Self-efficacy and expectancy-value influences on university students' selection of scientific majors and careers

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Self-efficacy and expectancy-value influences on university students' selection of scientific majors and careers

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Self-efficacy and expectancy-value influences on university students' selection of scientific majors and careers

by

Julie Madison Corkery

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ABSTRACT

The study was an investigation of the influences of mathematics achievement, mathematics self-efficacy, and life-styles orientation on university students' career choices. The first group of 249 subjects rated 83 occupations representing Holland's six general occupational themes for their compatibility with meeting leisure and relationship needs both inside and outside the job. The second group of 241 subjects identified the college major and occupation they were considering most and completed the Mathematics Self-Efficacy Scale (MSE) (Betz & Hackett, 1982) and the Life-styles Inventory - Relationship scale (LSI) (Epperson, Lucas, & Zytowski, 1983). They rated the extent of consideration they give to entering 83 occupations representing Holland's six themes. American College Tests - Mathematics (ACT-Math) scores were accessed for 166 of these subjects.

Results of the first study confirmed that the three gender-stereotyped Holland themes of particular interest received relationship-compatibility ratings in descending order: Social, Investigative, and Realistic.

For the second study, it was hypothesized that gender differences in ACT-Math, MSE, and LSI-Relationship would moderate gender differences in career choices. The results of hierarchical regression analyses indicated that only ACT-Math and MSE mediated gender differences in science-relatedness of major. All three mediated differences in consideration of Realistic occupations, only MSE mediated differences in consideration of Investigative occupations, and ACT-Math and LSI-Relationship mediated differences in consideration of Social
occupations. The three variables did not predict differentially for males and females. Post-hoc analyses suggested that gender differences in LSI-Relationship may affect entry into physical sciences.
INTRODUCTION

Women comprise nearly half of the work force, but their earning power remains well below men's. Fully employed female heads of households earn approximately 67% of the income of fully employed males (Hacker, 1986). Although men and women agree that male-dominated occupations are associated with more job-related rewards (Wheeler, 1983), the tendency to make career choices along gender-stereotyped lines continues (Hacker, 1986).

Women's avoidance of science-related university majors constitutes one aspect of the sex-segregation in the workplace (Goldman & Hewitt, 1976). Women are particularly underrepresented in the physical sciences. In 1986, 15% of employed scientists and engineers were female. One in four scientists was female, and only 1 in 25 engineers was female (National Science Foundation, 1988). Women are least represented in engineering and physical sciences, including physics, chemistry, and mathematics. They have somewhat greater representation in the biological sciences and are best represented in the social sciences.

Several gender differences have been postulated to contribute to the career imbalances: differences in mathematics achievement, self-efficacy, and values. By the end of high school, males outperform females slightly on mathematics achievement tests, particularly among samples of highly capable persons (Hyde, Fennema, & Lamon, 1990). For highly talented samples, male superiority in mathematical reasoning skills is apparent by approximately age twelve (Benbow & Stanley, 1980; 1983a).
The reasons for the gender differences in mathematics achievement test scores have remained controversial. Some studies suggest differential aptitude (Benbow & Stanley, 1983b), whereas others support the influence of differential course taking (Pallas & Alexander, 1983). Girls do, in fact, take fewer high school mathematics courses than do boys (National Science Foundation, 1988). Again, however, there is little consensus about why boys persist longer in the study of mathematics. Based on their study of talented seventh grade students for whom there were no gender differences in math course work, Benbow and Stanley (1983b) concluded that boys have greater talent in mathematics reasoning. Pallas and Alexander (1983) found that when they controlled for ninth grade math ability, differential course taking accounted for math achievement test differences for a general sample of high school juniors and seniors. Eccles, Adler, and Meece (1984) found that subjective task value for mathematics mediated some of the gender difference in continuing to study math beyond required high school courses.

Hackett and Betz (1981) proposed that Bandura's (1977) self-efficacy theory may be useful in understanding gender differences in career choice content. In a general sample of university students, males reported equivalent overall self-efficacy with regard to male-dominated and female-dominated occupations, whereas females reported lower self-efficacy for male-dominated occupations than for female-dominated occupations (Betz & Hackett, 1981). The occupations for which more men than women rated themselves as self-efficacious emphasized mathematics (accountant, engineer, and mathematician) along with
occupations with very few women (drafter and highway patrol officer). Self-efficacy for male-dominated occupations was related to range of male-dominated occupations considered. Post-Kammer and Smith's (1985) examination of eighth and ninth grade students resulted in similar findings.

Lapan, Boggs, and Morrill (1989) demonstrated that self-efficacy for occupational groups mediates some of the gender differences in occupational interests for university students. Entering college freshmen males rated themselves as having more technical and scientific interests than did entering college females. A path analysis indicated that self-efficacy for technical and scientific fields and math achievement scores mediated the gender differences in interests.

Using path analysis, Hackett (1985) demonstrated the effect of math self-efficacy (MSE) on career choice. The effect of gender on MSE was mediated by years of high school math, ACT-Math, and Bem Sex Role Inventory - Masculine scores (Hackett, 1985). MSE directly influenced science-relatedness of college major.

Kirsch (1986) and Marziller and Eastman (1984) have criticized self-efficacy theory for its deemphasis on the influence of outcome expectancy. Bandura (1986) acknowledged that his basic self-efficacy research has been aimed at elucidating the effects of self-efficacy rather than at the identification of multiple influences. His research has targeted behavior changes that are generally considered desirable (e.g., decreasing phobic avoidance), thus the effects of outcome value have been partially controlled.

Whether or not entrance into a math-related male-dominated field
would generally be considered desirable is an empirical question. Opting out of such careers generally carries financial costs referred to earlier. Selecting male-dominated careers may be associated with perceived non-financial costs that have not yet been fully considered by researchers.

The influence of outcome-expectancy had received much greater emphasis in Vroom’s (1964) earlier theoretical paper. He introduced expectancy-valence theory to explain occupational effort and behavioral choice. According to the theory, the force on the individual to exert a given level of effort is a function of the person’s expectation that the level of effort will lead to various outcomes and the valence (desirability) of those outcomes. Feather (1986) distinguished between values and valences. Values are relatively broad belief sets held across situations and time. A valence is a specific response to a situation. In the case of expectancy-valence theory, it describes the degree to which a particular outcome is viewed as positive or negative. Values, once aroused, are believed to influence valence. "One can assume that terminal values will influence the valence of specific outcomes, so that some outcomes are seen as more attractive or more aversive than others . . ." (Feather, 1986, p. 39). According to Feather’s expectancy-value theory, values influence the affective response to any outcome, the outcome valence. A person’s actions are determined by the positive and negative valences implicit in a situation and the likelihood that attractive or aversive outcomes will occur if particular actions are taken.

Mitchell (1974) argued for the need to assess outcomes that are
viewed negatively as well as those that are viewed positively. Early researchers focused on costs of potential failure (Atkinson, 1964). More recent researchers have recognized costs associated with limited time for pursuit of other activities (Parsons, 1983). Eccles (1987), who was formerly named Parsons, considered competing demands of life styles in her model of career decision-making. She proposed that the perceived demands of occupations influence choices. If life roles other than career are highly valued, then the perceived amount of effort required by an occupation is expected to weigh negatively on the choice to pursue that occupation.

Miller and Sjoberg (1973) believed that three dimensions encompass the major activities of adults in the United States. The dimensions were work/study, leisure/recreation, and kinship/friendship. Epperson, Lucas, and Zytowski (1983) developed the Life-Style Inventory (LSI) to measure college students' orientation towards these primary adult roles. They simplified the three labels to work, leisure, and relationship orientations. They supported their belief that some individuals could be classified as having a primary life style that is dominant over the other two. Relationship orientation was the only dimension for which there were gender differences. Lyson (1984) found similar gender differences in value for relationships. Women in gender-typical fields were concerned primarily with working with people and with helping others, whereas men in gender-typical fields were concerned primarily with leadership opportunities and having freedom from close supervision.
Comparisons of Self-Efficacy and Expectancy-Valence in Predicting Career-Choices

In two comparisons of the influences on career choice, self-efficacy was shown to be more important than expectancy-valence (Lent, Brown, & Larkin, 1987; Wheeler, 1983). The expectancy-valence measures may not have been sensitive to the broad life style consequences that may be associated with career choice.

Although male and female college students comprising Wheeler’s (1983) sample agreed that the outcomes of male-dominated jobs were more positive than female-dominated jobs, males expressed greater liking for male-dominated jobs than did females. Subjects’ ratings of ability-job matches were used as measures of self-efficacy. Ability-job matches for occupations were more highly correlated with liking for occupations than were outcome-valence ratings. However only valences of outcomes more integral to occupations (e.g., variety, learning, high salary) were measured, ignoring perceived outcomes related to opportunities for development of personal and/or family relationships. Jobs were rated for opportunities for leisure, but the outcome-valence for that item was not considered separately from the eleven other outcome ratings.

Lent, Brown, and Larkin (1987) compared self-efficacy with interest congruence and consequence thinking in predicting grades in technical courses, persistence in technical/scientific majors, and range of perceived scientific career options. Self-efficacy was superior in predicting grades and persistence, whereas both self-efficacy and congruence predicted range of perceived career options. To measure consequence thinking, the authors used an open-ended question prompting
subjects to list consequences of majoring in the science or engineering field they were considering. The measure may not have been sensitive to outcomes less integrally related to occupations.

Statement of the Problem

Multiple factors influence career choice. The influence of interests on career choice has been well documented (Holland, 1973). More recently, beliefs about one's specific capabilities, self-efficacy expectations, have been shown to influence consideration given to occupational fields (Betz & Hackett, 1981) and persistence in those fields (Lent, Brown, & Larkin, 1987). The influence of values and valences for specific job-related outcomes has been shown to affect career choice (Vroom, 1966). Although Epperson, Lucas, and Zytowski (1983), Eccles (1987), and Super (1980) have asserted the importance of life-style values, empirical study of the influence of values on career choice content has been limited.

In previous comparisons of self-efficacy and expectancy-valence, self-efficacy better accounted for college students' choice of major (Wheeler, 1983) and persistence in a scientific field (Lent, Brown, & Larkin, 1987). Expectancy-value theory is expected to better account for gender differences in choice of major when broader life-style values are considered (Eccles, 1987). Life-style preferences have been shown to be related to career related interests, academic behaviors (Epperson, Lucas, & Zytowski, 1983), and college major (Weiner & Hunt, 1983).

Women and men are assumed to make career-related choices for consistent reasons, although they may not always articulate the reasons on a conscious level. This study reflects an attempt to explain self-
efficacy and expectancy-value influences on students' career choices. Clearly job-related rewards comprise only one factor that people consider when they make career decisions. The purpose of this study is to account for multiple cognitively-mediated factors that influence university students' career choices, with a focus on explaining gender differences in choice of university major and preferred occupations.

Relationships between mathematics achievement, mathematics self-efficacy, outcome expectancies associated with occupations, life-style value orientations, and career choice content were examined. Extent of consideration given to careers, current choice of college major, and anticipated entrance into subsequent occupation were used to measure career choice content. It was anticipated that expectancy-value theory would better account for gender differences in career choice content when expectancies for opportunities to develop relationships are considered.
REVIEW OF THE LITERATURE

Demographics of Women in the Labor Force

Women constitute a major proportion of today’s labor force. Hacker’s (1986) summary of United States Department of Labor figures indicated that in 1986 44% of the work force was comprised of women. In 1984 the odds that any woman would work outside the home sometime during her life were 95 out of 100. The mean number of years that women could expect to work outside the home was 29.3 compared to 39.1 years for men (United States Department of Labor, 1984). Women who work outside the home during a substantial proportion of their lives have become the norm rather than the exception.

In 1984 approximately one third of working women were married to husbands who earned adequate incomes, but two thirds were single, widowed, divorced, separated, or were married to husbands whose incomes were below $15,000 (U.S. Department of Labor, 1984). Many women work, in part, to support themselves and their families financially.

The extent to which women work has become increasingly similar to that of men. However the occupational fields that women choose remain different from those chosen by men. Hacker (1986) reported that approximately four million women entered the work force between 1970 and 1984. More than 3.3 million women entered nursing, bookkeeping, secretarial positions, and other female-dominated supportive fields.

Women are particularly underrepresented in the physical sciences. In 1986, 15% of employed scientists and engineers were female. One in four scientists was female, and only 1 in 25 engineers was female (National Science Foundation, 1988). Women are least represented in
engineering and physical sciences, including physics, chemistry, and mathematics. They have greater representation in the biological sciences and are best represented in the social sciences.

Pfafflin (1984) reported that women's participation in male-dominated professions has been rising in some cases. After years of representing less than 1% of the graduates of engineering schools, in 1981, 11% of them were women. The increase appears to have stabilized; also in 1985, 11% the engineering baccalaureates were awarded to women (National Science Foundation, 1988). Although the proportion of women entering physical sciences is increasing, their representation remains well below men's.

Costs Associated with Choosing Female-Dominated Fields

Often the choice to enter a female-dominated field carries an economic cost. The financial return for women's paid employment has remained much lower than the return for men's. The earning power of women, on average, is 60% of that of men (Ferraro, 1984). Hacker (1986) reported that fully employed female heads of households earn 67% of the mean income for males.

Differences in career choices contribute to the economic imbalance; achievement within occupational fields may contribute also. Often women do not reach the same level of status within an occupational field as do men. Even in the female-dominated field of education, women are less likely than men to enter and complete advanced graduate programs (Eccles & Hoffman, 1984). Educational differences do not account fully for the economic imbalance, however. Males who have no post high school education earn more than female college graduates (Hacker, 1986).
Terman and Oden's (1959) follow-up study of male and female geniuses illustrates the weak relationship between women's aptitude and career achievement. All subjects had scored above 135 on a standardized intelligence test prior to age 15. By their mid-forties about half of the women had been and continued to be full-time homemakers. Of the half who were working outside the home, 21% were elementary or secondary school teachers, and 21% were secretaries. Only 5% were physicians, lawyers, or psychologists; 9% were writers, artists, or musicians, and 8% were executives. In contrast, 46% of the men were employed in professional occupations; they included lawyers, university professors, engineers, and physicians. Another 30% had business managerial occupations.

The Terman study illustrates the economic dependence often associated with women's traditional career choices. During the subjects' mid-forties, the median income of the fully employed female subjects was less than one half the median income of male subjects. These women had experienced a high standard of living because of their partners' economic contributions to their marriages.

Often the experience of young women today is different. Weitzman (1985) documented the devastating economic impact of divorce on women today, when 50% of all marriages are predicted to end in divorce (Davis, 1983). Since the institution of no-fault divorce laws during the 1970's, divorced men have been given less legal responsibility to provide financial support to their former wives. Based on needs by income indices for the 2500 California divorce cases she examined, Weitzman concluded that men fare much better financially than women.
following divorce. After one year following legal divorce, men had experienced a 42% improvement in their postdivorce standard of living, whereas women had experienced a 73% decline.

Gender differences in career-related choices may have psychological costs also. During the most recent follow-up of the Terman subjects (Sears, 1979) some of the women, then in their mid-sixties, said they wished they had placed less importance on the homemaker role and more importance on a career. The women were less satisfied than the men with their occupational development. However the women did report greater satisfaction with their friendships and the cultural richness of their lives than did the men.

Sholomkas and Axelrod’s (1986) results also suggest that women’s traditional choices may carry psychological costs. Mothers of preschool-aged children who had chosen to remain home with their children scored significantly lower on the Coopersmith Self-Esteem Scale than did career or non-career working mothers of preschool-aged children. Although a causal relationship cannot be determined, mothers’ choices to opt out of employment were associated with their scoring lower on a self-esteem measure. Satisfaction with primary roles was important also. Women’s self-esteem was positively and significantly related to satisfaction with their primary roles.

**Holland’s Theory**

Holland (1973) proposed a theory of vocational choice that is based on one of the oldest assumptions in career theory (Williamson, 1939), that of person-environment match. Holland articulated the following four assumptions. First, people in our culture can be categorized into
six interest types. Second, all work environments can be categorized into corresponding types, which have since been labeled general occupational themes. Third, people seek environments where they can express interests, skills, and values. Finally, work-related behavior is a function of the interaction between personality and work environment.

Holland (1959) identified six work environments in his original theoretical statement: motoric, intellectual, esthetic, supportive, persuasive, and conforming. The titles have since been renamed. The Realistic (motoric) type describes occupations that call for aggressive behavior, physical skill and strength, and concrete solutions to problems. An example of a Realistic occupation is carpentry. Investigative (intellectual) occupations require thinking rather than acting, and organizing rather than persuading. An example is computer programming. Artistic (esthetic) occupations require creative self-expression. Photography is an example of an Artistic occupation. Enterprising and Social occupations involve working with people. Social (supportive) occupations, such as guidance counseling, require teaching or therapeutic skill. Enterprising occupations involve dominating and persuading others. An example of an Enterprising occupation is restaurant management. Finally, Conventional (conforming) occupations, such as accounting, are typified by structured rules and regulations.

People have been classified as having interests consistent with one or more of the six themes. On measures of general occupational themes using raw scores or combined-sex normative scores, females obtain higher mean scores on the Social, Artistic, and Conventional themes, whereas
males obtain higher scores on the Realistic, Investigative, and Enterprising themes (Gottfredson, Holland, & Gottfredson, 1975; Holland, 1972; Prediger & Hanson, 1976). Social interests are far more predominant among females, whereas Realistic interests are far more prevalent among males (Prediger, 1980).

Self-Efficacy Theory

Hackett and Betz (1981) proposed that Bandura’s (1977) self-efficacy theory may be useful in understanding gender differences in career choices. They argued that opportunities for developing beliefs about one’s capabilities often differ for girls and boys. Due to socialization experiences, women lack sources of information hypothesized to provide the bases for strengthening beliefs in personal efficacy, especially in traditionally masculine domains.

Bandura (1977) had introduced self-efficacy theory asserting that it could account for a variety of behavioral changes. A self-efficacy expectation is the conviction that one can successfully execute a behavior. Bandura distinguished self-efficacy expectations from outcome expectations, persons’ estimates that given behaviors will lead to certain outcomes. He argued that self-efficacy expectations are major determinants of choice of activities, determining the level and duration of effort expended in attempts to perform those activities given adequate incentives.

