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Factors influencing the educational and occupational choices of women

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Factors Influencing the Educational and Occupational Choices of Women

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ABSTRACT

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The purpose of this study is to examine self-efficacy in mathematics and various motivating factors among female college students whom choose college majors in traditionally female-dominated fields as compared to those who chose college majors in traditionally male-dominated fields. The Mathematics Self-Efficacy Scale and an adapted version of the College Survey were administered to forty-six female college students. Differences between groups in the outcomes of the surveys were measured using a one-way anova for the MSES and a chi-square and gamma test for individual items from the College Survey. The findings were that the MSES indicated differences between the groups in the manner expected, but the differences did not prove to be statistically significant. There were statistically significant differences between the groups on different items from the adapted College Survey that indicated differences in motivational factors contributing choice of college major.

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Chapter 1: The Problem

Need

A need for research into the reasons why female students choose their respective fields of study in college is demonstrated by the fact that women are under-represented in a number of occupational fields which tend to be math and science- oriented, such as chemistry, computer science and engineering. The gender imbalance in these fields could be indicative of an imbalance in other sectors of social life, such as domestic life, the educational system, the media, or other areas not mentioned here. Examining the etiology of this phenomenon could therefore provide important insights into our culture and possible clues as to how to present math and science-oriented careers as viable options to women.

Purpose

The purpose of the study is to examine why the majority of female students tend to pursue academic and occupational paths in certain fields, which tend to be unrelated to mathematics. The study will examine self-efficacy in mathematics as well as various motivating factors among female college students whom choose non-traditional majors as compared to those who choose more traditional majors.

Hypothesis

The anticipated result of the study is that scores on the Mathematics Self-Efficacy Scale will be significantly higher for female students who chose college majors in traditionally male-dominated fields such as computer science, engineering, and chemistry than those of female students who choose to major in more traditional fields such as education, psychology, and social work. Subjects whose majors do not fall into either of the two categories will be put into a third category, for majors that are not clearly male or female-dominated, which for the purpose of this study will be termed the "neutral group". The questionnaire will indicate differences in perceived ability to perform various math-related tasks. The expectation is that scores on the Mathematics Self-Efficacy Scale will be highest for students in the non-traditional group, and lowest for students in the traditional group, with the neutral group scoring in between the other two groups. In addition, subjects will fill out a questionnaire concerning motivating factors involved in their choosing their respective majors. The independent variable in this study is the questionnaires that are being given. The dependent variable is the differences in questionnaire results between the three groups of subjects; those with traditionally female majors, those with non-traditional majors, and those with "gender-neutral" majors. The expectation is that that there will be significant differences in the results of both questionnaires for the students in the three groups.

Theory

Data collected by the U.S. National Center for Education Statistics in 1994 showed that higher concentrations of male students received degrees in majors such as engineering, computer science, architecture, chemistry, and physics, to name a few.

Heavier concentrations of female students were in education, social work, psychology, home economics, library science, and English (U.S. National Center for Education Statistics, 1996).

Many theorists have examined the reasons behind the low number of women in mathematically and scientifically-oriented fields. One theory that is comprehensive with respect to the subject is Eccles's Expectancy-Value Model of Achievement Motivation. Eccles proposes that achievement-related behaviors, specifically persistence, choice, and performance, can be predicted by an individual's evaluation of tasks, broad goals, self-schemata, and expectancies for success. Expectancies for success can apply to a broad or narrow domain, or be task-specific. Evaluations of tasks are influenced by socializers such as parents and teachers, and personal interpretations of past experiences. According to this model, occupational and educational choices are "influenced by expectations for success and the subjective values assigned to available achievement options"(Enman et.al. 2000). When engaging in achievement-related behaviors, individuals are influenced by perceptions of task difficulty, personal goals, self-concept, aptitudes, self-efficacy, and interpretations of past experiences. Eccles's model suggests these beliefs are shaped by one's perceptions of cultural norms, as well as social influences (Enman et.al. 2000).

Researchers have investigated the reasons why individuals choose to engage or disengage in various activities and how beliefs, values and goals relate to achievement behaviors. Research by Eccles and her colleagues has indicated that ability, self-concept and expectations about performance affect performance in math and English, while task evaluations predict enrollment decisions in math, physics, and English, as well as career choices. Self-concept and performance expectations relate directly to perceptions about

self-efficacy. According to Eccles and Wigfield (2002), the various prominent theories on achievement-related behavior can be grouped into categories.

Expectancy-focused theories examine beliefs about self-efficacy and competence, expectations for success, and perceptions of control over outcomes and offer explanations for performance, motivation and selection of tasks. Locus of control theories are included in this category, as well as Bandura's Theory of Self-Efficacy (Eccles and Wigfield 2002).

According to Bandura's theory, self-efficacy refers to one's expectations about his ability to successfully perform at a task or behavior. Low self-efficacy expectations about a certain behavior or behavioral domain leads to avoidance of those behaviors, and increases in self-efficacy should increase approach behavior. According to this theory, self-efficacy beliefs are formed and modified through information from past performance accomplishments, vicarious learning or modeling, verbal persuasion or encouragement, and emotional arousal, such as anxiety that arises in connection with a behavior (Bandura 1977).

Theories focused on the reasons for engagement, or values, include intrinsic motivation theories, goal theories, and interest theories. These theories are similar in that they focus on what motivates people to engage in certain tasks with an emphasis on rewards (Eccles and Wigfield 2002).

Covington's Self-Worth Theory also links ability and value-related constructs to motivation in academic settings, but is not easily classifiable as an expectancy or value-based model. He emphasized the motive to protect and maintain one's sense of self-worth, and hypothesized that children, who spend a large amount of time in school, are

motivated to protect their sense of academic competence as a major component of their self-worth. He discussed strategies that children use avoid threatening their sense of academic competence, including procrastination, making excuses, avoidance of challenging tasks, and not trying. By not trying, children do not risk failing and thus threatening their ability self-concepts and the opinions of others regarding their ability. Covington termed these strategies "failure-avoiding strategies", and discussed how even high-achieving students use such strategies. A study by Harter (1990) indicated that physical appearance and social competence predict self-worth more strongly than academic competence. Further research suggests that the power of any type of self-concept domain, for example, physical appearance, to influence one's overall sense of self-worth depends on the value that one attaches to that competence domain, and that people may reduce the value that they attach to tasks in domains in which they expect to fail to protect their sense of self-worth (Eccles and Wigfield 2002).

Theories that integrate expectancy and value constructs include Weiner's Attribution Theory and the Expectancy-Value model proposed by Eccles. Eccles's model is based in Attribution Theory in that it links achievement-related behavior to expectancy and task-value beliefs, but it also considers other psychological and social forces. Also, expectancies and values are considered to be positively related in Eccles's model, rather than inversely related, as in Weiner's model (Eccles and Wigfield 2002).

Expectancies in Eccles's model are defined as beliefs about how one will do on upcoming tasks in the immediate or long-term future. Eccles's conception of expectancies relate directly to Bandura's Self-Efficacy Theory; except whereas Bandura looked at outcome expectancies, Eccles' model looks at expectations related to self-

efficacy. Expectancies are distinguished from beliefs about ability, which are defined as an individual's evaluations of his or her competence in different domains, as opposed to beliefs about competence on a specific task (Eccles and Wigfield 2002).

Eccles et al. (1983) defined four components of task-value: attainment value, intrinsic value, utility value, and cost. Attainment value is described as the importance of doing well on a task and is also linked to engaging in a task that is relevant to confirming or disconfirming aspects of one's self schema, such as masculinity, femininity, or competence in various domains. Intrinsic value is the enjoyment one gets from an activity, or the subjective interest one has in an activity or subject. Utility value pertains to how well a task relates to a particular short-term or long-term goal, such as career goals. A task can have positive value because it facilitates the gain of important goals, even if the task itself is not enjoyable to the individual, such as, for example, a class. The fourth component of value defined by Eccles is cost. It is defined as the negative aspects of engaging in a task, such as performance anxiety or amount of effort needed to succeed (Eccles and Wigfield 2002).

