DIFFERENCES IN FEMALES' MATH AND SCIENCE SELF-EFFICACY BASED ON GENDER-TYPE SOCIALIZATION AND GENDER ROLE TYPE

A thesis presented to the faculty of the Graduate School of
Western Carolina University in partial fulfillment of the
Requirements for the degree of Master of Arts in School Psychology.

By

Ashley Megan Rayburn

Director: Dr. Candace Boan-Lenzo
Associate Professor of Psychology
Psychology Department

Committee Members: Dr. Lydia Aydlett, Psychology
Dr. Lori Unruh, Psychology

June 2009

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

DIFFERENCES IN MATH/SCIENCE SELF-EFFICACY

Ashley Megan Rayburn, M.A.

Western Carolina University (June 2009)

Director: Dr. Candace Boan-Lenzo

Research has suggested that there are significant gender differences in the fields of study that students choose after completing high school. Females are less likely to select a discipline that is based on math and science abilities than are males. While many researchers conclude that these differences are attributable to variations in attitudes, experiences, and/or achievement, there have been relatively few studies that have examined perceptions about math and science ability based on gender role type and gender-type socialization. Participants for this study included 65 female teachers teaching either a subject not heavily dependent on advanced math/science skills (e.g. elementary education, English, Social Studies) or a subject that relies heavily on understanding advanced concepts in math/science (e.g. chemistry, physics, biology, mathematics). Participants completed questionnaires designed to assess math self-efficacy, gender role type and gender-type socialization. The proposed design was to examine differences in math/science self-efficacy using a 2 (gender-type socialization) x 4 (gender role type) ANOVA. However, given the low numbers of individuals across groups, a one-way ANOVA comparing math/science self-efficacy scores by group was completed first. The independent variable was subject taught (non-math/science or math/science), the dependent variable was math/science self-efficacy. No significant

differences were found between groups on math/science self-efficacy. To test hypotheses involving gender role type and gender role socializations across majors, a series of Chi Square test of independence analyses were conducted. Results and implications of exploratory analyses will be discussed in the paper.

INTRODUCTION

Although the trend is for women to attend college at higher rates than men; women continue to be the minority in the fields of mathematics and science (American Association of University Women, 1999). Over the past few decades, the gender gap in performance in mathematics and science has almost disappeared with males and females receiving equal grades at all educational levels. Although, males and females receive similar grades, females continue to view themselves as less capable in math/science fields and are less likely to major in disciplines related to mathematics and science in college. It is believed that these differences in math/science are best explained by gender differences in experiences in the school and family.

Gender identity becomes established very early in childhood and can subsequently impact decisions made later in life. Around the age of two years, children begin to label themselves and others consistently as either male or female based on physical characteristics (Golombok & Fivush, 1994). When children are around three-years-old they begin to understand that people are male or female, have always been one or the other, and will continue to be male or female. However, they do not understand that gender remains constant across situations. They believe, for example, that their pre-school teacher is female, but would not carry that belief over to assume that she is also a mother to her own children when she is at home. It is not until the age of four that children understand that gender remains constant across time and situations. Thus, children's understanding of gender identity is constantly developing and occurs as a result of what they observe and hear at home, school, and in the community.

Both schools and family provide situations in which children observe what it means to be male or female in our culture. Although school is an important institution that impacts gender identity, only a brief overview of school effects will be provided in this paper. The focus of this paper will be on family factors that contribute to these variables. The next sections will provide an overview of research on gender differences in academic performance, academic experiences, and academic self-efficacy at different levels of education.

Preschool Age

Boys and girls do equally well in all subjects in early elementary school and there are very few differences in self-efficacy among males and females at this age (American Association of University Women, 1999). However, there are differences in their experiences at school, especially when receiving feedback from teachers and other adults. In early childhood boys and girls tend to receive positive feedback for different types of behaviors. Teachers tend to praise boys for knowledge and giving the correct answer, whereas they tend to praise girls for obedience and compliance (Golombok & Fivush, 1994). In early elementary school, teachers give boys more praise and criticism than they do girls, both through overt verbal feedback and covert nonverbal feedback. From a very early age children are rewarded for different behaviors depending on their gender rather than their ability level.

Elementary School Age

Girls continue to consistently receive grades equal to or higher than those of boys throughout their educational careers; however, on standardized tests boys outperform girls in the areas of history, geography, mathematics, and science (American Association

of University Women, 1999). Girls score higher than boys in reading and writing on standardized tests. Though there is no change in mathematics and science performance in the classroom during middle childhood, Simpkins, Davis-Kean, and Eccles (2006) found that youths' experiences in mathematics and science undergo a dramatic change between 5th and 12th grade. They found that the topics covered in classes become much more challenging and advanced as students move from 5th to 12th grade. In 5th grade mathematics and science courses are concrete and do not require an advanced understanding of these subjects. However, in 12th grade mathematics and science courses become more abstract and require a much more advanced understanding of mathematics concepts. This could explain why only a small proportion of students, regardless of gender, choose to take more advanced mathematics courses in high school. Research suggests that despite the fact that girls perform just as well as boys on standardized tests requiring advanced math skills, boys continue to take advanced math courses at a higher rate than do girls (American Association of University Women, 1999). Additionally, it stands to reason that teachers' reinforcement of higher order thinking in males gives them more confidence in classes requiring advanced understanding than females.

Some teachers possess a belief that boys are better at math than girls, and therefore have higher expectations for boys than for girls (Brownlow, Jacobi, & Rogers, 2000; Oakes, 1990). Teachers tend to place boys with high abilities into top mathematics groups but girls with high abilities in average ability groups (Oakes, 1990). Girls may then begin to perceive themselves as being less capable than boys in these subjects. In mathematics classes, teachers call on boys more often, praise them more frequently, or

hold higher expectations for them than they do girls (Byrnes, 2005; Golombok & Fivush, 1994).

While in elementary school girls and boys report having equal confidence in their mathematics ability, but by the time they enter high school, boys tend to report more confidence than do girls (Pajares, 2005). In fourth grade, males and females have similar views about mathematics; however by the time they reach twelfth grade males are more likely than females to state that they enjoy mathematics (National Center for Education Statistics, 2000). This "confidence gap" begins to occur in middle school and is well established by the time the students graduate high school (Pajares, 2005).

Middle and High School Age

Girls and boys are equally enrolled in Advanced Placement (AP) courses in high school; however, girls take more AP exams than do boys in all subjects with the exception of mathematics, science, and computers (American Association of University Women, 1999). Gender differences continue to exist in the types of courses high school students enroll in. Girls tend to discontinue their math coursework with Algebra II, whereas boys tend to continue past Algebra II and take Pre-Calculus and Calculus. This may be because standards for entrance into colleges require students to only complete Algebra II, unless they are applying for entrance into mathematics and science related majors. Another explanation is that by the time girls reach high school, their academic self-efficacy in math and science is lower than that of boys and as a result they do not wish to major in these fields in college or take math courses beyond the minimum requirements.

When students reach high school, teachers continue to give more feedback to boys, but the feedback is even more academically focused than in early childhood (Brownlow, Jacobi, & Rogers, 2000; Golombok & Fivush, 1994). Teachers tend to ask girls fewer difficult questions, direct fewer comments toward them, and use them less in demonstrations to the class (Brownlow, Jacobi, & Rogers, 2000). Boys are also nominated more frequently for gifted and talented programs than are girls, even though girls and boys receive similar grades and score similarly on achievement tests (Byrnes, 2005). This could in part explain why more boys than girls chose to take more advanced mathematics and science courses in high school; they have been exposed to more challenging and advanced courses before they reach high school. Another aspect of teachers that may convey a message that mathematics and science are male-dominated fields is that more males than females teach the subjects of mathematics and science in high school, despite the fact that the majority of public school teachers are female (Golombok & Fivush, 1994).