Dimensions of self-efficacy expectations. Self-efficacy expectations can be described on three dimensions: level, strength, and generality (Lent & Hackett, 1987). The level corresponds to the degree of task difficulty that one believes he/she can successfully manage.
Often subjects are asked whether or not they could successfully perform a series of related tasks. The sum of the "yes" responses constitutes self-efficacy level. Strength refers to the persistence of the self-efficacy expectation in the face of contradictory evidence. Likert-ratings, more accurately labeled "confidence" ratings than "strength" ratings, are used. Subjects rate the degree of confidence with which they believe they can complete several tasks within a domain. The mean rating is used to determine a strength score. Generality has been tapped less frequently. In one study, snake phobics were asked to rate their self-efficacy for approaching and handling a snake that was a different from the one with which they had received training (Bandura, Adams, Hardy, & Howells, 1980). No standard method for measuring generality has emerged.

Sources of information on which self-efficacy expectations are based. Bandura (1977) categorized sources of efficacy information into four types: performance accomplishments, vicarious experience (live or cognitive modeling), verbal persuasion, and emotional arousal. Performance accomplishments are the most direct source of information; if persons successfully complete an activity, they are likely to believe they can accomplish it again (Bandura, Adams, Hardy, & Howells, 1980). Modeling, either by observation of another's performance or imagining oneself performing successfully, is the second most effective (Bandura, Adams, Hardy, & Howells, 1980). Theoretically verbal persuasion, including suggestion and encouragement, could increase the effort that one expends in attempting a behavior. Finally, Bandura (1977) has asserted that individuals incorporate assessments of their emotional
arousal in their estimates of self-efficacy levels, though he has not supplied empirical evidence.  

Causal role of self-efficacy expectations. Bandura (1977) purported that self-efficacy expectations influence activity choices and amount of effort expended. In his first self-efficacy paper, he presented data on the treatment of snake phobics. Some subjects underwent self-directed enactive training that involved approaching snakes; others merely observed a model approach and handle a snake. Although enactive training decreased snake avoidance more effectively, posttreatment self-efficacy ratings corresponded highly to actual posttest behavior for both groups. Even for behaviors not performed in the pretest assessment, the degree of congruence between perceived self-efficacy and subsequent behavior was equally high for enactive (82%) and vicarious (79%) treatments. In the research group's subsequent study, the degree of congruence between self-efficacy and behavior was equally high, regardless of whether snake phobic treatment involved participant modeling, live modeling, cognitive modeling, or desensitization (Bandura, Adams, Hardy, & Howells, 1980).  

Frequently self-efficacy judgments are better predictors of changes than are previous behaviors performed during enactive treatments (Bandura & Adams, 1977). The predictive power of self-efficacy expectations over previous behavioral performance suggests that the self-efficacy expectations play a causal role rather than an inert one.  

Self-efficacy is related to interest in activities also (Bandura, 1982). Bandura and Schunk (1981) demonstrated that short-term goals were more effective at increasing competence, self-efficacy, and
intrinsic interest in mathematic subtraction problems than were distal
goals, no suggested goals, and a no-treatment control. Regardless of
treatment, self-efficacy ratings corresponded highly with ratings of
intrinsic interest in mathematics.

**Self-efficacy as a mediator of avoidance.** Bandura (1977) argued
that low self-efficacy expectations cause anxiety and avoidance
behavior, challenging Joseph Wolpe's assumptions. Wolpe (1982) had
developed systematic desensitization to successfully treat avoidance
behavior. His treatment was based on the assumption that situational
anxiety causes avoidance behavior. Situational anxiety is believed to
trigger avoidance; avoidance is then reinforced by anxiety-reduction.
Bandura (1977) argued that self-efficacy theory explains systematic
desensitization better than the theory from which Wolpe was working.

In systematic desensitization, a hierarchy of threatening scenes is
utilized. Increasingly threatening imaginal scenes are paired with
physical relaxation, which is incompatible with anxiety, until anxiety
reactions to even the most threatening scenes are eliminated. According
to Wolpe (1982), because anxiety is no longer activated by the scenes,
avoidance is no longer reinforced by anxiety reduction. Therefore,
avoidance is extinguished. In contrast, Bandura and Adams (1977) argued
that systematic desensitization increases self-efficacy for coping with
the situation, thereby decreasing anxiety and avoidance.

Bandura and Adams (1977) studied subjects who no longer signalled
anxiety responses to the most threatening imaginal scenes in subjects' hierarchies. Some of these subjects did not perform subsequently in
actual stressful situations. For the subjects who were desensitized
completely to imaginal scenes, self-efficacy expectations added to the prediction of future approach behaviors (Bandura and Adams, 1977). If Bandura and Adams' assumption that subjects accurately rated their anxiety levels is correct, the results support the interpretation that anxiety and avoidance are coeffects of low self-efficacy expectations.

Bandura's research group has shown the explanatory power of self-efficacy theory for predicting changes in behaviors as diverse as post-coronary rehabilitation exercise (Bandura, 1982), mathematics subtraction performance (Bandura & Schunk, 1981), shopping, walking, patronizing restaurants, and coping with heights by agoraphobics (Bandura, Adams, Hardy, & Howells, 1980), as well as the generally less clinically relevant snake-approach behavior (Bandura, 1977). DiClemente (1986) reviewed evidence that self-efficacy expectations predict success in abstaining from addictive behaviors also.

Criticisms of self-efficacy theory. Self-efficacy is not without critics. Marziller and Eastman (1984) have noted difficulty in separating self-efficacy expectations from outcome expectations, and they question typical measurement systems. They, along with Kirsch (1986), argue that frequently incentives are more influential than Bandura acknowledges.

First, Marziller and Eastman (1984) argued that although self-efficacy and outcome expectancy may be conceptually distinct, they cannot be separated in reality. An outcome changes the nature of the subsequent task, which in turn, requires a new self-efficacy rating. For example, the outcome of picking up a snake may be that it wriggles. This outcome calls for a new self-efficacy judgment. Bandura (1984)
countered that the problem lies with difficulty developing self-efficacy measurements for complex behaviors rather than with the concepts themselves.

Maddux, Norton, and Stoltenberg (1986) have taken an intermediate position. They argued that although the two concepts are conceptually distinct, they are often confounded in research. For example, in a study of women preparing for childbirth, the self-efficacy measure reflected "anticipated ability to control the pain of labor and delivery without medication" (Manning & Wright, 1983, p. 424). The self-efficacy estimate was confounded with the outcome expectation of controlling pain.

Attending to conceptual differences between self-efficacy and outcome expectations, Maddux, Norton, and Stoltenberg (1986) developed measures of expectations about using an assertion skill. The self-efficacy measure was not significantly correlated with the outcome expectation measure. The authors attributed the independence of their measures to wording of items that was true to the conceptual distinctions.

In a second criticism, Marziller and Eastman (1984) questioned the typical measurement of self-efficacy. They perceived a contradiction in measurement systems that allow subjects to respond to a single behavior with level ratings of yes and strength ratings of 1, quite uncertain. Although Bandura (1984) accused the authors of engaging in "quibbles about such minutiae as the semantic equivalence of the standard descriptor 'quite uncertain' at the low end of the self-efficacy scale and its description as 'high certainty' at the high end of the scale"
(p.240), he suggested a remedy through the use of single-judgment format scales from 0 to 100. A rating of zero would indicate that the subject has no confidence in his/her ability to perform the task.

Although the study of self-efficacy theory has suffered from methodological problems, these can be remedied. The single-judgment scales address the issue of contradictory self-efficacy estimates. In some cases, self-efficacy can be distinguished from outcome expectancy.

Kirsch (1986) criticized self-efficacy on theoretical grounds. He argued that when perceived consequences are aversive, the "self-efficacy ratings" actually measure willingness. To demonstrate, he showed that some snake phobics who had initially reported that they could not pick up a snake changed their "self-efficacy" estimates when asked to consider hypothetical cash incentives.

Bandura (1986) noted two flaws in Kirsch's argument: (a) the snake phobic subjects were selected using self-report, known to include less fearful subjects than those selected by behavioral tests, and (b) self-efficacy theory does not deny that self-efficacy estimates change under varying circumstances. Outcome expectancies appear to comprise one category of varying circumstances. Finally, in a related criticism, Marziller and Eastman (1984) questioned the importance of self-efficacy ratings in determining behavior. They "place outcome more firmly in the center of the determinants of human action" (p. 261).

Again Maddux and Stanley (1986) have taken an intermediate position, arguing that self-efficacy and outcome expectancy make significant and independent contributions in the prediction behavioral intention. They pointed to the need for research that addresses the
relationship between the types of expectancies, their relative influence on behavior, and the conditions under which their influence will vary.

Maddux, Norton, and Stoltenberg (1986) experimentally manipulated outcome expectancy, outcome value, and self-efficacy expectation for performing the broken record technique sometimes included in assertion training programs. The treatments accounted for approximately equal amounts of variance in behavioral intention to use the technique. The results supported the authors' hypothesis that self-efficacy and outcome expectancies make independent contributions to the prediction of behavioral intentions.

Bandura (1986) acknowledged that human behavior is multiply determined. His theory posits that self-efficacy ratings are a common change mechanism rather than an exclusive one. Self-efficacy research has targeted behavior changes that are generally considered desirable (e.g., decreasing phobic avoidance, decreasing addictive behaviors), thus the effects of outcome value have been partially controlled. Bandura (1986) acknowledged that his experiments have been aimed at elucidating the effects of one particular mechanism rather than at identifying all mechanisms.

Expectancy-Value Theory

Vroom (1964) introduced expectancy-valence theory to explain occupational effort and behavioral choice. He stated that the force on the individual to exert a given level of effort is a function of the person's expectation that the level of effort will lead to various outcomes and the valence of those outcomes. In Vroom's original model and in the early tests of the model, the expectation that effort would
result in performance that meets a criterion was confounded with the expectation that performance that meets the criterion would lead to certain outcomes (Mitchell, 1974).

The expectation that effort will result in performance that meets a specified criterion has been referred to as expectancy for success. Kirsch (1986) effectively argued that expectancy of success in achievement situations is operationally equivalent to self-efficacy. Bandura (1986) countered with the assertion that success is an outcome rather than a behavioral dimension. However the expectancy of success measures appear to tap expectation of meeting a performance criterion. For example, Feather (1963) asked subjects to "estimate as accurately as possible what you expect your chances are of unscrambling all the words correctly" (p. 233). Although the use of the phrase "expectancy of success" has created ambiguity, self-efficacy for performing a behavior implies some criterion level that many authors (e.g., Feather 1963, Kirsch 1986, Vroom, 1964) have labeled "success." The feelings of pride or accomplishment expected to result seem to be a closely associated intrinsic outcome that expectancy of success measures have not tapped.

As stated earlier, the expectation that performance of behaviors will lead to certain outcomes is labeled "outcome expectancy." "Valence" is used to refer to the desirability of the expected outcomes. Feather (1986) distinguished between values and valences. Values are a class of motives or drives that have a judgment or "oughtness" quality. They are relatively broad belief sets held across situations and time. A valence is a specific response to a situation. In the case of expectancy-valence theory, it describes the degree to which a particular
outcome is viewed as positive or negative.

Values, once aroused, are believed to influence valence. "One can assume that terminal values will influence the valence of specific outcomes, so that some outcomes are seen as more attractive or more aversive than others. . ." (Feather, 1986, p. 39). According to Feather's expectancy-value theory, values influence the affective response to any outcome, the outcome valence. A person's actions are determined by the positive and negative valences implicit in a situation and the likelihood that attractive or aversive outcomes will occur if particular actions are taken.

Mitchell's (1974) review indicated that later tests of Vroom's (1964) model incorporated the three components: the degree to which working hard was seen as leading to good performance (self-efficacy), the likelihood that good performance would lead to a set of organizational outcomes (outcome expectancy), and the degree to which each of these were valued (valence). Similarly, Atkinson's (1964) achievement motivation model incorporated three similar constructs.

Vroom (1966) demonstrated that expectancy-valence predicts job choice. The product of valence ratings for 15 occupational rewards (e.g., high prestige, freedom from supervision) and the outcome expectancy ratings associated with three different potential work sites predicted industrial administrators' job attractiveness ratings and subsequent employment choices. These subjects had been trained in their selected occupational field and were therefore selecting a particular job within their field. Although the gender of the subjects was not reported, given the use of masculine pronouns and the year of the study,
it appears that only males subjects were included.

Mitchell (1974) discussed methodological issues associated with the study of expectancy-valence theory. He pointed to the need to assess outcomes that are viewed negatively as well as those that are viewed positively. Early researchers focused on costs of potential failure (Atkinson, 1964). More recent researchers have recognized costs associated with limited time for pursuit of other activities (Parsons, 1983).

Gender Differences in Occupational Self-Efficacy

Following Hackett and Betz' (1981) application of self-efficacy theory to gender differences in career choices, they published supporting data (Betz & Hackett, 1981). In a general sample of university students, males reported equivalent overall self-efficacy with regard to male-dominated and female-dominated occupations, whereas females reported lower self-efficacy for male-dominated occupations than for female-dominated occupations. The occupations for which more men than women rated themselves as self-efficacious emphasized mathematics (accountant, engineer, and mathematician) along with occupations with very few women (drafter and highway patrol officer). Male gender, interest in male-dominated occupations, and self-efficacy for male-dominated occupations were related to range of male-dominated occupations considered.

Gender differences in self-efficacy did not reflect gender differences in ability only. Correlations between ability measures and self-efficacy ratings were generally significant but only moderate in magnitude. Although men generally score higher than women on
mathematics achievement measures upon college entrance (Hyde, Fennema, & Lamon, 1990), Betz and Hackett's (1981) female subjects' American College Test (ACT) Mathematics and English scores did not differ significantly from males' scores.

Post-Kammer and Smith's (1985) sample of eighth and ninth graders responded similarly but with fewer gender differences in self-efficacy for traditionally male-dominated occupations. Males were more likely to rate themselves as self-efficacious for the educational requirements and job duties of only two occupations: drafter and engineer. The authors speculated that the differences from Betz and Hackett's earlier findings may have been due to greater openness among young students, the four-year time lapse between the two studies, and/or less clarity about the actual requirements of jobs and educational programs among younger students.

Rotberg, Brown, and Ware's (1987) examination of a junior college sample did not result in similar gender differences in self-efficacy for male-dominated, female-dominated, and non-gender-dominated careers. However, sex-role orientation, as measured by the Bem (1974) Sex Role Inventory, did predict self-efficacy for female-dominated and non-gender-dominated careers.

The failure to replicate prior results may have resulted from the inclusion of the non-gender-dominated category, the use of different occupational titles for similar scales, or different statistical analyses. The authors used different occupational titles selected to equate occupational levels across the three scales. "Engineer" was the only job title that appeared on both Rotberg, Brown, and Ware's (1987)
and Betz and Hackett's (1981) scales for male-dominated occupations. Rotberg, Brown, and Ware's (1987) other male-dominated job titles: sales manager, stock and bond salesperson, pharmacist, and designer, appear not to be very strongly gender stereotyped. Use of more conservative multivariate, rather than univariate, statistics could have contributed to the failure to replicate Betz and Hackett's (1981) results also.

Self-efficacy's relationship to interest in occupations. Self-efficacy is related to interest in career-related activities. In Betz and Hackett's (1981) university student sample, Rotberg, Brown, and Ware's (1987) community college sample, and Post-Kammer and Smith's (1985) eighth and ninth grade sample, self-efficacy for occupations was related to interest in those occupations.

Lapan, Boggs, and Morrill (1989) demonstrated that self-efficacy for occupational groups mediates some of the gender differences in occupational interests for university students. Entering college freshmen males rated themselves as having more Realistic and Investigative interests than did entering college females. A path analysis showed that self-efficacy for Realistic and Investigative fields and math achievement scores mediated the gender differences in interest in Realistic and Investigative occupations.

Mathematics Filter

Women tend to see themselves as less efficacious at math-related careers and are underrepresented in those careers. The reasons for these phenomena have remained equivocal.

Gender differences in mathematics achievement. Recently Hyde,
Fennema, and Lamon (1990) performed a meta-analysis of 100 studies of math achievement. For samples of the general population across ages six to adult, females outperformed males slightly. There was a slight female superiority in computation, no difference in understanding of concepts, and a slight male superiority in problem solving. Females outperformed males slightly throughout elementary school and junior high. By the end of high school, however, males showed moderately higher scores; this trend continued throughout college.

When studies of more highly talented samples were included with studies of general samples, males showed a slight superiority. This gender difference, excluding studies that have used the Scholastic Aptitude Tests (SAT) - Mathematics scale, has decreased over time, however. For such studies published after 1973, the overall gender difference index (approximately one sixth of a standard deviation) was half the magnitude of the difference observed in studies published before and during 1973 (approximately one third of a standard deviation).

Gender differences in SAT-Math scores remained about the same between 1976 through 1986, with females scoring slightly less than one half a standard deviation lower than males throughout the decade (National Science Foundation, 1988). However Hyde and Linn (1986) reported that more females than males take the SAT, thus the sample of males is more select. Although sampling differences account for some of the SAT-Math gender difference observed, it is in the same direction as was observed in general samples of 11th and 12th-graders (Hyde, Fennema, & Lamon, 1990).
Goldman and Hewitt (1976) found that SAT-Math scores accounted for much, but not all, of the gender differences in college major choices. They coded college majors on a science-nonscience continuum that included fine arts, humanities, social sciences, biological sciences, and physical sciences. Gender differences in SAT-Math scores moderated much of the gender difference in college major selection across the continuum.

Sells (1980) referred to "the mathematics filter" that has screened women from careers in physical sciences. In 1972 she randomly sampled student records at the University of California at Berkeley. Fifty-seven percent of the men had sufficient high school mathematics preparation to enroll in freshman calculus. In contrast, only 8 percent of the women were similarly prepared. The calculus sequence was required for biological and physical science majors. Although now most universities offer prerequisite math courses, many women have entered college at a serious disadvantage.

