ELEMENTARY STUDENTS' PERCEPTIONS OF GENDER EQUITY IN MATHEMATICS CLASSES

by

Debra Jacobson

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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2015

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APPROVED BY:

Michelle B. Goodwin, Ed.D., Committee Chair

Kathy D. Spradlin, Ed.D., Committee Member

Rebecca Douglass, SLP.D., Committee Member

Scott B. Watson, Ph.D., Associate Dean, Advanced Programs

ABSTRACT

There have been various research studies stating that in elementary school, gender bias in all subjects is nonexistent. However, other researchers interested in gender equity in the mathematics classroom have recognized that gender bias does not occur in early elementary school grades but exists by middle school. Thus, research in this area is greatly needed. This study examined children in the third, fourth, and fifth grades to determine whether students' perceptions of their own mathematical abilities relate to their perceptions of their teacher's beliefs about gender bias in mathematics. Pearson Product-Moment correlation and Point-Biserial correlations were used to analyze data. The results of the current study found no significant correlation between students' perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics. However, it established a significant relationship between the gender of students and the perceptions of their mathematics teacher's gender equity behavior as well as a significant relationship between gender and their perceptions regarding their own mathematical ability.

Acknowledgements

I would like to thank my family as I would never have been able to complete anything without their ongoing support and encouragement. My parents always referred to me as their "forever student" and I would just like them to know that this long, never-ending formal educational ride is finally over. Without your assistance and patience, I might have given up a long time ago. Words cannot express how much you mean to me and how grateful I am to have you as my parents. You have stuck with me throughout all life's topsy-turvy endeavors, and for that, I am appreciative more than you will ever know.

I would also like to thank my entire committee: Dr. Michelle Goodwin, Dr. Rebecca Douglass, Dr. Kathy Spradlin, and Dr. Scott Watson. Thank you all for helping me pursue my dream of getting a doctorate and enduring this long dissertation process. Dr. Goodwin, great appreciation is extended to you as you accepted the position of being my chair, even when you were full and not able to take any additional dissertation candidates. Despite this, you accepted the responsibility of being my committee chair and all the work that revolves around that role. Dr. Rebecca Douglass, thank you for helping me throughout this process and helping with both research procedures and the dissertation paper, itself. You have also personally been through this processes (as so have my other committee members as well); however, you also went "the extra step" to help me with getting all of my data analyzed. Dr. Spradlin, I also wanted to thank you for your insight from someone outside the School of Education "bubble." You were very patient and were a wonderful asset to my committee. In addition, a special thank you to Dr. Watson. You have been with me from the very beginning of this process. Being head of a department, you are exceptionally busy, and I understand that. However, you understood my

circumstance and assisted me in helping find an appropriate committee. For that, I will be forever grateful.

In addition, I would like to thank Dr. Keith Douglass. I am overwhelmed with the assistance you gave me and the loving nature in which you did so. You were honest, straight-forward, yet demonstrated those characteristics in a loving, helpful, nurturing way. While the editing and personal advice throughout the dissertation process was matter-of-fact, your wonderful personality and kindness supported me along the way. When I had any question, you were immediately there to help answer it in an expeditious way. Thank you for putting up with my impatient and anxious personality. I would also like to thank Dr. Vann Scott. While the principle investigator coded all the raw data into a spreadsheet, both she and Dr. Scott analyzed the data together. Dr. Scott, you helped to analyze all my research data and explained what all the numbers meant. You were very patient and worked with me to help me conceptualize the results. I could not have done this without you. I'm so glad Dr. Rebecca Douglass pointed me in your direction.

Lastly, I would like to thank my brother, Michael Gentilella. Thank you for all your help with technological aspects of my dissertation and helping me format everything properly. In addition, you kept me from losing my dissertation several times. You were patient with me and my lack of technological ability. It's amazing the amount of knowledge that you have regarding electronics and how you were able to walk me through all my technological disasters throughout this process. You truly make me proud to be your sister. You are such a great person, and don't let anyone ever tell you differently.

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List of Abbreviations

American Association of University Women (AAUW)

Curriculum Based Measurement (CBM)

Gender bias in textbooks (GBIT)

Graduate Record Examination-Mathematics (GRE-M)

Education Testing Service (ETS)

Institutional Review Board (IRB)

Massachusetts Institute of Technology (MIT)

National Institute of Health (NIH)

National Public Radio (NPR)

Preliminary Scholastic Aptitude Test (PSAT)

Purdue Spatial Visualization Test: Rotations (PSVT:R)

Scholastic Aptitude Test (SAT)

Science, technology, economics, and mathematics (STEM)

Student evaluation of instruction (SEI)

Third International Mathematics and Science Study (TIMSS)

United Nations Education, Scientific, and Cultural Organization (UNESCO)

CHAPTER ONE: INTRODUCTION

A topic of continuing interest in education has been gender equity in school classrooms, especially in science and mathematics. Many studies have demonstrated that teachers' attitudes and behaviors differ by gender in mathematics and science classes (Valentine, 1998). This is labeled gender bias, which is the unequal treatment and expectations due to attitudes based on the gender of a group (Karp & Shakeshaft, 1997). Due to behaviors of teachers and students in mathematics and science classrooms, females tend to have lower expectations of success in those subjects. Female students often have a limited view of their potential in mathematics and science, which leads to feelings of incompetence (Windham, 1997). However, in this study, the focus will be solely on mathematics. This inquiry updates current knowledge regarding gender bias in modern elementary mathematics classrooms so that society may address gender equity in the classroom accordingly. Gender bias is the belief or attitude that one sex or gender is of higher power than the other. This can lead to unfair difference in the treatment of men or women because of their sex or gender (Legal Resources, 2007).

Background

The proportion of women active in mathematic academic programs and occupational fields requiring mathematics was at an all-time low in 2003 (Schober, Reimann, & Wagner, 2004). Those disturbing findings may be attributed to a concept labeled as "stereotype threat." Stereotype threat is defined as the risk of confirming a negative stereotype about one's group as a self-characteristic (Hanna, 2003). Ryan and Ryan (2005) stated that females were more depressed and underperformed anytime the stereotype threat was activated. They asserted that even moderately well achieving females could experience stereotype threat. Stereotype threat can cause anxiety, apprehension, low self-esteem, low expectations for success, and result in

lower test performance. Most research on stereotype threat was conducted with late adolescent students. However, by 11 or 12 years old, the conditions for stereotype threats are already in place.

There are some who contend that gender bias does not exist. In Ireland, according to Flynn (2007), there are more women working than men in the medical and medical-related fields. Seventy-seven percent of this job market was comprised of females in 2007. Thirty percent of the students seeking law degrees were male, and they continued to dominate in the areas of engineering and construction.

Berezow (2011) argued that more women than men received Ph.D.'s in the academic year of 2009-2010. They received 60% of the master degrees, and there were more women undergraduate students as they composed 57% of the student population, versus 43% men. Females have outnumbered males in undergraduate studies since 1993. Berezow states that gender bias continues to exist in science; however, she argues that this is misleading, as there is a "soft science" and "hard science." The soft sciences include social and behavioral sciences as well as health sciences, whereas hard science refers to chemistry, physics, and engineering.

In the 2009-2010 academic year, 60% of social and behavioral science doctoral degrees were awarded to women, while 70% of women were awarded Ph.D.'s in behavioral science (Berezow, 2011). In the hard sciences, more than 75% of new veterinarians were female and over 50% of new medical doctors were women. She added that women obtained 51% of doctoral degrees in biological and agricultural sciences. Those who state that gender bias continues to exist, even in hard sciences, are erroneous in their assertions that gender discrimination occurs. It may be that women prefer, for various reasons, not to enter into the

hard sciences. "While sexism in academia likely existed decades ago, today it is largely a myth" (Berezow, 2011, para. 15).

One purpose of the No Child Left Behind Act has been to encourage females to attempt and succeed in mathematics. In contrast to gender bias information that has been presented in the past, according to Hanna (2003), gender comparisons now show that girls are starting to outperform males, with males under-represented in mathematics and science classes. Hanna (2003) contended, "this is because girls tend to get higher high school grades." Research states that boys are more likely to be labeled educationally impaired and assigned to special education classrooms" (p. 213). There has been a great deal of research stating that in elementary school, gender bias in all subjects is nonexistent (Herbert & Stipek, 2005). However, Berezow (2011) noted contrary evidence. Windham (1997) was interested in gender equity in the mathematics classroom and recognized gender bias as present in upper elementary grades. Leaper & Brown (2008) noted that their adolescent participants recognized gender discrimination, including sexual harassment as well as academic sexism. Over half of the girls reported hearing negative comments regarding their mathematical, scientific, and technological abilities in addition to 90% of them experiencing sexual harassment at least once.

For much of their lives, from three years old until about eighteen years old, children learn about society's beliefs and expectations through classroom experiences (Herbert & Stipek, 2005). According to Hwang, Chen, and Hsu (2006), women were represented in classrooms as having traditional female roles. Additionally, males had a greater presence overall than females in textbooks. This is considered gender bias. Karp and Shakeshaft (1997) defined gender bias as unequal treatment and expectations due to attitudes based on the gender of a group. Salkind and Rasmussen (2008) reported that gender bias is the differential treatment of individuals based

upon their gender. Salvia and Ysseldyke (2004) stated, "even though society strives for total equality, not all groups are treated equally" (p. 324).

Textbooks, teacher behavior towards students, assessments, and the language and concepts studied within most classrooms should depict equality, as this promotes educational opportunities for students with diverse backgrounds (Salvia & Ysseldyke, 2004). Warwick and Jatoi (1994) stated that teacher characteristics, in addition to teaching methods, can impact student performance. They contend that gender bias in the classroom exists in most countries. According to Drudy (2008), "in Western societies the earliest stages of the formation of masculine identity involve processes which result in the association of a masculine identity with patterns of behavior that are not feminine" (p. 319). In patriarchal societies, as more women participate in an occupation that is highly feminized, the harder it is for males to attain positions in that job as the gender discrepancy creates a difficult choice for them.

Schmurak (1994) stated that "girls are the only group that start school ahead and end up behind" (p. 63) and the more current 2010 study by Fryer and Levitt confirms this. Fryer and Levitt (2010) note that no mean differences exist between the two genders when they enter schooling; however, in the first six years, girls lose as much as two tenths of a standard deviation in math performance. In kindergarten, 45% of females are in the top 5% of math test scores. However, by fifth grade, this percentage drops significantly. By the end of their elementary school experience, females make up only 28% of the top 5% of math performers.

In Fryer and Levitt's 2010 study, they found that there was no distinguishable difference in math performance when children entered school; however, by the end of their first grade school year, females were 0.08 standard deviations below their male counterparts. This gap increased throughout school. By the end of the third grade year, female math performance,

again, was below male performance by 0.21 standard deviations. This gap, although not statistically significant, remains at this level throughout elementary school years.

Johnson, Arumi, Ott, and Hamill (2006) reported the existence of gender bias in school mathematics courses. The negative attitudes toward students in the classroom are a direct result of curricular content, various teaching methods, and the environment of the classroom, according to Zhao and Hoge (2005). Some researchers, such as Herbert and Stipek (2005) proposed that gender differences in math competency begin as early as first grade. He stated in contrast, that other research has indicated that gender differences remain relatively stable throughout the elementary grades. According to Windham (1997), most research, however, has not demonstrated gender differences in early elementary grades. Gender bias begins in late elementary to middle grades according to most investigators.

Problem Statement

This study examined students in the third, fourth, and fifth grades to determine whether there is a relationship between perceptions of gender bias between girls and boys regarding their own mathematical ability, as well as student perceptions regarding their teacher's beliefs and displays of gender bias in the mathematics classroom. A gap in the current research exists regarding students' observations of their teacher's behavior as well as the teacher's beliefs and how this correlates to the students' perceptions of their own mathematical ability.

Purpose Statement

The purpose of this correlational study was to investigate whether students perceive gender equity in mathematics classes, and whether the perception of gender bias has a relationship to students' self-perceptions of their mathematical ability. The relationship between students' perceptions of their math teacher's gender equity or inequity and the impact it has on

their perceptions of their own mathematical ability was explored. One of the variables of interest, gender, was defined as being male or female. The other variable of interest, perception, was defined as becoming aware of the world around a person causing personal thoughts and beliefs. The relationship between gender bias in classrooms and the impact it has on mathematical performance in upper elementary grades has had little investigation. Additional research is necessary in this area.

Significance of the Study

The focus of this research was to examine aspects of children's perceptions of gender bias. This research concentrated on whether students' perception of their own mathematical ability had a relationship with their perceptions of their teacher's beliefs about gender bias in mathematics.