By the time girls reach high school their attitudes toward mathematics and science are more negative than the attitudes of boys (Oakes, 1990). Even though high school girls and boys do equally well in mathematics and science courses and are equally motivated to succeed in all subjects; girls are less confident that they will actually be successful. Simpkins, Davis-Kean, and Eccles (2006) found that when adolescents' beliefs about the importance of mathematics and science are examined that boys rated these subjects as more important than did girls. Girls also give up more easily than do boys when they fail or encounter a difficult task (Oakes, 1990). Boys are more confident in their abilities in mathematics and mathematics achievement tests than are girls.

College Age

Despite the steady decline in the gender gap in mathematics and science achievement in the past few decades, women continue to be underrepresented in the fields of mathematics and science after high school (American Association of University Women, 1999). One explanation for the difference in postsecondary education choice may be the perceptions males and females have toward these subjects. Female college students are less confident in their abilities in mathematics and science than equally achieving male students (Catsambis, 2005). Eccles (1994) found that women are less likely to enter the fields of mathematics and science because they have little confidence in their ability and because they tend to place less value on these fields compared to other occupations.

Research suggests that males' and females' educational experiences in math and science differ considerably. More specifically, findings suggest that teachers hold different expectations based on gender (e.g., Brownlow, Jacobi, & Rogers, 2000), provide different types of feedback based on gender (e.g. Golombok & Fivush, 1994), and make different recommendations for placement in higher ability groups based on gender (e.g., Oakes, 1990). Additionally, there appears to be a developmental trend in which females' confidence in their math and science ability becomes significantly lower than males' confidence in their math and science ability as they get older (Pajares, 2005). Therefore, although there are few differences in academic performance, females are significantly underrepresented in math and science based disciplines as emerging adults (American Association of University Women, 1999). As described above, educational experiences are an important component for understanding gender differences in experiences related

to math and science education. However, this paper will focus primarily on individual and family variables that contribute to females' math and science self-efficacy and females' selection of a major in college.

LITERATURE REVIEW

Self-efficacy refers to an individual's belief that he or she can master a given situation and produce favorable outcomes (Bandura, 1997). An individual's self-efficacy influences his or her choice of tasks, level of performance, amount of effort put toward performance, and perseverance. Self-efficacy is typically divided into several different facets, including academic self-efficacy. Academic self-efficacy is the belief that students have in their ability to perform academic tasks (Usher & Pajares, 2006). It is a measure of the degree to which individuals feel confident in their ability to succeed, understand, and perform at an appropriate level in academics. Academic self-efficacy can be measured as a global construct or as several distinct domains (e.g., math self-efficacy, science self-efficacy, language arts self-efficacy).

Academic self-efficacy is an area that has been widely researched. Research has demonstrated that males and females have different experiences and differences in their academic self-efficacy throughout their education (Bornholt, Goodnow, & Cooney, 1994; Jacobs, 1991; Oakes, 1990; Simpkins, Davis-Kean, & Eccles, 2006). Males have more positive perceptions of their abilities in mathematics and science with regards to perceived current performance (Bornholt, Goodnow, & Cooney, 1994). Interestingly, males' higher beliefs about their abilities in mathematics and science continue to exist, despite the fact that males and females have consistently equal grades in mathematics and science (Oakes, 1990; Simpkins, Davis-Kean, & Eccles, 2006). Males and females also differ in how they view their future performance (Bornholt, Goodnow, & Cooney, 1994; Jacobs, 1991). Findings suggest that males' perceptions of their abilities in mathematics with regards to future performance are higher than females' perceptions of their abilities.

Females perceive their likely success in math and science courses to be lower, and consequently, fewer women choose to major in fields related to mathematics and science once they reach college. Although there are many variables that may impact math/science self-efficacy, the next section will focus on individual and family factors that have been examined in the research.

Gender Differences in Math/Science Self-Efficacy

An individual's math/science self-efficacy can be impacted by family characteristics and values, gender role stereotypes held by their parents, and the individual's gender role type. The following sections will discuss research on math/science self-efficacy and how family factors, gender-type socialization, and gender role type contribute to an individual's math/science self-efficacy.

Family Factors. Parents tend to believe that girls perceive mathematics and science as more difficult than do boys and that advanced mathematics and science courses are more important for boys than for girls (Oakes, 1990). Though parents may not explicitly state this belief, their children comprehend it by the actions they observe in their parents. For example, they may encourage their son to take an advanced math course, while encouraging their daughter to take advanced English instead; even though their daughter is equally skilled in math. Parent involvement, support, and encouragement can also have a strong influence on math and science self-efficacy and on later choice of mathematics and science related college majors (Catsambis, 2005). Mothers' employment and the nature of that employment can also influence their daughters' self-efficacy with regards to mathematics and science as well as whether their daughters will pursue careers relating to mathematics and science.

In a study examining parental influences on achievement attitudes and beliefs, 22 fifth- through eleventh-grade classrooms were included (Parsons, Adler, & Kaczala, 1982). The students were administered a questionnaire that contained several scales including: difficulty of current math course, difficulty of future math courses, current expectancies, future expectancies, self-concept of ability and performance in math, perception of effort involved in math, child's perception of mothers' use of math, mothers' and fathers' enjoyment of math, and mothers' and fathers' beliefs regarding both the child's math ability and their expectancies for the child's performance. The parents were administered a questionnaire that contained items dispersed across three categories: the parents' perceptions of their own experiences in math and their own attitudes regarding mathematics, parents' beliefs about their children's attitudes toward math, and parents' beliefs about their children's math abilities and their children's math experiences. Results revealed a statistically significant relationship between the sex of the child and the parent's perceptions of their child's math ability and on parents' perceptions of the relative importance of various high school courses. Parents of females stated that math was harder for their daughters and that the daughters had to work harder to do well in math courses than parents of males. Parents of males stated that math was more important than other subjects for their sons than parents of females. These findings provide additional support for parents having different perceptions of their child's math ability depending on the sex of the child.

Gender-Type Socialization. The term gender-type socialization refers to how individuals learn what is deemed appropriate behavior for males and females in a given society (Basow, 1992). The socialization of gender roles begins very early in a child's

life with the agents of socialization being parents. As children grow older and begin school, peers and teachers reinforce gender roles and what is appropriate for each gender. Gender-type socialization by parents can also influence children's' academic self-efficacy.

Children learn from their parents, peers, and society in general what is appropriate for a certain gender. They also learn that subjects such as mathematics, science, and computer are viewed as masculine and that subjects such as humanities are viewed as feminine. Because of the stereotype placed on these subjects children tend to view themselves as more able in the areas traditionally attributed their own gender (Brownlow, Jacobi, & Rogers, 2000). When parents hold traditional views on gender roles they tend to provide different learning opportunities depending on the gender of their child (Eccles, 1994). When girls and women believe that "math = male," this can have a negative impact on their attitudes towards mathematics as well and their performance (Nosek, Banaji, & Greenwald, 2002). Because of these stereotypes, girls become less interested in mathematics and science and this can impair their performance in these subjects. However, when girls do not endorse gender stereotypes related to these subjects they are more likely to have higher perceptions of their abilities and perform better in these subjects (Schmader, Johns, & Barquissau, 2004).