Girls take math courses at the same pace as their male counterparts until they reach upper division math (Fennema, 1980; Fennema & Sherman, 1977; National Science Foundation, 1988). Approximately equal proportions of males and females enroll in algebra and geometry, generally taken in the 9th and 10th grades. In 11th and 12th grade math courses, however, the proportion of females decreases. Males are twice as likely than females to take calculus. In a talented sample, girls were consistently enrolled in lower level math classes than were boys the same age, and fewer girls studied calculus in high school (Benbow & Stanley, 1983a).
Explanations for gender differences in mathematics achievement. The explanations for males' more rapid acceleration and longer persistence in mathematics courses along with higher high school math achievement test scores remain controversial. Some studies suggest a strong biological component (Benbow & Stanley, 1980; 1983a), but other studies indicate that differential course taking (Pallas & Alexander, 1983) and math-related attitudes (Fennema & Sherman, 1978) influence gender differences in math achievement.

More high school boys than girls whose mathematics achievement scores fall below the median persist in taking higher level math classes (Fennema & Sherman, 1977). This finding was not explained by gender differences in eight math attitudes: attitudes toward success in mathematics, math as a male domain, confidence in learning mathematics, perceived usefulness of mathematics, and perceived attitudes of mother, father, and teacher. However the results suggest that boys somehow differ in their decision-making about perseverance in mathematics.

Benbow and Stanley (1980; 1983a) studied high achievers in their Study of Mathematically Precocious Youth. Students who had scored at or above the 97th percentile on a standardized achievement test were eligible to join the study prior to their thirteenth birthdays. Each participant took the SAT-Math, a college entrance exam which covers the domains of arithmetic, algebra, and geometry. Boys who scored extremely high (above 700) on the SAT-Math outnumbered comparable girls 13 to 1. Because there were no statistically significant gender differences in prior math classes for the entire subject pool, the authors concluded that their findings disconfirmed the differential course-taking
hypothesis. In another article, they suggested that innate differences account for differential course-taking among high school students and achievement test differences (Benbow & Stanley, 1983b).

The SAT-Math gender differences were clear, but the conclusion that the students had been exposed to similar math course work may not be entirely accurate. Although gender differences in math course taking were not statistically significant for the entire sample, backgrounds may have differed for the small proportion of extremely high scorers. For an earlier cohort of similarly recruited subjects, boys' subsequent educational acceleration was highly related to measured mathematical ability. This same relationship, however, did not hold for girls (Fox & Cohn, 1980). Perhaps even prior to age thirteen extremely talented boys (those scoring above 700 were estimated to be in the top one in 10,000 in their age group) had been accelerated.

However Benbow and Stanley (1983a) have observed "that among the top 10 percent of . . . [their subjects], the majority do not even know first-year algebra well" (p. 1031). Still those scoring above 600 on SAT-Math, where boys outnumber girls 4.1 to 1, comprised only approximately 4 percent of the select sample. Generalizations from the entire subject pool to the top few percent may not be fully warranted. However given that boys with SAT-Math scores above the male sample's mean score outnumbered girls 1.5 to 1, it is unlikely that differential course taking would account for the entire gender difference observed for this group.

Pallas and Alexander (1983) demonstrated that for a general sample, 11th or 12th grade SAT-Math performance is responsive to variations in
high school mathematics course-taking after controlling for prior math ability. The authors used ninth grade School and College Ability Test - Quantitative scores to control for prior math ability. Benbow and Stanley (1983b) argued that this inventory, though highly correlated with the SAT-Math, taps mathematical reasoning ability to a lesser extent. They had concluded that boys exceed girls in mathematical reasoning ability rather than computation or arithmetic reasoning. Therefore the pretest was not sensitive to gender differences. Pallas and Alexander (1983) continued to assert that their findings support the differential course-taking hypotheses for a general sample of high school students if not for Benbow and Stanley's (1983a) group selected from the top three percent.

Experiences within the classroom are not identical for boys and girls. Elementary teachers interact more with male students than with female students, especially in math and science classes (Eccles, 1984; Sadker & Sadker, 1985). Koehler (1990) reviewed the literature on teacher-student interactions in mathematics classrooms and concluded that "females and males do receive differential treatment in the classroom. Regardless of the grade level, length of observation, or observation scheme that was used, differences were found consistently. . . . [Males] had more interactions with the teachers, received more help and more teacher attention, and had more informal contacts with the teachers (p. 134)." Webb (1984) found that students respond to each other differently on the basis of gender. In peer groups of junior high students, two-thirds of girls' requests for explanations remained unanswered compared to one-third of unanswered requests made by boys.
Fox and Cohn (1980) studied accelerated learning programs for mathematically precocious youth. Talented girls were less likely to complete accelerated programs and subsequently enroll in accelerated courses than were boys. However, an all-female section in which guest speakers talked about their exciting careers in mathematics and the female instructor emphasized cooperation was more effective in encouraging girls to accelerate their learning than were competitive, mixed-sex classes. Girls may respond the classroom environment in ways that are different from the way boys respond.

In summary, gender differences in mathematics achievement and preparation appear to contribute to gender differences in career choices. Whether math achievement differences result from innate ability, socialization influences, or an interaction of both remains unclear. Given that highly talented males are accelerated through mathematics education, whereas this same relationship does not hold for girls (Fox & Cohn, 1980), socialization seems to play, at minimum, a contributory role. Lower achieving males persist in mathematics more frequently than lower achieving females (Fennema & Sherman, 1977), again suggesting socialization influences. Additionally Hyde, Fennema, and Lamon's (1990) finding that gender differences have decreased over time supports the socialization hypothesis. It has been impossible to control the small, but pervasive gender differences in education (Eccles, 1984; Koehler, 1990; Sadker & Sadker, 1985). Additionally, optimal environments for girls may differ from that for boys (Fox & Cohn, 1980). Therefore environmental influences and their interactions with innate differences cannot be ruled out.
Mathematics confidence and self-efficacy. Females have less confidence than males in their ability to use mathematics. Female sixth through eighth grade students reported less confidence than males in their math ability, though their math achievement scores did not differ significantly from males' (Fennema & Sherman, 1978). This finding held, though the assessment of math achievement included higher level math skills for which boys have been purported to have more talent. In Sherman and Fennema's (1977) study of mathematics achievement and related variables, male students in three of the four high schools studied had greater confidence in learning mathematics than did female students. Also Lapan, Boggs, and Morrill (1989) found that ACT-Math scores accounted for much of the variance in university students' MSE, but gender accounted for additional variance. These findings suggest that females underestimate their capability for mathematical tasks.

Hackett and Betz (1989) studied the relationship between gender, mathematics performance, and mathematics self-efficacy in university students. They failed to support their hypothesis that women's self-efficacy expectations are unrealistically low compared to men's. However, MSE did predict math-relatedness of college major, whereas ACT-Math scores did not.

Math self-efficacy's relationship to career choices. Expectancy beliefs have been shown to affect science-relatedness of college major for university students. MSE, gender, years of high school math, and math anxiety contributed significantly to the choice of major along Goldman and Hewitt's (1976) science-nonscience continuum (Betz & Hackett, 1983). After variance associated with these factors was
controlled, ACT-Math scores did not contribute significantly to the prediction. Because ACT-Math scores theoretically provide relevant information on which subjects base self-efficacy expectations and are correlated with MSE, the order in which the variables were entered into the prediction is questionable. ACT-Math was entered after MSE and would not necessarily be expected to make an independent contribution.

In a related path analysis, MSE did add to the prediction of science-relatedness of college major beyond ACT-Math scores (Hackett, 1985). The effect of gender on MSE was mediated by years of high school math, ACT-Math, and Bem Sex Role Inventory - Masculine scores (Hackett, 1985). MSE directly influenced science-relatedness of college major, mediating effects of ACT-Math scores and Bem Sex Role Inventory - Masculine scores.

Lent, Brown, and Larkin (1986) studied undergraduates enrolled in educational planning courses for students considering science and engineering majors and careers. As might be expected, more than twice as many men as women were enrolled. The group was high-achieving; the mean high school rank was at the 83rd percentile. In contrast to Betz and Hackett's (1981) findings for a general sample of college students, there were no gender differences in self-efficacy for educational requirements and job duties performed in fifteen scientific and technical occupations. Lent, Brown, and Larkin's (1986) subjects had self-selected into the classes and were relatively high-achieving. The decision to enroll in the class for persons considering math-related majors probably served to screen out students with low MSE. It was not possible to determine if students who are high in mathematics ability,
but low in MSE failed to self-select into the course.

Although gender differences in self-efficacy were not apparent, the usefulness of the self-efficacy construct was supported. Beyond variance associated with math achievement test scores, high school rank, and interest in occupations, self-efficacy for educational requirements of scientific and technical occupations predicted range of scientific and technical careers considered. Further, self-efficacy added to the prediction of subsequent grades in technical classes and persistence in a science or engineering major over one year. The hypotheses based on self-efficacy theory were confirmed, supporting the theory's usefulness in explaining effort and persistence in career-related behavior.

Value and persistence in mathematics. Eccles, Adler, and Meece (1984) compared self-efficacy theory to expectancy-valence theory in explaining persistence in high school mathematics. High school students' decisions to continue to study math beyond required courses was the dependent variable. Although females rated their mathematics self-efficacy as slightly weaker than did males, mathematics self-efficacy did not moderate gender differences in persistence. Subjective task value for mathematics, however, did moderate gender differences.

Gender Differences in Career-Related Values

Lyson (1984) studied gender differences in work values. Women in gender-typical fields were concerned primarily with working with people and with helping others, whereas men in gender-typical fields were concerned primarily with leadership opportunities and having freedom from close supervision.

Feather (1984) explored the relationship between gender-typing of
individuals and their values. He used the Bem (1974) Sex Role Inventory and the Spence, Helmreich, and Holahan (1979) Extended Personal Attributes Questionnaire to measure sex typing. In most groups he studied, males scored higher on the masculine scales, and women scored higher on the feminine scales. Gender-typing was related to specific sets of values. Masculinity scores were positively correlated with the relative importance of an exciting life, social recognition, and being ambitious and independent. They were negatively related to the importance of inner harmony, happiness, and being forgiving and helpful. Femininity scores were positively correlated with the relative importance assigned to mature love and being forgiving, helpful, honest, and polite, and negatively related to the importance assigned to an exciting life, pleasure, and being ambitious. Feather (1984) concluded that many of the differences in sex-typing of values were associated with distinction between expressiveness (femininity) and instrumentality (masculinity).

Influence of choice cost. Outcome expectancies for occupational rewards undoubtedly influence career choices. Mitchell (1974) noted that costs contribute to choices as well. Super's (1980) concepts of life space assume that a heavy commitment to one role, such as career, may be made at the expense of space for other roles. He listed nine roles that most people play at some time during their lives: child, student, leisurite, citizen, worker, spouse, homemaker, parent, and pensioner. Beliefs about the amount of life space that occupations are expected to fill and the values placed on career and other roles may predict career choices.
Eccles (1987) considered competing demands of life styles in her model of career decision-making. She proposed that the perceived demands of occupations influence choices. If life roles other than career are highly valued, then the perceived amount of effort required by an occupation is expected to weigh negatively on the choice to pursue that occupation.

Women do appear to consider costs associated with achievement. Paludi and Fankell-Hauser (1986) interviewed 80 women who ranged from teen-agers to women in their eighties. Ninety-six percent of them acknowledged having questioned whether achievements had been worth costs to themselves and/or to their families. Perceived costs of employment and parenting children explained much of the difference in female high school students' plans for balancing work and family throughout their adult lives (Leslie, 1986).

Super (1980) specified nine life roles; Miller and Sjoberg (1973) believed that three dimensions encompass the major activities of adults in the United States. The dimensions were work/study, leisure/recreation, and kinship/friendship. Epperson, Lucas, and Zytowski (1983) developed the Life-Style Inventory to measure college students' orientation towards these primary adult roles. The authors simplified the three labels to work, leisure, and relationship orientations. They supported their belief that some individuals could be classified as having a primary life style that is dominant over the other two.
Relationships Among Life-Style Orientations and Career-Related Interests and Behaviors

Relationship orientation. Relationship orientation is related to career interests. Among university students, relationship orientation on the LSI is negatively correlated with Realistic and Investigative Vocational Preference Inventory (VPI) scores (Epperson, Lucas, & Zytowski, 1983). The descriptions of the Realistic type as thing oriented and the Investigative type as thing and idea oriented are consistent with the inverse association with relationship orientation. Relationship orientation is positively correlated with Social VPI score. The Social type is described as people oriented; thus it would be consistent with relationship orientation. Women in Epperson, Lucas, and Zytowski's (1983) sample of university students scored higher on the Relationship scale than did the men.

Work orientation. Greenhaus (1974) developed and used a unidimensional scale to measure career salience among college students. Subjects who were very low in career salience were more career undecided than were those who indicated a moderate to high level of career salience. Similarly in Weiner and Hunt's (1983) university student sample, work salience was positively related to decidedness on a major. It appears that motivation to make career decisions is facilitated by a threshold level of career salience.

Life-style orientations have differential associations with academic achievement. Epperson, Lucas, and Zytowski (1983) compared honors students with a general sample of university students who had
comparable ACT composite scores. Honors students were more likely to be work oriented than were comparably able nonhonors students.

Career centeredness has been shown to be inversely related to traditional femininity. Women who scored high on the Bem Sex Role Inventory - Femininity scale scored lower on a Career Centeredness Measure that was designed to detect emphasis on career over other life roles (Marshall & Wijting, 1980).

Leisure orientation. Leisure orientation is related to academic and career-choice behavior. In a sample of more than 500 university students, leisure orientation was generally higher than work orientation. Recreation majors scored higher on leisure orientation than did students majoring in agriculture, engineering, business, and physical education (Weiner & Hunt, 1983). In Epperson, Lucas, and Zytowski's (1983) comparison of honors and nonhonors students, honors students of comparable ability were less likely to be leisure oriented.

Comparisons of Self-Efficacy and Expectancy-Valence in Predicting Career-Choice Behavior

In two comparisons of the influences on career choice, self-efficacy was shown to be more important than expectancy-valence (Lent, Brown, & Larkin, 1987; Wheeler, 1983). However the expectancy-valence contributions may not have been adequately tested.

Although male and female college students comprising Wheeler's (1983) sample agreed that the outcomes of male-dominated jobs were more positive than female-dominated jobs, males expressed greater liking for male-dominated jobs than did females. Subjects' ratings of ability-job matches were used as measures of self-efficacy. Ability-job matches for
occupations were more highly correlated with liking for occupations than
were outcome-valence ratings. However, only those valences such as
variety, learning, and high salary that reflected outcomes more integral
to occupations were measured, ignoring perceived outcomes related to
opportunities for development of personal and/or family relationships.
Jobs were rated for opportunities for leisure, but the outcome-valence
for that item was not considered separately from the eleven other
outcome ratings.

Lent, Brown, and Larkin (1987) compared self-efficacy with interest
congruence and consequence thinking in predicting grades in technical
courses, persistence in technical/scientific majors, and range of
perceived scientific career options. Self-efficacy was superior in
predicting grades and persistence, whereas both self-efficacy and
congruence predicted range of perceived career options. To measure
consequence thinking, the authors used an open-ended question prompting
subjects to list consequences of majoring in the science or engineering
field they were currently considering. The measure may not have been
sensitive to outcomes less integrally related to occupations.

Statement of the Problem and Hypotheses

Although males and females agree that male-dominated careers are
associated with greater job-related rewards (Wheeler, 1983),
occupational segregation along gender lines remains. Women tend to
choose lower status, supportive occupations.

In previous comparisons of self-efficacy and expectancy-valence,
self-efficacy better accounted for college students' choice of major
(Wheeler, 1983) and persistence in a scientific field (Lent, Brown, &
Expectancy-value theory is expected to better account for gender differences in choice of major when broader life-style values are considered. Life-style preferences are related to career related interests, academic behaviors (Epperson, Lucas, & Zytowski, 1983), and college major (Weiner & Hunt, 1983).

Women's values tend to differ from those of men on many dimensions. Occupational choices are assumed to reflect work-related values as well as broader life-style values. The influence of career, leisure, and relationship life-style orientations on choice of college major will be examined. Expected occupational outcomes of facilitation or impingement on preferred life style are believed to affect career choices.

One aspect of the occupational segregation is that a low percentage of women is represented in math-related careers. Differences in achievement level, self-efficacy, and task value appear to contribute. Women's self-selection out of these careers is related to less high school mathematics education (Sells, 1980), lower high school mathematics achievement (Goldman & Hewitt, 1976), and lower mathematics self-efficacy expectations (Hackett, 1985). Subjective task value for mathematics moderated gender differences in high school students' decisions to persist in the study of mathematics, whereas self-efficacy estimates did not (Eccles, Adler, & Meece, 1984).

Women and men are assumed to make career-related choices for consistent reasons, although they are not necessarily consciously articulated. This study reflects an attempt to explain why students make the choices they do. It addresses questions about the influence of
self-efficacy, expectancy-value, and gender on university students' career choices.

Hypotheses related to expectancies associated with occupations are as follows:

Hypotheses for Study 1.

A1. Realistic and Investigative occupations will be perceived as less compatible with relationship development, both on and off the job, than will Social occupations.

A2. Conventional occupations will be perceived as more compatible with developing relationships outside the job than will occupations with other general occupational themes.

More speculative hypotheses are as follows:

A3. Enterprising occupations will have higher "leisure needs met outside the job" ratings than will occupations with other general occupational themes.

A4. Artistic occupations will be perceived as more compatible with meeting leisure needs on the job than will occupations with other general occupational themes.

Hypotheses for Study 2.

Hypotheses regarding gender differences in dependent and moderating variables are as follows:

B1: University major given greatest consideration by males will be more science-related than majors given greatest consideration by females.
B2: Males will score higher on Consideration of Occupations - Realistic and Investigative than will females. Females will score higher on Consideration of Occupations - Social than will males.

B3: Males will be more likely than females to select a Realistic or Investigative occupation as the single occupation to which they are giving greatest consideration. Females will be more likely than males to select a Social occupation.

B4: Males will score higher on ACT-Math and MSE than will females. Females will score higher on Relationship orientation on the LSI than will males.

Hypotheses regarding relationships between moderating variables and dependent variables are as follows:

B5: Selection of a Realistic or Investigative occupation as the single occupation given greatest consideration will be associated with higher ACT-Math and MSE scores than will selection of other occupational types.

B6: Selection of a Social occupation will be associated with higher LSI-Relationship scores than will the selection of other occupational types.

B7: Relationship orientation will account for variance in the prediction of science-relatedness of university major, beyond that accounted for by ACT-Math and MSE. MSE will account for variance beyond that accounted for by ACT-Math.