Research Questions

RQ1: Do students' perceptions of their mathematics teacher's gender equity behavior correlate with students' perceptions of their own mathematics ability?

RQ2: Does the gender of students relate to their perceptions of their mathematics teacher's gender equity behavior and to their own mathematical ability?

Null Hypotheses

$H_0$1: There is not a statistically significant correlation between a students' perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure a students' perception of their teacher's gender equity beliefs in mathematics.

$H_0$2: There is not a statistically significant relationship between the gender of students and how students perceive their teacher's perception of gender equity behavior.

$H_0$3: There is not a statistically significant relationship between gender and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey.

Identification of Variables

There were multiple variables in this study. The significant variables included gender and perceptions of the students, specifically perception of their mathematics teacher's gender equity behavior as well as students' perceptions regarding their own mathematical ability. Many confounding variables were also present such as the demographics of each school as well as the instructional model used. One school departmentalized in fourth and fifth grades while the other did not. Departmentalizing is an instructional model in which all students from that specific grade level have different teachers for different subjects.

Definitions

Following are definitions that are essential in understanding the literature and research regarding gender equity and bias. Each of the definitions presented are conceptual in nature rather than just direct definitions from encyclopedias. Therefore, the reader will have a better understanding of the terms used in theory and those related to this study.

1. *Conventional gender ideologies* - attitudes and beliefs that are conventional in nature and that conform to society's beliefs. Traditional gender ideology examples are that females are weaker and emotional while males should be stronger and more rational (Spencer, Porche, & Tolman, 2003).
2. *Cross-gender classrooms* - a classroom that is comprised of both male and female students and teachers (Warwick & Jatoi, 1994).
3. *Culture* - the way a society lives, their norms, ideas, and their beliefs are all based

upon culture, which characterizes a society and gives it an independent identity (Karp and Shakeshaft, 1997).

4. *Departmentalization model of instruction* - an instructional model where students receive instruction from several different individuals in a given school day (Chang and Koshewa, 2008).
5. *Gender* - either of the two main categories (male and female) into which humans and many other living things are divided on the basis of their reproductive functions. It is based upon a society's ideas and practices of what the terms males and females denote (Karp and Shakeshaft, 1997).
6. *Gender bias* - the prejudice in action or treatment against people on the basis of sex or gender. Gender bias is basically the belief or attitude that one sex or gender is of higher power than the other. This can lead to unfair difference in the treatment of men or women because of their sex or gender (Legal Resources, 2007).
7. *Gender Discrimination* - the unfavorable treatment of individuals based upon their sex or gender. This discrimination denies the person of rights, opportunities or resources (Reeves & Baden, 2000).
8. *Gender Equity* - gender equity notes the equivalent treatment of a person regardless of gender or sex. It is the ideology that women have the same opportunities as men in life. The phrase defines that males and females have different needs and interests; however, despite this, they receive the same treatment (Blumberg, 2009).
9. *No Child Left Behind Act of 2001* - the purpose of this act is improving academic achievement and closing the achievement gap through accountability, flexibility, and

choice. This act was based upon the Elementary and Secondary Education Act of 1965. There are 4 specific principles in which NCLB is based upon:

1. Stronger accountability for results
2. Increased freedom for states and communities
3. Additional choices for parents
4. Proven educational methods (U.S. Department of Education, 2009).

10. *Perception* - the process of becoming aware of the world around a person through his senses (Positive Thinking Principles, 2008).
11. *Performance Standards* - educational guidelines that represent expectations for instruction, assessment, and student work. They define the level of work that demonstrates achievement of the standards. The performance standards isolate and identify the skills that are needed to reason, communicate, and problem solve (Georgia Department of Education, 2009).
12. *Self-contained model of instruction* – where students are taught by one teacher every day, thus one teacher administers all the different subject-area instruction (Chang et al., 2008).
13. *Self-efficacy* - the beliefs of people about their competency to successfully perform a task (Ancis & Phillips, 1996).
14. *Sex* - the biological characteristics that make a person male or female (Karp and Shakeshaft, 1997).
15. *Stereotype* - a widely held but fixed and oversimplified image or idea of a particular type of person or thing (Hanna, 2003).

16. *Stereotype threat* - a situational predicament in which individuals are at risk of confirming negative stereotypes about their group (Hanna, 2003).
17. *Title IX* - enacted in 1972. An education amendment that prohibits sex-based discrimination in schools under penalty of loss of federal funds (Owens, Smothers, & Love, 2003).

Summary

There has been a great deal of research stating that in elementary school, gender bias in all subjects is nonexistent (Herbert & Stipek, 2005). However, there is contrary evidence as noted by Windham (1997). Gender equity has been a very controversial subject in education for many years. There have been numerous studies that support and reject the existence of gender bias in perception to certain academic subjects. Additional exploration is needed in this area.

CHAPTER TWO: LITERATURE REVIEW

This chapter explores the literature contributing to gender equity and gender bias in academia. This section presents ideas contributing to society's current knowledge about the subject and will present theoretical and analytical positions related to mathematics and gender. Sources included journal articles, books, and other educational materials, but information was also accessed through websites and databases. This literature review explores gender bias and presents possible solutions to increase gender equity.

Bandura (2002) noted social cognitive psychology as the study of a society's influence on people's cognition and the way they behave, think, and feel. Human functioning is based upon three agency modes and their influences over a person. The first is direct personal agency in which a person's behaviors are influenced by their own cognitions. The second and third agencies, proxy agency and collective agency, are others' influence on a person. A person learns a great deal of the time through social environments.

Self-efficacy, or a person's perceptions about their own capabilities for learning or performing actions at designated levels (Schunk, 2012), is a result of all three agencies interacting together. Bandura (2002) noted that self-efficacy is a way to control human functioning. Consequently, a human's motivations, cognitions, behaviors, and decisions are influenced not only by oneself, but also by other people and the community that surrounds them. They affect how a person thinks and acts in either a self-hindering way or in a positive, self-enhancing way. Others affect a person's choices, decisions, motivations, morality, emotions, achievement, and ability to persevere in times of great difficulties.

Humans vicariously learn through reciprocal actions between themselves and others. Self-efficacy influences task choices, persistence through tasks, the use of learning strategies,

and overall achievement behaviors. In turn, these behaviors affect self-efficacy, as the influence between the factors is reciprocal. This can be demonstrated as students self-monitor their own learning and demonstrate a progression of mastery via certain tasks, their self-efficacy increases (Schunk, 2012).

One central concept of social cognitive theory is that humans learn through two primary ways: through physically doing an activity through vicarious experiences. Most of student learning comes from both models of learning. However, learning through the environment and vicarious experiences cannot be understated. An example of this is when "able students who want to be socially accepted by their peers may not demonstrate the full range of their learning so as to appear more in line with their classmates' competencies" (Schunk, 2012, p.105). Through vicarious learning, people shape their lives and their futures. Sometimes, especially in the classroom, students do not proactively decide what they pay attention to or what they learn. While academic knowledge is one concept of learning in the classroom, another involves higher order conceptual thinking. Students are taught critical thinking skills as well. Therefore, a student is able to conceptualize actions in the classroom, process them accordingly, and create feelings and emotions based upon what they see (Schunk, 2012).

The interpretations of actions and the ability to create new future actions are also known as learning through symbolic processing. A person adapts and alters their future as a result of these processes. There are three types of vicarious learning through modeling: inhibition and disinhibition, response facilitation, and learning through observation. Response facilitation does not reflect learning, as the person already knows how to perform the action. An example of response facilitation is when "an individual walking down a street who encounters a group of

people looking in a store window may stop and look in the window" (Schunk, 2012, p. 106). The other two types of modeling are, in fact, ways of learning.

Inhibition and disinhibition are "when the model strengthens or weakens [a person's] inhibitions to perform [tasks] or behaviors" (Schunk, 2012, p. 106). One example of this is when students perform an undesirable behavior in the classroom such as getting out of their seat. This behavior is inhibited by the teacher punishing students and classmates learning from this situation. However, it could also be disinhibited if the teacher does not punish students and their classmates observe this lack of punishment. Similarly to response facilitation, inhibition and disinhibition are not ways of new learning as this performance is of previously learned behaviors. When the behaviors were not previously learned, prior to modeling, this is known as observational learning (Schunk, 2012).

Schunk (2012) also stated that observational learning consists of motivation, attention, production, and retention. Human behavior is often repetitious, especially in the classroom. The higher the amount of repetition, the more the student is able to retain concepts. As an example, the teacher may model a certain feeling or personal belief in the classroom each day through grading assignments, calling on students to participate, or choosing students to lead the classroom in various activities. As the teacher may be unaware of these displays of their feelings, these same characteristics become common in the everyday classroom. Students may, inadvertently, learn these behaviors as well and perform accordingly, as demonstrated by motivation and participation. If students learn that the teacher calls on girls more frequently to answer questions orally, the male students may discontinue participation knowing that the teacher will not call on them.

Theoretical Framework

For much of their lives, from three years old until about 18 years old, children learn about society's beliefs and expectations through classroom experiences (Herbert & Stipek, 2005). According to Hwang et al. (2006), women were represented in classrooms as having traditional female roles. Additionally, the appearance of males in textbooks had a greater presence overall than females. This is labeled as gender bias. Karp and Shakeshaft (1997) defined gender bias as unequal treatment and expectations due to attitudes based on the gender of a group. Salkind and Rasmussen (2008) noted that gender bias is the differential treatment of individuals based upon their gender. Salvia and Ysseldyke (2004) stated, "even though society strives for total equality, not all groups are treated equally" (p. 324).

Teachers, in addition to the community, convey their personal biases every day to students. The impact on their students is either implicitly or explicitly expressed (Tiedemann, 2002). Brown & Bigler (2005) noted that children's discrimination perceptions are important for both applied and theoretical reasons. "Perceiving oneself to be the target of discrimination is likely to affect individuals' identity formation, peer relations, academic achievement, occupational goals, and mental and physical well-being" (p. 533).

Tiedemann (2002) noted that these messages may be neutral or may be based upon gender bias. According to Bianco et al. (2011),

> These messages are [often] unintended and are communicated to students by what is expected of them, how they are treated, how and what they are taught, how learning is assessed, and the type of encouragement they receive relative to pursuing different paths throughout their school trajectory and beyond. (p. 172)

According to Fryer and Levitt (2010), a great deal of evidence suggests that the gender gap in mathematics does not exist before students enter school; however, it is prevalent by the time the students attend middle school.

Brown and Bigler (2005) noted developmental knowledge of discrimination. By age one, children visually see differences in groups (e.g., he is African American, or she is a girl). By age four, children have the ability to label not only others' gender, but their own gender as well. In the beginning of childhood, children's perceptions of race and gender are physical; however, by adolescence, this knowledge expands to include sociobiological factors as well.

According to Brown and Bigler (2005) "most children (92%) are familiar with the meaning of discrimination by the age of ten, with name calling the most frequently cited example" (p. 534). In addition, as they get older, children become gradually able to take others' prospective into account. They contend, "perspective-taking ability is positively correlated with age" (p. 541). In a study by Brown et al. (2011), elementary and middle school students were interviewed in addition to submitting their daily diaries and self-report measures to determine awareness of gender equity or bias. Results indicated that girls in sixth grade were more often able to give examples of gender bias against their gender than were the boys. The boys often were found to be unaware of the bias.

Spencer et al. (2003) believe a pathway that involves gender equitable practices, gender ideologies, and psychological health leads to positive academic outcomes. Gender ideologies and what society perceives as gender appropriate has an effect on psychosocial health in addition to gender equitable practices. Psychosocial health is correlated with academic outcomes and plays a significant role. Mental health affects performance significantly; however, the

experiences and practices in the classroom that are implemented by the teacher are important as well.

Historically, the traditional role of teachers was to instruct students in appropriate sequences through rote learning, and memorization (Hanna, 2003). Hanna stated that teachers should have exercises for the students that consist of "memorizing procedures, exploring models instead of memorizing formulas, searching for solutions, and solving problems rather than just completing exercises" (p. 109). This approach may lead to more gender equity in classrooms, as males and females think about concepts using different cognitive methods. It is noted that males are given more time when answering questions and are asked more higher-order questions than females (Schmurak, 1994). Male roles in textbooks have characteristics such as being strong, aggressive, successful, independent, responsible, and self-confident. Females were perceived as nurturing and depicted in roles that demonstrated warm, emotional, passive personalities (Erden, 2009).