In a study examining gender differences in attitudes toward math and science relative to arts and language, 83 undergraduate students were administered implicit attitude tasks, an implicit identity task, and a paper-pencil questionnaire to assess their feelings toward math and arts as academic domains (Nosek, Banaji, & Greenwald, 2002). Results revealed a statistically significant difference between implicit attitudes toward

math/science depending on gender, with women showing more negative evaluations of math/science than did men. Women also had stronger negative attitudes toward math relative to arts and science. Women also identified more strongly with arts than with math, whereas men did not preferentially identify with either arts or math. These findings provide additional support to the idea that women come to view math and science more negatively because they internalize the negative stereotypes that society in general places on women and math/science.

In a study examining the influences of gender stereotypes on the mathematics attitudes of parents and children, 424 6th- through 11th-grade students and their parents were administered questionnaires regarding the children's beliefs and attitudes about mathematics (Jacobs, 1991). Results revealed no significant differences between mothers' and fathers' gender stereotypes for mathematics, however parents of girls held more stereotyped beliefs (favoring males) than did parents of boys. With regard to mothers' ability perceptions, there was a significant interaction between stereotypes and the sex of the child. Mothers' stereotypes also had indirect effects on children's self-perceptions and later grades. Greater stereotyping among mothers was related to lower ability beliefs for daughters and higher ability beliefs for sons. As stereotypes became stronger, the sex difference in parents' perceptions became larger. With regards to fathers, stereotypes also had a significant interaction depending on the sex of the child and the child's mathematical abilities. Fathers' stereotypes had an indirect effect on children's self-perceptions and later grades. Fathers who had stronger stereotypes had lower ability beliefs for their daughters than they did for their sons. The interaction between sex and stereotypes had a significant influence on parent expectancies and an

indirect influence on children's future expectancies and grades. These findings provide additional support for the effect of parent's stereotypes on their children's math self-efficacy.

Gender Role Type. The term gender role type refers to whether an individual considers himself or herself to be more masculine, feminine, androgynous, or undifferentiated (Basow, 1992). An individual with a masculine gender role type will display characteristics traditionally attributed to males such as: independence, aggressiveness, dominance, logicalness, little emotionality, and adventurousness. An individual with a feminine gender role type will have characteristics traditionally attributed to females such as: dependence, passiveness, subjectiveness, and emotionality. An individual with an androgynous gender role type will show high amounts of both masculine and feminine characteristics. An individual with an undifferentiated gender role type will show low amounts of both masculine and feminine characteristics.

Research on gender role type and math/science self-efficacy has been limited. Andre, Whigham, Hendrickson, and Chambers (1999) found that both boys and girls rated mathematics and science occupations as more male-dominated, with boys viewing these jobs as more male-dominated than did girls. This suggests that males and females may view the occupations as more masculine or more appropriate for an individual with a masculine gender role type. Eccles (1994) stated that children are so strongly assimilated into the "culturally defined gender role schema" and that it has a profound effect on how they view the world and as a result, activities that are classified as part of the opposite gender role are rejected without evaluation or reflection.

In a study examining differences among gender role types in specific, academic, and general self-efficacy, 215 undergraduate students were administered the Self-Efficacy Scale (SES), the College Academic Self-Efficacy Scale (CASES), a course-specific self-efficacy scale, and the Personal Attribute Questionnaire (PAQ) (Choi, 2004). Results revealed a statistically significant relationship between gender role type and level of self-efficacy. The four groups were significantly different in general and academic self-efficacy, however there were no significant differences among the four groups in course-specific self-efficacy. Participants with masculine and androgynous gender role types had significantly higher general and academic self-efficacy than did participants with undifferentiated or feminine gender role types. These findings provide additional support for the affect of gender role type on academic self-efficacy.

In a study examining gender construct among students who chose to major in nursing, 384 nursing students were administered the Bem Sex Role Inventory (BSRI), a questionnaire assessing gendered views of nurse specialisms, the Occupational and Academic Self-Efficacy for Nursing (OSEN), and a questionnaire assessing career aspirations (Muldoon & Reilly, 2003). Results revealed a statistically significant interaction between academic self-efficacy and gender, with males reporting higher academic self-efficacy than females. There was also a significant interaction between gender role type and academic self-efficacy, with participants with masculine gender role types having higher efficacy scores than participants with androgynous gender role types, who had higher scores than participants with feminine gender role types. The findings provide additional support for the impact of gender role type on academic self-efficacy.

Overall, the research examining gender differences in math/science self-efficacy based on family variables and gender role type has been limited. There is some indication that parents' stereotypes about performance in math/science differ based on gender (Oakes, 1990; Parsons, Adler, & Kaczala, 1982). There is also an indication that gender role type is linked with academic self-efficacy (Andre et al, 1999; Choi, 2004). However, the research examining specific differences in math/science self-efficacy based on gender role type and gender-type socialization is non-existent. A second focus of this paper is to examine differences in major (math/science discipline versus non-math/science discipline) in terms of gender-type socialization and gender role type. The next section will discuss previous research in these areas.

Selection of Major

When students select a college major, their choices are influenced by the expectations of their families, their gender-type socialization, and their gender role type. The following sections will discuss research on how family factors, gender–type socialization, and gender role type impact an individual's choice of major in college.

Family Factors. Adolescents who have parents who are more authoritarian, more permissive, or less authoritative tend to receive lower grades in high school (Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987). Parents who are more authoritative tend to have adolescents who have higher grades and are more confident in their abilities. Parents' expectations for their adolescents' future educational outcomes have been shown to affect the adolescents' own educational goals as well as their actual performance (Jodl, Michael, Malanchuk, Eccles, & Sameroff, 2001). When parents encourage their children, children become more confident in their abilities and as a result may take more advanced

classes in high school which in turn can have an effect on their selection of major in college.

Parents can have a direct effect on their children's perceptions of viable options available to them when it comes to choosing a field of study in college. They can do this by the options they make available to their children (e.g. by supplying or refusing to give funds for college) and those seriously considered (e.g., by encouraging or discouraging certain options) (Eccles, 1994). More highly educated parents tend to convey less conventional ideals about what constitutes appropriate behavior for women and as a result may be more encouraging of daughters who chose to pursue male-dominated majors (Oakes, 1990). Seymour (1999) found that women are almost twice as likely as men to have chosen a science, math, or engineering major as the result of the active influence of someone close to them.

Regardless of the sex of a child, parents who believe that their children are not able in mathematics and science tend to have children who have lower grades in these subjects and who are less confident in their abilities (Golombok & Fivush, 1994). Many studies have shown that parents tend to expect boys to perform better and view them as more able in mathematics and science than girls (Andre, Whigham, Hendrickson, & Chambers, 1999; Leaper, 2002). Parents also tend to believe that girls must work harder than boys in order to be successful in mathematics and science (Golombok & Fivush, 1994). Parents tend to attribute success for boys and girls differently; they tend to attribute effort as the most important factor to girls' success and talent to boys' success. As a result, girls are learning that their success in mathematics and science are due to effort and hard work, whereas boys are learning that their success is due to natural talent

and ability. These factors could explain why more males than females choose majors that heavily rely on mathematics and/or science.

