortable sharing ideas and feelings and receive encouragement in their academic and social activities.
5. To expose students to campus and community resources.
6. To teach students about gender-related issues in higher education.
7. To expose students to career developmental theories.
8. To expose students to multiple-role planning.
9. To provide women with role models.

Required Reading:

Texts:

Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill.

Gmelch, S. B. (1998). *Gender on campus: Issues for college women*. New Brunswick, NJ: Rutgers University Press.

Biographical or autobiographical readings on a woman scientist or mathematician (student's choice with instructor approval).

1. Class attendance and participation. (Only one absence allowed.)
2. Completion of in- and out-of-class exercises listed on syllabus (career center feedback meeting, scavenger hunt, exercises from reading). Please schedule a meeting with a Career Center counselor for feedback on a career interest inventory and for an orientation to the Career Center.

Week 6	<i>Gender on Campus</i>
Th., Sept. 25	Feminism, sexism, the classroom, language, sports

Assignment: *Gender on Campus:* Gender Issues on Campus—Chs. 1, 2, 3, 4

Week 7 *Self-Efficacy Activity*
Th., Oct. 2 Part 1 of Computer Workshop

Assignment: Second Journal Entry Due

Week 8 *Self-Efficacy Activity*
Th., Oct. 9 Part 2 of Computer Workshop

Week 9 *Women of Math and Science*
Th., Oct. 16 PowerPoint Presentations of Biographies

Assignment: Third Journal Entry Due

Week 10 *Women of Math and Science*
Th., Oct. 23 PowerPoint Presentations of Biographies

Assignment: Biography Reaction Papers Due

Week 11	<i>Women and Work</i>
Th., Oct. 30	Career theories, sexual harassment, discrimination, and other perceived barriers

Assignments:

<i>Coming Alive:</i>	Workplace Diversity—pp. 159-168 Complete exercises at end of chapter.
<i>Gender on Campus:</i>	Women and Work—Ch. 14
Fourth Journal Entry Due	

Week 12 *Multiple Role Planning and Dual Careers*
Th., Nov. 6 Panel of Women Mathematicians and Scientists

Assignment: *Coming Alive:* Timestyles/Workstyles—Ch. 6
Complete exercises at end of chapter.

Week 13	<i>Diversity on Campus and at Work</i>
Th., Nov. 13	Disability, Age, Race/Ethnicity, Sexual Identity

Assignments: *Gender on Campus:* Dealing with Diversity—Ch. 5, 6, 7, 8
Fifth Journal Entry Due

Week 14	<i>Personal Strategies for Success</i>
Th., Nov. 20	Goal-setting and decision-making

Assignments: *Coming Alive:* Decisions, Decisions—Ch. 8
 Complete exercises at end of chapter.
 Reaction page due—attendance at organization meeting

Week 15	<i>Wrap-Up</i>
Th., Dec. 4	Course evaluation and assessment and completion of research instruments.

Assignments: *Coming Alive:* Work Affects the Soul—Ch. 9

Journal Assignments

Directions for each journal assignment: You will complete five thoughtful journal entries during your time in the class. The due date for each journal entry is indicated below. Journal entries should be at least one page (double-spaced) and answer at least all of the questions listed for each assignment. Thoughtful and meaningful journal entries will better assist you in writing down career planning goals at the end of the semester.

Personal Discovery Journal

Due Week 5

Reflect on the class exercises you completed with Chapters 1 and 2 of *Coming Alive*. How would you describe your personality? What doesn't describe your personality? Give examples of both. Which jobs in math, science, and technology appeal to you? Which careers would you like to find more information about?

Study Skills, Time, and Stress Management Journal

Due Week 7

Based on what you learned about study skills and time and stress management, reflect on your strengths and weaknesses in these areas. Describe at least three goals for improvement in these areas. Make your goals measurable. How will you know if you have completed these goals for this semester? Please include completed worksheets on time and stress management from class handouts.