Traditionally, in the United States, women were "not allowed equal access to educational, political, and professional institutions" (Corey, 2005). In the seventeenth and eighteenth centuries, women were not represented in pictorial images or in text (Hanna, 2003). Higher education was offered to men, while women were excluded from enrollment in the 1800s (Silverstein, 2000). Since women were assigned to domestic roles, they were considered the sole caretakers of children. In the early nineteenth century, many American cities began establishing separate high schools for girls. Ralph Tyler, a psychologist who studied curricula, reported that women created educational curricula based on the interests and language of children (McNeil, 2006). Mendick (2005) noted that before the mid to late twentieth century, "reversal" of gender differences in mathematics became more common. Females tend to outperform males in

mathematics, yet on the other hand, femininity was also known as "poor performance" (p. 206). Even though women now had access to mathematics instruction, they were not expected to perform to the level of their male counterparts. This demonstrated the negative effects of being feminine before the occurrence of gender differences in mathematics.

There are many hypotheses about the evolution of gender differences. The history behind gender differences shows that some used to think that mathematical ability had nothing to do with age, as it was genetic in nature (Fan, 1995). While some research demonstrates that males tend to possess better visual-spatial skills than females, Jones (2010) stated that this is due to parents encouraging females less and buying fewer toys that build those visual-spatial skills. Until the 1960's, equity in mathematics instruction was not a priority for education in the United States. However, the feminist movement of that decade created more gender equality as well as access to mathematics educational opportunities for females (Ryan & Ryan, 2005).

Some researchers note that the primary reasoning behind the gender gap in academics is biological in nature. Fryer and Levitt (2010) indicated that males have better spatial skills, brain development, and higher order thinking skills. Hanna (2003) explored gender differences in 1992, and proposed that women were inferior to males in mathematics because of biological factors. It was Hanna's opinion that females were geared more towards language arts while males had "mathematical minds." Furthermore, one could not be "good" in both subjects.

Hanna (2003) stated that females attributed success to pure luck, whereas, males attributed their success to having a high ability level. Males tended to attribute failure to external factors. This is known as the expectancy model of attributions. According to Beyer and Bowden (1997), "expectancies that are consistent with one's performance lead to attributions to stable causes, whereas expectancies that are inconsistent with one's performance lead to attributions to

unstable causes" (p. 159). Therefore, if females expect males to be better at mathematics or any other subject, their own high performance in that area is inconsistent with their internal beliefs.

Beyer and Bowden's (1997) data explored the accuracy of self-evaluations of performance, where male and female participants were presented with gender-typed tasks. The masculine task consisted of sports trivia, while the feminine task consisted of trivia that related to show business, movies, and television shows. Results indicated that when the task was masculine, females tended to underestimate their performance (Beyer & Bowden, 1997). "This suggests that females have greater difficulty [in] evaluating their performance on a gender-incongruent masculine task than males have on a gender-incongruent feminine task" (Beyer & Bowden, 1997, p. 169). As inaccurate self-evaluation has an effect on self-esteem and self-efficacy, the implications of this study are significant. As the researchers noted, negative self-evaluations can lead to medical as well as behavioral problems. Females tend to underestimate their performance due to having low self-consistency tendencies and expectations. The low expectancies can lead to limited task performance in the future. "Misperception of one's ability could thus affect the kinds of tasks, courses, careers, and so forth that one chooses, and one's persistence and performance in those areas" (p. 169).

Harvard President Larry Summers claimed that the reasoning behind fewer women enrolling in science and engineering majors might be due to innate differences (Agogino, 2006). However, Agogino's research stated that the root cause of the gender gap is structural and implicit gender bias. She reported that women in academia leave more frequently because of the environment and its unfriendly climate. Furthermore, nothing can be changed in a society without someone advocating for equality first. In addition, most commodities in society were designed for the average male. As an example, Agogino noted the design of automotive bags.

Many lives were lost until the size of the person was considered. That did not occur until members in society protested and advocated for consideration of gender as well as the size of the person. Agogino continued by noting that diverse backgrounds of individuals were also frequently ignored.

Current research suggests that mathematical ability is partially biological in nature; however, ability is equally dependent upon psychosocial, psychological influences on physiology, as well as in the teacher's modeling of instruction (Ryan & Ryan, 2005). In addition, social and cultural factors contribute to math ability (Hanna, 2003). Even the way a society recognizes, frames, and answers problems is highly gendered. Gender bias cannot be solely attributed to biology, but that male-gendered society enforces gender schemas. While gender schemas may have a foundation in biology, society encourages and even pressures women to pursue their nurturing tendencies, while it encourages achievement, power, and prestige in males. "We don't accept biology as destiny…. We vaccinate, we inoculate, we medicate" (Sommers, 2008, p. 1).

Brown and Bigler (2005) stated that children's beliefs about discrimination are much more complex than biology. There are several factors that are involved such as cognition skills, individual factors, in addition to situational variables. Cognitive skills emerge as early as six years old and then social, as well as interactional factors, follow. All of these interactions contribute to gender bias beliefs.

The proportion of women active in mathematical academic programs and mathematical occupational fields was at an all-time low in 2003 (Schober et al., 2004). The disturbing findings reported could be attributed to a concept labeled as "stereotype threat." Stereotype threat is defined as the risk of confirming a negative stereotype about one's group as a self-characteristic

(Hanna, 2003). Ryan and Ryan (2005) stated that because of the negative stereotypes about females, females were depressed and underperformed anytime the stereotype threat was activated. They asserted that even moderately well achieving females could experience stereotype threat. Stereotype threat can cause anxiety, apprehension, low self-esteem, low expectations for success, and can result in low test performance. Most research on stereotype threat was done with late adolescent students. However, by 11 or 12 years of age, the conditions for stereotype threats are already in place.

By early adolescence, students are aware of gender-based discrimination, including both gender bias and sexual harassment. Leaper and Brown (2008) noted that 90% of adolescent females reported experiencing sexual harassment at least once. The negative stereotypes and harassment have a large effect on girls who are still developing their gender identity. Stereotype threats do not necessarily lower women's expectations for success on mathematics exams; however, they make women evaluate themselves negatively, such as internalizing feelings of lower self-competency, lower self-esteem, a lower body image, and lower feeling of self-worth. In the study conducted by Leaper and Brown (2008), over half of the girls reported hearing discouraging comments about their own abilities in math, science, and technology. The authors noted that this not only lowers motivation to continue in math, science, and technology courses, but "our society suffers when we lose potentially talented individuals in these increasingly important fields" (Overall Trends in Girls' Perceptions of Personal Sexism, para. 4).

Hagedorn (1996) found that stereotype threat increased anxiety because females knew about the negative stereotype and felt pressured to disprove it. Consequences included frustration and increased apprehension. Owens, Smothers, and Love (2003) noted that the many historical differences in the treatment of girls and boys result in enduring learning patterns that

remain with female students for the rest of their academic careers. Thus, the alterations in their learning patterns may lead to less efficient cognitive processing.

Valentine (1998) described six types of sexism. The first was gender reinforcement. Examples of this occur when someone tells the person to "act like a boy" or "act like a girl." The next type was embedded discrimination. This included sexism in language usage, records, and textbooks. Third was gender role stereotyping. This included expectations that people behave in certain ways according to traditional social role expectations. Examples included women as housewives or men as doctors. The fourth type of sexism was gender discrimination, where one gender controls the other, such as boys not allowing girls equal access to a computer. The fifth type of discrimination was active discrimination. This is denying activities to one gender but not the other. An example of this is "boys only" clubs. Lastly, with explicit sexuality, there was treatment of females as sex objects. Schmurak (1994) conducted a study that included observation in several schools. Forty-one of 80 school classes were found to contain sexist behaviors. Embedded discrimination was the most frequent type of sexism.

In one study, Herbert and Stipek (2005) found that the earliest perception of gender bias against females occurred in the first grade. However, the differences in bias between male and female students in the rest of the elementary school grades were insignificant. Gender differences appeared in first grade but tended to diminish over time. However, in another study, it was found that girls' attitudes became more negative about mathematics as they grew older, beginning at age 12. Gender bias has an effect on girls' self-perceptions. Males have lower expectations for success in academics in general, while girls tended to have lower expectations for success in math, science, and technology (Drysdale & Milne, 2005). Studies have shown that there are gender differences in perceptions of ability in math. Girls have low perceptions of their

competencies in math. These low perceptions of competence by female students have been related to low participation and low performance in mathematics, science, and technology (Herbert & Stipek, 2005). Karp and Shakeshaft (1997) reported that a good predictor of whether students will continue in mathematical courses that are optional in high school is students' perception of their level of ability.

Classroom Influences in General Education

Schmurak (1994) stated that "girls are the only group that start school ahead and end up behind" (p. 63), and the more current 2010 study by Fryer and Levitt confirms this. Fryer and Levitt (2010) noted that no mean differences exist between the two genders when they enter schooling; however, in the first six years, girls lose as much as two tenths of a standard deviation in math performance. In kindergarten, 45% of females are in the top 5% of math test scores. However, by fifth grade, this percentage drops significantly. At the end of their elementary school experience, females make up only 28% of the top 5% of math test scores.

In Fryer and Levitt's 2010 study, they found that there was no distinguishable difference in math performance when children entered school; however, by the end of their first grade school year, females were 0.08 standard deviations below their male counterparts. This gap increased throughout school as seen by the end of the third grade year. Females' math performance, again, was below male performance by 0.21 standard deviations. This gap, although not statistically significant, remains at this level throughout elementary school years.

In a study conducted by Matthews et al. (1998), classroom observations indicated that, even in fifth grade, there appeared to be gender segregation. The students sat with classmates of their own gender. Afterwards, males played in a more physical, competitive manner while female students engaged in conversations with each other, walking the sidewalks and track.

According to Owens (2003), efforts should be made to ensure that individuals from diverse backgrounds are represented in textbooks and classrooms in both traditional and nontraditional roles. Students spend 80% to 95% of their classroom time using textbooks. Blumberg (2009) contends that gender bias in textbooks, or GBIT, is greater in weaker countries that have poorer school systems. Gender bias is evident in lines of texts, citations in indices, titles of books, and proportion of named characters, both human and animal. Although improvement over the past few decades is evident, progress is slow. Spencer et al. (2003) argued that curriculum and educational materials should not address occupations solely in relation to gender but represent gender equity in roles of power and social justice.

Textbooks, teacher behavior towards students, assessments, as well as the language and concepts studied throughout most classrooms should depict equality, as this promotes educational opportunities for students with diverse backgrounds (Salvia & Ysseldyke, 2004). Warwick and Jatoi (1994) stated that teacher characteristics, in addition to teaching methods, can affect students' performance. Brown and Bigler (2005) noted that even five-year-old children can correlate teacher behavior with discrimination.

> In their study, in contrast, older children (eight- to ten-year-olds) consistently attributed a teacher's behavior to discrimination if the teacher had a history of gender bias and attributed a teacher's behavior to other causes (e.g., the students' ability or effort) if he or she showed a history of gender fairness. (p. 535)

When children are very young, they can characterize peers' behavior and actions as being unfair; however, they fail to see authorities' behaviors and actions in this manner. Children begin to understand that authority figures can act in an unfair and unjust manner by the age of

six. By the age of eight, they begin to base their views upon equity reasoning. Thusly, by early adolescence, children's perceptions of discrimination are extremely sophisticated.

Warwick and Jatoi (1994) contend that gender bias in the classroom exists in most countries. According to Drudy (2008), "in Western societies, the earliest stages of the formation of masculine identity involve processes which result in the association of a masculine identity with patterns of behavior that are not feminine" (p. 319). In patriarchal societies, as more women participate in an occupation that is highly feminized, the harder it is for males to ascertain positions in that job as the gender discrepancy creates a difficult choice for them.

Karp and Shakeshaft (1997) observed teachers who encourage helplessness in girls by completing more complex problems for them when female students had difficulty with the problem. In addition, teachers give boys eight times more information to solve problems than girls. According to Berekashvili (2012), males receive greater specialized interaction in math while similar assistance was not given to the females (Berekashvili, 2012; Karp and Shakeshaft, 1997). Females receive more instruction in reading. This may contribute to males not feeling as helpless as females after receiving more help on assignments. One solution to this problem may be to use another type of instruction. "When cooperative instruction occurs in small groups on a consistent basis, and when those groups are single-sexed, even larger gains can result in female acceptance of science and mathematics as enjoyable activities" (Lockwood, 1994, p. 27). This creates a ripple effect. More enjoyment of a subject increases students' self-confidence, which in turn leads to better grades.