Parents who have higher levels of education and who are actively involved in their child's education have daughters who attain higher grades and are more confident in their abilities in mathematics and science (Simpkins, Davis-Kean, & Eccles, 2006). Parenting behaviors and involvement appear to be powerful predictors of children's' confidence in their abilities and consequently can have an effect on their later choices of college major. Oakes (1990) found that women in science majors had parents who were involved in their high school academic activities more often than did males in science majors.

Gender-Type Socialization. Children begin to understand gender roles at a very young age. Children begin to categorize information based on whether it involves their own sex (the in-group) or the opposite sex (the out-group) and this information will then help them make decisions about toys and behavior and whether it is appropriate for them (Stockard, 1999). Parents influence children's understanding of gender roles in various ways. Parents tend to offer their children gender-stereotyped toys and they also tend to encourage gender-stereotyped play (Leaper, 2002). Parents tend to offer boys more sports equipment, tools, and automobiles, whereas they tend to offer girls more dolls, toy food and cooking utensils, and toy furniture. Parents also have been found to communicate their approval of gender-stereotyped play in both verbal and nonverbal ways (Leaper, 2002). They can simply do this by smiling at a child when they are engaging in gender appropriate play and ignoring them when they are not playing in a gender appropriate manner. Children's peers also influence their understanding of gender

roles. Children reinforce each other for those behaviors that are considered appropriate or inappropriate for their gender (Stockard, 1999).

As a result of gender role socialization throughout children's' lives, males and females typically anticipate differences with regards to family-work roles and in turn college major selection will depend on what extent students perceive majors as either consistent or inconsistent with these anticipated roles (Frehill, 1997). Males tend to choose male-dominated majors because they perceive these majors to be consistent with their anticipated family-work roles. Females tend to choose majors in female-dominated fields because these fields are consistent with their anticipation of being family caregivers.

When women reject the gender stereotypes placed on the field of mathematics and science, they are more likely to have positive perceptions of their abilities and are more likely to attend graduate school in these fields than are women who accept the stereotype (Schmader, Johns, & Barquissau, 2004). Even when women verbally reject these negative stereotypes, they do continue to internalize them to some degree (Blanton, Christie, & Dye, 2002). Women who do pursue mathematics and science related fields are often negatively stereotyped and when this is observed by girls it may convince them that these fields are not viable options for them (Kiefer & Shih, 2006). Because of the negative stereotype placed on women in the fields of mathematics and science, girls tend to receive less encouragement and information about fields related to these subjects than do boys (Oakes, 1990).

In a study examining why students chose to major in engineering, the data on 4,192 students who participated in the High School and Beyond study was used (Frehill,

1997). The students had been administered two survey question-stems in 1980. Results revealed that engineering was the third most popular major among males; however engineering was the least popular major among females. There was a significant interaction between high school math courses and major choice. For both males and females, as the number of high school math courses increased so did the likelihood of choosing engineering as a major as opposed to a major in the liberal arts. Each additional mathematics course taken in high school more than doubled females' chances of choosing engineering as a major. These findings provide additional support for how women place more importance on intrinsic rewards, as a result of gender-type socialization, and in doing so are more likely to choose majors in the liberal arts or life sciences rather than engineering.

Gender Role Type. Jones and Lamke (1985) studied the relationship between gender role type, self esteem, and college major. The study included two groups of undergraduate women: engineering majors and home economics majors. The results indicated that there was a larger number of feminine women in home economics than in engineering, and a larger number of masculine women in engineering than in home economics. There was not a significant difference between the numbers of androgynous or differentiated individuals in either group.

In a study examining differences in students' choices of college major in gender traditional and nontraditional majors, 242 students enrolled in six different majors were administered the *Bem Sex Role Inventory* (BSRI), the *Personal Attributes Questionnaire* (PAQ), the *Internal Control Index*, the *Internal-External Locus of Control Scale*, the *Academic Self-Concept Scale*, the *Rokeach Value Survey*, a student academic

questionnaire, and a task values questionnaire (Lackland & De Lisi, 2001). Results revealed that three sex-role identity scores were significant predictors of choices for college majors. Participants who endorsed humanitarian concerns and who scored higher on the femininity scales were more likely to be in the helping professions than in sciences. Participants who endorsed utility values, scored higher on the masculinity scales, and had higher male-female sex role scores were more likely to be in the sciences rather than the helping professions. These findings provide additional support for the idea that gender role type is an important aspect when it comes to choice of college major.

In a study examining gender construct among students who chose to major in nursing, 384 nursing students were administered the *Bem Sex Role Inventory* (BSRI), a questionnaire assessing gendered views of nurse specialisms, the *Occupational and academic Self-Efficacy for Nursing* (OSEN), and a questionnaire assessing career aspirations (Muldoon & Reilly, 2003). Results revealed that gender role type was a significant predictor of "HR" career aspirations (e.g., midwifery, school nurse, pediatrics, and practice nurse). Participants with more feminine gender role types had more interest in "HF" careers (e.g. EMT). These findings also provide additional support for the idea that gender role type is an important aspect when it comes to choice of college major.

In summary, the research on college major selection has documented the importance of family factors and individual factors. Gender-type socialization impacts beliefs about performance and about appropriate course of study (Blanton, Christie, & Dye, 2002; Schmader, Johns, & Barquissau, 2004). Gender role type has been demonstrated to impact major selection as well (Jones & Lanke, 1985; Lackland &

DeLisi, 2001; Muldoon & Reilly, 2003). However, the research on these variables is still somewhat limited for math/science discipline compared to non-math/science disciplines.

STATEMENT OF THE PROBLEM

Despite the increase of women represented in the fields involving mathematics and science, women continue to be the minority in these fields. Past research has attributed this underrepresentation to women not having an innate ability to comprehend advanced levels of mathematics and science (Benbow & Stanley, 1980). However, more recent research has demonstrated that there are no differences in males' and females' math and science abilities (American Association of University Women, 1999; Brynes, 2005; & Catsambis, 2005).

Gender type socialization and gender role type may have an impact on an individual's math/science self-efficacy. Several studies have demonstrated that gender socialization has an impact on math/science self-efficacy (Jacobs, 1991; Schmader, Johns, & Barquissau, 2004). Other studies have demonstrated the impact of gender role type on math/science self-efficacy (Choi, 2004; & Muldoon & Reilly, 2003). Although these variables have been included in past research, they have not been combined in studies on math/science self-efficacy.

Several studies have also attempted to identify factors that contribute to the choices students make in college major such as parental influences and gender role socialization. Some of these studies have examined the impact of these factors on selection of major (Eccles, 1994; Frehill, 1997; Jodl, Michael, Malanchuk, Eccles, & Sameroff, 2001). Although these variables have been included in prior research, they have not been combined with gender role type. Research regarding gender role type and choice of college major is quite limited. An individual's gender role type is the result of the socializing agents that they have been surrounded by, typically parents. Given the

effects of gender role socialization and parental influences and expectations on students' choice in college major, more research is warranted on the impact of gender role type because it is the result of gender role socialization.

The purpose of this study was to: (1) examine differences in math/science self-efficacy based on gender-type socialization and gender role type, and (2) examine differences in gender-type socialization and gender role type across subjects the females teach. The following hypotheses were tested in this study:

Hypothesis 1:

Previous research has suggested that there are differences in math/science self-efficacy across the four different gender role types (Choi, 2004; Muldoon & Reilly, 2003). The first hypothesis is that females with androgynous and masculine gender role types will score higher on math/science self-efficacy than females with feminine or undifferentiated gender role types.