Definitions

Academic self-concept: One's perception of oneself in terms of academic strengths and weaknesses, and overall aptitude or intelligence

Expectancies: An individual's expectations for success at a given task

Socializers: Parents, teachers, role models, cultural influences

Task-Evaluations: An individual's evaluation of a particular task, such as algebra regarding value, difficulty, and usefulness

Assumptions

Some basic assumptions of this study are as follows: 1) that the questionnaires being used will measure what they are supposed to measure: self-efficacy, task-evaluations, broad goals, social influences, and expectancies for success; 2) that all participants will interpret the survey questions in the same way; 3) the testing conditions will be the same for all participants; 4) the test will be administered in the same way for all participants; 5) that female students are fundamentally no different from male students in terms of aptitude, and gender differences in fields of study are due to extrinsic rather than intrinsic factors; and 6) that the groups of students are defined appropriately as traditional, non-traditional and neutral.

Limitations

Some limitations to this study related to validity are the sample size, selection process for the sample, and homogeneity of the sample. The geographic region of the population from which the sample was drawn was limited, and variability of the sample in terms of ethnicity was very limited.

Summary

The previous sections have discussed the purpose, need, hypothesis, and theory behind the study. The next chapter reviews theories of achievement motivation more in depth, as well as theories dealing with the psychology of women, including gender-schema formation, and a review of literature pertaining to the differential treatment of female students in education. In chapter three, the methods of the study will be

discussed. Chapter four reviews the outcomes of the study, and chapter five is a discussion of the results.

Chapter 2: Review of Literature

Introduction

Despite the large number of women in higher education, women are underrepresented in mathematically and scientifically related fields, such as Physics, Chemistry, Engineering, and Math. According to the data collected by the U.S. National Center for Educational Statistics in 1994, women earned 16% of the bachelor's degrees in engineering, 17.7% of bachelor's degrees in physics, and 28.4% of bachelor's degrees in computer and information sciences. Women also earned 77.3% of bachelor's degrees in education, 85% of those in social work, 73% of those in psychology, and 90.4% of those in nursing (U.S. National Center for Educational Statistics, 1996). According to White, (1992), women comprise 8% of the total of employed engineers, 36% of mathematical and computer scientists, and 27% of chemists. Psychologists have looked at a variety of factors in the etiology of this phenomenon. Research has indicated that social factors such as parental influences, classroom bias, and stereotypes affect women's achievement in science, as well as psychological factors such as perceptions of self-efficacy and ability, values, and attributions (Enman et. al. 2000).

Achievement Motivation

The motive to achieve is a basic component of motivation for college students. J.W. Atkinson considered achievement motivation to be composed of two polarities: "hope for success" and "fear of failure". According to this theory, each individual's

motive to achieve is comprised of some combination of these two psychological constructs. A study of Chinese students found that "hope for success" predominates for males, and "fear of failure" predominates among females, and thus concluded that among females, the achievement motive is passive (Cheng & Xie 2000).

A study in the Netherlands by Kuyper et. al. (2000), achievement motivation, fear of failure and prior achievement were found to be prominent predictors of mean achievement in fifth-grade students. A gender difference in the students' choice of examination subjects was also observed, with boys choosing mathematics, chemistry, and physics 30% more often than girls. A study in Israel looked at variations between schools at gender and ethnic inequalities in physics and biology courses. An analysis of twelfth graders showed that sciences were taken less often by underprivileged Jewish students, biology was taken more often by females, while physics was taken more often by males, and gender-typing was found to be more prominent in math-oriented schools (Ayalon 1995).

In a study on women's career aspirations in developing countries, six female doctoral students from a range of developing countries, including Africa, Brazil, Asia, the Pacific, and southern Europe, were interviewed about their motivations and challenges in pursuing higher education. The findings indicated that despite diverse cultural backgrounds, the women had many similar characteristics. They all had the intrinsic motivation to succeed in their professional development. In addition, they all felt that staring and maintaining a family was a necessary priority in their lives due to traditions and expectations of their respective cultural societies (Bhalalusesa 1998).

A study on the undergraduate student experiences of direct and re-entry college students in London used a questionnaire to examine the impact of age, gender, past experiences in school, and motivation for participating in higher education on academic self-concept, academic stress, and global self-esteem. Those students who were re-entry students rather than direct entry straight from high school reported more negative experiences of school. Results suggested that females expressed a lower academic self-concept than males. Self-reported academic stress levels were higher for students participating in higher education for career goals rather than interest. Higher academic self-concept was reported by students who claimed interest to be their primary motivation for attending (Mitchie et. al. 2001).

The Role of Values

The beliefs that one holds about the value of various tasks and their relevance to personal goals have a significant impact on motivation. Eccles and colleagues define subjective task-values as one's incentives for performing a task, and posit that one will perform tasks that they positively value and avoid tasks that they negatively value. Task value is composed of four factors in their model. The first is interest, which is personal enjoyment of the activity. The second is attainment value, which is the importance of accomplishing the task to confirm aspects of one's self-schema. The third is utility value, which is the relevance to the task to achieving one's goals. The fourth factor is cost, which is the negative aspects of engaging in a task. Results from a number of studies (Eccles 1984, Eccles & Harold 1991, Feather 1988, Meece, Wigfield, & Eccles 1990) have indicated that interest, perceived attainment value, and perceived utility value

predict choices such as taking math classes, engaging in sports, and choosing a major in college (Fredricks & Eccles, 2002). Research has found perceived self-efficacy at a given task and perceived task-value to be positively related. In addition, it has been found that the relationship between self competence in a given area and perceptions of utility value in that area grow stronger as children mature into adults. Research indicates that perceived competence is related to increased interest and perceived value for an activity (Eccles et. al. 1983, Eccles & Wigfield 1995, Harter 1986, 1990).

The Role of Attributions

Weiner's Self-Attribution Theory attributes the student success to six factors; effort, luck, task difficulty, ability, health, influence of others. Weiner's research indicated that males tend to most often to attribute achievement to ability and failure to lack of effort, while females tend to attribute achievement to effort or luck and failure to lack of ability, leading to the conclusion that female students lack self-confidence. In a study of college students at Hubei University, significant differences in student's attributions for success and failure were found across gender. Males attributed success primarily to effort, and secondly to ability, while females attributed success primarily to effort and secondarily to task difficulty. Males attributed failures to primarily to lack of effort and secondarily to task difficulty, while females attributed failures primarily to effort, and secondly to their lack of ability (Cheng & Xie 2000).

Learned helplessness is a concept that relates to attributional theory, in that it involves the way individuals interpret their perceptions of their abilities and the causes of outcomes. An individual who has developed learned helplessness does not perceive a

connection between his behavior and outcomes. A student who is "learned helpless" believes that no matter what he does, or how hard he tries, he will not be able to do well in school. A learned helpless student sees no stable connection between his behavior and the outcome of achievement. Often students with learning problems develop this orientation; they attribute their history of academic failure to lack of ability, which they see as stable, uncontrollable and internal. Research has shown that students high in learned helplessness are less likely to persist at tasks (Linnenbrink & Pintrich, 2003).

Self-Efficacy and Motivation

The concept of self-efficacy is part of a larger theory called social cognitive theory, which postulates that achievement depends on an interaction between behaviors, cognitions and feelings, and the environment (Bandura 1986). Bandura (1977) described self-efficacy one's estimate that a given behavior will lead to certain outcomes. He presented four factors that influence this construct: mastery experiences, physiological and emotional cues, vicarious experiences, and verbal persuasion. Self-efficacy is hypothesized to influence task choice, effort, persistence, and achievement (Bandura 1986). Students who feel competent participate more readily, work harder, persist longer and achieve more. This construct has contributed to professionals' understanding of how student beliefs about academic self-efficacy are good predictors of academic achievement and subsequent career choices. Educational research into writing competence has indicated that student confidence in writing skills is related to writing competence, perceived value of writing, and achievement goals. Some researchers have gone so far as to suggest that teachers and counselors should consider student perceptions of

competence to be as important as actual competence because perceptions can more accurately predict student motivation and subsequent academic choices (Pajares et. al. 2001). Unrealistically low perceptions of self-efficacy can be responsible for maladaptive academic behavior, avoidance of courses, and diminished school interest and achievement (Bandura, 1997; Betz & Hackett, 1997).