There is sometimes a negative association with poor student performance in relation to the gender of the teacher (Drudy, 2008). Teaching is considered to be a feminine role, so there may be a lack of respect for the teacher's logical abilities. There is evidence that the abilities of

women teachers are considered less competent than male teachers. However, more female student teachers graduated with honors than their male counterparts. It appears society may erroneously believe that teaching is an occupation that should be embarked upon primarily by caregivers or females (Drudy, 2008).

Schumarak (1994) demonstrated that confidence in the eighth grade is the best indicator of mathematical achievement in the eleventh grade for both genders. Gender differences in mathematical performance decreased over the last few decades (Herbert & Stipek, 2005). Many studies investigated gender differences in mathematics. Valentine (1998) suggested that the two genders think and learn differently. Males tend to learn with more of an abstract problem solution strategy that enables them to adapt more readily to learning different techniques to accomplish tasks. "Boys [are] more readily able to adapt and develop a new technique to solve a problem that [goes] beyond techniques learned [in the classroom]" (Valentine, 1998, p. 5). However, other researchers are quick to argue that this study had a small sample size and more research needs to be completed before any conclusions can be drawn for gender and learning strategies.

According to Hanna (2003), in most grade levels, communities, and subjects, boys control classroom communication. Male students talk more, are permitted to respond to more questions, and receive more praise in the classroom than girls. Even in colleges, this is true. Faculty tends to ignore female students, which prevents them from engaging in performance accomplishments that enhance self-efficacy (Ancis & Phillips, 1996). Salkind and Rasmussen (2008) note that socialization, as well as teacher attitudes and classroom resources, have an unequal effect on males and females. Females tend to be called upon less frequently than boys and are asked more basic recall questions while teachers ask boys more complex and open-ended

questions. "Teachers appear to teach more and to teach it [instructional material] more warmly to students from whom they have more favorable expectations" (Berekashvili, 2012, p. 40). Thus, teacher treatment of the two genders is critical.

Students who participated in a study by Spencer et al. (2003) indicated that when teachers demonstrated gender ideologies that were equal and fair, the students had less conventional gender ideologies as well. "Perceived teacher fairness is positively related to scholastic competence, negatively related to reported acting out behaviors, and positively related to students' year-end grade point average" (Spencer et al., 2003, p. 1792). Teacher fairness was measured by teachers' actions as well as in gender equitable opportunities within the classroom. As a whole, even when students reported perceived gender equality in school, more in-depth observations revealed a different story, one resulting in gender preference both in teacher behavior and student behavior.

Teachers' ratings sometimes noted females more favorably regarding predictive test scores; however, when asked about mathematics ability specifically, teachers underrated female students (Fryer & Levitt, 2010). According to Salkind and Rasmussend (2008), it has been speculated that,

> Discriminatory aspects of the academic environment serve to limit female students' academic and career success by causing them to contribute less in class, to avoid seeking outside-class help, to drop out, or to lower their career and educational aspirations (p. 132).

According to Erden (2009), teacher education regarding gender bias needs to occur in preservice trainings. The main purpose of those trainings is to increase awareness of potential difficulties,

to learn how to manage them, and to gain knowledge about content. However, teacher training must address gender equity issues (Erden, 2009).

Sadker and Zittleman (1998) noted that female students tend to learn how to read earlier, cooperate more with teachers, and earn higher grades. Despite this, teachers need to be aware that they wait longer for boys' responses, they tend to punish boys more often for behavior even when the same behavior is demonstrated by a female, call on boys more often than girls in oral responses, and provide more precise feedback to males.

> In some cases female teachers have been used as a scapegoat for boys' perceived under-achievement….data on gender differences in performance in public examinations in many countries indicate that girls' performance is better overall; however, there is no evidence that it is necessarily correlated with the feminization of teaching. (Sadker & Zittleman, 1998, p. 313)

Matthews et al. (1998) agreed with Sadker (2012) in that teachers punish boys more severely than girls for the same infractions and, when in a mixed gender group, boys tend to take more leadership positions while "females tend to defer their decisions [to the boys in the group]" (p. 54).

Sadker and Zittleman (2005) noted that boys tend to exhibit more negative and problematic behaviors in the classroom. Even though society reports that gender bias may not be as problematic as it was fifty years ago, it remains an issue for both boys and girls. Gender bias affects the sexes in different ways. Girls tend to experience bias in math and science, while males experience bias in reading and writing. This bias begins early in life. Boys tend to receive more science and math oriented toys, while females tend to receive toys that allow them to

produce more creativity, such as picture journals, imagination books, and letter puzzles (Sadker & Zittleman, 2005).

Girls' reception of these types of toys can be positive as, according to the American Association of University Women "reading is the most important skill learned in school" (Ravitch, 1996, p. 168). In addition, research suggests that during the early years of life, ideas about the future and its conditions are driven by fantasy. However, as they get older, children form more concrete ideas regarding future occupations. By adolescence, this conceptualization of possible and probable future occupations evolves. This is the time when children form their career aspirations (Riegle-Crumb et al, 2011). Some note that this lack of bias for females in relation to reading and writing can drive their future career choices (Sadker & Zittleman, 2005).

In a 1975 study entitled "Dick and Jane as Victims," researchers examined 134 textbooks in elementary school, specifically 2,760 stories (Sadker, 2012). There was a correlation of 5:2 indicating that stories were centered on boys, characters were identified as males in a 3:1 ratio when compared to women, and fairy tales that were written by men rather than females in a 4:1 ratio. In addition, even history books tend to exhibit gender bias as well. Even though social studies reviews national history, there are five more males to every female mentioned. As an example, texts often mention male soldiers that fought in the Revolutionary War; however, females are rarely depicted in this role. Sadker (2012) mentions that women have been seen as a "disposable labor force." As an example, "women were hired during World War II when they were needed to replace men in factories and fired when the war was over" (p. 959).

Sadker (2012) noted that there are seven forms of gender bias evident in curriculum. The first is invisibility and the second is stereotyping. The third form is imbalance and selectivity, which is when the curriculum presents only one side of a story and does not present the other.

This can also occur by distorting events and simplifying the issues by omitting facts. The fourth form is unreality in which the curriculum is represented in an illusionary way. An example of this is historical curriculum omitting difference in class, race, and gender discrimination. The fifth type of gender bias is fragmentation when "textbooks may place information about women in a special box or insert, separating the discussion from the main narrative" (Sadker, 2012, p. 960). This portrays women as an additive part of the curriculum but not mainstream. In addition, there is linguistic bias and cosmetic bias. Cosmetic bias can easily be seen on the covers of books and in pictures. "These attractive features mislead the reader who will encounter little context in the text…" (Sadker, 2012, p. 960). In contrast, Brown and Bigler (2005) dictated that group membership is also a form of discrimination.

Along this line, the frequency of female authorship in the indices of textbooks increased significantly from 5% in the 1960s, to 13% in the 1980s, and then to 16% in the 1990s (Blumberg, 2009). In 1973, it was found that boys outperformed girls in mathematical achievement at the age of 13 years. Title IX of 1972 then stated "no person should be denied educational programs because of sex" (Owens et al., 2003, p. 32). Before this, males were expected to take sports, shop, math, and science classes, while females were expected to take home economics (Salkind & Rasmussen, 2008). According to Owens et al. (2003) this law caused teachers to start examining textbooks for gender bias.

Gender bias not only pertains to textbooks, but curriculum as well. Derman-Sparks (1988) reviewed a film entitled Anti-Bias Curriculum. They concluded that educators need to discuss an anti-bias approach; in addition, they need to put this approach into action. There are four steps in transforming curriculum into one that is anti-biased: teachers build a support group to discuss how to integrate an anti-bias curriculum into the one that already exists; teachers

become more knowledgeable about how children build their identities related upon race, gender, and disability; teachers evaluate their internal attitudes and classroom environments that they have created; and teachers develop a plan to train parents relating to the anti-bias curriculum.

Daniels (1995) noted that those who create the curriculum in schools need to be cognizant of the appropriate programs for learning, the relationship between curriculum and teacher education, the various curriculum processes, and the relationship between the curriculum and standardized tests. In addition, self-reflection is necessary in transforming curriculum. The creators need to understand what has worked and where improved curriculum is needed. "It is vital the curriculum being developed challenges prejudices based on sex, which include the formal and 'hidden' or informal curriculum" (Daniels, 1995, p. 51). Curriculum authors need to consider women and minorities in history and sex education; division of labor at home and in the community regarding gender, anti-sexism and anti-racism in language; and jobs and careers for women. The curriculum could include how women are invisible in both historical life in addition to social, political, and economic life. Other topics need to be addressed such as gender roles in being passive or submissive, that most of humanity is viewed in the male form, as well as the degree to which females are depicted as being dependent. "Issues of gender equity could be neglected if rhetoric is not turned into reality" (Daniels, 1995, p. 52). "With increased challenges in sustainability, security, health, urbanization, natural disasters, population growth, and globalization, the engineering enterprise cannot afford to waste the education and problem-solving potential of half of its population" (Agogino, 2006, p. 88).

Curricular activities often involve the use of technology, and technology is becoming more popular in the classroom. Lin, Tutwiler, and Chang (2012) specifically addressed virtual-environment-based curricular interventions in Taiwan. Males tended to be quicker in virtual

responses when compared to females. Males noted feeling more comfortable with the use of technology than their female counterparts, thus causing a disparity between gender and the use of virtual-based interventions. The authors concluded that females use and perceive virtual systems differently than males. Gender equity has not entirely been established but large strides have been made in identifying and intervening in classrooms to decrease gender discrepancies in the mathematics (Hagedorn, 1996).

General and Special Education

Raftery and Valiulis (2008) noted that girls were underserved in special education programs. They contended that teachers often refer children for special education evaluations when they noticed them performing "outside the range of tolerance" (Raftery & Valiulis, 2008, p. 305). Especially when emotional behavioral disabilities were considered, the authors discovered gender played a significant role. Since girls tended to be more reserved and quiet, and behaved in an appropriate manner, their special learning needs were often overlooked. The same was noted for every disability category. "Girls with undiagnosed learning disabilities are more likely to drop out of school, face teenage pregnancy, and a life time of poverty and public assistance" (Raftery & Valiulis, 2008, p. 305).

Teacher referrals of students into the gifted program were examined in relation to gender. Bianco et al. (2011) conducted a study that indicated a significant difference; teachers were more likely to refer male students to gifted education programs in comparison to females when the exact same student descriptions were presented. In addition, interviews among teachers noted that the reasons for the referral decisions as well as descriptions of students were significantly different based upon the gender of the student.

As classroom teachers are so vital in the early referrals of gifted education students, the study conducted by Bianco et al. (2011) was damaging to the education field. "Teachers' judgments and recommendations of whom to include for formal assessment often become the first step in the identification process….teachers are the gatekeepers" (p. 171). Therefore, if teachers experience gender bias in the referral process, it is clear that they will refer more males to the gifted and talented programs.

> According to the authors, teachers refer students: who conform to their expectations of what gifted students look like, how they perform on various measures of achievement, how they behave in the classroom, and how they use existing ideals based on dominant cultural assumptions to guide their judgments of giftedness. (Bianco et al, 2011, p. 171)

Therefore, even though a female student may meet or exceed the requirements for gifted screenings of a school district, females may be unrecognized.

Student Performance

Popularity becomes an important issue about the age when children enter middle school. In grades six and seven, according to Sadker and Zilttleman (2005), females "start rating popularity more important than academic competence or independence" (p. 28). They become more interested in others' reactions to them and experience strong feelings of needing to belong. Teachers should be cognizant of this and combat the gender-based expectations as much as possible. Displays and exhibits need to demonstrate more gender equality.

According to Ryan and Ryan (2005), in general, females and males tend to score equally in math except in word problems and on the most difficult mathematical items, where males do better. They state that girls often attribute their success to luck and effort, while males attribute their success to ability. According to Beyer and Bowden (1997), competence is related to the

type of task as well. "A task is gender typed if either of the sexes [are] better than members of the other sex at that task" (p. 160). However, these perceptions do not need to be accurate in order to affect a person's self-expectancy. Males are more confident performing academic tasks involving science, mathematics, spatial abilities, physics, technology, and computers. In their study, both genders performed equally on an academic task; however, females underestimated their performance. Sadker and Zittleman (2005) noted that this relays a message to girls: "trying harder or risking a new approach won't make much difference because you're simply not smart enough" (p. 29).