Work Values Journal

Due Week 9

Choose the top 3-4 values that you find are most important to you at this point in your life. Why are these important to you at this point in your life? Do you foresee these values will be altered as you gain new experiences? What occupations are consistent with your most important work values? What occupations are not consistent with your most important work values? Will your core life values play a role in your choice of an occupation?

Skills and Interests Journal

Due Week 11

What would you say are your strongest interests? What would you say are your strongest skills? What skills would you like to improve? How would you describe your self-efficacy regarding math, science, and technology?

Personal Strategies Journal

Due Week 13

Reflect on the readings and discussion regarding multiple role planning. Describe plans and strategies that you can envision using to balance your career and other important aspects of your present and future life. What do you perceive to be the biggest challenges ahead of you in trying to accomplish all that is important to you? Do you think a math, science, or technology career presents particular challenges as you contemplate doing all that you want to do?

Appendix I

First Year Experience Course for Students
with Interests in Math, Science, and Related Majors
Lesson Plans

Lesson Plan—Week 1—Thursday, August 21
Introduction and Overview

Objectives:

Upon completing this unit, students will be able to:

1. Describe the expectations for the course (syllabus).
2. Describe the backgrounds and maybe know the names of the other students in the class.
3. Know how to get in touch with instructor and course assistant.
4. Understand the informed consent they've given to be in the study (informed consent would be obtained beforehand in order for students to have enrolled in the course).
5. Understand upcoming assignments.

Procedures:

1. Introduce upper-class course assistant. Have everyone in the class introduce herself and tell something about herself.
2. Review research informed consent. Review importance of confidentiality for the class.
3. Ask students what they hope to gain.
4. Review syllabus and upcoming assignments. Answer questions.
5. Complete assessment instruments.
6. Explain scavenger hunt—it needs to be completed by next class.

Lesson Plan—Week 2—Thursday, August 27
Exploring Resources

Objectives:

Upon completing this unit, students will be able to:

1. Locate offices on campus that provide academic and social support to students.
2. Describe resources and know some staff related to tutoring, academic advising, career counseling, counseling center, and math and science departments.

Procedures:

1. Have student course assistant go over scavenger hunt results and process the experience.
2. Allow time to talk about how first week of school has gone.
3. Introduce guests from tutoring, academic advising, career counseling, and math and science departments.

4. Dispel myths regarding use of support services (for example, career counseling is not something you wait and use in your senior year when you are ready to find a job or investigate graduate school).
5. Have guests describe their services and answer questions. Have course assistant give “testimonial” about what resources have been helpful to her.
6. Distribute handouts and exercises for next week.
7. Remind students to bring name of person they’ve selected and reading sources for biography or autobiography by next week.
8. Look over students’ information interview questions.

Lesson Plan—Week 3—Thursday, September 4

Personal Discovery

Readings: Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill, Ch. 1 and 2.

Objectives:

Upon completing this unit, students will be able to:

1. Describe the resources available at the career center.
2. Know how to conduct an information interview.
3. Briefly describe Holland’s theory of career interests.

Procedures:

1. Talk about questions people have for their information interview with a professional. Stress the importance of learning about that person’s career path. Encourage students to visit person’s place of work and shadow the person for part of a day if possible to observe what the person does on the job.
2. Process the experience of having attended a career center orientation.
3. Talk about what students learned from assessments at the end of the chapter.
4. Give brief overview of Self-Directed Search (completed during assessment). [Have students meet with a career counselor to go over results. Work on arranging a mentor for each student in the personal appointments as well.)
5. Have students submit name of person they’ve selected to learn about for “women of math and science” projects.

Lesson Plan—Week 4—Thursday, September 11

Note taking/Studying/Reading Comprehension/Test Taking Strategies

Readings: Handouts

Objectives:

Upon completing this unit, students will be able to:

1. Describe techniques and strategies for taking notes, studying, reading, and taking tests.

2. Describe the importance of completing math problems and attending study sessions offered for classes (with emphasis on math and science).

Procedures:

1. Take time to talk about how the past week has gone.
2. Collect information interviews and allow students to describe how the experience impacted them and what they learned.
3. Introduce guest speakers from academic advising, and math and science departments who will conduct workshop on effective study skills. Course assistant will share her experiences as a student in learning how to be a more effective student.
4. Distribute handouts and exercises for next week.
5. Ask if students have any questions about journal assignment due next week.