An individual's feelings of self-efficacy are a primary determinant of motivation. In a longitudinal study by Jacobs et. al. (2002), perceptions of self-efficacy and the value of tasks for children in grades one through twelve in the domains of mathematics, language arts and sports. The impact of changes in perceived self-competence on changes in task-value judgments was examined, as well as gender differences in mean levels and trajectories of change in perceived competence and values. The study found that for both genders, perceptions of competence and task values declined with age within all domains, at different degrees and rates for each. Significant gender differences were found in most domains. The developmental trajectories were domain-specific. The gender differences did not appear to increase with age, as would be expected according to some socialization theories. Beliefs about self-competence were found to account for much of the age-related decline in perceptions of task-values, and accounted for most of the gender differences in task value judgments for language arts and sports. The gender differences in task-value judgments were different for all three domains; thus, the degree to which perceived competence accounted for gender differences in task-value judgments varied as well. Competence beliefs in math differed for boys and girls in mean level and trajectory over time, although boys and girls were nearly identical in math-value judgments.

Students were found to be much more likely to value math, language arts, and sports when they felt competent in the domain.

In correlational studies of self-efficacy and academic performance, students are asked about their feelings of self-efficacy about a task and then asked to perform the task. Such studies have shown that self efficacy judgments predict student effort, persistence, and performance on the task, even when another measure of prior knowledge in the subject area exists (Linnenbrink & Pintrich, 2003). In experimental studies where students are assigned to two conditions, one group receiving instruction, and the other receiving instruction plus feedback to enhance self-efficacy, those receiving the encouraging feedback showed improved efficacy, effort, persistence and performance over the instruction-only group (Linnenbrink & Pintrich, 2003).

When a student feels academically un-efficacious, anxiety can result. One study aimed at examining the causes of math anxiety reported the observation that students had a feeling of urgency to understand the material, and that these feelings often led to anxiety when they could not arrive at a solution (Murr 2001). A body of research has been devoted to understanding how college students approach the study of math-related topics and coursework. As many as one-third of college students who consult university counseling centers discuss for "math-anxiety" concerns (Piotrowski et. al. 2002). Many of these are students in the social sciences; commonly, psychology majors experience high levels of stress surrounding statistics courses. Several authors have developed instruments to assess "statistics anxiety" such as the Statistics Anxiety Scale or the Mathematics Information Processing Scale (Piotrowski et. al. 2002). In a study by Brownlow et. al. (1997) to examine the influence of gender, background, and personality

factors on science anxiety students took the Science Anxiety Scale (Mallow, 1994), provided background information about past experiences, and completed several scales that examined personality attributes, including the Fear of Negative Evaluation (Leary, 1990), Perfectionism (Burns, 1980), Self-Handicapping (Jones & Rhodewalt,1991), and (Multidimensional-Multiattributional Causality Scale; Lefcourt, von Baeyer, Ware, & Cox, 1979), which examined attributional styles. Results showed that students with science anxiety took fewer science courses in college, and reported that their science teachers were not helpful. Results also indicated that students with science anxiety also were perfectionistic, which the authors took to suggest that science anxiety may result from a desire to avoid tasks that do not ensure success, rather than a dislike of the subject or lack of ability. It was reported male subjects displayed more self-handicapping and made more external attributions for their failures, such as luck. Other gender differences reported involved differential interpretations of personal ability for males and females, and the influence of parental gender typing on their pursuit of science (Brownlow et. al. 2000).

Socialization: At Home and In the Classroom

Social influences, such as that of parents, teachers, and cultural norms contribute to the educational and career decisions of women. The socialization of women begins in childhood. Social influences shape beliefs about self-efficacy and the value of activities, which in turn impact children's motivation and participation. Eccles and colleagues developed a model to explain how socializers such as parents and teachers influence a child's competence and value-beliefs. Parents' perceptions of their children's abilities are

very influential. Children's beliefs are shaped by parental messages about their ability and the value of participating in activities. Research has supported a short-term link between parental beliefs and children's beliefs (Eccles, 1993; Jacobs & Eccles, 1992; Parsons, Adler, & Kaczala, 1982). One's competence-related beliefs are judgments about one's ability to accomplish certain tasks, expectations for future performance, and self-efficacy (Fredricks & Eccles, 2002). These beliefs impact effort, persistence, engagement, and achievement, and have been proven to do so even after previous performance has been controlled in studies (Bandura, 1994; Eccles et al. 1998; Schunk, 1991).

According to cognitive developmental theories, the children engage in gender typing while in the process of forming an understanding of oneself and the world. Once the process has begun, children begin to act female or male in their interests, according to the gender identity that they adopt (Matlin 98). Social learning theory says that boys and girls learn to act masculine and feminine by imitating adults and receiving rewards for the "correct" behavior (Matlin 97). These concepts are incorporated into Bem's Gender Schema Theory (Matlin 101). Bem said that we use gender as a cognitive organizing principal in forming our understanding of the world. Gender schema theory incorporates elements of social learning theory and cognitive developmental theories by saying that children actively form these schemas, but that society is responsible for the elements incorporated into these schemas. Children are taught to gender type their world, and they also evaluate themselves accordingly (Matlin 101). Perhaps the most powerful influence on this process is input from parents. Research examining the relationship between maternal occupations and goals of their pre-school age children indicated a relationship

between what the children wanted to be when they grew up and the mother's occupation (Jacklin & Reynolds 202). A study by Levy (1989) showed that girls whose mothers were employed demonstrated greater gender-role flexibility (Jacklin & Reynolds 203). In a study by Burke and Tully (1977), middle school students were given a survey about their perceptions of masculine and feminine, and rated themselves on a list of typically masculine and feminine attributes. Among boys and girls, those with a more feminine self- image did better in all subjects, including math and science, than students with a more masculine self image (Burke 164). This finding seems to suggest that "people with particular role identities choose behaviors which have meanings similar to the meanings of their own identities" (Burke 165) and that one defines one's own gender identity based on an interrelation of factors more complex than thier biologically determined sex.

A study by Jodl et. al. (2001) examined the relationship between dimensions of parenting with adolescents' occupational aspirations. Multiple measures were used to indicate parental values and behaviors, adolescents' values and behaviors, adolescents' positive identification with parents, and occupational aspirations. In the academic domain, parents' values were found to predict their children's values directly through their behaviors. Contrary to expectations, positive identification with parents did not affect the transmission of values from parents to children. However, positive identification with parents was directly related to adolescents' values in academics. Results of the study indicated that parental values predict adolescents' occupational aspirations both directly and indirectly. Higher paternal perceptions of their children's academic ability were related to higher evaluations of academic self-concept in adolescents. Maternal judgments of "chances for positive outcomes" were positively

related to adolescents' aspirations. Adolescents' educational expectations most strongly predicted career aspirations. Similar results were found for both African American and European American males and females. The findings of the study were taken by the authors to be demonstrative of the high amount of influence that parents exert as socializers of achievement-related values, and adolescents' occupational aspirations. The results also indicated that the link between parental values and adolescent occupational aspirations is mediated by the adolescents' expectations for academic success (Jodl et. al 2001). One could see this last point as applicable to a scenario for example, of an adolescent, whose parents want him to go to medical school, while the more powerful impact of negative academic experiences influences him to instead pursue a career that does not require a college degree.

Another study investigating the role of family as an influence on gender-typing and achievement in science, young adolescent students averaging between eleven and thirteen years of age were observed with their parents engaging in structured teaching activities. One observation was that the teaching language of fathers with sons was more "cognitively demanding" than with daughters. Results from questionnaires in the same study indicated that parents were more likely to believe that science was more difficult and uninteresting for daughters than sons. Also, parental beliefs were found to be significantly predictive of children's perceived self-efficacy and interest in science (Tenenbaum 2003).

There has been extensive research and debate concerning the topic of the differential treatment of male and female students. Different treatment leads to different educational experiences across gender. Research has indicated a general tendency of

teachers to interact differently with male students than with female students at the elementary, middle, and high school levels. Generally, male students receive more attention in class from teachers than female students. These interaction patterns may partially depend on the gender of the teacher and the subject of the class (Duffy, Warren, Walsh 2001). Educational experiences can have lifetime effects on an individual's academic and professional development. Because they provide the motivation and ability for achievement in the business and financial sectors and elsewhere, discrimination at the school level is potentially devastating for women (Grossman & Grossman, 1994; Sadker & Sadker, 1994).