In contrast, Hanna (2003) suggested that the major reason for differences in mathematical performance was due to different approaches to schoolwork by both genders, such as achievement goals and classroom behavior. However, Kenney-Benson, Patrick, and Pomerantz's (2006) research suggested the opposite. They found that approaches to schoolwork did not differ significantly between male and female students. Windham (1997) reported that women were beginning to enroll in more math and science courses than before. Thilmany (2010) noted, "girls from countries where gender equity is more prevalent are more likely to perform much better on mathematics assessment tests" (p. 15).

Gender Differences in Foreign Countries

Karp and Shakeshaft (1997) agreed with the American Association of University Women's 1992 research that identified gender bias as present in schools, thereby "'shortchanging girls" (p. 85). Research in some countries has found gender differences favoring males, while research in other countries has found that no gender differences exist (Hanna, 2003). Many students believe that the academic areas of science and math need to have

a greater emphasis on gender equity; however, when asked to rate the importance of problems in schools, they ranked gender equity at the bottom in their "importance" list (Johnson et al., 2006).

Warwick and Jatoi (1994) studied classrooms in Pakistan that were segregated by the gender of the teacher and the gender of the students. Some schools were divided into those with male teachers and male students, female teachers and female students, as well as coeducational schools with males and females. They found that the students of male teachers scored significantly higher on mathematical tests than the students of female teachers. Thus, teacher gender may play a role in "mathematical achievement when included with variables from the student's background and from the teacher and classroom" (Warwick & Jatoi, 1994, p. 383). However, this study may have been flawed because it did not include cross-gender classrooms. Cross-gender classrooms are classrooms that contain both male and female students as well as teachers.

In Africa, "curriculum prepared girls to be obedient wives and dutiful mothers, thus disadvantaging them academically in relation to boys" (Raftery & Valiulis, 2008, p. 305). In Brazil, the patriarchal structure creates a society that undervalues women and delegates them to the lower levels of the employment market only. In Canada, a study revealed that 70% to 90% of academic learning time encompassed textbooks. The authors contend that textbooks, in general, are influenced by a society's ideologies regarding gender discrimination. Therefore, student exposure to gender bias is significant. A study of textbooks revealed common themes associated with males, such as bravery, while females were most associated with beauty and external characteristics. Ninety-six percent of textbooks in India depict only men. While the ratio decreased significantly in China, pictures continued to portray women in stereotypical roles and positions.

There are some that contend that gender bias does not exist. In Ireland, according to Flynn (2007), there are many more women working in the medical and medical-related fields. Seventy-seven percent of this job market was comprised of females in 2007. Males were 30% of the students seeking law degrees. While females tended to dominate those labor forces, males continued to dominate in areas of engineering and construction.

Drudy (2008) noted that gender bias exists and that it is a universal topic in the United States, Latin America, Africa, Ireland, and the United Kingdom. The United Nations Education, Scientific, and Cultural Organization (UNESCO) reported that in the later part of the twentieth century, the amount of women primary level teachers have increased in most regions. However, there is a great need for improvement in the hiring process, especially in the less developed countries. As the grade levels increase, the number of female teachers decreases. At the secondary level, the number of women who are teachers is less than that at the primary level.

Mathematics Instruction

Johnson et al. (2006) reported the existence of gender bias in school mathematic courses. The negative attitudes from students in the classroom are a direct result of curricular content, various teaching methods, and the environment of the classroom, according to Zhao and Hoge (2005). There is conflicting evidence amongst researchers when gender differences in math competency begin, as some believe that it starts as early as first grade (Herbert & Stipek, 2005). Ravitch (1996) states, in contrast, that other research has indicated that gender differences remain relatively stable throughout the elementary grades. According to Windham (1997), most research, however, has not demonstrated gender differences in early elementary schools. Gender bias begins in late elementary to middle grades, according to most investigators.

According to Wigfield and Byrnes (1999), girls tend to outperform males in grades, but boys tend to perform better than females on mathematical standardized tests. They propose that gender differences in test performance in mathematics are due to differences in math-fact retrieval time. According to Matthews et al. (1998), when asked about the higher achieving students in mathematics, males named another male student, while females named both female and male students, because they believed that the two genders were equal in mathematics. When asked about the highest performing students in English, females named other females as the best students, while the male participants named both male and female students.

Another concept that stems from self-efficacy is measurement of success. Females define success as receiving a score of eighty-nine or better. Males defined the same concept of success with a score of seventy-nine or better. Therefore, on a class assignment, even though two students are identical in performance and receive the exact same grade, the female student sets a higher expectation for the level of success than does her male counterpart. Self-assessment and self-perception is important in people's belief of whether they have ability, such as the ability to be an engineer (Jones, 2010).

Standardized Testing

According to Ryan and Ryan (2005), the No Child Left Behind Act of 2003 speaks of the "attainment of high achievement for all students" (p. 53). Ryan and Ryan stated that females' math test scores begin to differ from males in early adolescence. This may be due to social stereotypes rather than mathematical ability. In turn, this has a negative effect on standardized math test scores.

Trends continued to suggest that female students scored lower than males in certain kinds of mathematics tests (Wigfield & Byrnes, 1999). Owens et al. (2003) suggest that females will

usually choose less demanding math courses in high school due to the stereotype threat. Hwang et al. (2006) state that boys are more likely to be in advanced mathematical courses in high school.

According to Herbert and Stipek (2005), girls have lower perceptions of their mathematical competency even though their standardized math scores are generally equal to that of males. Even after obtaining high grades in science and mathematics courses, girls tend to have a low self-esteem and a dim view of their ability to succeed in these subjects (Lockwood, 1994). This may be because teachers, parents, and many adults demonstrated gender stereotyped views that females were less competent in mathematics compared to males (Bembenutty, 2005). Lockwood (1994) found that male teachers, in comparison to female teachers, sent out subtle negative messages to female students. Thus, girls tended to internalize gender stereotypes about their ability to succeed in mathematics. Due to this, parental encouragement and support is necessary to provide positive expectations for female students in mathematics (Bembenutty, 2005).

Standardized math test performance in addition to progress monitoring tools for females versus males, is a serious source of concern (Mendick, 2005). Yeo, Fearrington, and Christ (2011) assessed the Curriculum Based Measurement (CBM) slope, which assesses reading, in relation to gender equity and performance. The researchers found that only the CBM-Maze scores differed by gender. The CBM-R, or the portion of the tool that looks specifically at reading aloud, was found to be unbiased in relation to gender.

The Scholastic Aptitude Test (SAT), written by the Educational Testing Services (ETS), "plays a significant role in determining who gets ahead in America and who falls, or stays, behind" (Silverstein, 2000, p. 671). After World War I, mass testing became popular as colleges

used SAT scores as a ranking in the admission process. Lewis Terman, the author of the Stanford-Binet Intelligence Test noted that, the SAT appears fair as "multiple choice tests measure whether a person will succeed in college without being biased by the quality of the individual's elementary and high school education" (Silverstein, 2000, p. 675). Subsequently, large scaled testing became popular.

In a study conducted by Dorner and Hutton (2002), the SAT mathematics portion (SAT-math) was used to predict the success of 1,388 freshman-level students. Their research explored whether the test was over-predicting or under-predicting actual grades for either gender. Results indicated that the SAT-math "predicted grades differently for both men and women. There is gender bias in the system" (Dorner & Hutton, 2002, p. 28), as this test under-predicted the performance of females in mathematics. In addition, other variables were found that add to the gender bias of the SAT-math such as placement test scores as well as previous mathematics courses and the grades received in these classes. The conclusion was that tests that are internally created or those that are purchased through commercial companies contain gender bias, therefore underscoring females' abilities. Fryer and Levitt (2010) note that in the last forty years, females have performed three-tenths of a standard deviation worse than their male counterparts on the math portion. This is equivalent to 2.5 months of schooling. On the verbal portion, however, there is not a gender difference.

The Preliminary Scholastic Aptitude Test (PSAT) carried on this tradition of standardized testing. However, in 1994, the ETS added another section. This was due to the fact that complaints were made from the population regarding bias civil rights in relation to gender. The company consequently added a writing section, as females were thought to outperform males in the academic areas of reading and writing while males dominated math and science. Due to this

addition, the gender gap decreased within the first two years by almost 26%. Recently, the ETS has added a writing section to the SAT as well to decrease the remaining difference between the genders (Silverstein, 2000).

While Title IX addresses educational programs, it does not directly address standardized testing. In Sharif v. New York State Education Department (1989), the Scholastic Aptitude Test (SAT) was challenged for violating Title IX on the basis that it was discriminatory towards females. The defendants claimed that many college scholarships were based primarily upon SAT scores, thusly, violating Title IX. Then in 1994, the National Center for Fair and Open Testing complained and charged Educational Testing Services (ETS) with discriminating against females in their design of the PSAT. In 1999, ETS added a section to the PSAT that was multiple choice and addressed writing as well (Silverstein, 2000).

According to Hanna (2003), girls tend to have lower SAT scores in math. In 2009, according to an article in Women in Higher Education (Anonymous, 2009), females scored an average of 27 points lower on the overall score than their male counterparts. Some universities reject females as a result of lower SAT-math scores. On the SAT-math between 1992 and 1995, females scored 45.5 points lower than males on the math section of the SAT. According to the College Board, 2012 SAT scores in math demonstrate a 32-point discrepancy between the two sexes, with females being lower (College Board, 2012).

Owens et al. (2003) stated that differences in instruction could not account for gender differences in mathematics performance. An example of this is on the Graduate Record Examination-Mathematics (GRE-M). The GRE-M was linked to gender differences in math performance for high-achieving women. High-achieving women in mathematical fields tend to score lower than their male counterparts on the GRE-M.

Parental and Teacher Influence

In a study reported by Schober et al. (2004), parents stated that the science, technology, and math fields are not relevant for their daughters' later careers. These studies suggest that mothers tend to perceive their daughters to be better at literacy-related skills and underestimate their math ability (Herbert & Stipek, 2005). Schober et al. (2004) stated that even gifted girls were at "high risk" because their talent is overlooked, and they are not encouraged properly. Even when the mother worked in a math-related occupation, females were noted to lose just as much ground as when the mother's occupation was not math-related (Fryer & Levitt, 2010). Dickens and Cornell (1993) report that parent expectations of their daughter's math success depend on the parent's experiences in their own school math classes. Thus, parents tend to shape their children's beliefs about their mathematical ability at an early age (Gavin, 2000). Parents often have more of an impact than anything or anyone else on their child's career and ultimate choices; therefore they have a significant influence on their children's perception of themselves. Research conducted by Bleeker (2004) stated that parents tended to monitor their daughters' progress more than their sons.

According to Tiedemann (2002), parents transmit their gender bias views as well. They credit females with more effort while they credit males with having more ability, even when the tasks and results are equivalent between the two genders. "These beliefs are more gender differentiated than are objective indicators of the children's actual performance" (Tiedemann, 2002, p. 51). This may be due to the parent's stereotypical beliefs and the learned socialization attributes that society held when they were raised. Path analysis noted that the gender stereotypical characteristics attributed to each gender remained relatively consistent among mothers and fathers alike.

According to Fryer and Levitt (2010), even when data is further broken down into gender differences among the different races, the gender gap remains consistent. This pertains to public schools as well as private schools. However, their research notes more significant losses by females. The gender gap is not solely independent of the type of school in which the student attends, but is influenced by the mother's education level as well. Statistically, this gender gap is the greatest at the highest socioeconomic level.

It is not solely parents' opinions that are taken into account by students. The thoughts and perceptions of teachers also play an integral part of a student's academic growth. Teachers demonstrate views based upon their experiences (Riegle-Crumb & Humphries, 2012). In their 2012 study, as course levels increase, the disparity between white males and white females regarding math grades increases. "Differences in GPA [grade point average] appear smaller than those for test scores, yet the magnitude of differences increases in accordance with the level of the course" (Riegle-Crumb & Humphries, 2012, p. 300).

> They found that when compared to their white male peers in the same level class, and controlling for grades and test scores, high school math teachers are less likely to judge white females as being in a class that is too easy for them, indicating an omnipresent stereotype in high school classrooms. Math, comparatively speaking, is just easier for white males than it is for white females. (Riegle-Crumb & Humphries, 2012, p. 312)

According to Jones (2010), the mind-set of teachers, in addition to that of the students, is influential as well. There are two views of intelligence: one of growth and one of stability. Those that have a growth mind-set believe intelligence fluctuates and is fluid. Thus, intelligence can be altered, and mistakes made in the course of learning are a valuable part of the process.

> People who have a growth mind-set believe that math and science skills can be learned and can improve with practice. In addition, they tend to believe less in the stereotype threat that females are less likely to be successful in math in addition to females being less suited for scientific careers. (Jones, 2010, p. 60)

In contrast, there are others that believe intelligence does not change and remains relatively consistent over time.