B8: Similarly, relationship orientation will account for variance in the prediction of Consideration of Occupations - Realistic, Investigative, and Social, beyond that accounted for by ACT-Math.
and MSE. MSE will account for variance beyond that accounted for by ACT-Math.

Hypotheses regarding relationships between gender, moderating variables, and dependent variables are as follows:


B10: ACT-Math will be a better predictor of the science-relatedness of university major for males than for females. MSE and Relationship orientation will be better predictors of science-relatedness of university major for females than for males.

B11: ACT-Math will be a better predictor of Consideration given to Realistic, Investigative, and Social occupations for males than for females. MSE and Relationship orientation will be better predictors for females than for males.
METHOD

Subjects

Two groups of subjects were recruited to complete one of two sets of inventories. Both groups were undergraduate students enrolled in psychology classes at a large midwestern university. Group 1 included 84 first-year students (31 males, 53 females), 105 second-year students (42 males, 63 females), 45 third-year students (18 males, 27 females), and 15 fourth-year students (6 males, 9 females), for a total of 249 subjects (97 males, 152 females).

The second group of subjects was comprised of 117 males and 124 females for a total of 241 subjects. ACT-Math scores were available for 96 males and 70 females. Of those with ACT scores available, 84 were first-year students (42 males, 42 females), 44 were second-year students (26 males, 18 females), 19 were third-year students (14 males, 5 females), and 12 were fourth-year students (9 males, 3 females). Including 7 who did not indicate their grade level (5 males, 2 females) there was a total of 166 subjects (96 males, 70 females). Participation was voluntary, but subjects in both groups received extra credit in the psychology course in which they were enrolled for their involvement in the study.

Group 1 subjects completed one set of inventories; group 2 subjects completed another set. The collection of inventories in each set will be delineated later. Given that the inventory tasks were redundant, the each set was designed to take less than one hour to complete. Because of the time limitation, it was deemed impractical for subjects to complete both sets. Both groups of subjects were drawn from the same
Instruments

Relationship and Leisure-Compatibility Questionnaire. Lapan, Boggs, and Morrill's (1989) General Occupational Theme - Self-Efficacy Scale (GOT-SE) was adapted to obtain university students' expectancy ratings for developing relationships and meeting leisure needs should they enter and perform successfully in 83 occupations that corresponded with those on the GOT-SE. The Relationship and Leisure-Compatibility Questionnaire appears in Appendix B. Although the authors of the GOT-SE did not acknowledge the source of the job titles, most appear as occupational scales on the Strong-Campbell Interest Inventory. Subjects were asked to rate the extent to which entering each of the occupations would allow them to develop four aspects of their lives. They indicated the extent to which they could expect to develop personal relationships both on and off the job and the extent to which they could expect to meet leisure needs both on and off the job. Each occupation was rated for each of the four aspects on 6-point Likert scales with "1" indicating "not at all" and "6" indicating "to a great extent". Subjects' mean scores were calculated for each of the six general occupational themes, resulting in four expectancy scores for Realistic, Investigative, Artistic, Social, Enterprising, and Conventional occupations.

American College Tests (ACT) - Mathematics. ACT scores were included as part of the application to the university at which the study was conducted. The scores and testing dates were accessed from the subjects' student records. Some subjects took the Enhanced ACT, which
has been administered since October, 1989. Both the ACT-Math and the Enhanced ACT-Math were designed to measure quantitative reasoning. The original ACT-Math is a 40-item multiple choice test with a 50-minute time limit (American College Testing Program, 1983). The Enhanced ACT is a 60-item, 60-minute multiple choice test (American College Testing Program, 1989). The tests cover content areas of pre-algebra, elementary algebra, coordinate geometry, plane geometry, and trigonometry. The American College Testing Program has published concordance tables to allow conversion of Enhanced ACT scores to comparable ACT scores. Because most subjects took the original ACT, all scores were converted to "ACT equivalents". The American College Testing Program dropped the word "Enhanced" from the test title after using it for one year; the test will be referred to as simply "ACT" throughout this paper.

The mean ACT-Math score for over two million college-bound students who graduated from high school between 1984 and 1986 was 17.1; the standard deviation was 8.1 (American College Testing Program, 1988). ACT-Math scores were moderately correlated with high school ($r = .47$) and college ($r = .37$) grade point averages. For a sample of over 500 students, ACT-Math scores were moderately correlated with grades in Mathematics 102 courses ($r = .38$).

Mathematics Self-Efficacy (MSE). The MSE scale, appearing in Appendix E, was developed by Betz and Hackett (1983). The 52-item scale consists of three subscales: mathematics tasks (18 items), math-related college courses (16 items), and math problems (18 items). Mathematics tasks consist of "everyday" math applications (e.g., figure out a tip on
a dinner bill split eight ways). Math-related courses are university level math and science courses. Math problems consist of arithmetic, algebra, and geometry problems. For mathematics courses, subjects rate their confidence in their ability to complete each with a grade of "B" or better. For math tasks and math problems, subjects rate their confidence in their ability to successfully complete each. All items are rated on 10-point Likert scales with "1" indicating "no confidence" and 10 indicating "complete confidence". Mean item scores can be computed for each of the three subscales. Only total scores were used in this study.

Betz and Hackett (1983) reported that the internal consistency (coefficient alpha) for the entire scale was .96. Those of math tasks, math problems, and math courses subscales were .92, .96, and .92, respectively. Item-total correlations ranged from .24 to .63 for math tasks, .38 to .68 for math problems, and .16 to .70 for math courses. Validity data indicate that MSE predicts math-relatedness of college major beyond variance accounted for by ACT-Math (Hackett, 1985).

Life-Style Inventory (LSI). The LSI is 45-item measure of life-style dimensions of work, leisure, and relationships. The inventory appears in Appendix F. Each of the three subscales consists of 15 items. Items include statements that reflect value for work, leisure, or relationships. Subjects rate the extent to which they agree with each statement on a 5-point Likert scale. Mean scores were calculated for each of the three dimensions; thus, scores could range from 1 to 5.

For an earlier version, Epperson, Lucas, and Zytowski (1983) reported internal consistencies of the scales based on a sample of 875
university students. The coefficients were .66 for Leisure, .70 for Work, and .80 for Relationship. Four-week test-retest reliabilities for 209 subjects were .75 (Leisure), .78 (Work), and .82 (Relationship). Epperson, Lucas, and Zytowski (1983) reported concurrent validity data. Among university students, relationship orientation on the LSI was negatively correlated with Realistic and Investigative Vocational Preference Inventory (VPI) scores. The descriptions of the Realistic type as thing oriented and the Investigative type as thing and idea oriented are consistent with the inverse association with relationship orientation. Relationship orientation is positively correlated with Social VPI score. The Social type is described as people oriented; thus its positive association with relationship orientation is reasonable.

Epperson, Lucas, and Zytowski (1983) reported a correlation of .46 between the original Work subscale and Greenhaus' (1971) Career Salience Questionnaire. The moderate correlation is appropriate, given that many of the Career Salience Questionnaire items pit value for work against value for relationships; whereas the LSI allows independent ratings of value for either. The authors confirmed their hypothesis that honors students would be more likely to be work oriented and less likely to be leisure oriented than nonhonors students with comparable ACT composites.

Hogan (1990) revised the inventory to improve the internal consistencies. Her modified version was used in this study. She modified the Leisure scale to reflect two defining characteristics of leisure: perceived freedom and intrinsic motivation. She wrote five new Leisure items and modified nine others. She also wrote two new Work scale items. The final 45-item form included five new items, five
revised items, and 35 of the original 51 items. Hogan reported improved alpha coefficients of .78 for Leisure, .74 for Work, and .80 for Relationship, based on a sample of 302 students. She reported moderate correlations between self ratings and those of close friends and relatives on the three LSI subscales, supporting the LSI’s validity.

Consideration of Occupations Scale. Lapan, Boggs, and Morrill’s (1989) GOT-SE Scale was modified to measure of extent of consideration given to entering 83 occupations across the six occupational themes. The Consideration of Occupations Scale appears in Appendix G. The occupational titles corresponded with those in the Relationship and Leisure-Compatibility Questionnaire. Each occupation was rated for the extent it would be considered on a 10-point Likert scale, with "1" indicating "Would Not Consider At All" and "10" indicating "Would Consider Very Seriously". Mean scores were calculated for each of the six general occupational themes.

Goldman-Hewitt science-nonscience continuum. Subjects were asked to indicate their university major or the major to which they were currently giving most consideration. The university majors were coded on Goldman and Hewitt’s (1976) 5-point science-nonscience continuum. Categories are fine arts, humanities, social sciences, biological sciences, and physical sciences. Betz and Hackett (1982) found that university students perceptions of the math-relatedness of majors was strongly correlated ($r = .77$) with the science-nonscience continuum.

Majors offered at the university at which the study was conducted were placed on the 5-point scale. Two independent raters placed each major in the category with what appeared to be the most similar majors.
Interrater agreement was 88%. Of the sixteen majors for which there were disagreements, only five were indicated as subjects' majors. Raters discussed disagreements until they reached agreement. The version of the continuum that was used appears in Appendix H.

**Holland code for occupation given most consideration.** Subjects were asked to indicate the occupation to which they were giving greatest consideration. The occupations were given one-letter Holland codes, using Gottfredson and Holland's (1989) *Dictionary of Holland Codes*. The dictionary lists more than 12,000 occupational titles along with the general occupational themes into which each falls. The authors reported that raters independently rated a sample of 289 occupations with 87.5% agreement.

**Procedure**

The first group of subjects completed the Relationship and Leisure-Compatibility Questionnaire. The second group of subjects completed each of the other measures described. Two forms of the second questionnaire packet were used, with the order partially counterbalanced. Data to be used as dependent variables were collected first in both forms. These included questions regarding current major and occupation given greatest consideration, followed by the Consideration of Occupations Questionnaire. In one packet the measures appeared in the following order: the measures used as dependent variables, the MSE, an additional measure of self-efficacy, a Negative Affectivity measure and a self-esteem measure not used in these analyses, and the LSI. In the second packet, the LSI preceded the additional self-efficacy measure, the negative affectivity measure, and the self-esteem measure,
which were followed by the MSE. ACT-Math scores were accessed for all subjects in Group 2 who had scores available in university records.

Analyses

Outcome expectations associated with general occupational themes. Split plot analyses of variance (ANOVAs) were utilized to test the hypotheses regarding expectancies for developing relationships and meeting leisure needs associated with Holland's six themes. The six general occupational themes constituted the within subjects variable, and gender was the between subjects variable. The dependent variables were expectancies for developing relationships on the job, developing relationships outside the job, meeting leisure needs as part of the job, and meeting leisure needs outside the job. Significant overall F-tests were followed by correlated t-tests. Values for each of the six general occupational themes was compared with values corresponding with each of the other themes, thus there were 15 comparisons following each significant F-test. A Bonferroni procedure was used to control experimentwise error. When general occupational theme of job titles interacted with gender to predict relationship or leisure-compatibility estimates, separate one-way ANOVAs were performed for males and females. Again, significant overall F-tests were followed by correlated t-tests pairwise comparisons, using a Bonferroni procedure to control experimentwise error.

Gender Differences. Gender differences in consideration of Realistic, Investigative, and Social occupations and science-relatedness of university majors were tested using one-tailed t-tests. Hypotheses regarding gender differences in ACT-Math, MSE, and LSI-Relationship were
tested using one-tailed t-tests also.

To confirm that subjects intended to pursue gender-stereotyped occupations, the relationship between gender and Holland code of occupation under greatest consideration was tested using a chi-square analysis.

**Representativeness of subjects with ACT-Math scores.** Because both gender and ACT-Math scores were available for only 166 of the 241 subjects, chi-square analyses were conducted to assess the representativeness of subjects with ACT-Math scores compared to the total sample. The following two associations were tested: gender with ACT-Math availability, and Holland code of occupation given greatest consideration with ACT-Math availability.

As a test for systematic differences in MSE between subjects who had ACT-Math scores and those who did not, a two-way ANOVA was conducted blocking on gender and availability of ACT-Math scores, with MSE as the dependent variable.

**ANOVA predicting ACT-Math, MSE, and LSI-Relationship.** Two-way ANOVAs were used to test the hypotheses that gender, Holland code of occupation under greatest consideration, and their interaction would be related to differences in ACT-Math, MSE, and Relationship Life-Style orientation. Significant overall F-tests were followed by Newman-Keuls multiple comparison tests.

**Hierarchical regressions.** A series of hierarchical regressions was employed to determine if ACT-Math, MSE, and LSI-Relationship moderated gender differences in science-relatedness of university major and consideration of Realistic, Investigative, and Social occupations. Two
analyses were run for each of the four dependent variables. For the first analysis in each pair, independent variables (IVs) were entered in the following order: gender, ACT-Math, MSE, and LSI-Relationship. Gender was entered after ACT-Math, MSE, and LSI-Relationship for the second analysis. Hierarchical regression analyses were conducted using BMDP2R.

**Standard regressions.** A series of standard multiple regression analyses was performed to explore the effects of interactions between gender and the three IVs: ACT-Math, MSE, and LSI-Relationship on four dependent variables. The first series was performed with science-relatedness of university major as the dependent variable. The series was repeated three times with Consideration given to Realistic, Investigative, and Social occupations as dependent variables. Models with IVs of ACT-Math, MSE, LSI Relationship, and gender were compared to models that also included the interaction between gender and each of the other three IVs. Standard regression analyses were run using BMDP1R.
RESULTS

Relationship-Compatibility and Leisure-Compatibility Estimates

Split plot ANOVAs were performed to determine the association of gender and general occupational theme with expectancy for meeting leisure and relationship needs in relation to various occupations. The Gender X Occupational Theme split plot ANOVA was repeated four times, with dependent variables of expectancy of meeting relationship needs outside the job, expectancy for meeting relationship needs in the job, expectancy for meeting leisure needs outside the job, and expectancy for meeting leisure needs as part of the job. In all analyses, gender was the between subjects variable and occupational theme was the within subjects variable.

Expectancy of meeting relationship needs outside the job. Results of the first ANOVA, listed in Table 1, account for expectancy for meeting relationship needs outside the job. General occupational theme significantly predicted expectancy for meeting relationship needs outside the job, $F(5, 247) = 86.96$, $p = .0001$. Gender of subject did not predict significantly. However, the Gender-by-Occupational Theme interaction was significant, $F(5, 1235) = 3.60$, $p = .0031$.

The overall F-test was followed by pairwise correlated t-tests, using a Bonferroni procedure. These comparisons are reported in Table 2. The general occupational themes were rated in the following order: Social, Conventional, Artistic, Enterprising, Investigative, and Realistic. The Social theme was rated higher than the Conventional, Artistic, and Enterprising themes at the .0033 level; these were rated higher than the Realistic theme at the .0033 level also. No other
Table 1
ANOVA of Estimates of Getting Relationship Needs Met Outside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (A)</td>
<td>.04</td>
<td>1</td>
<td>.04</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>735.81</td>
<td>247</td>
<td>2.98</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Theme (B)</td>
<td>97.93</td>
<td>5</td>
<td>19.59</td>
<td>86.96**</td>
</tr>
<tr>
<td>A X B</td>
<td>4.05</td>
<td>5</td>
<td>.81</td>
<td>3.60**</td>
</tr>
<tr>
<td>Error</td>
<td>278.15</td>
<td>1235</td>
<td>.23</td>
<td></td>
</tr>
</tbody>
</table>

**p<.01.
Table 2
T-tests for Comparisons of Estimates of Meeting Relationship
Needs Outside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Occupational Themes</th>
<th>Total Sample</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Social</td>
<td>4.45ₐ</td>
<td>.91</td>
<td>4.53ₐ</td>
<td>.87</td>
</tr>
<tr>
<td>Conventional</td>
<td>4.01ₐ</td>
<td>.88</td>
<td>4.01ₐ</td>
<td>.91</td>
</tr>
<tr>
<td>Artistic</td>
<td>3.88ₜ</td>
<td>.69</td>
<td>3.91ₜ</td>
<td>.68</td>
</tr>
<tr>
<td>Enterprising</td>
<td>3.8ₜ</td>
<td>.80</td>
<td>3.8₁ₜ</td>
<td>.81</td>
</tr>
<tr>
<td>Investigative</td>
<td>3.8ₜ</td>
<td>.87</td>
<td>3.7₉ₜ</td>
<td>.88</td>
</tr>
<tr>
<td>Realistic</td>
<td>3.5₅ₜ</td>
<td>.86</td>
<td>3.5₄ₜ</td>
<td>.90</td>
</tr>
</tbody>
</table>

Values within columns that share identical subscripted letters are not significantly different at the .0033 confidence level.
comparisons reached significance.

Because the gender-by-occupational theme interaction term was significant, one-way ANOVAs were conducted separately for males and females. For female subjects only, the overall $F(5, 750)$ of 72.95 for occupational theme was significant, $p = .0001$. Post-hoc t-tests appear in Table 2. Female subjects rated the themes in the following order: Social, Conventional, Artistic, Enterprising, Investigative, and Realistic, the same order as for the general sample. The Social rating was significantly higher than other ratings. The Conventional rating exceeded ratings for Enterprising, Investigative, and Realistic themes. Artistic, Enterprising, and Investigative theme ratings did not differ significantly from each other. The Realistic rating was significantly lower than all other ratings. All comparisons were tested using the .0033 level.

The overall $F(5, 490)$ of 27.02 for occupational theme was significant ($p = .0001$) for male subjects also. T-test comparisons displayed in Table 2 indicate that the Social theme was rated significantly higher than any other theme. The Conventional rating was higher than the Investigative and Realistic ratings. Artistic, Enterprising, and Investigative theme ratings did not differ significantly from each other, but they exceeded the Realistic theme rating. The Realistic theme was rated significantly lower than any other theme. Comparisons were tested using the .0033 criterion.

Expectancy of meeting relationship needs within the job. Results of the second ANOVA, presented in Table 3, account for expectancy for meeting relationship needs within the job. General occupational theme
### Table 3
ANOVA of Estimates of Getting Relationship Needs Met Inside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (A)</td>
<td>6.03</td>
<td>1</td>
<td>6.03</td>
<td>1.85</td>
</tr>
<tr>
<td>Error</td>
<td>805.83</td>
<td>247</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Theme (B)</td>
<td>96.67</td>
<td>5</td>
<td>19.33</td>
<td>63.01**</td>
</tr>
<tr>
<td>A X B</td>
<td>5.51</td>
<td>5</td>
<td>1.10</td>
<td>3.59**</td>
</tr>
<tr>
<td>Error</td>
<td>378.96</td>
<td>1235</td>
<td>.31</td>
<td></td>
</tr>
</tbody>
</table>

**p < .01.
significantly predicted expectancy for meeting relationship needs within the job, \( F(5,1235) = 63.01, p = .0001 \). Gender of subject did not predict significantly. However, the gender-by-occupational theme interaction was significant, \( F(5,1235) = 3.60, p = .0031 \).