Studies involving analyses of classrooms have found that female students receive less active instruction, and that there are differences across gender in both the amount and type of teacher attention that is received. Research in elementary schools has shown that teachers with good intentions inadvertently tend to spend more time directing, correcting, and paying attention to boys. Boys are often the "main characters" in the classroom; those students who take up the majority of the teacher's time and attention and tend to dominate classroom discussions. Quantified analyses of classrooms have found that on average, boys are 12 times more likely than girls to talk in class and five times more likely to get the teacher's attention. The teacher attention can be positive as well as negative. A typical scenario would be one in which the teacher has to consistently attend to the same boys because of their behavior; they may joke around, call out in class, ask more questions (not necessarily related to the lesson), and "perform" for their classmates. Girls are more often quiet and well-behaved. In a series of classroom observations, boys dominated discussions and called out questions and comments eight times more than

girls. When asked why they spend more time helping boys, a common teacher response is that "boys need it more"(Sadker & Sadker 1994). Other researchers have framed the same phenomenon differently, stating that boys seem to receive more attention because they initiate more interaction with teachers than the girls. In both elementary and junior high school classes, boys were observed to be more likely to call out in class than girls (Duffy, Warren & Walsh 2001).

Some research has indicated that the quality or type of instruction that is given to boys and girls is also different. During classroom observations, teachers were more likely to give instructions to boys on how to do things for themselves, while they were more likely to do things for girls rather than offer instructions (Sadker & Sadker 1994).

The various studies pertaining to the effect of differential classroom treatment on subsequent academic achievement have yielded somewhat contradictory results.

A concern of some educational researchers is that classroom bias contributes negatively to many adolescent girls' self-esteem. One component of self-esteem is perceived self-efficacy. Compared to boys, girls think less of their academic skills and shy away from certain academic subjects, particularly math and science. According to the survey conducted by the American Association of University Women, 55% of elementary-age boys agreed that they were "good at a lot of things"; the number declined 13 points to 42% in high school. For girls, the number in agreement was 45% in elementary school, and declined 22 points to 23% in high school (Sadker & Sadker 1994). Lack of confidence is often a primary reason that females do not enroll in many of the higher level math and science classes, thus creating obstacles for success in the future. It is also likely that females are not offered the necessary encouragement to excel

in these areas (Campbell & Evans, 1994). Female students who do enroll in these classes find themselves in a predominantly male environment, with teachers who more frequently favor male students with positive feedback and attention for achievement (Grossman & Grossman, 1994). This differential treatment given to males and females sends subtle messages to students that high academic achievement is a male domain (Jones et. al. 2000).

Other researchers have challenged educational gender bias theories, and have questioned the importance of conscious reports of self-esteem, which is a commonly used method of measuring the construct. One study suggested that self-esteem is not a good indicator of academic achievement or future success, pointing out found discrepancies between girls' high grades and reported low self-esteem. It has been argued that students may think well of their abilities and perform poorly, or vice versa, and that it is difficult to quantify the effects of self-esteem in any direct way (Woodward 1998).

It has been hypothesized that perceived self-efficacy within domains such as mathematics can be socially influenced, and that the strength or extent of this influence increases with age. Fredricks and Eccles (2002), examined changes in children's perceived self-competence and value-judgments in the stereotypically male domains of mathematics and sports from the beginning of elementary school to the end of high school. The study was similar to that of Jacobs et. al. (2002), but using a different analytic techniques and examining data spanning a larger age range. Building from prior research, they hypothesized that interest and perceptions of competence and value would decline for all students over time, but that boys would have higher perceptions of self-efficacy and value in the given domains. It was hypothesized that the gender gap would

increase with age due to socialization of gender roles, and to a larger extent in sports than math, because sports is a more stereotypically masculine domain. The authors also hypothesized that children whose parents had higher perceptions of their competence would have higher competence and value beliefs, and that the relationship would be stronger in the domain of sports than in math. Correlations between children's beliefs, parental beliefs, and aptitude measures in math and sports were calculated at the beginning of the study and end of elementary school to see changes over time. Results of the study indicated that children's perceptions of competence were positively related to their reported interest and perceptions of activity-value at both time points. The strength of this relationship was stronger in the later grades for both domains, and overall stronger for sports than math. Parental ratings of their children's ability were most strongly related to their children's perceptions of their own ability, and the strength of the relationship increased over time. Parental beliefs were found to influence patterns of change in children's competence and beliefs over time as well. Student perceptions of mathematics and sports ability decreased over time for both genders. When parental perceptions of their children's ability are high, the decline in children's self-competence and task values are less dramatic over time. Corresponding decreases in perceived importance were also observed, however an increase in the judgment of mathematics importance appeared in tenth grade, which the authors estimated to be related to students' increased recognition of mathematics importance in high school for future educational and occupational pursuits, as students become more oriented to thinking about the future. Corresponding increases in mathematics interest were not viewed, however, a result that supports Eccles's theory that interest and importance are distinct components of the judgment of

value (Eccles et. al. 1983). The results did not support that hypothesis that the gender gaps should increase with age due to socialization; instead, they supported more egalitarian theories, which state that although boys and girls enter school with sex-typed beliefs and interests, experiences in and out of school reduce those differences. As expected, a gender gap was found for both domains. However, the gender gap decreased over time in math, while the gender gap in sports remained relatively stable from childhood to adolescence. The authors' interpretation of this unexpected finding was that participation in math has become more socially acceptable for girls over the past two decades, while sports involvement is still viewed as a more masculine activity, and that due to lower sports participation for girls, fewer opportunities are had for success that would modify competence beliefs (Fredricks & Eccles, 2002).

Summary

Social influences such as that of parents and teachers impact achievement motives directly through modeling, gender stereotyping, and nonverbal cues, as well as indirectly, by affecting self-efficacy beliefs, which impact on motivation, values, and goals. An individual's motive to achieve is reduced when feelings of academic self-efficacy are low. Research supports the idea that individuals adjust their values and interests to coincide with areas in which they feel efficacious. A wealth of research supports the fact that parental influences strongly impact children's self-efficacy and goals. Some educational researchers have determined through quantitative observational analyses that gender biases exist in the classroom, which affects self esteem and self-efficacy in female students negatively. Studies relating to attributional theory have concluded that female

students are less academically confident, in that they tend to attribute their academic successes to factors other than innate ability. Low self-efficacy or confidence, overall as well as in specific domains, has a significant role in determining the academic choices that an individual makes.

Chapter 3: Design of the Study

Restatement of Hypothesis

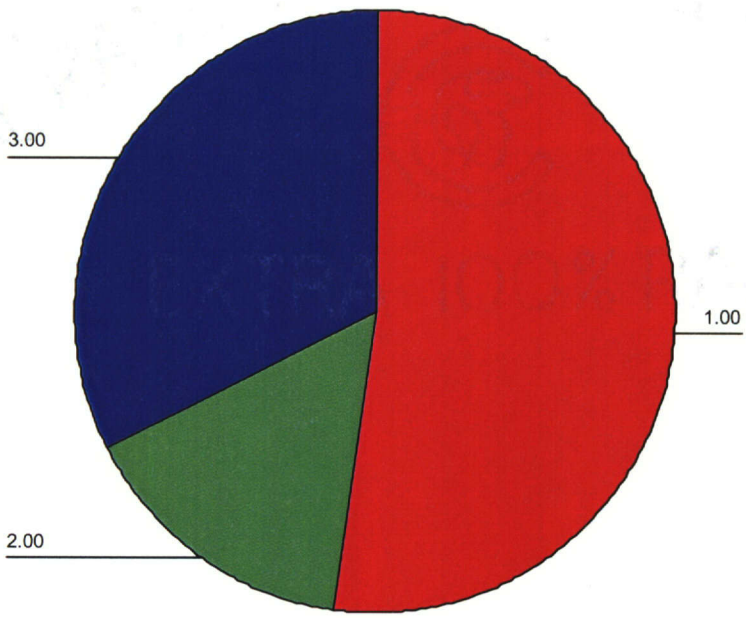
Scores on the Mathematics Self-Efficacy Scale will be significantly higher for female students who chose college majors in traditionally male-dominated fields than those of female students who chose to major in traditionally female fields. Subjects in the neutral category of majors that are not clearly male or female-dominated will score higher than the traditional group, but lower than the non-traditional group. There will also be significant differences in the information gathered in the adapted College Survey among the three groups. The null hypothesis is that there will be no significant difference between the scores on the MSES or the adapted College survey among the three groups.