Hypothesis 2:

Previous research has also suggested that there are differences in math/science self-efficacy depending on gender-type socialization (Nosek, Banaji, & Greenwald, 2002; Jacobs, 1991). The second hypothesis is that females with low gender-type socialization will score higher on math/science self-efficacy than females with high gender-type socialization.

Hypotheses 3 and 4:

Previous research has suggested that choice of college major is influenced by gender-type socialization and gender role type (Frehill, 1997; Lackland & De Lisi, 2001; Muldoon & Reilly, 2003). The third hypothesis is that females majoring in a discipline

that requires advanced math/science skills will be more likely to have a gender role type of androgynous or masculine and be from a home with non-traditional gender-type socialization than females majoring in a discipline that relies less heavily on advanced math/science skills. The fourth hypothesis is that females majoring in a discipline that relies less heavily on advanced math/science skill will be more likely to have a gender role type of feminine and be from a home with traditional gender-type socialization than females majoring in a discipline that requires advanced math/science skills.

METHOD

Participants

The participants in this study were 65 female high school teachers from a large school district in the southeastern region. The participants were grouped based on the subject they teach (heavily relying on advanced math/science and not heavily relying on advanced math/science). A Demographic Form (see Appendix A) was used to gather data such as age. There were 34 participants in the non-math/science group which had a mean age of 30.82 and a standard deviation of 5.08. In the math/science group there were 31 participants whose mean age was 33.48 with a standard deviation of 5.96. There was not a statistically significant difference ($F(1,63) = 3.77$, $p = .056$) in age between the two groups. Chi square tests of independence revealed no significant differences in expected frequency for mother's education level ($\chi^2 = 1.95$, $df = 5$, $p = .86$), father's education level ($\chi^2 = 1.15$, $df = 5$, $p = .95$), mother's occupation ($\chi^2 = 7.95$, $df = 5$, $p = .16$), or father's occupation ($\chi^2 = 6.35$, $df = 4$, $p = .18$) across subject taught groups (non-math/science versus math/science). For this reason, demographic information on these variables has been collapsed across groups. For mother's highest level of education, 70% had completed some college or obtained postsecondary degree(s). For father's highest level of education, 80% had completed some college or obtained postsecondary degree(s). With regard to occupation, over 46% of mother's occupations were classified as professional while 60% of father's occupations were classified as professional.

The majority of the subjects had an undifferentiated gender-role type regardless of their score on the Academic Self-Efficacy Scale. 37 of the 65 participants had a gender-role type of undifferentiated, 13 had a feminine gender-role type, 10 had an androgynous

gender-role type, and 5 had a gender-role type of masculine. This suggests that most participants score low on both the masculine and feminine scales on the Personality Attributes Questionnaire. The majority of participants, 54 of the 65 total, came from non-traditional homes based on their responses to the Sex-Role Orientation Scale. This suggests that, regardless of math/science self-efficacy, most participants were raised in homes where non-traditional sex-roles were observed or promoted.

Materials

Participants completed a demographics form, the *Academic Self-Efficacy Questionnaire* (Wood & Locke, 1987), the *Personal Attributes Questionnaire* (PAQ; Spence & Helmreich, 1974), and *Sex-Role Orientation Scale* (SROS; Brogan & Kutner, 1976).

Demographics Form. The demographics form (see Appendix A) was used to determine age, college major and family variables that may be associated with academic self-efficacy. Information obtained from the demographics form was used to monitor other variables that might impact the results of the study.

Academic Self-Efficacy Scale. The *Academic Self-Efficacy Scale* (Wood & Locke, 1987) is an instrument designed to measure self-efficacy specific to a course in seven major academic areas (class concentration, memorization, exam concentration, understanding, explaining concepts, discriminating concepts, and note-taking). Class concentration assesses the amount of time in a class that a student feels able to concentrate or fully focus on the material. Memorization measures the proportion of facts and concepts in class that the student feels able to memorize or recall. Exam concentration measures the proportion of time during exams for which the student feels

able to focus. Understanding measures the proportion of facts and concepts covered in the course that the student feels able to understand. Explaining concepts assesses the proportion of facts or concepts that the student feels able to explain clearly to others in his or her own words. Discriminating concepts measures the proportion of time that the student feels able to discriminate between relevant and irrelevant information presented in class material. Note-taking measures the proportion of time that the student feels able to compile course notes that make sense, clarify concepts, and make links between important course materials.

For each academic skill area several items with equal intervals measure self-efficacy in relation to the course and course material. There are 4 to 5 items per task area, with 33 items total. Individuals are asked to indicate whether they could achieve a certain level of attainment (yes or no) and their degree of confidence that they could perform at that level (on a 0 to 10 scale). For example, for the Memorization scale,

> The proportion of facts and concepts covered in this course that you feel you are able to memorize and recall on demand (e.g., at exam time or in response to questions).
>
> | | Can Do | Confidence |
> |---|---|---|
> | 1. Memorize 60% of facts and concepts | | |
> | 2. Memorize 70% of facts and concepts | | |
> | 3. Memorize 80% of facts and concepts | | |
> | 4. Memorize 90% of facts and concepts | | |
> | 5. Memorize 100% of facts and concepts | | |

Scores range from 0 to 330, with higher scores indicating higher math/science self-efficacy. The score is based on whether the person feels as if they can perform the task and if they answer “yes,” to what degree they feel confident in their ability to do so.

Wood and Locke (1987) demonstrated adequate reliability of the instrument with highest mean inter-item correlation to be .84 and the lowest standard error of measurement (SEM) to be 6.28. Validity studies demonstrated a significant relationship between scores on the instrument and measures of academic performance and academic grade goals. In a study by Choi (2004) an internal consistency reliability coefficient of .94 was obtained for the seven items.

Personal Attributes Questionnaire. The *Personal Attributes Questionnaire* (PAQ; Spence & Helmreich, 1974) is an instrument designed to measure an individual's gender role type. This instrument contains 54 items and is used with adolescents and adults. The respondent is asked to indicate on a 5-point Likert scale how well each of the characteristics describes himself or herself. A rating of 1 would indicate "Very True of Me" and a rating of 5 would indicate "Not at All True of Me." The scale yields three scores: a masculinity score, a femininity score, and a masculine-feminine score and is used to classify people as masculine, feminine, androgynous, or undifferentiated. High scores on the masculine traits suggest that the individual possesses a masculine gender role type. High scores on the feminine traits suggest that an individual possesses a feminine gender role type. High scores on both the masculine and feminine traits is suggestive of an androgynous gender role type. Low scores on both masculine and feminine traits are suggestive of an undifferentiated gender role type. From this instrument, individuals are classified as masculine, feminine, androgynous, or undifferentiated.

The PAQ displays adequate internal consistency, with coefficient alphas of .85 for the masculine scale, .82 for the feminine scale, and .78 for the masculine-feminine scale

(Wilson & Cook, 1984). Construct validity of the PAQ has been supported through coorelations with typical masculine and feminine traits (Burnett at al., 1995). Test-retest reliability has been supported with a coefficient of about .60 over a 25 month period (Yoder, Rice, Adams, Priest, & Prince).