College and Beyond

In 1986, 44% of the workforce in the United States was comprised of women. However, they constituted only 15% of employed scientists, mathematicians, and engineers (Dickens & Cornell, 1993). Yet, there has been significant improvement within the past fifteen years. The Bureau of Labor Statistics (2012) noted that approximately 47% of the labor force consisted of females while 53% were male. In the 1990s, college educated workers with appropriate mathematical and technical skills were needed (Hagedorn, 1996). Drudy (2008) noted that women work in essential jobs; however, they are paid less, have a lower status, and work in worse conditions than their male coworkers.

Even though, according to the Higher Education Policy Institute, "more women than men are gaining admission to universities and they are more likely to stay once they get there," there is still a significant discrepancy in the classes they take and the majors they choose (Student Gender Bias, 2009). In 2011, there were 60% fewer women majoring in science, technology, economics, and mathematics or STEM than men (Riegle-Crumb et al., 2011). According to Toglia (2013):

> Female students made up 98% of the students enrolled in cosmetology, 87% of childcare students, and 86% of those in health-related fields [in community college]…however,

> girls are largely absent from traditionally male courses comprising only 4% of heating/air conditioning, and refrigeration students, 5% of welding students, 6% of electrician and plumber students, and 9% of automotive students. (p. 14)

The author notes that the U.S. Department of Commerce reported that only one in seven engineers is female.

According to the U.S. commission to study gender bias (Student Gender Bias, 2009), women obtain 60% of master's degrees and 58% of undergraduate degrees. In the age range of 25 to 34 year olds, more women than men have graduated from college and earned a degree. According to Jeffrey (2012), this trend continues as 25% fewer men receive college degrees. In college, men choose to take technical and mathematical classes more than females. This leads to females being underrepresented in these areas. This puts women, historically, at an economic disadvantage in higher paying careers (Herbert & Stipek, 2005).

However, once women enter the collegiate level, Ancis & Phillips (1996) state that they tend to experience more gender bias in both overt discrimination as well as subtle discrimination. Women students tend to report their college experiences as having to compensate for more inappropriate comments, sexual harassment, and a lack of positive support by other male counterparts as well as by faculty members. They noted that there is a perception among higher education faculty members that female students are not as serious and competent when compared to male students. Female students do not have as many female role models and mentors. Faculty, especially in the fields of science, technology, and mathematics, tend to be predominately male. Women in Higher Education (Ex-Researcher Wins Big Gender Bias Suit, 2011) at Dana-Faber Cancer Institute noted that there were virtually no female faculty in leadership positions and 73% of males reported feeling respected while only 35% of woman felt

this way. Even more rare are women faculty who hold tenured positions. Thus, female students' self-efficacy can decrease due to these negative influences. Bingham and Nix (2010) confirmed that women faculty members experience bias based upon gender.

According to Drudy (2008), even though there is gender bias among teachers and the subjects they teach, there are not a significant number of male teachers outside of the math, science, and technology fields. There is a perception that teaching is a more feminine occupation, as it pertains to a caregiver role. "The reasons suggested for the dropping numbers of male primary teachers indicated a bias towards seeing the ideal primary teacher as female, based on an essentialist belief that a woman's nature tends to make her better with children" (Drudy, 2008, p. 312). Both students and teachers believe this to be the case for the dominance of female teachers in general education. Students reasoned this to be true as they noted that teaching was a more "boring" job and one that required a great deal of patience. In many countries, research has indicated that there is a negative correlation between income and femininity of the occupation. "The more feminine an occupation is considered, the more likely it is to be poorly paid" (Drudy, 2008, p. 317). Despite this, Drudy (2008) suggested no evidence that having male teachers necessarily increases male student performance.

Heilman, an organizational psychologist, conducted a comparative study on two groups of student teachers in relation to their ability levels. One group of students was told that men and women were receiving their annual performance assessments. The performance of those that they were evaluating was relatively unclear. The second group evaluated both men and women; however, they were told explicitly that the men and women were high performing and were very successful. The results indicated that, when performance was made explicit, men and women were evaluated in the same manner and were found equally competent. However, when there

was more ambiguity in employee performance, females tended to receive a lower rating indicating that the women were significantly less competent, less diplomatic, and less congenial than their male counterparts (Jones, 2010).

According to Jones (2010), educators at Michigan Technological University evaluated gender in relation to the visual-spatial skills of college engineering students. The Purdue Spatial Visualization Test: Rotations (PSVT:R) was administered. Interviews indicated that males played with toys enforcing visual-spatial skills such as Erector Sets and Lincoln Logs, while females were encouraged to play with dolls. Quantitative analysis of the data indicated that females tended to fail the test three times more so than males. The researchers then developed a course where instruction was based upon improving these skills. At the end of the semester, the students took the PSVT:R again, and scores improved dramatically indicating that poor performance can improve with learning, even in processing areas that are thought to be innate (Jones, 2010).

Bingham & Nix (2010) noted that women faculty in higher education tends to focus more attention and time on teaching, as opposed to male faculty, who focus on research. In addition, occupations that require higher education levels tend to focus more on skills and production than communication and relationships. Thus, women tend to be deprived of higher positions due to their inherently biased communication styles. As research discussed, males tend to be more task oriented where females are more likely to focus on interpersonal relationships and communication (Bingham & Nix, 2010). Higher education is not the only role that affects women in this manner. Even though research demonstrates that women are more communication-oriented, leadership and leadership styles are significant as well. In the authors'

opinion, society is going towards more team-based management and global cohesiveness (Bingham & Nix, 2010).

Trinidad and Normore (2005) stated that, even with this so-called "strength" of women over men regarding communication, there continues to be a significant discrepancy between male and female leaders. Leadership styles are indicative of gender bias in that men and women can display similar characteristics; however, they are viewed differently. The personal characteristics that are important in managerial and leadership jobs include emotional stability, leadership ability, aggressiveness, and self-reliance. It is noted, however, "that when women demonstrate these same characteristics, they are considered pushy, brash, aggressive, abrasive, and masculine" (Garn & Brown, 2008, p. 60).

Trinidad and Normore (2005) noted what is called the femininity/competency bind. This theory contends that behaving in a masculine way is associated with ability while behaving in a feminine manner is associated with incompetency. Leadership tends to be, by way of social construction, based upon a masculine model. "The common belief is that women need to be trained up to the level of men" (p. 577). Therefore, women need to exhibit behaviors that are associated with femininity; yet, they need to gain credibility by being masculine as well. Jones (2010) found that women could be either likeable or competent but not both. The good news is that there tends to be more visibility about the relationship between gender and leadership than in previous years (Trinidad and Normore, 2005).

Even after college, gender stereotypes continue to affect people and their perceptions. According to and Chatard et al. (2007), it was found that "the more students endorse gender stereotypes prior to recall, the more they display stereotype-consistent recall of school marks" (p. 1020). More female students reported that males had more ability in mathematics and

underestimated their own performance in this academic area. Therefore, the more the student is exposed to gender stereotypes, the more stereotypical they estimate their own behavior to be. The authors noted that even asking about the gender stereotype in mathematics in relation to ability elicited recall that was consistent with that stereotype.

The Massachusetts Institute of Technology (MIT) even recognized that more men were admitted into the institution than women, but women engineering faculty encountered more gender bias (Dorner & Hutton, 2002). According to Bert (1999), in the spring of 1999, MIT admitted that their women faculty tended to experience more subtle discrimination. This was additionally true as junior faculty rated feeling more self-confident than senior women staff as well. Several indicators of gender bias included discrepancies in salaries, availability of positions of power, as well as availability and accessibility to supplies and room. "Discrimination consists of a pattern of powerful but unrecognized assumptions and attitudes that work systematically against women faculty even in the light of obvious good will" (Dorner & Hutton, 2002, p. 11).

Ancis & Phillips (1996) proposed that individual behaviors, known as behavioral agency, can increase the likelihood of attending not only college, but graduate school as well. Agentic behaviors are career relevant. Self-efficacy is central to the idea that the individual will behave in a way that is relevant to their possible career. Bandura (2002) defined self-efficacy in his learning theory as the beliefs of individuals about their competency to perform a task successfully. Sources of self-efficacy can be from emotional arousal, verbal persuasion, vicarious learning, and personal accomplishment. Evidence demonstrates that "self-efficacy is predictive of a variety of women's career-related behaviors, such as the range of occupations" (Ancis & Phillips, 1996, p. 131).

Banks (1998) noted that, in spite of advances in education, women continue to feel that they are "strangers in a strange land" (p. 138). This is true especially in law school. Women tend to feel unwelcome in an environment that centers around upper-middle class, white, male cohorts. Banks (1998) mentioned that even though women may have equal access to a legal education, they might not actually receive that equal education. Banks' study verified this to be true; women law students tend to view the law classroom as hostile and alienating. The participants noted several reasons for this including hostility from male counterparts, lack of support and encouragement (or even discouragement) from law professors, and, in general, the law school environment.

Gender bias affects how dissertations, research papers, and other scientific papers are evaluated, accepted, and published. Sharp (2006) discussed many studies in which a common way to measure gender bias is to change the name of story character from a female name to one that is male (or vice versa). This was done in a study evaluating papers from various candidates. Participants tended to rate the papers more favorably towards the male authors than to those of the female gender.

The American Association of University Women, or AAUW, (American Association of University Women, n.d.) indicated that working women make 77 cents for every dollar that men earn. Even though there was an approximate 13 cent increase in the past thirty-five years, this difference is significant. According to trend analyses, it will take another 60 years at this rate of wage increase before American society achieves pay equity. Women are more likely to have higher student loan debt than men due to the pay gap. As social security income is based upon earnings, it is the AAUW's position that women are penalized twice due to this gender pay gap. In addition, one can only contribute to a 401(k) based upon a person's salary, therefore

reinforcing another gender pay gap. "From an economic perspective, the traditional female careers into which significant numbers of girls are directed pay substantially lower wages than nontraditional fields" (Togila, 2013, p. 15).

After schooling, Esposito (2003) discussed gender in relation to the labor market and the economy. There is a glass ceiling for working women preventing them from senior management positions. This is due to gender bias. Barker (2010) interviewed one thousand teachers. They expressed a common theme of a lack of support in relation to career progression. In addition, 40% of the teachers reported that it was easier for men to become a primary head-teacher than for females. More than 50% of those interviewed "thought men were advantaged in appointments to secondary headships" (Barker, 2010, p. 15).

Esposito (2003) noted that, even though large strides have been made regarding equality in college with relation to gender, men continue to dominate the fields that result in technological jobs such as physical science, math, engineering, as well as computer and information science.

> The proportion of women in lower- and middle-level management positions has shifted. But the proportion of women in senior management has changed very little over the last twenty years, despite the fact that women's representation among workers, managers, and business students has increased dramatically. (p. 1A)

Gender bias does not solely affect the labor force, but this concept permeates throughout society. As Walden (2007) noted, even medical treatments were derived from this bias. Most clinical trial studies are few and far between regarding female participants or female issues. It was once considered unethical to include women from 12 to 55 years of age, as this time span was one in which a woman was vulnerable to pregnancy. The exception to this is hormone replacement and related therapies. However, the National Institute of Health (NIH) instituted a

policy in 1990 requiring females to be included in NIH-sponsored clinical research (Sommers, 2010).

Brooks and Sala (2009) state, however, that the recognition of females' influence in society may be changing. In a study analyzing earlier versions of Cortex Publishing books, there were 73.79% that had male authors while only 26.21% of authors were female. However, in analyzing current books from the company, there was more of a balance between gender and authorship. Now, 47.55% of the books are written by females. It is important that not only authorship is free of bias, but the influences of society, as a whole, are just as significant. Society itself seems to be male dominated. Examples of this include everyday language that is used throughout the United States universally. Words such as mankind, forefather, and policeman prevail throughout oral communication. Nonverbal communication examples are displayed in books, signs, and other societal presentation of information (Salkind & Rasmussen, 2008).

According to Brooks and Sala (2009), in higher education, not only do the research responsibilities required of teachers play an important role in college employment, but the work environment and their sociocultural factors is of consideration as well.