The overall F-test was again followed by uncorrelated t-tests. Mean ratings for general occupational themes shown in Table 4 were in the following rank order: Social, Artistic, Enterprising, Conventional, Investigative, and Realistic. The Social theme rating significantly exceeded all others. Artistic and Enterprising theme ratings were significantly higher than the Conventional and Investigative theme ratings, which were significantly higher than the Realistic theme rating. Comparisons were made using the .0033 criterion level.

Because the Gender-by-Occupational Theme interaction term was significant, one-way ANOVAs were conducted separately for males and females. For females only, the overall \( F(5,750) \) of 44.72 for occupational theme was significant, \( p = .0001 \). T-test comparisons are shown in Table 4. The Social theme was rated significantly higher than all others. Artistic and Enterprising theme ratings exceeded Conventional, Investigative, and Realistic ratings. The Conventional rating was significantly higher than the Realistic rating also. Significant differences met the .0033 criterion.

The overall \( F(5,485) \) of 28.69 for occupational theme was significant (\( p = .0001 \)) for male subjects also. T-test comparisons for male subjects appear in Table 4 also. The rank order of the mean ratings for occupational themes was identical to the females subjects' rankings. The Social theme rating was not significantly higher than the
Table 4
T-Test Comparisons of Estimates of Meeting Relationship Needs Inside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Occupational Themes</th>
<th>Total Sample</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Social</td>
<td>4.17&lt;sub&gt;a&lt;/sub&gt;</td>
<td>1.08</td>
<td>4.32&lt;sub&gt;a&lt;/sub&gt;</td>
</tr>
<tr>
<td>Artistic</td>
<td>3.88&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.74</td>
<td>3.90&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Enterprising</td>
<td>3.82&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.83</td>
<td>3.90&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Conventional</td>
<td>3.65&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.89</td>
<td>3.68&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td>Investigative</td>
<td>3.54&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.91</td>
<td>3.55&lt;sub&gt;cd&lt;/sub&gt;</td>
</tr>
<tr>
<td>Realistic</td>
<td>3.32&lt;sub&gt;d&lt;/sub&gt;</td>
<td>.94</td>
<td>3.38&lt;sub&gt;d&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Values within columns that share identical subscripted letters are not significantly different at the .0033 confidence level.
Artistic rating, but exceeded the other four ratings. The rating for the Artistic theme was higher than ratings for Conventional, Investigative, and Realistic themes. The Enterprising theme rating exceeded ratings for Investigative and Realistic themes. The Conventional and Investigative themes were rated significantly higher than the Realistic theme. T-test comparisons were made using the .0033 significance criterion.

Expectancy of meeting leisure needs outside the job. Results of the third Gender X Occupational Theme split plot ANOVA, presented in Table 5, account for expectancy for meeting leisure needs outside the job. General occupational theme significantly predicted expectancy for meeting leisure needs outside the job, $F(5,1235) = 69.56, p = .0001$. Gender of subject did not predict significantly. Again, the Gender-by-Occupational Theme interaction was significant, $F(5,1235) = 3.76, p = .0022$.

The overall F-test was followed by t-test comparison tests, indicated in Table 6. General occupational theme ratings were in the following rank order: Social, Conventional, Artistic, Enterprising, Investigative, and Realistic. The Conventional-Artistic comparison was not significant, nor was the Enterprising-Investigative comparison; all other comparisons were significant at the .0033 level.

One-way ANOVAs were again conducted separately for males and females. For females only, the overall $F(5,750)$ of 56.42 for occupational theme was significant, $p = .0001$. Post-hoc t-test results are presented in Table 6. Females rated occupational themes in the following order: Social, Conventional, Artistic, Enterprising,
Table 5
ANOVA of Estimates of Getting Leisure Needs Met Outside the
Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (A)</td>
<td>.04</td>
<td>1</td>
<td>.04</td>
<td>.02</td>
</tr>
<tr>
<td>Error</td>
<td>702.34</td>
<td>247</td>
<td>2.84</td>
<td></td>
</tr>
<tr>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational</td>
<td>70.35</td>
<td>5</td>
<td>14.07</td>
<td>69.56*</td>
</tr>
<tr>
<td>Theme (B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A X B</td>
<td>3.81</td>
<td>5</td>
<td>.76</td>
<td>3.76*</td>
</tr>
<tr>
<td>Error</td>
<td>249.82</td>
<td>1235</td>
<td>.20</td>
<td></td>
</tr>
</tbody>
</table>

* p<.01.
Table 6
T-Test Comparisons of Estimates of Meeting Leisure Needs Outside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Occupational Themes</th>
<th>Total Sample</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Social</td>
<td>4.39&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.88</td>
<td>4.44&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.85</td>
</tr>
<tr>
<td>Conventional</td>
<td>4.05&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.81</td>
<td>4.10&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.81</td>
</tr>
<tr>
<td>Artistic</td>
<td>3.98&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.73</td>
<td>4.00&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.69</td>
</tr>
<tr>
<td>Enterprising</td>
<td>3.84&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.76</td>
<td>3.82&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.74</td>
</tr>
<tr>
<td>Investigative</td>
<td>3.82&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.90</td>
<td>3.79&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.93</td>
</tr>
<tr>
<td>Realistic</td>
<td>3.64&lt;sub&gt;d&lt;/sub&gt;</td>
<td>.76</td>
<td>3.61&lt;sub&gt;d&lt;/sub&gt;</td>
<td>.77</td>
</tr>
</tbody>
</table>

^Values within columns that share identical subscripted letters are not significantly different at the .0033 confidence level.
Investigative, and Realistic, the same order as for the general sample. Again the Conventional-Artistic and Enterprising-Investigative comparisons were not significant; all others met the .0033 criterion.

For males, the overall F (5,485) of 23.88 for occupational theme was significant also, p = .0001. T-test comparisons for males also appear in Table 6. Males rated the themes in the following order: Social, Artistic, Conventional, Investigative, Enterprising, and Realistic. The Social theme rating was significantly higher than all others. The Artistic, Conventional, and Investigative ratings were significantly higher than the Realistic theme rating. The significance criterion used for the comparisons was .0033.

Expectancy of meeting leisure needs as part of job. Results of the fourth Gender X Occupational Theme split plot ANOVA, shown in Table 7, account for expectancy for meeting leisure needs inside the job. General occupational theme significantly predicted expectancy for meeting leisure needs inside the job, F(5,1235) = 107.79, p = .0001. Gender of subject did not predict significantly. However, the Gender X Occupational Theme interaction was significant, F(5,1235) = 4.55, p = .0004.

The overall F-test was again followed by t-test pairwise comparison tests; results appear in Table 8. Social and Artistic general occupational themes were rated significantly higher than the Enterprising theme, which was rated higher than the Realistic, Investigative, and Conventional themes. Differences were significant at the .0033 confidence level.

Again because of the significant Gender X Occupational Theme
### Table 7

ANOVA of Estimates of Getting Leisure Needs Met Inside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (A)</td>
<td>1.99</td>
<td>1</td>
<td>1.99</td>
<td>.62</td>
</tr>
<tr>
<td>Error</td>
<td>792.32</td>
<td>247</td>
<td>3.21</td>
<td></td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Theme (B)</td>
<td>142.69</td>
<td>5</td>
<td>28.54</td>
<td>107.79**</td>
</tr>
<tr>
<td>A X B</td>
<td>6.03</td>
<td>5</td>
<td>1.21</td>
<td>4.55**</td>
</tr>
<tr>
<td>Error</td>
<td>326.95</td>
<td>1235</td>
<td>.26</td>
<td></td>
</tr>
</tbody>
</table>

**p<.01.
Table 8
T-test Comparisons of Estimates of Meeting Leisure Needs Inside the Job Across Occupational Themes

<table>
<thead>
<tr>
<th>Occupational Themes</th>
<th>Total Sample</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Social</td>
<td>3.77&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.89</td>
<td>3.89&lt;sub&gt;a&lt;/sub&gt;</td>
</tr>
<tr>
<td>Artistic</td>
<td>3.74&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.76</td>
<td>3.81&lt;sub&gt;a&lt;/sub&gt;</td>
</tr>
<tr>
<td>Enterprising</td>
<td>3.20&lt;sub&gt;b&lt;/sub&gt;</td>
<td>.85</td>
<td>3.22&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Realistic</td>
<td>3.08&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.82</td>
<td>3.07&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td>Investigative</td>
<td>3.04&lt;sub&gt;c&lt;/sub&gt;</td>
<td>.88</td>
<td>3.00&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td>Conventional</td>
<td>3.01&lt;sub&gt;c&lt;/sub&gt;</td>
<td>1.02</td>
<td>3.04&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Values within columns that share identical subscripted letters are not significantly different at the .0033 confidence level.
interaction term, one-way ANOVAs were conducted separately for males and females. The overall F(5,750) of 87.59 for females only was significant, p = .0001. T-test results appear in Table 8. Social and Artistic general occupational themes were rated significantly higher than the Enterprising theme, which was rated higher than the Realistic, Investigative, and Conventional themes, the same significant differences as for the general sample.

The overall F(5,485) of 35.63 for males only was significant, p = .0001. Newman-Keuls comparisons for males also appear in Table 8. Males rated Artistic and Social themes significantly higher than the other four themes. The Enterprising, Realistic, and Investigative themes were rated higher than the Conventional theme, which received the lowest rating. Also, the Enterprising theme was rated higher than Investigative theme. Each of these differences met the .0033 criterion.

Influences on Career Choices

Gender differences in dependent variables. One-tailed t-tests were used to test for gender differences in dependent variables: science-relatedness of university major and Consideration of Realistic, Investigative, and Social occupations. The science-nonscience mean rating of 3.71 for males' majors was significantly higher than the 2.83 mean rating for females' majors, t(164) = 6.24, p < .01. Consideration of Occupations - Realistic was higher for males (M = 3.93) than for females (M = 2.26), t(164) = 9.23, p < .01. Similarly, Consideration of Occupations - Investigative was higher for males (M = 4.20) than for females (M = 3.59), t(164) = 2.95, p < .01. Finally, females scored higher (M = 4.49) than males (M = 3.79) on Consideration of
Occupations - Social, $t(165) = 3.39, p < .01.$

The relationship between gender and Holland code of occupation under greatest consideration was tested using chi-square analysis. Again there was a significant relationship, chi-square $(5, 239) = 36.68, p < .01$. Number of subjects who are giving greatest consideration to occupations from each of the six themes are categorized by gender in Table 9. The proportion of female subjects out of all subjects considering occupations with each Holland code are as follows: Realistic, 19%; Investigative, 32%; Artistic, 67%; Social, 73%; Enterprising, 67%, and Conventional, 42%.

Gender differences in mediating variables. Using the .01 level of significance, the mean ACT-Math score of 24.03 for males did not differ significantly from the mean ACT-Math score of 22.30 for females, $t(165) = 1.75, p = .041$. Males' mean MSE score of 7.80 was significantly higher than females' mean MSE score of 7.20, $t(239) = 4.19, p = .0001$. Females' mean score of 4.06 on LSI-Relationship was significantly higher than males' mean score of 3.57, $t(239) = 7.43, p = .0001$.

Representativeness of subjects with ACT-Math scores. Ninety-six of the 115 males had available ACT-Math scores, compared to 70 of the 124 females subjects who had ACT-Math scores available. A chi-square analysis indicated that gender was significantly related to ACT-Math availability (chi-square $= 6.635, df = 1, p < .01$).

A chi-square analysis was also conducted to assess the representativeness of subjects with ACT-Math scores across Holland code of occupation given greatest consideration. Holland code of occupation under consideration was significantly related to ACT-Math availability,
Table 9
Gender Differences in Single Occupation Given Greatest Consideration

<table>
<thead>
<tr>
<th>Holland Code</th>
<th>Male n</th>
<th>Female n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realistic</td>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td>Investigative</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Artistic</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Social</td>
<td>19</td>
<td>52</td>
</tr>
<tr>
<td>Enterprising</td>
<td>30</td>
<td>37</td>
</tr>
<tr>
<td>Conventional</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>124</td>
</tr>
</tbody>
</table>

Chi-square = 36.68, df = 5, p < .01.
chi-square $(5, N = 239) = 15.47, p < .01$. Only 52% of subjects giving greatest consideration to Social occupations had ACT-Math scores available, whereas percentages of subjects with available ACT-Math scores ranged from 70 to 80 for all other themes.

To test whether subjects with low MSE were systematically less likely to have ACT-Math scores available, an ANOVA was conducted blocking on gender and availability of ACT-Math scores, with MSE as the dependent variable. The effect of gender on MSE was significant, $F(1,235) = 9.21, p = .0027$, with women (mean = 7.20) scoring lower than men (mean = 8.00). However availability of ACT-Math scores was not significantly associated with MSE, $F(1,235) = 1.35, p = .2466$, nor was the Gender X ACT-Math Availability interaction $F(1,235) = .06, p = .8022$.

Relationships between gender, Holland code of the occupation considered, MSE, LSI - Relationship, and ACT-Math. Two-way ANOVAs were used to test the hypotheses that gender, Holland code of occupation under greatest consideration, and their interaction would be related to differences in ACT-Math, MSE, and Relationship Life-Style orientation. The ANOVA was repeated three times, with dependent variables of MSE, LSI-Relationship, and ACT-Math scores.

Gender was found not to be a significant predictor of ACT-Math, $F(1,154) = .08, p = .7820$. One-letter Holland code of occupations being considered was positively associated with ACT-Math scores, $F(5,154) = 3.77, p = .0030$. The gender-by-Holland code interaction term was not significant, $F(5,154) = .72, p = .6087$.

Newman-Keuls pairwise comparison tests indicated that subjects
considering Realistic occupations \( M = 28.07 \) had a higher mean ACT-Math score than the mean of those considering any other occupational type. Subjects considering Investigative \( M = 25.67 \), Enterprising \( M = 24.95 \), or Conventional \( M = 24.44 \) occupations had higher mean ACT-Math scores than those considering Social \( M = 21.16 \) or Artistic \( M = 20.57 \) occupations. Differences met the .01 significance level.

Using the two-way ANOVA, gender was found not to be a significant predictor of MSE, \( F(1,227) = 2.63, p = .1063 \). However, the difference was found to be significant using the more liberal one-tailed t-test reported above. One-letter Holland codes of occupations being considered was associated with MSE, \( F(5,227) = 6.01, p = .0001 \), whereas the gender-by one-letter code interaction term was not significantly related to MSE, \( F(5,227) = .71, p = .6136 \).

Newman-Keuls pairwise comparison tests indicated that subjects who selected occupations with Investigative \( M = 8.50 \), Realistic \( M = 8.41 \), or Conventional \( M = 8.15 \) one-letter Holland codes had higher MSE scores than subjects who selected occupations with Enterprising \( M = 7.29 \), Social \( M = 7.08 \), or Artistic \( M = 6.82 \) codes. Subjects considering entering Enterprising occupations had significantly higher MSE scores than those considering entering Artistic occupations also. Comparisons were made using the .01 significance level.

Gender was found to be a significant predictor of LSI-R scores, \( F(1,227) = 18.56, p = .0001 \). One-letter Holland codes of occupations given greatest consideration was related to LSI-Relationship scores, \( F(5,227) = 3.20, p = .0083 \), but the gender-by-Holland code interaction was not, \( F(1,227) = .55, p = .7414 \).
Newman-Keuls pairwise comparisons using a .01 confidence level indicated that subjects considering occupations with one-letter Social Holland codes ($M = 4.04$) scored higher on LSI - Relationship than did subjects who were considering Artistic ($M = 3.87$), Investigative ($M = 3.65$), Conventional ($M = 3.63$), or Realistic ($M = 3.42$) occupations, though they did not score significantly higher than subjects considering Enterprising ($M = 3.94$) occupations. Subjects considering Enterprising or Artistic occupations scored significantly higher on LSI Relationship than did subjects considering Investigative or Conventional occupations, who scored significantly higher than those considering Realistic occupations.

Results of hierarchical regression analyses. A series of hierarchical regressions was employed to determine if ACT-Math, MSE, and LSI-Relationship mediated gender differences in science-relatedness of university major and consideration of Realistic, Investigative, and Social occupations. Two analyses were run for each of the four dependent variables. For the first analysis in each pair, independent variables (IVs) were entered in the following order: gender, ACT-Math, MSE, and LSI-Relationship. Gender was entered after ACT-Math, MSE, and LSI-Relationship for the second analysis. Hierarchical regression analyses were conducted using BMDP2R.

Gender, ACT-Math, MSE, and LSI-Relationship were regressed on science-relatedness of university major. Table 10 displays the incremental $F$ values for each entering variable, and standardized regression coefficients (beta), along with $R$, $R^2$, and the adjusted $R^2$ after entry of all four IVs. $R$ was significantly different from zero at
Table 10
Hierarchical Multiple Regression of Gender, ACT-Math, MSE, and LSI-R on Science-relatedness of University Major

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{Increase}}$</th>
<th>df</th>
<th>Beta</th>
<th>$R^2_{\text{Increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>31.72**</td>
<td>1,162</td>
<td>.28</td>
<td>.14</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>38.00**</td>
<td>1,161</td>
<td>.29</td>
<td>.16</td>
</tr>
<tr>
<td>MSE</td>
<td>5.60*</td>
<td>1,160</td>
<td>.20</td>
<td>.02</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.02</td>
<td>1,159</td>
<td>-.01</td>
<td>.00</td>
</tr>
</tbody>
</table>

$R = .57^{**}$
$R^2 = .32$
Adjusted $R^2 = .31$

*p<.05.  **p<.01.
the end of each step. After step four, with all IVs in the equation, $R = .57$, $F(4,159) = 19.04$, $p < .01$. When entered first into the equation, gender accounted for 14% of the variance. ACT-Math accounted for an additional 16% of the variance. MSE accounted for an additional 2%. LSI-Relationship did not account for a significant proportion of additional variance beyond that accounted for by the first three IVs.