Sample

Forty-six female college students from Rowan University were surveyed. Each subject indicated their college major on the survey. Each subject was classified as "traditional", "non-traditional" or "neutral" depending on their choice of major. This determination was based on the data collected by the U.S. National Center for Education Statistics, which lists the percentages of Bachelor's Degrees Conferred to Women in various major fields of study in 1994. Majors in which the percentage of degrees conferred to women was below 41% were categorized as non-traditional; fields in which 41%-59% of degrees were conferred to women were categorized as neutral, and majors in

which 60% and above of the degrees were conferred to women were categorized as traditional. The age of the sample ranged from 18 to 25 years. The ethnicity of the sample was 86% white/Caucasian, 2% African American, and 2% Puerto Rican; 10% did not indicate their ethnicity. The sample consisted of 51% traditional majors, 15% non-traditional majors, and 34% neutral majors.

3.1 Breakup of Sample by College Major



1= Traditionally female-dominated college majors; 51%

2= Traditionally male-dominated college majors; 15%

3= Neutral college majors (not clearly male or female-dominated); 34%

Measures

The Mathematics Self-Efficacy Scale (MSES) is a survey intended to measure beliefs regarding personal ability to perform various mathematically-related tasks. Three behavioral domains are addressed in the survey. The first is solving math problems, such

as those that would typically be found on an aptitude test. The second domain is mathematical behaviors required in every day life, such as calculating tax or tip. The third is performance in college courses requiring mathematical knowledge and mastery.

The reliability evidence for the MSES is good. In testing internal reliability values, a coefficient alpha of .96 was found by Betz and Hackett for the overall scale, and .92, .96, and .92 for the tasks, problems, and courses subscales. Other researchers reported similar findings. Test-retest reliabilities at a four-week interval were found to be .68, .72, and .75 for the tasks, problems, and courses subscales (Betz and Hackett 1993).

There has been extensive analysis confirming the validity of the MSES. There is evidence for content, concurrent, and construct validity, according to a number of studies by the scale's authors as well as various other researchers (Betz and Hackett 1993).

A questionnaire composed of questions taken from the "College Survey", one of several student questionnaires used in the Michigan Study of Adolescent and Adult Life Transitions will be administered to ascertain students' motives for choosing their respective majors. The Michigan Study of Adolescent and Adult Life Transitions used this survey to examine how social and academic experiences at school, home, work, and with peers relate to one's work and educational options and psychological adjustment during adolescence and the early twenties. The questionnaire contains indicators of a wide range of environmental characteristics and achievement-related motivational constructs. It is intended to assess a broad range of student beliefs, values, and attitudes related to math, English, social activities, and other constructs. There were also items eliciting information about students' perceptions of their teacher's fairness and friendliness, competition and social comparison among students, the opportunity for

comparative learning among students, and their teacher's interest in mathematics. Theoretical, empirical, and design criteria were used in developing the questionnaires. Extensive pilot work was done on any new items, and most of the measures consisted of both open-and close-ended questions (www.rcgd.isr.umich.edu/msalt). The original questionnaire is as of yet unpublished. There is no reliability or validity data available. The short questionnaire used in this study is adapted from the original. A number of questions have been omitted which did not suit the purpose of this study.

Design

The design of the study is correlational, using survey data. Each subject answered both surveys. It is expected that there will be a correlation between college major and perceived self-efficacy in mathematics. Subjects with traditional majors should score lower on the MSES, while subjects with non-traditional majors should score higher, and those in the neutral category should score in between the other two groups.

Analysis

Scores on the Mathematics Self-Efficacy Scale were computed individually for each subject by averaging the self-reported ratings of perceived ability to successfully carry out various mathematical tasks in part 1, and perceived ability to earn an "A" or "B" in a number of mathematical courses in part 2. The data was analyzed using a one-way ANOVA.

Differences between subjects' answers on the adapted College Survey were compared for the three groups using a Chi-Square test and a Gamma test for eight

questions extracted from the survey. The eight items analyzed in response to the question, "Why did you choose your college major?" are as follows: "I think I can make a lot of money in this area", "The kinds of jobs I can get in this area will allow me to be home with my kids when I need to be", "This is my area of interest", "I am good at this area", "Someone suggested this major to me", "People who are important to me have majored in this area", "It is easier for people of my sex to get jobs in this area", and "A professor encouraged me to go into this field".

Summary

Subjects will be given the Mathematics Self-Efficacy Scale and a questionnaire adapted from the College Survey portion of the Michigan Study of Adolescent and Adult Life Transitions. It is hypothesized that the results of both questionnaires will be significantly different for subjects whom have chosen majors in male-dominated fields, gender-mixed fields, and traditionally female fields.

Chapter 4: Analysis of Results

Restatement of Hypothesis

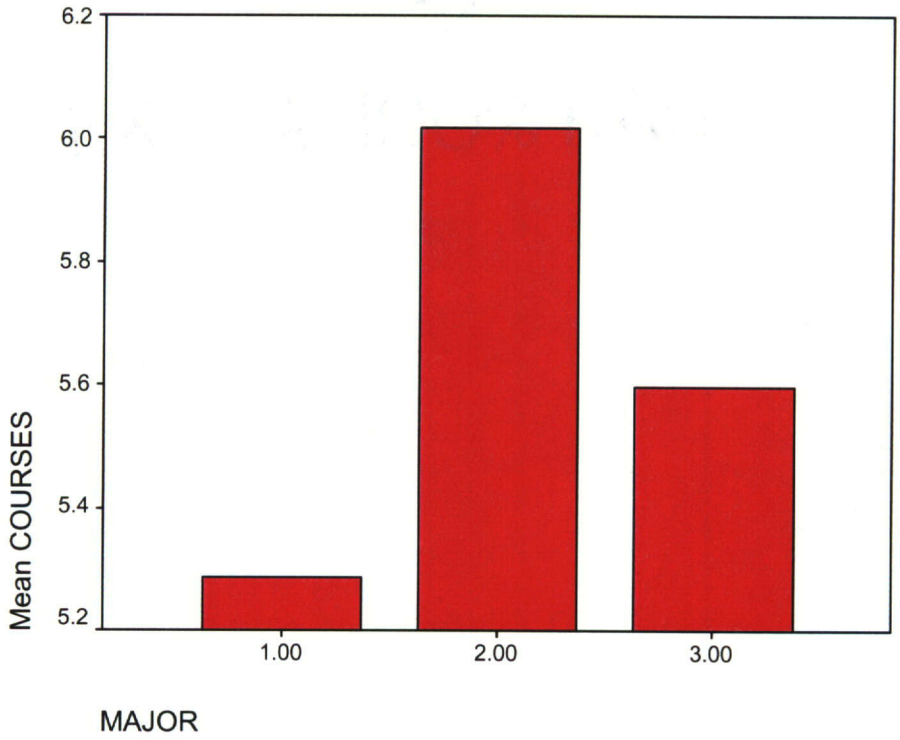
Scores on the Mathematics Self-Efficacy Scale will be significantly higher for female students who chose college majors in traditionally male-dominated fields than those of female students who chose to major in more traditional fields. Subjects in the neutral category of majors that are not clearly male or female-dominated will score higher than the traditional group, but lower than the non-traditional group. There will also be significant differences in the information gathered in the adapted College Survey among the three groups.

Interpretation of Results

The data obtained with the Mathematics Self-Efficacy Scale was analyzed using a one-way ANOVA. An F value of 3.21 was needed to reject the null hypothesis at the .05 significance level. For the tasks portion of the survey, an F value of 1.06 was obtained, with a significance level of .354. For the courses portion of the survey, an F value of .585 was obtained, with a significance level of .562. Thus, the null hypothesis must be retained. However, despite the lack of statistical significance, students' scores on the Mathematical Self-Efficacy Scale were different for the three groups in the manner that was predicted. As can be seen in Figures 4.1 and 4.2, the mean scores for both the tasks and courses portions of the survey were highest for the group who had chosen majors in

traditionally male-dominated, mean scores on both sections for the group of students whom chose to major in traditionally female-dominated fields were the lowest, and mean scores for those with "neutral" majors were in the middle.