> There is a perception that an academic career in the scientific field will not result in a permanent job for up to seven years after a bachelor's education. Many women consider this an obstacle to their plans to start a family, and are concerned that they will only just be getting a foot on the career ladder when they are considering having children. (p. 1130)

Gibney (2012) found that gender bias exists in hiring practices as well. When considering applicants, Yale faculty more often chose a male candidate, as they perceived the

candidate was more competent. Even if the description of the applicant was the same, they chose the male applicant over the female. Gibney found that the staff was more willing to mentor these male applicants. This occurred in management positions where the manager was male, but in female managers as well. This study demonstrated that gender inequity could be found among faculty as well. "Academics like to think we're more objective than other people, we approach data and arguments with an open mind and therefore people with an open mind. But everyone can suffer from unconscious bias" (Gibney, 2012, p. 24).

Bañuelos (2008) noted that, across the country, women superintendents of school systems experience gender bias in the form of sexual harassment. In Bañuelos' (2008) study, women superintendents were interviewed regarding their overall experiences in this position. Some female superintendents stated that men were treated with more respect and esteem while female superintendents were treated with more disrespect and their authority was questioned more frequently. They received condescending remarks from faculty, overheard inappropriate jokes more often, and they perceived that their boards (or superiors) expected more of them than the male superintendents. Therefore, the women superintendents noted they needed to document more, provide more evidence, and explain things more thoroughly than their male counterparts. Another theme that resonated through the interviews was inappropriate touching and the transmitted sense of powerlessness. Most often women did not report the incidences or were apprehensive at doing so because of a feeling of the lack of support from the board.

Richardson (1992) noted that, while levels of respect may have improved over the years, women still have to work harder and attain more success than their male counterparts in order to achieve the same status. The study indicated that women entrepreneurs were few and far between. Males tended to dominate small owner businesses. The National Women's Business

Council noted that women-owned businesses fall short of being successful at a rate of seven to eleven percent more than male-owned businesses (Richardson, 1992). The kinds of gender bias problems that women owners say is most prevalent are self-imposed psychological barriers, internalized sexism, stereotyping by male colleagues, lack of female role models, and "failing to adapt or understand the unwritten rules of a male-dominated game" (Richardson, 1992, p. 33). In addition, it was noted that suppliers tend not to take women seriously, creating another barrier. According to Richardson (1992), persistence is the key.

Garn and Brown (2008) found three major themes amongst superintendents who were interviewed: overcoming obstacles, the importance of mentoring, and overcoming stereotypes related to gender. Only 18% of all school districts in 2004 had a woman superintendent. Even though there have been some improvement over the years, Garn and Brown (2008) noted that even if women follow typical career paths, they continue to experience limited opportunities. Many of the women interviewed disclosed that, in order to gain leadership, volunteering for many district and school-wide activities was a necessity. While all superintendents tended to agree that this was a prerequisite to their positions, women must volunteer more so than their male counterparts. Another barrier is perception of women leaders. This negative perception is held not only by some male leaders, but by some female leaders as well. "There was also a belief commonly held among participants that other female candidates were not as prepared for the interview process and that partially explained the small number of female superintendents" (Garn & Brown, 2008, p. 52).

Garn and Brown (2008) noted that many of the female superintendents felt that forming female support groups for higher education faculty should be implemented; however, other participants felt that this notion would only cause more separation between the two genders and

do more damage than produce positive results. The authors found that, in counties where female superintendents were employed, the board members had a higher percentage of females. Their study found that female superintendents must fight harder, accomplish more, and be more resilient than their male counterparts. "The findings illustrate that the women perceived gender stereotypes to be embedded in the career path to the superintendency and work experiences on the job" (Garn & Brown, 2008, p. 66). Gender bias in superintendency continues to exist, despite the small improvements in the field (Garn & Brown, 2008).

In addition to employee position, a person's personality contributes to perception of gender bias or equity. Classroom behavior by the students as well as the teachers is of great significance. Women tend to use narrative language while men prefer abstract language. Many times, teachers in higher education, especially in law school, use the more abstract mode to communicate ideas and concepts. The bigger the classroom, the more competitive it can become. Females often exhibit less competitive behavior than males and the classrooms tend to promote feelings of division and seclusion. Women tend to participate less in class when their environment is one that fosters lower self-esteem or a feeling of less empowerment (Banks, 1998). On the other hand, Berekashvili (2012) states that boys are encouraged more to think independently, be patriotic, and to be self-assured while the encouragement tends to focus more on accuracy for females. Teachers negotiate more with boys and pay much closer attention to them. In Berekashvili's study, the only scenario in which females received more attention was in homework check. While teachers may criticize boys more frequently, there is an ending component of praise that more often exists with this criticism towards males rather than females.

Baldwin and Blattner (2003) state that student evaluation of instruction (SEI) is one way that universities evaluate teacher effectiveness. The teacher can be influenced by the size of the

class, student grade point averages, time of day of the class, the level of the class being taught, and the subject matter of the class as well as the student's interest in the area. These, along with gender bias, can be very influential in a teacher's ability to keep their job. Many low ratings of female collegiate professors may be due to gender bias among their male students, as college teaching continues to be a male occupation. Research indicated that male students rated female faculty lower than male instructors.

When the participants were asked about this, they consistently found that competency was a significant issue. The students held the female faculty at a higher standard than their male counterparts. It was perceived that women faculty members were not solely responsible for the knowledge of the subject as well as ability to teach, but, in addition, they were expected to demonstrate more interpersonal and organizational skills. Therefore, faculty evaluations may not be as valid as the college once assumed. In the authors' opinion, "if fair and appropriate administrative decisions are to be made with regards to promotions, tenure or teaching improvements, multiple sources of information must be drawn upon" (Baldwin & Blattner, 2003, p. 28).

Subsequent from the American Association of University Women's original report in 1992, National Public Radio (NPR) presented an updated report in 1998 titled *Gender Gaps: Where Schools Still Fail Our Children*. In the short six year time period between reports, over 1,000 research articles and journals were thoroughly analyzed and a different conclusion was made. It was noted that the gender gap is no longer prevalent. Boys continue to fall slightly ahead of girls regarding performance in math and science; however, teachers are becoming more encouraging to their female students to enter into high school calculus, biology, and chemistry classes. According to NPR, "schools are more girl-friendly now" (Adams & McMahon, 1998, p. 1). Sexual

harassment, discrimination, and sexist language tend to be decreasing and there are more female authors present in the textbooks of these classes (Adams & McMahon, 1998). There is emerging evidence that the gender gap is closing in mathematics achievement. In addition, ten years later, research indicated that girls were doing just as well as boys in mathematics in most grades and in most states (Greenfield-Boyce, 2008).

Summary

Much conflicting evidence has been presented regarding the presence of gender bias throughout the school years. While some contend that it begins before elementary school, others claim that gender bias is non-existent in schooling. With such conflicting evidence, both for and against gender bias in our education system, it is clear that more research must be conducted to eliminate the question regarding inequity in the classroom. There are various studies suggesting that, if gender bias is present in a society, these gender inequities extend throughout life. From career choices to employment opportunities to pay scales, it is clear that any kind of bias plays a significant role in society and its culture.

CHAPTER THREE: METHODS

This study expanded on previous research noting the conflicting views regarding gender bias. The relationship between students' perceptions of their math teacher's gender equity or inequity and the impact that it has on students' perceptions of their mathematical abilities was explored. This study looked to determine if later elementary school children, both males and females, perceive there to be gender bias in their math teachers' behaviors and how that related to student perceptions regarding their own mathematics ability. The research design and procedures will be described in detail. The participants, setting, and the specific instruments used will be discussed.

Design

This study was correlational in nature to determine if gender was related to students' perception regarding their own mathematical ability, as well as the correlation between their perception regarding their own mathematical ability and their mathematics teacher's gender equity behavior. The study was correlational and not experimental, as there was not a random selection of participants since the students were specifically chosen at two schools (Gall, Gall, & Borg, 2006). The investigator focused on the relationships of the perceptions of students regarding their teachers' behavior in relation to the students' perceptions about their own mathematical ability. Specifically, this study used a correlational research design. The data obtained lent itself to determining a relationship between the variables and the degree to which the variables were associated and was the rationale behind utilizing this design (Gall et al., 2006). The variables of interest and the units of analysis were gender, students' perception of gender equity or bias by their teacher in the math classroom, as well as student's perceptions of

their own mathematical ability. Two surveys were used to assess students' perceptions about gender equity in addition to the effect, or lack thereof, on their mathematical abilities.

Research Questions

RQ 1: Do students' perceptions of their mathematics teacher's gender equity behavior correlate with the students' perceptions of their own mathematics ability?

RQ 2: Does the gender of students relate to their perceptions of their mathematics teacher's gender equity behavior and to their own mathematical ability?

Null Hypotheses

$H_0$1: There is not a statistically significant correlation between students' perception of their mathematics teacher's gender equity behavior and student's self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics.

$H_0$2: There is not a statistically significant relationship between the gender of students and how students perceive their teacher's perception of gender equity behavior.

$H_0$3: There is not a statistically significant relationship between gender and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey.

Participants and Setting

Prior to the beginning of this research study, the investigator gained approval from the Institutional Review Board (IRB) at Liberty University. Once the investigator obtained final written approval from the southern school district, the final approval letter was obtained (see Appendix A) from the IRB, and the investigator was approved to conduct the research study.

All third, fourth, and fifth grade students, approximately 700, in two separate schools in a southern school district had the opportunity to participate in this study. The principle investigator informed parents approximately two weeks before the beginning of the research. A parent recruitment letter was distributed and sent home by placing them in the children's backpacks. This recruitment letter introduced the principle investigator, described the study, and described the procedures (see Appendix B). Convenience sampling was used as the principle investigator worked for the school district (not specifically for the schools); therefore, access to the students from these schools was readily available.

Approximately one week before the research study took place, an implied consent form was sent home. Only students that did not return the implied consent forms were used in this study. A total of 64 implied consent forms were returned indicating that their parents did not want them to participate in the study; however, 65 students without forms did not participate because they were absent, decided they did not want to participate, or were unavailable during the time the surveys were given. Therefore, 551 students actually participated in the study. Two hundred fourteen students at one elementary school in the district and 337 students at the other school were used in this study. However, the sample size used in analysis was reduced to 547 for various reasons, such as not indicating gender, not answering one or more of the questions on the principle investigator's survey, or not answering one or more questions on the Math & Me Survey. The final sample consisted of 273 males and 259 females.

Students in two separate schools from one large school district were chosen as participants in this study. All participating third, fourth, and fifth graders completed the surveys in their own classrooms. According to the school district's website, one elementary school had a total of 583 students during the 2014-2015 school year, as of November 10th. The racial

composition was 56.9% African American, 28.6% Caucasian, 5.5% Hispanic, 1.9% Asian, and 7.1 % Other. Of the 583 students, 94 were in third grade, 97 were in fourth grade, and 80 were in fifth grade. The student population was approximately 50.6% male and 49.4% female.

The other school in this district contained a total of 933 students as of November 10th. The racial composition was 22.3% African American, 63.9% Caucasian, 3.1% Hispanic, 4.9% Asian, and 5.8% Other. Of the 933 students, 157 were in third grade, 128 were in fourth grade, and 152 were in fifth grade. The student population was approximately 47.3% male and 52.7% female. The comparison of the two schools is listed in Table1.

Table 1

School Demographics

	Males	Females	Caucasian	African American	Asian	Hispanic	Other
School 1	51.3%	48.9%	28.6%	56.9%	2.7%	1.9%	7.1%
School 2	47.3%	52.7%	63.9%	22.3%	4.9%	3.1%	5.8%

These two schools were situated in a southern county in Georgia which is suburban and located on the southeastern part of Georgia. Estimation from the 2013 Census Bureau regarding the population of the city as a whole indicated a population of 278,434. The populations can be further broken down into race, which indicated 50.0% Caucasian, 40.2% African American, 0.3% American Indian, 2.7% Asian, 5.9% Hispanic/Latino, and 0.9% Other. This southern county had a median income of $45,653 from 2008-2012. In addition, 18.9% of the population was considered to live below the national poverty line. The demographics of the sample in comparison to the county are represented in Table 2.

Table 2

Comparative Demographics

	Males	Females	Caucasian	African American	Asian	Hispanic	Other
County	47.9%	52.1%	50.0%	40.2%	2.7%	5.9%	1.2%
Sample	51.8%	48.2%	48.1%	32.5%	2.6%	2.2%	14.6%

Instrumentation

One survey for this study addressing student's perceptions of their own ability was the Math and Me Survey (Adelson & McCoach, 2011). This survey was created based upon the Third International Mathematics and Science Study (TIMSS). According to Beaton et al. (1996) this study evaluated over half a million students in over 45 countries and in many different languages regarding student achievement in the mathematical and science areas. "The students who participated in TIMSS completed questionnaires about their home and school experiences related to learning mathematics" (Beaton et al., 1996, p. 3). Gender results indicated that both males and females in many countries were approximately equivalent in mathematical achievement. In a few of the countries, the differences of achievement often favored males over females.