Table 11 displays comparable values when gender was entered into the equation last. ACT-Math accounted for 20% of the variance when entered first. MSE accounted for an additional 5%. LSI-Relationship did not account for a significant proportion of additional variance. Finally, gender accounted for 6% of unique variance. The block of three IVs: ACT-Math, MSE, and LSI-Relationship mediated more than half of the variance in science-relatedness of university major that was associated with gender.

A follow-up hierarchical multiple regression analysis was conducted using a dichotomized scale on the science-nonscience continuum. Because Realistic occupations consistently received the lowest relationship-compatibility ratings, it was thought that valuing relationships may weigh negatively on the decision to enter Realistic occupations. Upon examining the Goldman-Hewitt science-nonscience continuum, it was found that category 5, "Physical Sciences", which includes Engineering, was most closely related to Realistic occupations, whereas category 4, "Biological Sciences", which includes Biology and Physiology, was more closely related to Investigative occupations. Also, forty-four of the 49 subjects who were planning to major in a physical science were studying some branch of engineering, which is likely to lead to a
Table 11
Hierarchical Multiple Regression of ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, LSI-R\textsuperscript{c}, and Gender on Science-relatedness of University Major

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>Standardized Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT-Math</td>
<td>46.95**</td>
<td>1,162</td>
<td>.29</td>
<td>.20</td>
</tr>
<tr>
<td>MSE</td>
<td>11.42**</td>
<td>1,161</td>
<td>.20</td>
<td>.05</td>
</tr>
<tr>
<td>LSI-R</td>
<td>3.58</td>
<td>1,160</td>
<td>-.01</td>
<td>.02</td>
</tr>
<tr>
<td>Gender</td>
<td>13.37**</td>
<td>1,159</td>
<td>.28</td>
<td>.06</td>
</tr>
</tbody>
</table>

$R = .57^{**}$
$R^2 = .32$
Adjusted $R^2 = .31$

\textsuperscript{a}American College Tests - Mathematics (ACT-Math). \textsuperscript{b}Math Self-Efficacy (MSE). \textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R).

*\(p<.05\). **\(p<.01\).
Realistic occupation. Only three of the subjects who were not studying a physical science planned to enter Realistic occupations. Therefore, the science-nonscience continuum was dichotomized with categories of one through four collapsed into an "Other Majors" category. The Physical Sciences category was left intact. Gender, ACT-Math, MSE, and LSI-Relationship were regressed on the dichotomized physical science - other majors variable.

Table 12 displays the incremental F values for each entering variable and standardized regression coefficients (beta), along with R, R², and the adjusted R² after entry of all four IVs. R was significantly different from zero at the end of each step. After step four, with all IVs in the equation, R = .54, F(4,160) = 16.32, p < .01. When entered first into the equation, gender accounted for 9% of the variance. ACT-Math accounted for an additional 19% of the variance. Neither MSE nor LSI-Relationship accounted for a significant proportion of additional variance beyond that accounted for by the first two IVs.

Table 13 displays comparable values when gender was entered last into the equation. When entered first, ACT-Math accounted for 22% of the variance. MSE accounted for an additional 3%. LSI-Relationship did not account for a significant proportion of additional variance. Finally, gender accounted for 3% of unique variance. The block of three IVs: ACT-Math, MSE, and LSI-Relationship shared with gender 6% of the total variance, two thirds of the gender difference in whether or not subjects majored in physical sciences.

Gender, ACT-Math, MSE, and LSI-Relationship were regressed on Consideration of Realistic occupations. Table 14 displays the
Table 12
Hierarchical Multiple Regression of Gender, ACT-Math\(^a\), MSE\(^b\), and LSI-R\(^c\) on Dichotomized Physical Science Variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>(F_{\text{increase}})</th>
<th>df</th>
<th>\text{Standardized Beta}</th>
<th>(R^2_{\text{increase}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>19.17(^{**})</td>
<td>1,163</td>
<td>.21</td>
<td>.09</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>42.94(^{**})</td>
<td>1,162</td>
<td>.34</td>
<td>.19</td>
</tr>
<tr>
<td>MSE</td>
<td>2.71</td>
<td>1,161</td>
<td>.15</td>
<td>.01</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.43</td>
<td>1,160</td>
<td>-.05</td>
<td>.00</td>
</tr>
</tbody>
</table>

\(R = .54\)
\(R^2 = .29\)
Adjusted \(R^2 = .27\)

\(^a\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R).

\(^* p < .05. \quad ** p < .01.\)
Table 13
Hierarchical Multiple Regression of ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, LSI-R\textsuperscript{c}, and Gender on Dichotomized Physical Science Variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>Standardized Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT-Math</td>
<td>50.00\textsuperscript{**}</td>
<td>1,163</td>
<td>.34</td>
<td>.22</td>
</tr>
<tr>
<td>MSE</td>
<td>5.71\textsuperscript{*}</td>
<td>1,162</td>
<td>.15</td>
<td>.03</td>
</tr>
<tr>
<td>LSI-R</td>
<td>3.63</td>
<td>1,161</td>
<td>-.05</td>
<td>.02</td>
</tr>
<tr>
<td>Gender</td>
<td>5.90\textsuperscript{*}</td>
<td>1,160</td>
<td>.21</td>
<td>.03</td>
</tr>
</tbody>
</table>

$R = .54$

$R^2 = .29$

Adjusted $R^2 = .27$

\textsuperscript{a}American College Tests - Mathematics (ACT-M).
\textsuperscript{b}Math Self-Efficacy (MSE).
\textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R).

\textsuperscript{*}p<.05. \textsuperscript{**}p<.01.
incremental F values for each entering variable and standardized regression coefficients (beta), along with R, R^2, and adjusted R^2 after entry of all four IVs. R was significantly different from zero at the end of each step. After step four, with all IVs in the equation, R = .54, F(4,160) = 16.18, p < .01. When entered first into the equation, gender accounted for 27% of the variance. Neither ACT-Math, MSE, or LSI-Relationship accounted for a significant proportion of additional variance beyond that accounted for by gender.

Table 15 displays comparable values when gender was entered last into the prediction of Consideration of Realistic occupations. ACT-Math accounted for 2% of the variance when entered first. MSE accounted for an additional 3%. LSI-Relationship accounted for an additional 6%, all of which was shared with gender. Finally, gender accounted for 17% of unique variance. The block of three IVs: ACT-Math, MSE, and LSI-Relationship accounted for 11% of the total variance, 10% of which was shared with gender, more than a third of the variance in Consideration of Realistic occupations associated with gender.

Gender, ACT-Math, MSE, and LSI-Relationship were regressed on Consideration of Investigative occupations. Table 16 displays the incremental F values for each entering variable and standardized regression coefficients (beta), along with R, R^2, and the adjusted R^2 after entry of all four IVs. R was significantly different from zero at the end of each step. After step four, with all IVs in the equation, R = .29, F(4,160) = 3.66, p < .01. When entered first into the equation, gender accounted for 4% of the variance. ACT-Math did not account for additional variance. MSE accounted for 4% of the variance. LSI-
Table 14
Hierarchical Multiple Regression of Gender, ACT-Math, MSE, and LSI-R on Consideration of Realistic Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>Standardized Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>61.00**</td>
<td>1,163</td>
<td>.48</td>
<td>.27</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>1.80</td>
<td>1,162</td>
<td>.04</td>
<td>.01</td>
</tr>
<tr>
<td>MSE</td>
<td>.80</td>
<td>1,161</td>
<td>.09</td>
<td>.00</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.42</td>
<td>1,160</td>
<td>-.05</td>
<td>.00</td>
</tr>
</tbody>
</table>

$R = .54$

$R^2 = .29$

Adjusted $R^2 = .27$

Table 15
Hierarchical Multiple Regression of ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, LSI-R\textsuperscript{c}, and Gender on Consideration of Realistic Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT-Math</td>
<td>5.24*</td>
<td>1,163</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>MSE</td>
<td>6.84**</td>
<td>1,162</td>
<td>0.09</td>
<td>0.03</td>
</tr>
<tr>
<td>LSI-R</td>
<td>13.85**</td>
<td>1,161</td>
<td>-0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Gender</td>
<td>38.07**</td>
<td>1,160</td>
<td>0.48</td>
<td>0.17</td>
</tr>
</tbody>
</table>

$R = 0.54$

$R^2 = 0.29$

Adjusted $R^2 = 0.27$

\textsuperscript{a}American College Tests - Mathematics (ACT-Math). \textsuperscript{b}Math Self-Efficacy (MSE). \textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R). \textsuperscript{*}$p<0.05$. \textsuperscript{**}$p<0.01$. 

$R^2 = 0.29$

Adjusted $R^2 = 0.27$
Table 16
Hierarchical Multiple Regression of Gender, ACT-Math\(^a\), MSE\(^b\), and LSI-R\(^c\) on Consideration of Investigative Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>(F_{\text{increase}})</th>
<th>df</th>
<th>Standardized Beta</th>
<th>(R^2_{\text{increase}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>6.91(^{**})</td>
<td>1,163</td>
<td>.17</td>
<td>.04</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>.29</td>
<td>1,162</td>
<td>-.10</td>
<td>.00</td>
</tr>
<tr>
<td>MSE</td>
<td>6.98(^{**})</td>
<td>1,161</td>
<td>.25</td>
<td>.04</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.05</td>
<td>1,160</td>
<td>.06</td>
<td>.00</td>
</tr>
</tbody>
</table>

\(R = .29\)
\(R^2 = .08\)

Adjusted \(R^2 = .06\)

\(^a\)American College Tests - Mathematics (ACT-Math). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R).

\(^{**}\)p<.01.
Relationship did not add a significant proportion of variance beyond that accounted for by the other three IVs.

Table 17 displays comparable values when gender was entered last into the prediction of Consideration of Investigative Occupations. The R of .07 was not significantly different from zero after step 1, when only ACT-Math was entered, $F(1,163) = .69$, $p > .05$. R was significantly different from zero after steps two, three, and four. When entered first, ACT-Math did not account for a significant proportion of variance. MSE accounted for 6% of the variance. LSI-Relationship did not account for additional variance. Finally, gender accounted for 2% of unique variance. The block of three IVs: ACT-Math, MSE, and LSI-Relationship shared with gender only 2% of the total variance in Consideration of Investigative Occupations, all of which was attributable to MSE. Only 4% of the total variance was attributable to gender, half of which was mediated by MSE.

Gender, ACT-Math, MSE, and LSI-Relationship were regressed on Consideration of Social Occupations. Table 18 displays the incremental F values for each entering variable and standardized regression coefficients (beta), along with $R$, $R^2$, and the adjusted $R^2$ after entry of all four IVs. $R$ was significantly different from zero at the end of each step. After step four, with all IVs in the equation, $R = .41$, $F(4,160) = 8.18$, $p < .01$. When entered first into the equation, gender accounted for 4% of the variance. ACT-Math accounted for an additional 8% of the variance. MSE did not account for a significant proportion of the remaining variance. LSI-Relationship accounted for an additional 4% of the variance.
Table 17
Hierarchical Multiple Regression of ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, LSI-R\textsuperscript{c}, and Gender on Consideration of Investigative Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>$R_{\text{increase}}$</th>
<th>Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT-Math</td>
<td>.74</td>
<td>1,163</td>
<td>-.10</td>
<td>.00</td>
<td>0.00</td>
</tr>
<tr>
<td>MSE</td>
<td>9.96\textsuperscript{**}</td>
<td>1,162</td>
<td>.25</td>
<td>.06</td>
<td>0.06</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.04</td>
<td>1,161</td>
<td>.06</td>
<td>.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Gender</td>
<td>3.98\textsuperscript{*}</td>
<td>1,160</td>
<td>.17</td>
<td>.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>

$R = .29$

$R^2 = .08$

Adjusted $R^2 = .06$

\textsuperscript{a}American College Tests - Mathematics (ACT-Math). \textsuperscript{b}Math Self-Efficacy (MSE). \textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R).

\textsuperscript{*}p<.05. \textsuperscript{**}p<.01.
Table 18
Hierarchical Multiple Regression of Gender, ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, and LSI-R\textsuperscript{c} on Consideration of Social Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>$F_{\text{increase}}$</th>
<th>df</th>
<th>Standardized Beta</th>
<th>$R^2_{\text{increase}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>6.98**</td>
<td>1,163</td>
<td>-.07</td>
<td>.04</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>16.12**</td>
<td>1,162</td>
<td>-.31</td>
<td>.08</td>
</tr>
<tr>
<td>MSE</td>
<td>1.44</td>
<td>1,161</td>
<td>.07</td>
<td>.01</td>
</tr>
<tr>
<td>LSI-R</td>
<td>8.10**</td>
<td>1,160</td>
<td>.23</td>
<td>.04</td>
</tr>
</tbody>
</table>

$R = .41$

$R^2 = .17$

Adjusted $R^2 = .15$

\textsuperscript{a}American College Tests - Mathematics (ACT-M). \textsuperscript{b}Math Self-Efficacy (MSE). \textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R).

**$p<.01$. 
Table 19 displays comparable values when gender was entered last into the prediction of Consideration of Social Occupations. When entered first, ACT-Math accounted for 10% of the variance as a negative predictor. MSE did not account for additional variance. LSI-Relationship accounted for an additional 7% of the variance. Gender did not account for unique variance. The block of three IVs: ACT-Math, MSE, and LSI-Relationship shared with gender only 4% of the total variance in Consideration of Social Occupations. However, only 4% of the total variance was attributable to gender, all of which was mediated by ACT-Math and LSI-R.

Results of standard multiple regression analyses. A series of standard multiple regression analyses was performed with science-relatedness of university major as the dependent variable. The series was repeated three times with Consideration given to Realistic, Investigative, and Social occupations as dependent variables. Models with IVs of ACT-Math, MSE, LSI Relationship, and gender were compared to models that also included the interaction between gender and each of the other three IVs. Standard regression analyses were run using BMDP1R.

Table 20 displays the correlations between ACT-Math, MSE, LSI-Relationship and science-relatedness of major, the standardized regression coefficients (beta), the semipartial correlations, R, and R-squared. R for regression was significantly different from zero: $F(4,159) = 19.04, p = .0001$. Three of the IVs contributed significantly to the prediction of science-relatedness of university major: gender ($sr^2 = .06$), ACT-Math ($sr^2 = .05$), and MSE ($sr^2 = .02$). The four IVs in combination contributed another .19 in shared variability. Altogether
Table 19
Hierarchical Multiple Regression of ACT-Math\(^d\), MSE\(^b\), LSI-R\(^c\), and Gender on Consideration of Social Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>(F_{\text{increase}})</th>
<th>df</th>
<th>Standardized Beta</th>
<th>(R^2_{\text{increase}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT-Math</td>
<td>18.56(^{**})</td>
<td>1,163</td>
<td>-.31</td>
<td>.10</td>
</tr>
<tr>
<td>MSE</td>
<td>.46</td>
<td>1,162</td>
<td>.07</td>
<td>.00</td>
</tr>
<tr>
<td>LSI-R</td>
<td>12.86(^{**})</td>
<td>1,161</td>
<td>.23</td>
<td>.07</td>
</tr>
<tr>
<td>Gender</td>
<td>.75</td>
<td>1,160</td>
<td>-.07</td>
<td>.00</td>
</tr>
</tbody>
</table>

\[ R = .41 \]
\[ R^2 = .17 \]
\[ \text{Adjusted } R^2 = .15 \]

\(^d\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R).
\(^*p<.05. \quad ^{**}p<.01.\)
Table 20
Standard Multiple Regression of Gender, ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, and LSI-R\textsuperscript{c} on Science-relatedness of University Major

<table>
<thead>
<tr>
<th>Variables</th>
<th>Scinon\textsuperscript{d} (DV)</th>
<th>Gender</th>
<th>ACT-M</th>
<th>MSE</th>
<th>LSI-R</th>
<th>Standardized Beta</th>
<th>unique (sr^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scinon</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.37</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td>.28\textsuperscript{**}</td>
<td>.06</td>
</tr>
<tr>
<td>ACT-Math</td>
<td>.45</td>
<td>.13</td>
<td>1.00</td>
<td></td>
<td></td>
<td>.29\textsuperscript{**}</td>
<td>.05</td>
</tr>
<tr>
<td>MSE</td>
<td>.45</td>
<td>.26</td>
<td>.61</td>
<td>1.00</td>
<td></td>
<td>.20\textsuperscript{**}</td>
<td>.02</td>
</tr>
<tr>
<td>LSI-R</td>
<td>-.18</td>
<td>-.43</td>
<td>-.16</td>
<td>-.07</td>
<td>1.00</td>
<td>-.01</td>
<td>.00</td>
</tr>
<tr>
<td>Means</td>
<td>3.34</td>
<td>0.58</td>
<td>23.34</td>
<td>7.73</td>
<td>3.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard deviations</td>
<td>1.18</td>
<td>0.50</td>
<td>6.32</td>
<td>1.44</td>
<td>.55</td>
<td>(R^2 = .32^e)</td>
<td>(R = .57^f**)</td>
</tr>
</tbody>
</table>

\(^a\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R). \(^d\)Science-relatedness of university major (Scinon). \(^e\)Unique variability = .13; shared variability = .19.

\(^f\)p<.01.
32 percent of the variability in science-relatedness of university major could be predicted by knowing values on these four IVs.

The addition of interactions of gender with ACT-Math, MSE, and LSI - Relationship to the model did not add significantly to the prediction $F_{inc}(3,156) = 1.74$. Table 21 displays the standardized regression coefficients (beta), the semipartial correlations, $R$, and $R$-squared. In this model, only two of the IVs contributed unique variance to prediction of science-relatedness of university major: MSE ($sr^2 = .03$) and the Gender-by-ACT-Math interaction ($sr^2 = .02$). The seven IVs in combination predicted another .29 in shared variability. Altogether 35 percent of the variability could be predicted by knowing the four variables and the three interactions.

Table 22 displays the correlations between ACT-Math, MSE, LSI-Relationship and Consideration of Realistic Occupations, the standardized regression coefficients (beta), the semipartial correlations, $R$, and $R$-squared. $R$ for regression was significantly different from zero: $F(4,160) = 16.18$, $p = .0001$. Only one of the IVs, gender ($sr^2 = .17$), contributed significantly to the prediction of Consideration of Realistic occupations. The four IVs in combination contributed another .12 in shared variability. Altogether 29 percent of the variability in Consideration of Realistic Occupations could be predicted by knowing values on these four IVs.