Figure 4.1: Mean Score on Courses Section of Mathematics Self-Efficacy Scale by Type of Major

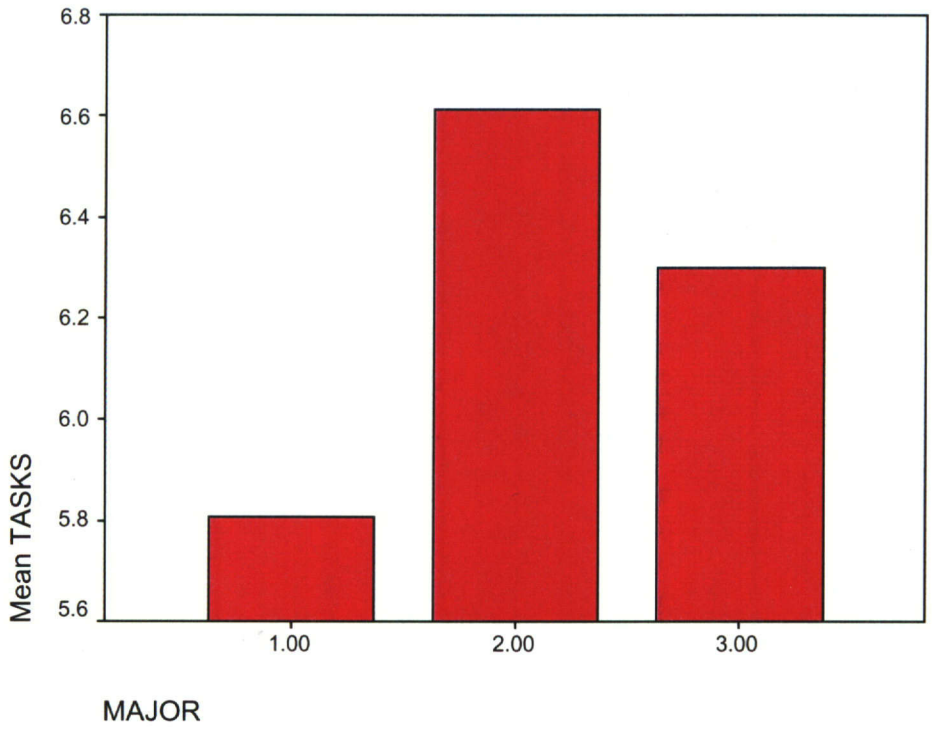


1= Traditionally female-dominated college majors

2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Figure 4.2: Mean Score on Tasks Section of Mathematics Self-Efficacy Scale by Type of Major



1= Traditionally female-dominated college majors

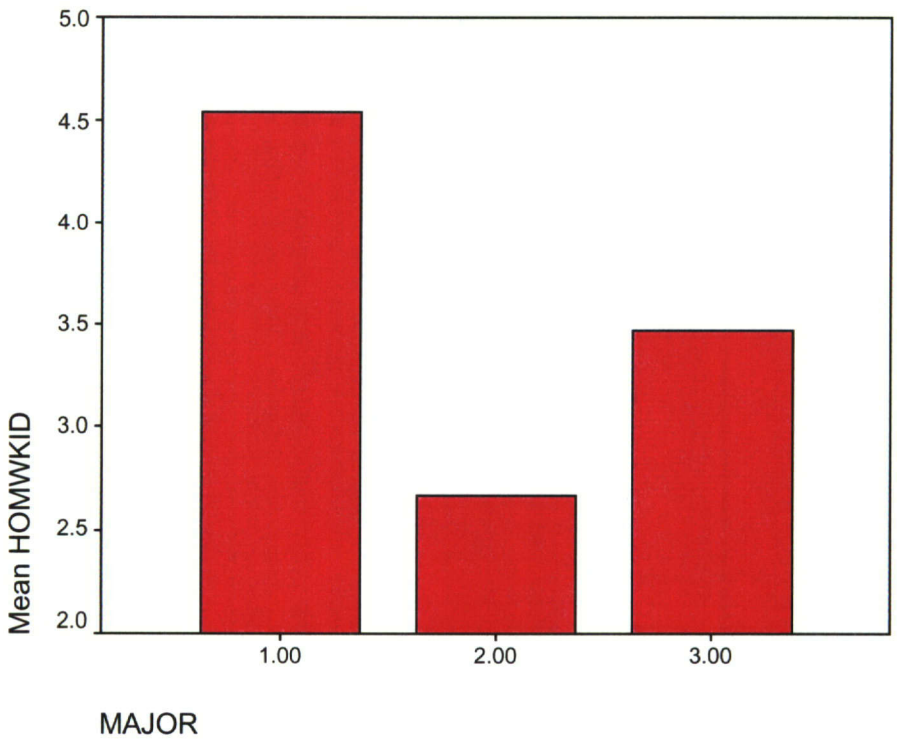
2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Results from the adapted College Survey were compared for the three groups using a Chi-Square test and a Gamma test for eight questions extracted from the survey. The Chi-Square test indicated that the difference was indicated a significance level of .059 for the item, "this is my area of interest". For the item, "I am good at this area", the significance level was at .07. The other six dimensions did not appear to be significant; they all yielded significance levels above .10. The non-parametric Gamma test indicated significance levels of .034, .001, .002, and .001 for the items "home with kids",

"interest", "good at it", and "money", respectively. The Gamma analysis indicated differences along the other dimensions to be non-significant. Figures 4.3 through 4.6 show the respective differences for each item between categories of college major.

Figure 4.3: Mean Rating of Agreement By Type of College Major for the Statement, "The kinds of jobs I can get in this area will allow me to be home with my kids when I need to be" (referring to college major)

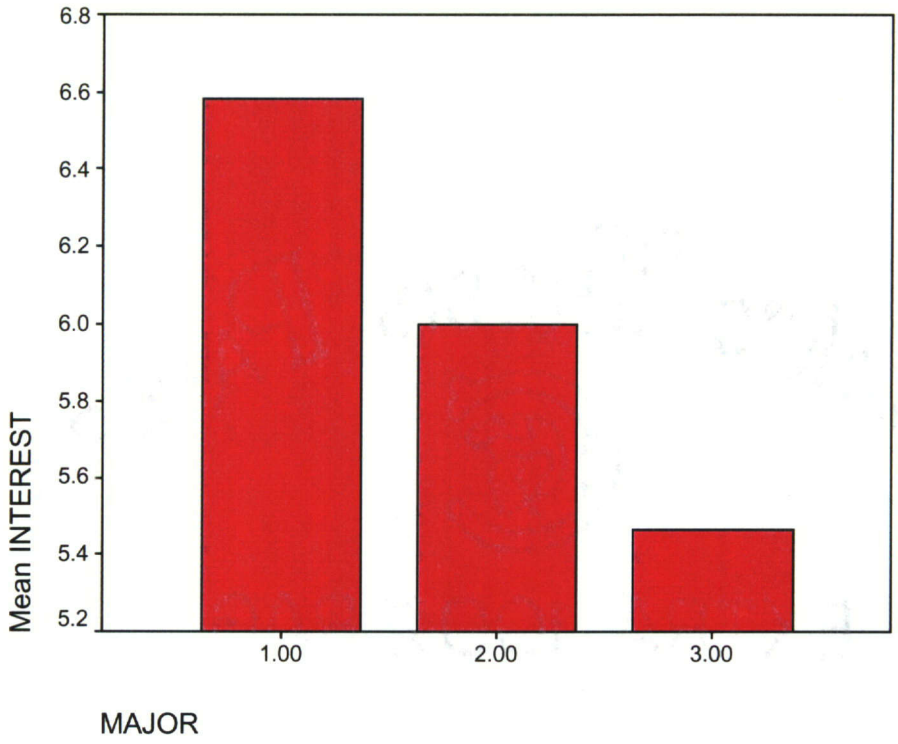


1= Traditionally female-dominated college majors

2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Figure 4.4: Mean Rating of Agreement By Type of College Major for the Statement, "This is my area of interest" (referring to college major)