Sex-Role Orientation Scale. The *Sex-Role Orientation Scale* (SROS; Brogan & Kutner, 1976) is designed to measure gender-type socialization in the home. There are two different scales, one for women and one for men. Respondents indicate whether they heard a statement while growing up and if they believe that they might make the statement to their children. The statements include things such as, "A woman's place is in the home". Two scores result by summing the number of gender-role consistent statements heard in the past and those predicted in the future. Individuals can then be classified as high or low with regard to the gender-type socialization in the home. No specific information about reliability or validity was available for this instrument.

Procedure

Informed consent was obtained from each participant before they completed the questionnaires (See Appendix B). Participants were group administered a demographics form, the *Academic Self-Efficacy Questionnaire* (Wood & Locke, 1987), the *Personal Attributes Questionnaire* (PAQ; Spence & Helmreich, 1978), and *Sex-Role Orientation Scale* (SROS; Brogan & Kutner, 1976). Both groups were administered the same questionnaires. The questionnaires were counterbalanced to minimize the likelihood of order effects. Questionnaires assessed gender-type socialization behaviors within the family, gender role type of the participant, and math/science self-efficacy. Confidentiality for participants was maintained by removing all identifying information.

Data Analysis

The proposed design was to examine differences in math/science self-efficacy using a 2 (gender-type socialization) x 4 (gender role type) ANOVA. However, given the low numbers of individuals across groups a one-way ANOVA comparing math/science self-efficacy scores by group was completed first. The independent variable was subject taught (non-math/science or math/science), the dependent variable was math/science self-efficacy. To test hypotheses 3 and 4, gender role type and gender role socializations across majors, a series of Chi Square test of independence analyses were conducted.

RESULTS

The first hypothesis, concerned with differences in math/science self-efficacy based on gender role type, and the second hypothesis, concerned with differences in math/science self-efficacy based on gender-type socialization, could not be tested due to the small number of participants in some of the groups (see Tables 1 and 2).

Table 1
Means and Standard Deviations on Academic Self-Efficacy Scale for Gender-Role Type

Masculine			Feminine			Androgynous			Undifferentiated		
M	SD	N	M	SD	N	M	SD	N	M	SD	N
250.0	68.4	11	199.8	75.5	11	263.2	37.6	25	257.1	57.5	18

Table 2
Means and Standard Deviations on Academic Self-Efficacy Scale for Gender-Type Socialization

	M	SD	N
Non-Traditional Gender Type Socialization	246.1	60.7	54
Traditional Gender-Type Socialization	260.6	54.7	11

To examine the difference between math/science self-efficacy scores a one-way ANOVA was conducted to explore the impact the subject the participants teach had on math/science self-efficacy. There was not a statistically significant difference in Academic Self-Efficacy scores for the two groups [$F(1,64) = .01$, $p = .93$] (see Table 3).

Table 3
Means and Standard Deviations on Academic Self-Efficacy Scale for Subject They Teach

	M	SD	N
Math/Science Teachers	249.3	55.4	31
Non-Math/Science Teachers	247.9	63.9	34

The third hypothesis suggested that females teaching a subject that requires advanced math/science skills would be more likely to have a gender role type of androgynous or masculine and be from a home with non-traditional gender-type

socialization than females teaching a subject that relies less heavily on advanced math/science skills. The fourth hypothesis suggested that females teaching a subject that relies less heavily on advanced math/science skills would be more likely to have a gender role type of feminine or undifferentiated and be from a home with traditional gender-type socialization than females teaching a subject that requires advanced math/science skills. There was a statistically significant difference ($\chi^2 = 9.53$, $df = 3$, $p = .02$) in gender role type between females who teach math/science and those who teach other subjects (see Table 4). 45.2 percent of females who teach math/science had a gender role type of undifferentiated, versus 11.8 percent of women who teach non-math/science subjects.

Table 4
Percentage of Females in each Gender-Role Type Based on What Subject They Teach

	Masculine	Feminine	Androgynous	Undifferentiated
Math/Science Teachers	12.9%	9.7%	32.3%	45.2%
Non-Math/Science Teachers	20.6%	23.5%	44.1%	11.8%

There was not a significant difference ($\chi^2 = .03$, $df = 1$, $p = .87$) in gender type socialization in females who teach math/science and those who each other subjects. The majority of females came from homes with non-traditional gender-type socialization regardless of what subject they teach. 83.9 percent of females who teach math/science subjects came from non-traditional homes and 82.4 percent of females who teach non-math/science subjects came from the same type of home (see Table 5).

Table 5
Percentage of Females in each Gender-Type Socialization Group Based on What Subject They Teach

	Non-Traditional Gender-Type Socialization	Traditional Gender-Role Type Socialization
Math/Science Teachers	83.9%	16.1%
Non-Math/Science Teachers	82.4%	17.6%

Exploratory analyses

Exploratory analyses were conducted to examine differences in ratings on items 12 through 19 of the demographics form based on subject taught. A One-Way ANOVA revealed no statistically significant differences f (1, 46) = .73, p =.76). No follow-up ANOVAs were examined given the lack of statistically significant differences on scores across these questions.

Based on the lack of statistically significant differences between the groups on individual items, mean scores on items will be collapsed across group. See Table 6 for the means and standard deviations for items 12 through 19. The scores on items generally indicated "very frequently" to "frequently" ratings with the exception of the following items: "To what extent did your mother encourage you to excel in Athletics?," "To what extent did your mother encourage you to excel in Band?," "To what extent did your father encourage you to excel in Athletics?," "To what extent did your father encourage you to excel in Band?," and "To what extent did your father encourage you to take Advanced Placement or Honors Language Arts/English?" On these items mean scores indicated a mean response of "infrequently."

Table 6
Means and Standard Deviations on Items 12 through 19

	Mean	Standard Deviation
12. To what extent did your mother encourage you to major in your selected discipline?	1.74	.85
13. To what extent did your mother encourage you to excel in Language Arts/English?	1.51	.62
To what extent did your mother encourage you to excel in History?	1.52	.64
To what extent did your mother encourage you to excel in Math?	1.51	.62
To what extent did your mother encourage you to excel in Science?	1.54	.64

To what extent did your mother encourage you to excel in Art or Music?	1.55	.71
To what extent did your mother encourage you to excel in Athletics?	2.69	1.44
To what extent did your mother encourage you to excel in Band?	2.82	1.40
14. To what extent did your mother encourage you to take Advanced Placement or Honors Language Arts/English?	1.94	.93
To what extent did your mother encourage you to take Advanced Placement or Honors History?	1.97	.97
To what extent did your mother encourage you to take Advanced Placement or Honors Math?	2.00	.98
15. To what extent did your mother encourage you to take Advanced Placement or Honors Science?	1.98	.94
16. To what extent did your father encourage you to major in your selected discipline?	1.75	.75
To what extent did your father encourage you to excel in Language Arts/English?	1.57	.64
To what extent did your father encourage you to excel in History?	1.57	.66
To what extent did your father encourage you to excel in Math?	1.52	.59
To what extent did your father encourage you to excel in Science?	1.52	.59
To what extent did your father encourage you to excel in Art or Music?	1.66	.80
To what extent did your father encourage you to excel in Athletics?	2.23	1.33
To what extent did your father encourage you to excel in Band?	3.02	1.46
17. To what extent did your father encourage you to take Advanced Placement or Honors Language Arts/English?	2.02	1.04
18. To what extent did your father encourage you to take Advanced Placement or Honors History?	2.00	1.08
19. To what extent did your father encourage you to take Advanced Placement or Honors Math?	1.95	1.02
To what extent did your father encourage you to take Advanced Placement or Honors Science?	1.95	1.01
To what extent did your mother encourage you to be independent?	1.22	.45
To what extent did your father encourage you to be independent?	1.31	.53

The participants answers to these questions suggest that the majority of them felt that their parents were encouraging of them in school and encouraging of the major they chose in college. The answers to these questions may also have been a factor in their

ASE scores. Because they came from encouraging homes, they may have felt more confident about their abilities in all subjects in school.