The addition of interactions of ACT-Math, MSE, and LSI - Relationship with gender to the model did not add significantly to the prediction of Consideration of Realistic Occupations, $F_{inc}(3,157) = 1.77$, $p > .05$. Table 23 displays the standardized regression coefficients
Table 21
Standard Multiple Regression of Independent Variables and Interactions with Gender On Science-Relatedness of University Major

<table>
<thead>
<tr>
<th>Variables</th>
<th>Standardized Beta</th>
<th>sr² unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-.36</td>
<td>.01</td>
</tr>
<tr>
<td>ACT-M&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.08</td>
<td>.00</td>
</tr>
<tr>
<td>MSE&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.28**</td>
<td>.03</td>
</tr>
<tr>
<td>LSI-R&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.04</td>
<td>.00</td>
</tr>
<tr>
<td>Gender X Math&lt;sup&gt;d&lt;/sup&gt;</td>
<td>.76*</td>
<td>.02</td>
</tr>
<tr>
<td>Gender X MSE&lt;sup&gt;f&lt;/sup&gt;</td>
<td>-.45</td>
<td>.00</td>
</tr>
<tr>
<td>Gender X LSI-R&lt;sup&gt;g&lt;/sup&gt;</td>
<td>.37</td>
<td>.00</td>
</tr>
</tbody>
</table>

<sup>a</sup>American College Tests - Mathematics (ACT-M).  <sup>b</sup>Math Self-Efficacy (MSE).  <sup>c</sup>Life-Styles Inventory - Relationship (LSI-R).  
<sup>d</sup>Interaction between gender and ACT-Math score (Gender X Math).  
<sup>f</sup>Unique variability = .06; shared variability = .29.  <sup>g</sup>Interaction between gender and Math Self-efficacy (Gender X MSE).  
<sup>h</sup>Interaction between gender and Life-Styles Inventory - Relationship (Gender X LSI-R).  

*<i>p<.05</i>.  **<i>p<.01</i>.
Table 22
Standard Multiple Regression of Gender, \(^a\)ACT-Math, \(^b\)MSE, and \(^c\)LSI-R On Consideration of Realistic Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>ConReal(DV)</th>
<th>Standardized Beta</th>
<th>(sr^2) unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>ConReal</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.52</td>
<td>.48**</td>
<td>.17</td>
</tr>
<tr>
<td>ACT-M</td>
<td>.15</td>
<td>.04</td>
<td>.00</td>
</tr>
<tr>
<td>MSE</td>
<td>.23</td>
<td>.09</td>
<td>.00</td>
</tr>
<tr>
<td>LSI-R</td>
<td>-.26</td>
<td>-.05</td>
<td>.00</td>
</tr>
<tr>
<td>Means</td>
<td>3.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R). \(^d\)Consideration of Realistic Occupations (ConReal). \(^e\)Unique variability = .17; shared variability = .12. **\(p<.01\).
(beta), the semipartial correlations, R, and R-squared. In the model with interactions, only two of the IVs contributed uniquely to prediction of Consideration of Realistic Occupations: ACT-Math ($sr^2 = .02$) and the Gender-by-ACT-Math interaction ($sr^2 = .02$). The seven IVs in combination predicted .25 in shared variability. Altogether 31 percent of the variability could be predicted by knowing the seven IVs.

Table 24 displays the correlations between ACT-Math, MSE, LSI-Relationship and Consideration of Investigative occupations, the standardized regression coefficients (beta), the semipartial correlations, R, and R-squared. $R$ for regression was significantly different from zero: $F(4,160) = 3.66, p = .0070$. Only two of the IVs contributed significantly to the prediction of Consideration of Investigative Occupations: gender ($sr^2 = .02$) and MSE ($sr^2 = .04$). The four IVs in combination contributed .01 in shared variability. Altogether 8 percent of the variability in Consideration of Investigative Occupations could be predicted by knowing values on these four IVs.

Again the addition of interactions of ACT-Math, MSE, and LSI-Relationship with gender to the model did not add significantly to the prediction $F_{\text{inc}}(3,156) = 2.29, p > .05$. Table 25 presents the correlations between interaction values and Consideration of Investigative Occupations and the standardized regression coefficients (beta), the semipartial correlations, R, and R-squared. Only the gender-by-ACT-Math interaction contributed significantly to prediction of Consideration of Investigative Occupations ($sr^2 = .03$). The seven IVs in combination predicted another .06 in shared variability. Altogether
Table 23
Standard Multiple Regression of Independent Variables and Their Interactions With Gender On Consideration of Realistic Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Standardized Beta</th>
<th>unique sr&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>.20</td>
<td>.00</td>
</tr>
<tr>
<td>ACT-M&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.27*</td>
<td>.02</td>
</tr>
<tr>
<td>MSE&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-.02</td>
<td>.00</td>
</tr>
<tr>
<td>LSI-R&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.14</td>
<td>.01</td>
</tr>
<tr>
<td>Gender X Math&lt;sup&gt;d&lt;/sup&gt;</td>
<td>-.76*</td>
<td>.02</td>
</tr>
<tr>
<td>Gender X MSE&lt;sup&gt;f&lt;/sup&gt;</td>
<td>.61</td>
<td>.01</td>
</tr>
<tr>
<td>Gender X LSI-R&lt;sup&gt;g&lt;/sup&gt;</td>
<td>.35</td>
<td>.00</td>
</tr>
</tbody>
</table>

<sup>a</sup>American College Tests - Mathematics (ACT-M).  
<sup>b</sup>Math Self-Efficacy (MSE).  
<sup>c</sup>Life-Styles Inventory - Relationship (LSI-R).  
<sup>d</sup>Interaction between gender and ACT-Math score (Gender X Math).  
<sup>e</sup>Unique variability = .06; shared variability = .25.  
<sup>f</sup>Interaction between gender and Math Self-efficacy (Gender X MSE).  
<sup>g</sup>Interaction between gender and Life-Styles Inventory - Relationship (Gender X LSI-R).  

*<sup>p</sup><.05.  **<sup>p</sup><.01.
Table 24

Standard Multiple Regression of Gender, aACT-Math, bMSE, and cLSI-R On Consideration of Investigative Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>dConInvest (DV)</th>
<th>Correlations</th>
<th>Regression Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standardized</td>
<td>Unique s²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beta</td>
<td>sr²</td>
</tr>
<tr>
<td>ConInvest</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.20</td>
<td>.17*</td>
<td>.02</td>
</tr>
<tr>
<td>ACT-M</td>
<td>.07</td>
<td>-.10</td>
<td>.01</td>
</tr>
<tr>
<td>MSE</td>
<td>.23</td>
<td>.25**</td>
<td>.04</td>
</tr>
<tr>
<td>LSI-R</td>
<td>-.01</td>
<td>.06</td>
<td>.00</td>
</tr>
<tr>
<td>Mean</td>
<td>3.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>1.53</td>
<td></td>
<td>R² = .08*</td>
</tr>
<tr>
<td>deviation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


*p<.05. **p<.01.
Table 25
Standard Multiple Regression of Gender, ACT-Math, MSE, LSI-R, Gender X ACT-M, Gender X MSE, and Gender X LSI-R on Consideration of Investigative Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>ConInvest(^g) (DV)</th>
<th>Correlations</th>
<th>Regression Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardized Beta</td>
</tr>
<tr>
<td>ConInvest</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.20</td>
<td></td>
<td>-.20</td>
</tr>
<tr>
<td>ACT-M</td>
<td>.07</td>
<td></td>
<td>.18</td>
</tr>
<tr>
<td>MSE</td>
<td>.23</td>
<td></td>
<td>.17</td>
</tr>
<tr>
<td>LSI-R</td>
<td>-.01</td>
<td></td>
<td>-.11</td>
</tr>
<tr>
<td>Gender X Math</td>
<td>.15</td>
<td></td>
<td>-.89(^*)</td>
</tr>
<tr>
<td>Gender X MSE</td>
<td>.21</td>
<td></td>
<td>.45</td>
</tr>
<tr>
<td>Gender X LSI-R</td>
<td>.22</td>
<td></td>
<td>.67</td>
</tr>
<tr>
<td>Mean</td>
<td>3.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.53</td>
<td></td>
<td></td>
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</tbody>
</table>

\(^a\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R).
\(^d\)Interaction between gender and ACT-Math (Gender X Math). \(^e\)Interaction between gender and MSE (Gender X MSE). \(^f\)Interaction between gender and LSI-R (Gender X LSI-R). \(^g\)Consideration of Investigative Occupations (ConInvest). \(^h\)Unique variability = .06; shared variability = .06.
\(^*p<.05. \^{**}p<.01.\)
12 percent of the variability could be predicted.

Table 26 displays the correlations between ACT-Math, MSE, LSI-Relationship and Consideration of Social occupations, the standardized regression coefficients (beta), the semipartial correlations, R, and R-squared. R for regression was significantly different from zero: $F(4,160) = 8.18, p = .0001$. Only two of the IVs contributed significantly to the prediction of Consideration of Social Occupations: ACT-Math ($sr^2 = .06$) was a negative predictor and LSI-Relationship ($sr^2 = .04$) was a positive predictor. The four IVs in combination contributed another .06 in shared variability. Altogether 16 percent of the variability in Consideration of Social Occupations could be predicted by knowing values on these four IVs.

As with the other three interaction models, the addition of interactions between gender and ACT-Math, MSE, and LSI-Relationship to the model did not add significantly to the prediction of Consideration of Social Occupations, $F_{inc}(3,157) = 2.31, p > .05$. Table 27 illustrates the correlations between interaction values and Consideration of Social Occupations and the standardized regression coefficients (beta), the semipartial correlations, R, and R-squared. Gender ($sr^2 = .02$), LSI-Relationship ($sr^2 = .02$), and gender-by-ACT-Math interaction ($sr^2 = .01$) contributed significantly to prediction of Consideration of Social Occupations. The seven IVs in combination predicted another .16 in shared variability. Altogether 21 percent of the variability could be predicted by knowing the four independent variables and the three interactions.
Table 26
Standard Multiple Regression of Gender, ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, and LSI-R\textsuperscript{c} On Consideration of Social Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>ConSoc\textsuperscript{d} (DV)</th>
<th>Correlations</th>
<th>Regression Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standardized</td>
<td>unique (sr^a)</td>
</tr>
<tr>
<td>ConSoc</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.19</td>
<td>-.07</td>
<td>.00</td>
</tr>
<tr>
<td>ACT-M</td>
<td>-.31</td>
<td>-.31**</td>
<td>.06</td>
</tr>
<tr>
<td>MSE</td>
<td>-.15</td>
<td>-.07</td>
<td>.00</td>
</tr>
<tr>
<td>LSI-R</td>
<td>.30</td>
<td>.23**</td>
<td>.04</td>
</tr>
<tr>
<td>Mean</td>
<td>4.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>1.84</td>
<td></td>
<td>(R^2 = .16^e)</td>
</tr>
<tr>
<td>deviation</td>
<td></td>
<td></td>
<td>(R = .41^{**})</td>
</tr>
</tbody>
</table>

\(^a\)American College Tests - Mathematics (ACT-M). \(^b\)Math Self-Efficacy (MSE). \(^c\)Life-Styles Inventory - Relationship (LSI-R). \(^d\)Consideration of Social Occupations (ConSoc). \(^e\)Unique variability = .10; shared variability = .06. \(^{**}\)\(p<.01\).
Table 27
Standard Multiple Regression of Gender, ACT-Math\textsuperscript{a}, MSE\textsuperscript{b}, LSI-R\textsuperscript{c}, Gender X Math\textsuperscript{d}, Gender X MSE\textsuperscript{e}, and Gender X LSI\textsuperscript{f} On Consideration of Social Occupations

<table>
<thead>
<tr>
<th>Variables</th>
<th>ConSoc\textsuperscript{g} (DV)</th>
<th>Correlations</th>
<th>Regression Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standardized Beta</td>
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<tr>
<td>ConSoc</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.19</td>
<td>-.19</td>
<td>1.23\textsuperscript{*}</td>
</tr>
<tr>
<td>ACT-M</td>
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<td>-.13</td>
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<td>MSE</td>
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<td>-.15</td>
<td>.11</td>
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<tr>
<td>LSI-R</td>
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<td>.30</td>
<td>.28\textsuperscript{*}</td>
</tr>
<tr>
<td>Gender X Math</td>
<td>-.32</td>
<td>-.32</td>
<td>-.63\textsuperscript{*}</td>
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<td>Gender X MSE</td>
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<td>-.26</td>
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<td>Gender X LSI</td>
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<td>-.14</td>
<td>-.49</td>
</tr>
<tr>
<td>Mean</td>
<td>4.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a}American College Tests - Mathematics (ACT-M). \textsuperscript{b}Math Self-Efficacy (MSE). \textsuperscript{c}Life-Styles Inventory - Relationship (LSI-R).
\textsuperscript{d}Interaction between gender and ACT-Math (Gender X Math). \textsuperscript{e}Interaction between gender and MSE (Gender X MSE). \textsuperscript{f}Interaction between gender and LSI-R (Gender X LSI). \textsuperscript{g}Interaction between gender and Social Occupations (ConSoc). \textsuperscript{h}Consideration of Social Occupations (ConSoc). \textsuperscript{h}Unique variability = .05; shared variability = .16. \textsuperscript{*}p<.05. \textsuperscript{**}p<.01.
DISCUSSION

It was hypothesized that Realistic and Investigative occupations would be perceived as less compatible than Social occupations with relationship development, both on and off the job. This hypothesis was supported. Both males and females rated Social occupations as more likely than either Investigative or Realistic occupations to lead to their meeting relationship needs both inside and outside the job. Investigative occupations were rated as more relationship-compatible than Realistic occupations, also. The magnitude of the difference between the relationship ratings for Social occupations and those for Realistic occupations was greater for females than for males. Social occupations were perceived as more relationship-compatible by women than by men, accounting for much of the gender difference in magnitude of the range of ratings across general occupational themes. Males did not believe their relationship needs would be met in Realistic or Investigative occupations to any greater degree than did females.

It was hypothesized that Conventional occupations would be perceived as more compatible with developing relationships outside the job than would occupations with other general occupational themes. Conventional occupations were associated with greater expectations of meeting relationship needs outside the job than were Artistic, Enterprising, Investigative, and Realistic occupations. Thus the hypothesis was partially supported. However, ratings associated with Social occupations were significantly higher than ratings for Conventional occupations.

Two speculative hypotheses were made regarding leisure-
compatibility ratings. Enterprising occupations were hypothesized to have higher "leisure needs met outside the job" ratings than occupations with other general occupational themes. Social, Conventional, and Artistic occupations were rated higher than Enterprising occupations. Thus, the third hypothesis was not supported. The rank order for these ratings was the same as those for "relationship needs met outside the job", except for a slight variation for males' results. It appears that perception of time-demand associated with occupations is the critical factor affecting expectancies for meeting needs outside of the job.

The fourth hypothesis was that Artistic occupations would be perceived as more compatible with meeting leisure needs on the job than would occupations with other general occupational themes. Artistic and Social occupational themes were associated with expectations that leisure needs would be met as part of occupations to a greater degree than were other general occupational themes by both males and females. Thus the hypothesis that the Artistic theme would be associated with greater leisure inside the job ratings than other themes received support.

Based on expectancy-value theory, a relationship orientation would be expected to be predictive of entering occupations associated with expectations of meeting relationship needs. The test of the first hypothesis confirmed that female-dominated Social occupations were associated with greater expectation of meeting relationship needs, clarifying the nature of the outcome expectancy. Conventional occupations were perceived as likely to lead to relationship needs being met outside the job, also clarifying that outcome expectancy. The tests
of the third and fourth hypotheses had less relevance to the explanation of gender differences in career selection, given no previously documented gender difference in leisure orientation.

The hypotheses regarding gender differences in dependent variables used in the second study were supported. Gender differences in science-relatedness of university major and in Consideration of Realistic, Investigative, and Social occupations were in the hypothesized directions. Gender differences in Holland theme of the single occupation given greatest consideration were in the hypothesized directions as well, with more males than females selecting Realistic and Investigative occupations and more females than males selecting Social occupations. The gender difference in science-relatedness of university major replicated earlier findings (Goldman & Hewitt, 1976). The differences in consideration across general occupational themes was closely related to earlier findings of gender differences in interest and selection of occupations across general occupational themes (Lapan, Boggs, & Morrill, 1989).

Similarly, support for hypotheses regarding gender differences in MSE and LSI-Relationship replicated earlier research. The failure to find gender differences in ACT-Math was not unprecedented, as Betz and Hackett (1981) did not find significant gender differences. Females were less likely than males to have ACT-Math scores available, and subjects considering occupations with Social codes were less likely than those considering other types of occupations to have ACT-Math scores available. The speculation that subjects with low MSE may have avoided the ACT-Math was not confirmed. ACT-Math availability was not a
significant predictor of MSE. It appears that university departments of majors with more female students may have been less likely to record their students' ACT-Math scores on the university records, thus fewer females had scores available. Many of these students had Composite ACT scores recorded, thus they would have taken the ACT-Math test.

It was hypothesized that subjects who selected a Realistic or Investigative occupation as the single occupation they were giving greatest consideration would score higher on ACT-Math and MSE than subjects who had selected other occupations. These relationships were generally supported. Selection of a Realistic occupation was associated with higher ACT-Math scores than was the selection of any other type of occupation. Selection of an Investigative occupation was associated with higher ACT-Math scores than were selections of Social or Artistic occupations. Contrary to hypothesis, those who had selected Investigative occupations did not score significantly higher on ACT-Math than those who selected Enterprising or Conventional occupations. The selections of Investigative or Realistic occupations were associated with higher MSE scores than were the selections of Social, Artistic, or Enterprising occupations. Investigative and Realistic occupations were not associated with significantly higher MSE scores than Conventional occupations.

The hypothesized positive relationship between LSI-Relationship and the selection of Social occupations was supported. Subjects who selected Social occupations scored higher on LSI-Relationship than those who selected occupations with other Holland codes, though not significantly higher than those who had selected Enterprising
occupations.