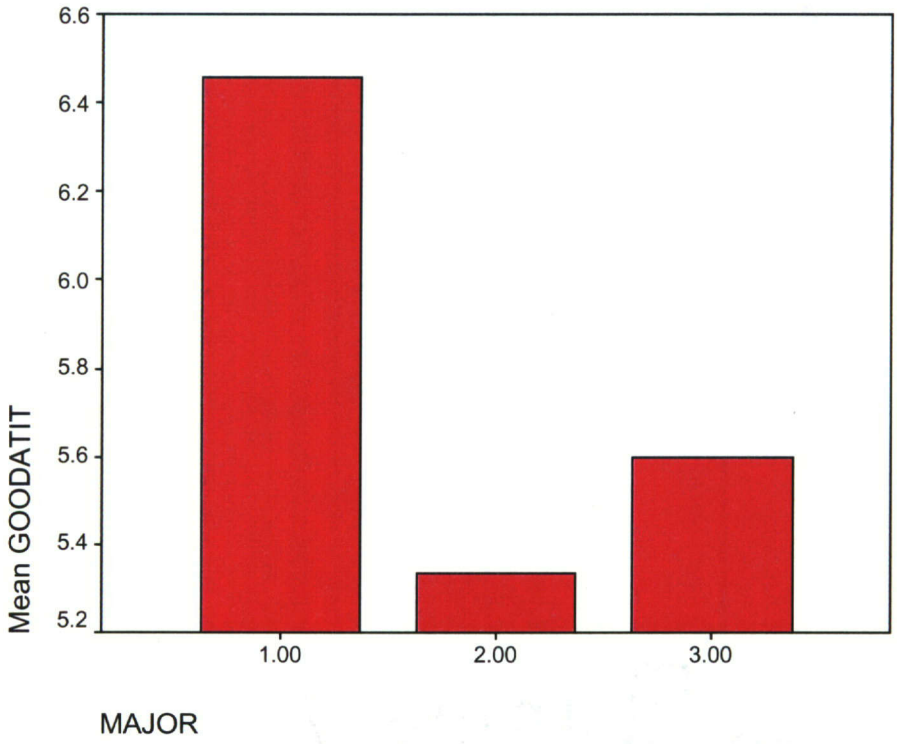


1= Traditionally female-dominated college majors

2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Figure 4.5: Mean Rating of Agreement By Type of College Major for the Statement, "I am good at this area" (referring to college major)

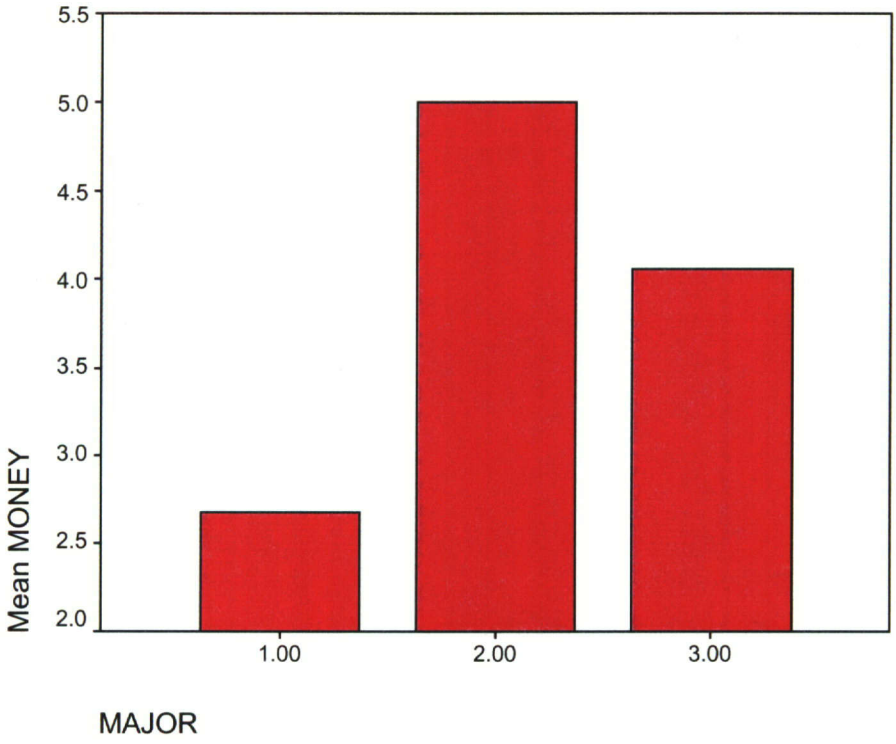


1= Traditionally female-dominated college majors

2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Figure 4.6: Mean Rating of Agreement By Type of College Major for the Statement, "I think I can make a lot of money in this area" (referring to college major)



1= Traditionally female-dominated college majors

2= Traditionally male-dominated college majors

3= Neutral college majors (not clearly male or female-dominated)

Chapter 5: Summary and Conclusions

Summary

The purpose of this study was two fold; first, to look for a connection between feelings of self-efficacy in mathematics and choice of college major, and secondly, to examine motivating factors for female college students that relate to their choice of college major.

Forty-six female college students were given the Mathematical Self-Efficacy Scale as well as a short survey adapted from the College Survey portion of the Michigan Study of Adolescent and Adult Life Transitions, which was meant to ascertain the influence of various motivations on each student's choice of college major.

The expectation was that there would be significant differences in scores on the Mathematics Self-Efficacy Scale for female students of different majors, as well as differences on the adapted College Survey. It was expected that students in majors characterized as non-traditional would score highest on the MSES, with traditional majors scoring the lowest, and the neutral group scoring in between the other two groups. Various items on the adapted College Survey concerning desire to be with one's children, making money, feelings of self-efficacy in one's chosen field, and the effect of the influence of role models and/or family members on choice of major were looked at as well. The expectation for the outcome of this survey was not clearly defined, only that

there would be some significant differences in subjects' responding among the three groups.

Conclusions

The result was that the students' scores on the Mathematical Self-Efficacy Scale differed across type of major in the manner predicted, but the differences were not statistically significant.

There were also differences indicated on the adapted College Survey in motivation for four items as they related to choice of college major. The items included being home with one's children, interest in the subject area, feelings of competency in the subject area, and the expectation of earning a lot of money. These differences appeared to be most significant statistically when a non-parametric analysis of the data was used. The traditional group averaged the highest ratings for being home with children, and feelings of self-efficacy in their chosen field; the non-traditional group averaged the lowest ratings for those areas, and the neutral group scored in between the other two. The traditional group also scored highest on the interest item, with the non-traditional group coming in second and the neutral group scoring lowest. The non-traditional group averaged the highest ratings for the expectation of money item, with the neutral group scoring second, and the traditional group averaging the lowest ratings.

Discussion

The poor statistical significance of the data obtained with the MSES was most likely due to factors such as small sample size, and homogeneity of the sample. Out of the

forty-six subjects surveyed, there were only seven students with majors characterized as "non-traditional"; majors in which less than 41% of degrees were conferred to women in 1994. Differences between the three groups may have been statistically significant if the non-traditional and neutral groups had been larger, as well as more strictly defined; an error in construct validity may have been at work in determining what constitutes a non-traditional major for female students. Perhaps the non-traditional majors should have been defined instead as subjects in which 30% or fewer degrees were conferred to women.

The method for collection of the sample was simply to obtain professors' permission to come to their classes to survey students. Over twenty professors in a variety of subject areas were approached. Which classes were surveyed was dependent on whom gave permission. The classes surveyed were an introductory computer science class, an advanced computer science class, an introductory biology class, an introductory sociology class, and an art class. Several more advanced courses in mathematical subject areas would have been needed to obtain a more proportionately even sample, as the higher level courses are more likely to have fewer female students; for example, the advanced computer science course that was surveyed contained seventeen males and four females.

Overall, findings of the Mathematics Self-Efficacy Scale indicated slight differences between the three groups in the manner hypothesized; the traditional group scored the lowest, the non-traditional group scored highest, and the neutral group averaged scores in-between the other two groups. With a better sample, the differences very possibly could have turned out to be statistically significant. The findings, though non-significant,

seem to be leading towards corroboration with research on the relationship between self-efficacy, motivation, and goal-setting.