DISCUSSION

The purpose of this study was to: (1) examine differences in math/science self-efficacy based on gender-type socialization and gender role type, and (2) examine differences in gender-type socialization and gender role type across subjects the females teach. However, the low number of individuals across groups warranted a one-way ANOVA comparing math/science self-efficacy scores by group (math/science teachers and non-math/science teachers). There was not a statistically significant difference between math/science self-efficacy scores for the two groups.

The findings indicate that the groups were too low in order to test the hypothesis stating that gender-role type and gender-type socialization is not associated with math/science self-efficacy. The one-way ANOVA findings indicate that subject taught is not associated with math/science self-efficacy. The results in this study may be due to the small number of participants in each group or to the fact that participants were chosen out of convenience rather than gathering a national sample. A larger sample chosen from a variety of regions may have yielded different results.

The findings also indicated that gender-role type is a related factor to what major females choose in college and thus the careers they chose. However, gender-type socialization was not a determining factor. In other words, the differences in percentage of individuals in each gender role type across subject area were likely to be related constructs. These findings were indicated despite previous research suggesting that choice of college major is influenced by gender-type socialization (Frehill, 1997; Lackland & De Lisi, 2001). The different results in this study could also be due to the

small number of participants in each group or to the fact that participants were chosen out of convenience rather than gathering a national sample.

The use of the Sex-Role Orientation scale may also have been a limitation to this study. Many of the statements participants were asked to respond to are not used today or not used as overtly as in the past. It is also interesting to speculate the possible reasons why almost all participants reported being raised in a home with non-traditional gender-type socialization. One possibility is that very few families continue to hold strict rules for what women and men should do. The findings could also lead to the speculation that, whether female teachers choose to teach subjects relying heavily on advanced math/science may be more related to interest in the subject rather than an underlying feeling of being skilled in the area of math/science.

Other factors that were explored as to possibly impacting the results of this study included age and parental education level. The mean age for each group was not statistically different and the standard deviation was small. The most frequently reported parental educational level for both groups was some college education to a college degree.

Future research in this area would involve a more national sample utilizing an updated measure for gender-type socialization and math/science self-efficacy. It might also be more effective to have participants' parents complete a survey on gender-type socialization, rather than have participants reflect back on what his or her home environment was like. It may also have been interesting to have participants' parents complete a survey and their own gender-role type. It may have also been even more effective to use high school students and their parents in the study rather than adults who

were asked to think about what their home was like when they were younger. This may have produced a more accurate measure of gender-type socialization. This would eliminate participants having to reflect back on how their home environment was as a child; they may have tended to view their family life as more non-traditional than it truly was because of current societal expectations or norms.

REFERENCES

American Association of University Women (1999). *Gender gaps: Where schools still fail our children.* Washington D.C.: American Association of University Women Educational Foundation.

Andre, T., Whigham, M., Hendrickson, A., & Chambers, S. (1999). Competency beliefs, positive affect, and gender stereotypes of elementary students and their parents about science versus other school subjects. *Journal of Research in Science Teaching, 36,* 719-747.

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

Basow, S. A. (1992). *Gender stereotypes and roles, 3rd edition.* Belmont, CA: Brooks/Cole Publishing Company.

Benbow, C. P., & Stanley, J. C. (1980). Sex differences in mathematical ability: Fact or artifact? *Science, 210,* 1262-1264.

Blanton, H., Christie, C., & Dye, M. (2002). Social identity versus reference frame comparisons: The moderating role of stereotype endorsement. *Journal of Experimental Social Psychology, 38,* 253-267.

Bornholt, L. J., Goodnow, J. J., & Cooney, G. H. (1994). Influences of gender stereotypes on adolescents' perceptions of their own achievement. *American Educational Research Journal, 31 (3),* 675-692.

Brownlow, S., Jacobi, T., & Rogers, M. (2000). Science anxiety as a function of gender and experience. *Sex Roles, 42 (1/2),* 119-131.

Byrnes, J. P. (2005). Gender differences in math: cognitive processes in an expanded framework. In A. M. Gallagher & J. C. Kaufman (Eds.), *Gender differences in*

mathematics: An integrative psychological approach (pp. 73-98). New York: Cambridge University Press.

Catsambis, S. (2005). The gender gap in mathematics: Merely a step function? In A. M. Gallagher & J. C. Kaufman (Eds.), *Gender differences in mathematics: An integrative psychological approach* (pp. 220-245). New York: Cambridge University Press.

Choi, N. (2004). Sex role group differences in specific, academic, and general self-efficacy. *The Journal of Psychology, 138 (2),* 149-159.

Dornbusch, S. M., Ritter, P. L., Leiderman, P. H., Roberts, D. F., & Fraleigh, M. J. (1987). The relation of parenting style to adolescent school performance. *Child Development, 58 (5),* 1244-1257.

Eccles, J. S. (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly, 18,* 585-609.

Frehill, L. M. (1997). Education and occupational sex segregation: The decision to major in engineering. *The Sociological Quarterly, 38 (2),* 225-249.

Golombok, S., & Fivush, R. (1994). Gender development. New York: Cambridge University Press.

Hackett, G., & Betz, N. E. (1989). An exploration of the mathematics self-efficacy/mathematics performance correspondence. *Journal for Research in Mathematics Education, 20 (3),* 261-273.

Jacobs, J. E. (1991). Influence of gender stereotypes on parent and child mathematics attitudes. *Journal of Educational Psychology, 83 (4),* 518-527.

Jodl, K. M., Michael, A., Malanchuk, O., Eccles, J. S., & Sameroff, A. (2001). Parents' roles in shaping early adolescents' occupational aspirations. *Child Development, 72 (4),* 1247-1265.

Jones, S. L., & Lamke, L. K. (1985). The relationship between sex role orientation, self esteem, and sex-typed occupational choice of college women. *Psychology of Women Quarterly, 9 (1),* 145-152.

Kiefer, A., & Shih, M. (2006). Gender differences in persistence and attributions in stereotype relevant contexts. *Sex Roles, 54,* 859-868.

Lackland, A. C., & De Lisi, R. (2001). Students' choice of college majors that are gender traditional and nontradiotnal. *Journal of College Student Development, 42 (1),* 39-48.

Leaper, C (2002). Parenting girls and boys. In M. C. Bornstein (Ed.), *Handbook of parenting* (2nd edition, pp. 189-225). Mahwah, NJ: Lawrence Erlbaum Associates, Inc., Publishers.

Lippa, R. (2004). Review of Bem Sex Role Inventory. In *Mental Measurement Yearbook.* Palo Alto, CA: Consulting Psychologists Press, Inc.

Muldoon, O. T., & Reilly, J. (2003). Career choice in nursing students: Gendered constructs as psychological barriers. *Journal of Advanced Nursing, 43 (1),* 93-100.

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math = male, me = female, therefore math ≠ me. *Journal of Personality and Social Psychology, 83 (1),* 44-59.