Lesson Plan—Week 5—Thursday, September 18
Time Management/Stress Management

Readings: Handouts

Objectives:

Upon completing this unit, students will be able to:

1. Identify their time management and stress management concerns.
2. Identify strategies for addressing their time management and stress management concerns.

Procedures:

1. Have course assistant help conduct this class.
2. Define the term “stress.” Facilitate discussion on stressors and how to cope with them.
3. Discuss time management strategies.
4. Ask students to complete a time and stress management plan for themselves.
5. Collect journal assignments. Encourage students to be reading their biographies.

Lesson Plan—Week 6—Thursday, September 25
Gender on Campus

Readings: Gmelch, S. B. (1998). *Gender on campus: Issues for college women*. New Brunswick, NJ: Rutgers University Press, Ch. 1, 2, 3, & 4.

Objectives:

Upon completing this unit, students will be able to:

1. Describe what “feminism” is and is not.
2. Describe where students might encounter sexism on campus.
3. Describe how language expresses our society’s values about gender.

Procedures:

1. Define “feminism” with help from students. Discuss how the book’s definition of feminism is alike or different from what they thought before the reading the book.
2. Discuss whether students encountered sexism before coming to college and whether they’ve encountered sexism since arriving at college. Discuss how they typically respond to sexism.
3. Involve students in some role plays of how they might confront sexism on campus.
4. Discuss students’ reactions to chapter on “Language and Gender.”
5. Discuss whether the readings had an impact on how they might behave or think about gender in the future.
6. Answer any questions about second journal entry due next week. Find out how Women of Science projects are coming. Are they reading their biographies?

Lesson Plan—Week 7—Thursday, October 2
Self-Efficacy

Objectives:

Upon completing this unit, students will be able to:

1. Begin to put together a computer and increase self-efficacy about doing so.
2. Describe what “self-efficacy” is.

Procedures:

1. Ask students how they feel about their ability to put together a computer.
2. Introduce guest speaker who will teach the students to begin to put together a computer.
3. Teach a short lesson on what “self-efficacy” is and why it is important to people’s success.
4. Take time at the end of the class to process how students feel about their self-efficacy in putting together a computer.
5. Collect journal assignments. Ask if students have questions about “women of math and science” presentations due in two weeks.

Lesson Plan—Week 8—Thursday, October 9
Self-Efficacy—Part II

Objectives:

Upon completing this unit, students will be able to:

1. Know how to put together a computer.

Procedures:

1. Complete activity on putting together a computer.
2. Discuss how students feel having completed the assignment.
3. Talk about what helps them personally feel connected to math, science, and technology. How can they keep that connection alive?

4. Take time to talk about how they are feeling about school mid-semester.
5. Ask if students have questions about third journal entry due next week or women of science projects that begin next week.

Lesson Plan—Week 9—Thursday, October 16
Women of Math and Science

Objectives:

Upon completing this unit, students will be able to:

1. Develop and present a PowerPoint presentation.
2. Describe a woman of science and her career path.

Procedures:

1. Have half of students present their PowerPoint presentations.
2. Collect third journal entries.

Lesson Plan—Week 10—Thursday, October 23
Women of Math and Science

Objectives:

Upon completing this unit, students will be able to:

1. Develop and present a PowerPoint presentation.
2. Describe a woman of science and her career path.

Procedures:

1. Have half of students present their PowerPoint presentations.
2. Collect biography reaction papers.
3. Ask students if there are any questions about fourth journal entries due next week.

Lesson Plan—Week 11—Thursday, October 30
Women and Work

Readings: Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill, pp. 159-168.

Gmelch, S. B. (1998). *Gender on campus: Issues for college women*. New Brunswick, NJ: Rutgers University Press, Ch. 14.

Objectives:

Upon completing this unit, students will be able to:

1. Describe issues and barriers for women at work.
2. Describe resources available for women who work outside of the home.
3. Define “sexual harassment.”