Findings of the College Survey can be viewed as corresponding with the literature on the interaction between socialization, self-efficacy and motivation. The fact that the traditional groups' high ratings of perceived self-competence in their chosen majors corresponded with high ratings of interest could be related to research findings, such as that of Jacobs et. al (2002), and Fredricks and Eccles (2002) that perceptions of competence were positively related to reported interest and perceptions of activity-value. The fact that the traditional group scored highest on the item concerning the desire to be home with one's children is indicative of the influence of gender-role socialization; subjects whom chose traditional majors indicated that they were influenced by traditionally female goals of raising children. Overall the findings of the adapted College Survey indicated differences between the three groups with regard to the relationship between socialization, motivation, and self-efficacy.

Implications for Future Research

More research using a larger sample, with more equally proportionate and ethnically diverse groups, and a possible re-defining of criteria for classifying traditional and non-traditional majors would most likely yield more significant and interesting discrepancies between female students who choose traditional and non-traditional majors.

References

Ayalon, Hanna. (1995). "Math as a Gatekeeper: Ethnic and Gender Inequity in Course Taking of the Sciences in Israel". American Journal of Education. Vol.104 pp. 34 –56.

Bandura, A. (1977). "Self Efficacy: Toward a Unifying Theory of Behavioral Change."*Psychological Review*, Vol. 84, pp. 191-215.

Bandura, A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. NJ: Prentice Hall, 1986.

Bandura, A. *Self-efficacy: The exercise of control*. New York: Freeman. 1997.

Betz, N. E., & Hackett, G. (1997). "Applications of Self-Efficacy Theory to the Career Assessment of Women". *Journal of Career Assessment*, Vol. 5, pp. 383-482.

Bhalalusesa, E. "Women's Career and Professional Development: Experiences and Challenges". *Gender and Education*. March 1998, Vol. 10, Issue 1.

Brownlow, Sheila, Rogers, Molly I., Jacobi, Tara. (2000) "Science Anxiety as a Function of Personality, Gender Roles, Experience with Science". *Sex Roles*. Jan. 2000, Vol. 42, pp. 119-132.

Burke, Peter J. "Gender Identity, Sex, and School Performance". *Social Psychology Quarterly*, 1989, Vol. 52, No.2, pp.159-169.

Campbell, K., & Evans, C. (1994). "Gender issues and the math/science curricula: Effects on Females." *People and Education*, Vol. 2, pp. 284-295.

Cheng, Gang, & Xie Guiyang. "Gender Differences in Academic Achievement and The Educational Implications". *Chinese Education and Society*, March/April 2000, Vol. 33, Issue 2.

Duffy, Jim; Warren, Kelly; Walsh, Margaret. "Classroom Interactions: Gender of Teacher, Gender of Student, and Classroom Subject." *Sex Roles: A Journal of Research.* November 2001.

Eccles, J.S., Adler, T.F., Futterman, R., Goff, S.B., Kaczala, C.M., Meece, J., Midgley, C. (1983) "Expectancies, Values, and Academic Behaviors". In J.T. Spence (Ed.) *Achievement and Achievement Motives.* (pp. 75-146) San Francisco: Freeman.

Eccles, J.S. and Wigfield, A. "Motivational Beliefs, Values and Goals". *Annual Review In Psychology.* 2002. Vol. 53, 109-132.

Eccles, J.S., Wigfield, A. "In the Mind of the Actor: The structure of adolescents' Achievement, tasks, values, and expectancy-related beliefs". *Personality and*

Social Psychology Bulletin, 21, 215-225.

Enman, Michael, Lupart, Judy. "Talented Female Students' Resistance to Science: An Exploratory Study of Post-Secondary Achievement Motivation, Persistence, and Epistemological Characteristics" *High Ability Studies*, Dec2000 Vol. 11.

Fredricks, Jennifer A., & Eccles, Jacquelynne S. (2002). "Children's Competence and Value Beliefs from Childhood Through Adolescence: Growth Trajectories in Two Male-Sex-Typed Domains". *Developmental Psychology*, July 2002, Vol. 38, Issue 4.

Greene, Barbara A.; Debacker, Teresa K.; Ravindran, Bhuvaneswari; Krows, A. Jean. "Goals, values and beliefs as predictors of achievement and effort in high school mathematics classes". March 1999.

Grossman, H., & Grossman, S. Gender Issues in Education. Boston: Allyn & Bacon, 1994.

Harter, S. (1986). "Processes Underlying the Construction, Maintenance and Enhancement of the Self-Concept in Children". In J.Suls & A.G. Greenwald (Eds.) *Psychological Perspectives on the Self.* Vol. 3, (pp. 137-181) Hillsdale, NJ: Erlbaum.

Harter, S. (1990) "Causes, Correlates, and the Functional Role of Global Self-Worth: A Lifespan Perspective". In J. Kolligan & R. Sternberg (Eds.) Perceptions of

Competence and Incompetence Across the Lifespan. (pp. 43-70) NY: Springer-Verlag.

Jacklin, C.N. & Reynolds, C. (1993). "Gender and childhood socialization". A.E. Beal & R.J. Sternberg (Eds.), *The Psychology of Gender*. New York: Guilford Press. pp. 197- 214.

Jacobs, J.E., Lanza, S., Osgood, D.W., Eccles, J.S., Wigfield, A. "Changes in Children's Self-Competence and Values: Gender and Domain Differences Across Grades One Through Twelve". *Child Development.* March/April 2002, Vol. 73, No. 2, pp. 509-527.

Jodl, Kathleen M.; Michael, Alice; Oksana, Malanchuk; Eccles, Jacquelynne S.; Sameroff, Arnold. "Parents' Roles in Shaping Early Adolescents' Educational Aspirations". *Child Development.* July/August 2001. Vol. 72, No. 4, 1247-1265.

Jones, Kelly; Evans, Cay; Byrd, Ronald; Campbell, Kathleen. (2000). "Gender Equity Training and Teaching Behavior." *Journal of Instructional Psychology*, Vol. 27, Issue 3.

Kuyper, H., Van Der Werf, M.P.C., & Lubbers, M.J. (2000). "Motivation, Meta-Cognition and Self-Regulation as Predictors of Long-Term Educational Attainment". *Educational Research and Evaluation.* Vol. 6. No. 3, pp. 181-205.

Linnenbrink, Elizabeth A., & Pintrich, Paul R. (2003). "The Role of Self-Efficacy Beliefs in Student Engagement in the Classroom". *Reading and Writing Quarterly*, Vol. 19: 119-137.

Matlin, Margaret W. *The Psychology of Women*. Third Edition. Fort Worth: Harcourt Brace College Publishers, 1996.

Michie, Frances, Glachan, Martin, & Bray, Diane. (2001). "An Evaluation of Factors Influencing the Academic Self-Concept, Self-Esteem, and Academic Stress for Direct and Re-entry Students in Higher Education". *Educational Psychology*, Vol. 24, No. 4.

Murr, Kathleen A. "Math Anxiety and How It Affects High School Students". *Ohio Journal of School Mathematics*. Spring 2001, pp. 43-47.

Pajares, Frank, Hartley, James, Valiante, Giovanni. "Response Format in Writing Self-Efficacy and Assessment: Greater Discrimination Increases Prediction". *Measurement & Evaluation in Counseling & Development*. Jan 2001, Vol. 33.

Piotrowski, Chris, Bagui, Subhash C., Hemasinha, Rohan. "Development of a Measure on Statistics Anxiety in Graduate-Level Psychology Students". *Journal of Instructional Psychology*; Jun2002, Vol. 29 Issue 2, pp.97-101.

Sadker, Myra & Sadker, David. Failing at Fairness: How Our Schools Cheat Girls. New York: Simon & Schuster, 1994.

Tenenbaum, Harriet R. (2003)."Parent-Child Conversations About Science: The Socialization of Gender Inequities?" Developmental Psychology; Jan 2003, Vol. 39 Issue 1, pp.34-48.

U.S. National Center for Educational Statistics. (1996). *Digest of Education Statistics, 1996*. Washington D.C.: U.S. Department of Education.

White, P.E. (1992). *Women and Minorities in Science and Engineering: An Update.* Washington, D.C.: National Science Foundation.

Woodward, A. "Gender Bias in Education." *Gale Encyclopedia of Childhood & Adolescence*. Gale Research, 1998.