Oakes, J. (1990). Opportunities, achievement, and choice: Women and minority students in science and mathematics. *Review of Research in Education, 16,* 153-222.

Pajares, F. (2005). Gender differences in mathematics self-efficacy beliefs. In A. M. Gallagher & J. C. Kaufman (Eds.), *Gender differences in mathematics: An integrative psychological approach* (pp. 294-315). New York: Cambridge University Press.

Parsons, J. E., Adler, T. F., & Kaczala, C. M. (1982). Socialization of achievement attitudes and beliefs: parental influences. *Child Development, 53,* 310-321.

Schmader, T., Johns, M., & Barquissau, M. (2004). The costs of accepting gender differences: The role of stereotype endorsement in women's experience in the math domain. *Sex Roles, 50,* 835-850.

Serbin, L. A., Powlishta, K. K., & Gulko, J. (1993). The development of sex typing in middle childhood. Chicago: The University of Chicago Press.

Seymour, E. (1999). The role of socialization in shaping the career-related choices of undergraduate women in science, mathematics, and engineering majors. In C. C. Selby (Ed.), *Women in science and engineering: Choices for success* (pp. 118-126). New York, NY: The New York Academy of Sciences.

Simpkins, S. D., Davis-Kean, P. E., & Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. *Developmental Psychology, 42 (1),* 70-83.

Spence, J. T. & Helmreich, R. (1974). Personality Attributes Questionnaire. *Gender role: A handbook of tests and measures* (pp. 147-163). New York: Cambridge University Press.

Stockard, J. (1999). Gender socialization. In J. S. Chafetz (Ed.), *Handbook of the sociology of gender* (pp. 215-228). New York: Kluwer Academic/Plenum Publishers.

Usher. E. L., & Parajes, F. (2006). Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemporary Educational Psychology, 31,* 125-141.

Wood, R. E., & Locke, E. A. (1987). The relation of self-efficacy and grade goals to academic performance. *Educational and Psychological Measurement, 47,* 1013-1024.

Appendix A

Demographic Questionnaire

1. Age:_____

2. Race (circle one) Black White Hispanic Asian Other

3. Graduation year from High School_____

4. State of residence_____

5. Major:_____ Minor:_____

6. Current GPA_____

7. SAT Score:

_____Verbal _____Quantitative _____Writing

8. What was the highest level of education attained by your parents? (circle one)

Mother	Father	
1	1	Some grade school
2	2	Completed grade school
3	3	Some high school
4	4	Completed high school
5	5	High school & some training but not college
6	6	Some college
7	7	College
8	8	Some graduate work
9	9	Graduate degree (M.D., Ph.D., M.A.)

9. What were your parents' occupations? (circle one)

Mother	Father	
1	1	Semiskilled or unskilled (truck driver, factory worker)
2	2	Skilled worker or foreman (machinist, carpenter, cook)
3	3	Farmer (owner-operator or renter)
4	4	Clerical or sales (but not manager)
5	5	Proprietor, except farm (owner of business)
6	6	Professional (architect, teacher, physician, lawyer)
7	7	No occupation outside home
8	8	Some graduate work
9	9	Don't know

10. What is/was your father's occupation? _____

11. What is/was your mother's occupation? _____

The following questions are about your perceptions of your mother (or the woman responsible for caring for you as a child)

12. To what extent did your mother (or other woman) encourage you to major in your selected discipline (circle one)

very frequently frequently infrequently very infrequently never

13. To what extent did your mother (or other woman) encourage you to excel in the following areas (circle one for each area):

Academics:

Language Arts/English

very frequently frequently infrequently very infrequently never

History

very frequently frequently infrequently very infrequently never

Math

very frequently frequently infrequently very infrequently never

Science

very frequently frequently infrequently very infrequently never

Art or Music

very frequently frequently infrequently very infrequently never

Athletics

very frequently frequently infrequently very infrequently never

Band

very frequently frequently infrequently very infrequently never

14. To what extent did your mother (or other woman) encourage you to take Advanced Placement (AP) classes or honors classes? (circle one for each area)

Language Arts/English

very frequently frequently infrequently very infrequently never

History

very frequently frequently infrequently very infrequently never

Math

very frequently frequently infrequently very infrequently never

Science

very frequently frequently infrequently very infrequently never

The following questions are about your perceptions of your father (or the man responsible for caring for you as a child)

15. To what extent did your father (or other man) encourage you to major in your selected discipline (circle one)

very frequently frequently infrequently very infrequently never

16. To what extent did your father (or other man) encourage you to excel in the following areas (circle one for each area):

Academics:

Language Arts/English

very frequently frequently infrequently very infrequently never

History

very frequently frequently infrequently very infrequently never

Math

very frequently frequently infrequently very infrequently never

Science

very frequently frequently infrequently very infrequently never

Art or Music

very frequently frequently infrequently very infrequently never

Athletics

very frequently frequently infrequently very infrequently never

Band

very frequently frequently infrequently very infrequently never

17. To what extent did your father (or other man) encourage you to take Advanced Placement (AP) classes or honors classes? (circle one for each area)

Language Arts/English

very frequently frequently infrequently very infrequently never

History

very frequently frequently infrequently very infrequently never

Math

very frequently frequently infrequently very infrequently never

Science

very frequently frequently infrequently very infrequently never

18. To what extent did your mother (or other woman) encourage you to be independent? (circle one)

very frequently frequently infrequently very infrequently never

19. To what extent did your father (or other man) encourage you to be independent? (circle one)

very frequently frequently infrequently very infrequently never

20. In answering questions 12-19, were you referring to your: (circle one for female and one for male)

Female (circle one):	Male (circle one)
Biological or Adoptive mother	Biological or Adoptive father
Stepmother	Stepfather
Grandmother	Grandfather
Other female relative	Other male relative
Female non-family member	Male non-family member
Other	Other:
Explain, _____	Explain, _____

22. Please list below all the math and science courses that you completed in high school.

_____
_____
_____
_____
_____

Appendix B

Consent Form

I give my consent to participate in the research entitled "Differences in Females' Math and Science Self-Efficacy in Different Fields of Study: Based on Parenting Behaviors, Gender Role Socialization and Gender Role Type," which is being conducted by Ashley M. Rayburn, a graduate student in psychology at Western Carolina University. Questions regarding this research may be directed to Ashley M. Rayburn at amrayburn@catamount.wcu.edu; Dr. Candace Boan-Lenzo, Professor in the School Psychology Training Program, at cboan@email.wcu.edu; or Dr. Meagan Karvonen, Institutional Review Board Chairman, at Karvonen@wcu.edu.

I understand that participation in this research is entirely voluntary. I may withdraw consent at any time without penalty. If I choose to withdraw consent, the results of the participation, to the extent that I may be identified, will be removed from the research records or destroyed.

I understand the following points:

1. The reason for this research is to examine differences in females' perceptions of their abilities in math and science in different fields of study.

2. I will participate in the research by completing four questionnaires.

3. There are no foreseen discomforts, stresses, or risks associated with my participation in this research.

4. The results on my participation in this research will be confidential. These results will not be released in any individually identifiable format without consent unless otherwise required by law.

5. Any further questions about the research should be directed to the investigator at the email address listed above.

Participant Name _____ Date _____

Participant Signature _____

Researcher Signature _____

If you would like to receive a copy of the final results of this study, please write your email address here: _____