4. Describe two major career theories (Holland's theory of career interests and Lent, Brown, & Hackett's Social Cognitive Career Theory).

Procedures:

1. Reflect back to Week 6 when we discussed Gender on Campus. What are the connections they see between that unit and these readings on women at work?
2. Discuss what issues in the readings they anticipate as being conflicts for themselves. How do they anticipate resolving any conflicts?
3. Review Holland's theory of career interests from Week 2. Describe concerns about theory as it applies to women. Describe Lent, Brown, & Hackett's Social Cognitive Career Theory (SCCT). Discuss self-efficacy and barriers emphasis in SCCT.
4. Collect fourth journal entries.

Lesson Plan—Week 12—Thursday, November 6
Multiple Role Planning and Dual Careers

Readings: Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill, Ch. 12.

Objectives:

Upon completing this unit, students will be able to:

1. Identify strategies working women employ to juggle and plan for multiple roles.
2. Identify differences in juggling roles that women might encounter based on race/ethnicity, disability, marital/partner status, parent status (whether or not woman has children), and sexual orientation.
3. Describe what an egalitarian marriage/relationship is.
4. Identify personal fears and concerns they have about juggling work and life.
5. Identify personal strategies that can use to plan for juggling.

Procedures:

1. Introduce concepts of multiple role planning and egalitarian marriages.
2. Introduce diverse panel of women scientists and mathematicians (women juggling careers who represent many experiences—try to include issues of women of color, women with disabilities, Lesbian women, mothers, single women, married women without children, etc.)
3. Allow time for students to ask questions and discuss concerns with panel members.
4. Ask students if there are any questions about fifth journal entries due next week.

Lesson Plan—Week 13—Thursday, November 13
Diversity on Campus and at Work

Readings: Gmelch, S. B. (1998). *Gender on campus: Issues for college women*. New Brunswick, NJ: Rutgers University Press, Ch. 5, 6, 7, & 8.

Objectives:

Upon completing this unit, students will be able to:

1. Define what a stereotype is.
2. Describe issues and barriers for people of color, people who are gay or lesbian, and people with disabilities.
3. Describe issues and barriers regarding age.
4. Describe what racism is.
5. Describe what homophobia and heterosexism are.
6. Describe myths about abilities of people with disabilities.

Procedures:

1. Ask students for reactions to reading. Ask what they learned.
2. Ask what students thought about “Beyond the Coed.” Ask what their reactions are to having nontraditional aged students on campus.
3. Have students help define: stereotype, racism, homophobia, heterosexism.
4. Have students brainstorm myths about people with disabilities
5. Ask students why this information is important to them as future employees and employers.
7. Collect fifth journal entries. Remind students to turn in organization reaction paper next week.

Lesson Plan—Week 14—Thursday, November 20

Personal Strategies for Success

Readings: Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill, Ch. 8.

Objectives:

Upon completing this unit, students will be able to:

1. Describe a personal strategy for success in their college and work careers.
2. Describe approaches to making career decisions.

Procedures:

1. Discuss fifth journal entries and the women’s strategies for success in college and in their careers.
2. Discuss career decision making information from the chapter.
3. Discuss how women can use the career center throughout their college years.
4. Collect organization reaction papers.

Lesson Plan—Week 15—Thursday, December 4

Wrap-Up

Readings: Michelozzi, B. N. (1999) *Coming Alive from Nine to Five: A Career Search Handbook*. (6th Ed.). McGraw-Hill, Ch. 9.

Objectives:

Upon completing this unit, students will be able to:

1. Describe major themes and resources in the two textbooks used.
2. Describe what they've learned about themselves as well as women in science and math careers.

Procedures:

1. Solicit student feedback on how the semester has gone in the course and outside the course. Ask for suggestions for future courses of this type. Do they recommend that this course be offered again?
2. Talk about how students can continue to find support for their majors and career goals.
3. Complete course evaluation.
4. Begin completing some of the post-test assessment instruments as time allows.
5. Complete post-test assessment instruments during time allotted for final exam.