The hypothesis that relationship orientation would account for variance in the prediction of science-relatedness of university major beyond that accounted for by ACT-Math and MSE was not supported. Consistent with hypothesis, MSE did account for variance beyond that accounted for by ACT-Math. The finding that MSE accounts for variance beyond ACT-Math replicated earlier findings.

LSI-relationship did add to the prediction of Consideration of Realistic Occupations, beyond ACT-Math and MSE. MSE also added to the prediction beyond ACT-Math. Thus the hypothesized relationships with Consideration of Realistic Occupations were supported.

Only MSE added to the prediction of Consideration of Investigative Occupations. The usefulness of LSI-Relationship in the prediction of Investigative Occupations was not supported.

Finally, although MSE did not add to the prediction of Consideration of Social occupations beyond variance associated with ACT-Math, LSI-Relationship did add to the prediction of variance, beyond that associated with ACT-Math and MSE.

ACT-Math, MSE, and LSI-Relationship were hypothesized to mediate gender differences in four dependent variables: science-relatedness of university major and Consideration of Realistic, Investigative, and Social occupations. Each independent variable was hypothesized to make independent contributions to the mediation of gender differences.

ACT-Math and MSE mediated slightly more than half of the gender difference in science-relatedness of university major. Relationship orientation did not mediate additional variance, however. Although
females have greater relationship orientation than males and expect relationship needs to be met to a lesser degree in science-related occupations, relationship orientation did not mediate a significant proportion of the gender difference in science-relatedness of major.

All except five of the 49 subjects who selected a physical science major were studying a branch of engineering, and engineering is a Realistic occupation. Because Realistic occupations consistently received the lowest relationship-compatibility ratings, the science-nonscience continuum was dichotomized to reflect a physical science - other major split. ACT-Math, MSE, and LSI-Relationship were tested for mediating effects. ACT-Math and MSE mediated small amounts of variance, accounting for two thirds of the gender difference in the dichotomized variable. The proportion of variance that was associated uniquely with LSI-Relationship approached, but did not reach significance at the .05 level.

ACT-Math, MSE, and LSI-Relationship each contributed to the mediation of gender differences in Consideration of Realistic Occupations. As a block, they mediated slightly more than one third of the gender difference, slightly more than half of which was attributable to the gender difference in LSI-Relationship.

The gender difference in Consideration of Investigative Occupations was relatively small; only four percent of the total variance was associated with gender. MSE mediated half of the gender difference. Contrary to hypothesis, ACT-Math and LSI-Relationship did not contribute variance.

It appears that gender differences in previously studied math-
related variables serve to screen women from science-related careers. Relationship orientation differences may serve as an additional filter for women entering physical sciences, the area in which fewest women are represented.

A small proportion of the variance in Consideration of Social Occupations was associated with gender, only four percent. The entire gender difference was mediated by gender differences in ACT-Math and LSI-Relationship. MSE did not make an independent contribution to the total variance beyond that accounted for by ACT-Math. Although all three IVs were hypothesized to mediate gender differences, the data supported the mediating effects of only two: ACT-Math and LSI-Relationship.

It was hypothesized that ACT-Math would be a better predictor of the science-relatedness of university major for male subjects than for females, whereas MSE and LSI-Relationship were hypothesized to be better predictors for female subjects than for males. It was also hypothesized that ACT-Math would be a better predictor of males' consideration of Realistic, Investigative, and Social occupations, whereas MSE and LSI-Relationship would be better predictors for females. When considered as a block, interactions between ACT-Math, MSE, and LSI-Relationship with gender did not add to the prediction of any of the four dependent variables. Thus the final two hypotheses received no support.

Conclusions

Math-related influences. The findings that ACT-Math mediates a portion of the gender difference in science-relatedness of university major and that MSE mediates additional variance replicated earlier
research. ACT-Math mediated gender differences in Consideration of Realistic and Social occupations, adding information about the decision-making process prior to the decision being narrowed to a single choice. MSE mediated some of the gender differences in Consideration of Investigative and Realistic occupations, beyond differences associated with ACT-Math.

Expectancy-value theory. Female-stereotyped occupational themes were associated with outcome expectancies of meeting relationship needs to a greater degree than were male-stereotyped occupational themes, which are generally related to science and math. Females are more relationship-oriented than males, on average. However, relationship orientation did not mediate gender differences in science-relatedness of university major across the five-point continuum.

Realistic occupations, closely associated with physical sciences, were rated as least compatible with meeting relationship needs, less compatible than Investigative occupations, which are more closely related to biological sciences. In a post-hoc regression analysis, the negative association between LSI-Relationship and selection of a physical science major approached but did not reach significance. LSI-Relationship mediated a portion of the gender difference in Consideration of Realistic Occupations, but it did not predict any variance associated with Consideration of Investigative Occupations. LSI-Relationship mediated gender differences in Consideration of Social Occupations, also. The possibility that gender differences in value for relationships may affect entry into physical sciences, but not biological sciences, is suggested by the data.
Comparison between self-efficacy and expectancy-value influences.

It appears that math self-efficacy influences account better than relationship value differences in explaining gender differences in career choices. Self-efficacy has been previously shown to be a better predictor than expectancy-value influences on college students' choice of major (Wheeler, 1983) and persistence in a scientific field (Lent, Brown, & Larkin, 1987). It was hypothesized that expectancy-value differences would account better for gender differences in career choices when relationship orientation was considered. The data provided only limited support for this.

Limitations

Although science-relatedness of university major was the primary dependent variable, most subjects were freshmen and sophomores. Therefore, subjects were predicting their future choices and actions. The selection of occupations given greatest consideration again reflects current thinking about an action to take place several years in the future. Therefore conclusions about majors and occupations apply to early thinking about decisions that will take place in the rather distant future. Clearly, many subjects will change their plans before they complete majors and begin their careers.

The design of the study was correlational. No attempt was made to experimentally manipulate the predictor variables. Therefore causal relationships cannot be determined. However, to the extent that gender differences in consideration of occupations and science-relatedness of university major are attenuated when variance associated with ACT-Math, MSE, and LSI-Relationship is ruled out it may be inferred that these
three variables mediate the effect of gender on career choices. Lent, Lopez, and Bieschke (1991) used a similar analysis to infer effects of mediating variables.

**Recommendations for Future Research**

In the current study, the importance of the distinction between physical sciences and biological science was supported in post-hoc analyses. Women are least represented in physical sciences. It appears that differences in relationship orientation may mediate gender differences in entering physical sciences but not biological sciences. The study needs to be replicated in a confirmatory effort to ensure that the pattern of results is not unique to this data set.

A longitudinal follow-up study could address two of the limitations. Actual majors in which students earn degrees would be a more meaningful outcome than are the current declared majors or major preferences. A longitudinal follow-up would address some of the causal relationships, given reasonable assumptions that correspond with chronology. For example, one would expect MSE to increase as students study mathematics. Therefore, studying mathematics may cause or be the result of high MSE. If MSE precedes the study of mathematics, more support for MSE’s influence is provided.

**Recommendations for Practice**

MSE mediates some of the gender difference in science-relatedness of university major beyond that accounted for by ACT-Math. MSE also mediated gender differences in Consideration of Investigative and Realistic occupations, beyond that accounted for by ACT-Math. Particularly because females tend to take fewer high school math courses
and subsequently score lower than males on the ACT-Math, counselors would be wise to ensure that their female clients are not prematurely and unnecessarily restricting themselves from math-related careers based on inaccurate assumptions.

It appears that females tend to avoid careers in physical sciences partially based on their outcome expectations of having relationship needs met to a lesser extent than they may in other careers. Counselors of women have the challenge of balancing the knowledge that women may fail to consider math-related careers based on faulty assumptions with sensitivity and respect for clients' values and outcome expectations they associate with the full range of options.

Finally, the accuracy of the outcome expectation has not been documented. Are male-oriented careers less relationship compatible than female-oriented careers? Given the consistency of female and male college students' perceptions, it would be surprising if the perceptions do not have some basis in reality. However, it also seems unlikely that job tasks in male-stereotyped occupations are inherently incompatible with the development of relationships, both inside and outside the job. It seems more likely that such occupations have been structured so as to support relationship development less than they could. Fox and Cohn (1980) found that mathematically talented girls were more likely to complete an accelerated mathematics program in an all-female section in which cooperation was emphasized than in mixed-gender sections in which competition was emphasized. It seems likely that norms, reinforcers, and sanctions in male-dominated adult organizations may not as supportive of fulfilling values that have been stereotyped as feminine
as they could be. Therefore, the final recommendation is directed at broad social change and is based on a value position rather than directly on the data. Those in positions of power should experiment with increasing job flexibility that allows workers to fulfill a more complete range of values.
REFERENCES

American College Testing Program (1989). Introducing the Enhanced ACT. ACT Publications: Iowa City, IA.


American College Testing Program (1983). Using the ACT assessment on campus. ACT Publications: Iowa City, IA.


ACKNOWLEDGEMENTS

I would like to acknowledge the people who have contributed to this project and more broadly to my development as a professional. Thank you to the members of my committee: to Dr. Kathy Benes, for your conscientious review of the manuscript, to Dr. Fred Borgen, for your thoughtful questions and input, and to Dr. Phyllis Miller, for your challenges to consider applications of research. Thank you to Dr. Robert Strahan for your statistical consultation. Thank you especially to my major professor, Dr. Douglas Epperson, for your on-going guidance and support as I have struggled with my research questions.

I would also like to thank my parents, Lillian and Clark Madison, for teaching me to consider ethical principles and guidelines long before I took a seminar. Thank you also to Dr. Marilyn Langhurst, my mentor during my undergraduate years, for your insistence that I continue my formal education. Thank you most of all to my husband, Brian. You have contributed emotionally and practically throughout the years of our marriage, which have coincided with my years as a graduate student. I look forward to our postdoctorate years.

This research has been approved by the Iowa State University Human Subjects Committee.
APPENDIX A:

INFORMED CONSENT FOR RELATIONSHIP AND LEISURE COMPATIBILITY QUESTIONNAIRE
Dear Research Participant,

I am collecting information about university students' perceptions of occupations. You will be asked to rate the extent of leisure and interpersonal relationship opportunities that you associate with various occupations. The information you provide will add a valuable component to the knowledge about the career decision-making process.

Your participation in this effort is voluntary, and your identity will be kept confidential. You will be instructed to use the last six digits of your social security number to code your answer sheets. Your identity will not be attached to your responses at any time.

The single questionnaire will take approximately 40 minutes. Completion of the questionnaire has no foreseeable discomforts or personal risks. You will earn one hour of extra credit in the psychology class that you specify on an extra credit card. You may ask questions or withdraw your consent at any time without penalty.

If you have questions regarding this study, you may contact me at 426 SSB, University Counseling Center, University of Utah, Salt Lake City, UT 84112. My telephone number is (801) 581-6826. Also you may contact the supervisor of this research, Douglas L. Epperson, Ph.D., at W206 Lagomarcino Hall, Iowa State University. His telephone number is (515) 294-2047.

If you have any difficulty concerning your rights, you may contact Dr. Norman Scott, Dr. Veronica Dark, and/or Dr. Lloyd Avant, Department of Psychology Ethics Committee Members, through the Department of Psychology, W108 Lagomarcino, Iowa State University. The Psychology Department telephone number is (515) 294-1743.

Thank you for your participation.

Sincerely,

Julie Corkery
Psychology Doctoral Candidate
APPENDIX B:
RELATIONSHIP AND LEISURE-COMPATIBILITY QUESTIONNAIRE
PLEASE NOTE

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APPENDIX C:

INFORMED CONSENT FOR STUDY OF FACTORS

INFLUENCING CAREER CHOICES
Dear Research Participant,

I am collecting information about university students' values and perceptions of their capabilities. The information you provide will add a valuable component to the knowledge about the career decision-making process.

Your participation in this effort is voluntary, and your identity will be kept confidential. You will be instructed to use your social security number to code your answer sheets. With your permission, your social security number will be used to confirm your ACT scores from university records. Given your permission, your social security number will also be used in a follow-up study five years from now to access information about the academic major you pursue. Only group data will be reported and analyzed. No individual scores will be reported. Your answer sheets will be separated from the questionnaires and stored in a locked file. Your answers will have no meaning separate from corresponding questions.

The questionnaires will take approximately 90 minutes. Completion of the questionnaires has no foreseeable discomforts or personal risks. You will earn two hours of extra credit in the psychology class that you specify on an extra credit card. You may ask questions or withdraw your consent at any time without penalty.

If you have questions regarding this study, you may contact me at 426 SSB, University Counseling Center, University of Utah, Salt Lake City, UT 84112. My telephone number is (801) 581-6826. Also you may contact the supervisor of this research, Douglas L. Epperson, Ph.D., at W206 Lagomarcino Hall, Iowa State University. His telephone number is (515) 294-2047.

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Thank you for your participation.

Sincerely,

Julie Corkery
Psychology Doctoral Candidate
PLEASE INDICATE YOUR SOCIAL SECURITY NUMBER: _____ - _____ - ______

CHOOSE ONLY ONE OF THE FOLLOWING OPTIONS. SIGN YOUR NAME AND INDICATE TODAY'S DATE AFTER THE OPTION TO WHICH YOU GIVE YOUR CONSENT.

OPTION 1:
In addition to use of the information I provide on the questionnaires today, you have my permission to confirm my ACT scores through university records. You may also access my eventual major from university records within the next five years. I understand that any information I provide will be kept confidential.

Signed________________________  Date____________

OPTION 2:
In addition to use of the information I provide on the questionnaires today, you have my permission to confirm my ACT scores through university records. You may NOT, however, access the record of my eventual major within the next five years. I understand that any information I provide will be kept confidential.

Signed________________________  Date____________

OPTION 3:
You may use the information that I provide on the questionnaires today. I do NOT give you my consent to access my ACT scores and my eventual major from university records. I understand that the information I provide on the questionnaires will remain confidential.

Signed________________________  Date____________
APPENDIX D:

DEMOGRAPHICS QUESTIONNAIRE
DIRECTIONS. PLEASE USE A NUMBER TWO PENCIL. FILL OVALS COMPLETELY.
On Side 1 of your first answer sheet, please enter the following information. Write your responses in the boxes and blacken the corresponding ovals in the grid.

1. Date of Birth. Indicate the month, day, and year of your birth.
2. Identification Number. Please enter your social security number using the first ten spaces on your answer sheet.
3. Special Codes. Enter "01" in the first two spaces.
4. Sex. Male or Female.
5. Grade or Educ. Please indicate current level according to the following:
   0 - non-degree seeking
   1 - freshman
   2 - sophomore
   3 - junior
   4 - senior
   5 - graduate student
   6 - other
6. Please specify your current major or the major you are considering currently. Please specify a major that you are considering, even if only tentatively.
   Major: _______________________
   Please circle the rating that reflects your level of certainty that you will pursue this major on a 1-to-10 scale, with "1" indicating "Not at all certain" and "10" indicating "Completely certain".

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<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

7. Please specify the occupation to which you are currently giving the most consideration. Please specify an occupation that you are considering, even if only tentatively.
   Occupation: _______________________
   Please circle the rating that reflects your level of certainty that you will pursue this occupation on a 1-to-10 scale, with "1" indicating "Not at all certain" and "10" indicating "Completely certain".

<table>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

8. Please indicate, to the best of your memory, the following:
   Your score on the ACT - Composite ______
   ACT - Mathematics ______
   ACT - English ______
   Did you take the ACT prior to October, 1989? ______
APPENDIX E:
MATH SELF-EFFICACY SCALE
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APPENDIX F:

LIFE-STYLE INVENTORY
Questionnaire # 5: LSI

Please enter your SOCIAL SECURITY NUMBER in the "identification number" section of your fourth answer sheet. Enter "04" in the first two columns under "special codes".

Instructions: Below are 45 statements which describe either attitudes or behaviors. Read each statement carefully and determine if the attitude is one that you hold or that the behavior is one that you engage in. Indicate your responses by blackening the appropriate circle on the answer sheet. Use the following key in determining which circle to blacken for each statement. Please note that the scale has five options.

1 - completely disagree
2 - somewhat disagree
3 - uncertain
4 - somewhat agree
5 - completely agree

1. Most of the people I admire are successful in their work.
2. I get sentimental about family and friends during holidays.
3. All work and no play make Jack and Jill dull persons.
4. A great deal of my time goes into "play" activities.
5. My friends help me maintain my self-esteem.
6. I feel best about myself when I work at a challenging job.
7. I often spend my evenings and weekends trying to catch up on my work or studies.
8. Working as a night guard (watchman) would bother me.
9. Most people do not know the importance of taking time out to enjoy life.
10. I often participate in leisure activities.
11. The greatest source of pride is in a job well done.
12. I feel at my best when I am with those I love.
13. My life would be empty without close friends.
14. People's main fulfillment should come from their job or occupation.
15. Childhood and retirement are the best periods of a person's life.
16. I spend at least as much time working or studying as my peers.
17. I seem to have a lot of time for family and friends.
18. Saturday and Sunday are the best days of the week.
19. I like to cook surprise dinners or do other nice things for my friends.
20. The best thing about weekends is being able to do what I want to do.
21. Hard work is its own best reward.
22. At work or school, I often daydream about the plans I have for the evening.
23. My address book has many names in it.
24. Some of my best and worst times occur while I am working.
25. Work and school are major sources of energy in my life.
26. When I have unexpected free time, I generally find a friend or relative to talk to.
27. I probably spend at least as much money on recreation as most people.
28. I want to be sure to have leisure interests throughout my life.
29. I am proud of my family and friends.
30. If I inherited a million dollars, I would continue to work.
31. Much of my creativity is expressed in work or school activities.
32. I live for weekends and vacations.
33. I (would) do not enjoy living alone.
34. I write or call my friends often.
35. The worst thing about work or school is not being able to do what I want to do.
36. The first thing I tell people about myself is my occupation or college major.
37. I get upset if I can't take time away for leisure activities.
38. I put much time and energy into meeting new people.
39. When I get really down, I usually take on a task that needs to be done.
40. Time really flies when I'm working or studying.
41. Helping friends is one of the most important things I do in my life.
42. When I get really down, I usually go do something just for fun.
43. I participate in sports/athletics because it gives me a chance to associate with people.
44. I get crabby if I don't get enough free time.
45. When I get an extra hour unexpectedly, I usually work on some unfinished task.

THANK YOU FOR YOUR PARTICIPATION.
APPENDIX G:

CONSIDERATION OF OCCUPATIONS SCALE
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APPENDIX H:

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