The Math and Me Survey, after consultation with many content validators, contained a 5-point Likert scale. An analysis of reliability indicated a Cronbach's coefficient of .92. There was adequate content, construct, and external validity calculated in this study. The questions were calculated to be at a 3.6, indicating text at the readability level for a student in the third grade in the sixth month of school.

Specifically, one portion of the Math and Me survey was utilized for this study. The mathematics self-perceptions scale indicates the degree to which the students feel competent

with their own mathematical ability. Students who score low on this scale believe that they do not have the ability to understand mathematics or solve mathematical problems. These students feel that mathematics is confusing and/or is difficult. Students who score high on this portion feel that they are competent in mathematics, can understand mathematics, and can solve mathematical problems. The Likert scale was adapted to include a three-point response choice rather than the original five-point Likert scale. The principle investigator believed that this was more appropriate and less confusing to the elementary participants, especially those in the third grade. This decision was based upon her experience with this age group and various literature noting that attention spans of students at this age level are short in addition to the fact that the more choices a person has, the more confusing it can be to make a decision. This reduction in the amount of possible choices was also commensurate with previous research done by Fang et al. (2011), specifically addressing 5-point Likert scales versus 3-point scales. This research noted that "people with lower literacy have difficulties answering 5-point response Likert scales" (p. 538).

There are three sub-areas on the Math and Me Survey. These areas are Mathematical Self-Perception, Mathematical Enjoyment, and Perceived Usefulness of Mathematics. Questions from two of the three areas were eliminated from the questionnaire; as a result, only questions applicable to the Mathematical Self-Perception scale portion were utilized. While this section was originally eight questions, the principle investigator chose to eliminate the question "math comes easily to me" upon recommendation of the dissertation committee. The rationale behind this was that this question was repetitious with a previous question, specifically "doing math is easy for me." Permission to use and adapt the Math & Me Survey can be found in Appendix E, while specific questions and adaptation of this survey is located in Appendix F. The principle

investigator obtained permission from Michelle Binur of Sage Publications, the publisher of the survey, to adapt and use it for this research.

Even though the Math & Me Survey had established reliability and validity data, this data was regarding the original survey. As it was adapted for the current research study, these adaptations affected the statistical validity. Validity data was not established for the Math & Me Survey with all the subsequent changes. Therefore, data regarding the original survey may not be fully applicable for the Math & Me Survey used in the current study.

The investigator's survey was derived from the many different cited literature regarding gender bias concepts such as dominating classroom conversations, males being called upon more frequently in class, more use of the male gender in examples and in textbooks, as well as tolerating misbehavior more so in males than in females. Specifically, two of the questions were adapted from the Gender Equity Questionnaire. This questionnaire is part of a curriculum kit for use as small group discussion questions in overcoming gender bias. They are open-ended or interview type questions. Consequently, the questions are more qualitative in nature. Other questions from the survey were from Murdock's (1999) study regarding student motivation. Specific questions and formatting of this survey is located in Appendix G.

The investigator altered the questions for the appropriate age level of the students and represented only math, as the present study focused on gender equity perception in the mathematics classroom. The possible response choices were modified by changing the scale from a written agree/disagree scale to a three-point pictorial scale based on happy, neutral, or sad faces. Originally, there were a total of nine statements; however, after various subject matter experts' opinions, two questions were added. The final amount of questions was eleven. There were three possible answers to each statement, asking the rater to agree, feel neutral, or disagree

with the statement. The statements in this survey asked about the students' perceptions of their teacher's gender equity behaviors and views portrayed in the mathematics classroom. The questions in the survey were written for the level of upper elementary students so that they would understand what was being asked of them. This survey had face validity in the fact that all questions were regarding gender and mathematics.

Standardization of the principle investigator's survey included a total of seven subject matter experts. Each expert was asked to review the principle investigator's survey and then rate each of the nine questions individually on a one- to five-point Likert Scale. A rating of one indicated that the question being evaluated was not relevant to gender bias. A five-point rating indicated the question was congruent with the objective. The experts were also asked to include comments, questions, and suggestions regarding each question. The principle investigator then altered the questions in accordance with the experts' critiques. Various research associates and testing coordinators from Pearson Assessments were also consulted regarding phrasing and direction of questions used in the survey.

Procedures

After the Institutional Review Board (IRB) approved the principle investigator's dissertation research, permission was obtained from the district as well as the principals of the two schools. Approximately one week before the study took place, implied consent forms were sent home (see Appendix C).

The implied consent forms were sent home with the students describing the study, its purpose, and the explanation of voluntary participation. Potential harm to the student, though very limited, was described. At both locations, the teachers distributed and collected any returned implied consent forms and kept them in a folder until the research was conducted.

When the principle investigator entered each classroom during data collection, she introduced herself and read the child assent form (see Appendix D). The assent form contained a brief description of the purpose of the study and an explanation of voluntary permission. It also described what the student would be asked to do and the procedures during the survey. All students who did not want to participate, even though they were able to do so based upon the implied consent, then raised their hand. Those students who were not participating were instructed to either complete work or read a book, as dictated by the teacher.

As one of the surveys asked about students' feelings toward their teacher's perceptions, it was decided, prior to the study, that the teachers of each classroom would not distribute the surveys to their classes and students. This could possibly create an environment in which students felt uncomfortable rating their teacher, if the same teacher asked the questions from the survey. The principle investigator then read the survey script (see Appendix H). The students were asked to circle the happy face, sad face, or neutral face to describe how they felt about each specific statement. As reading levels vary from student to student, the principle investigator read each survey question out loud in a group setting. She answered any specific questions from the students in case further clarification was needed. Most classrooms took approximately 15-30 minutes to complete the surveys and collect them at the end. The amount of questions in the survey was specifically limited to address a short time span. This time frame did not interrupt instructional time to a significant degree.

After participants finished the surveys, the principle investigator asked each participant to make sure that their appropriate grade level, gender, and ethnicity were at the top of their survey. They were instructed to not put their names on the survey; but, only their grade, gender, and ethnicity. The principle investigator than chose two students to collect the surveys; however, a

few classes had "class monitors," and those students collected the surveys. Records were kept in a file cabinet at the principle investigator's home. Confidentiality was taken into strict consideration and none of the surveys, nor the results, were shared with participants.

Data Analysis

Females were coded with a numerical value of zero, while males were coded as having a numerical value of one. This is a commonly accepted technique used in the analyzing of statistics, as the analysis uses gender as a dummy variable. In coding the survey responses, unless the question was reverse scored, the happy face was assigned to a numerical value of three, the neutral face was converted to a numerical value of two, and the sad face was converted to a numerical value of one. The higher the conversion value, the more the student agreed with the statement. The questions were scored in this manner as the data was not only ordinal in nature, but the scale was measured on an interval scale. If the data was to be ordinal in nature, the happy, sad, and neutral faces could be assigned in any arbitrary manner. However, as the interval scale is considered more desirable, the data was measured in this manner. The difference between ordinal and interval scales is that ordinal data refers to ranking; however, the difference between each ranking is not equivalent. For instance, in a marathon, the time difference between first and second place may not be equivalent to the difference in time between second and third place. In an interval scale, the difference between each data point is equivalent. Therefore, numbers one, two, and three were used to denote the increasing correlation between agreement and value used to code data.

Responses to the separate surveys were totaled for each individual participant. The principle investigator used the SAS System to statistically analyze the data. It was manually entered into the research database and a correlational analysis of the data, in addition to central

tendency measurements, were performed. The mean for a sample is the balance point, or average point, of the distribution (Hannerman et al., 2012). The mean is the point where, from the entire sample, the resulting data from below this central tendency point is equal to the number of data points above this central tendency point. The formula for the mean is to take the sum of the data points and then divide by the sample size. The totals of each survey were calculated, and then using a sample size of 547, as there were 273 males and 269 females, the mean for the individual surveys was calculated. The mean for the Math & Me Survey was 17.4, while the mean for the principle investigator's survey was 21.44.

Another measurement of central tendency regarding interval data is the standard deviation. The standard deviation of a sample is the dispersion of data points around the mean. The standard deviation is the square root of a data point minus the mean squared and then divided by the sample size (Hannerman et al., 2012). The standard deviation for the Math & Me Survey was 3.70 and for the principle investigator's survey, it was 2.79.

Pearson Product-Moment correlation and Point-Biserial correlations were used to analyze data. Pearson Product-Moment correlation is also called Pearson's r. Both analysis methods are used to measure the relationship between two variables. They not only measure if there is a relationship between variables but also measure the strength of the relationship. Positive correlations indicate that the variables vary together. As one variable increases, so does the other. Conversely, when one variable decreases the other decreases as well. In a negative correlation, as the value of one variable increases, the other value decreases.

Summary

In this chapter, the quantitative methods were discussed, as well as the specific research design, questions, and hypotheses. Specific data of the participants, the setting in which the

research took place, and the two separate instruments were explained. The statistical analysis and procedures were also described. The following chapter, Chapter Four, will describe the data from the research study, data analysis and the results. They will be presented in various statistical methods such as in tables as well as descriptions.

CHAPTER FOUR: FINDINGS

Research Questions

RQ 1: Do students' perceptions of their mathematics teacher's gender equity behavior correlate with the students' perceptions of their own mathematics ability?

RQ 2: Does the gender of students relate to their perceptions of their mathematics teacher's gender equity behavior and to their own mathematical ability?

Hypotheses

$H_0$1: There is not a statistically significant correlation between students' perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics.

$H_0$2: There is not a statistically significant relationship between the gender of students and how students perceive their teacher's gender equity behavior.

$H_0$3: There is not a statistically significant relationship between the gender of students and student's perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey.

Descriptive Statistics

Null Hypothesis One

There is not a statistically significant correlation between student's perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics. Table three indicates psychometric properties regarding both surveys.

Null Hypothesis Two

There is not a statistically significant relationship between the gender of students and how students perceive their teacher's of gender equity behavior. On the principle investigator-created survey measuring student perception regarding teacher beliefs, the range was zero to 33. The statistical mean, or average, was 21.44. As the standard deviation is the distribution of scores around the mean, the standard deviation was 2.79.

Null Hypothesis Three

There is not a statistically significant relationship between gender and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey. The scores on each individual item ranged from zero to three, thus a total range for the Math & Me Survey was zero to 21. The statistical mean, or average, was 17.40. As the standard deviation is the distribution of scores around the mean, the standard deviation was 3.70.

Table 3

Survey Ranges, Means, and Standard Deviations

	R	*M*	*SD*
Math & Me Survey	0-21	17.40	3.70
Investigator's Survey	0-33	21.44	2.79

Results

In a correlational research design, the principle investigator is interested in understanding if the variables vary together. When there is a positive correlation, the variables increase together and the slope of the trend line is positive. When there is a negative correlation, as one variable increases, the other variable decreases and the slope of the trend line is negative. The statistical methods used to analyze the data were Pearson Product-Moment correlation as well as

Point-Biserial correlations as the research design was correlational. A two-tailed analysis was used as this denotes a correlation, yet does not denote a correlational direction. A one-tailed analysis is often used when the hypothesis is directional, either positive or negative. The two-tailed analysis is stronger and more desirable as it is more conservative because the researcher is taking less of a risk committing a Type One error.

For the first research null hypothesis, a Pearson Product-Moment correlation was used to compare students' perception of their mathematics teacher's gender equity behavior with students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics. Therefore, gender was not separated into two groups, males and females, because the research question is addressing the student sample as a whole, regardless of gender. It merely looks at the correlation between the students' perception of their teacher's gender equity behavior with students' perception of their own mathematical ability. The p-value is the probability that the researcher committed a Type One error. A Type One error is when the research concludes that there is a statistical significance when there is not one. If the p-value were .05 or less, the results are considered significant. However, as the results indicated a value much higher than .05, the researcher concluded that there was no statistical significance between the self-perception of students' mathematical ability and their perception of their math teacher's gender equity behavior, $r(545)= .03$, $p=.54$.

In addressing the second research null hypothesis, Point-Biserial correlation was used. The relationship between the gender of student and their own mathematical ability, was found to be .21 while the p-value was analyzed to be .0001. The investigator found that there was a statistically significant relationship between the gender of students and their performance on the

Math and Me Survey, $r_{pb}(545)=.21$, $p<.05$. In addressing the third research hypothesis, Point-Biserial correlation was also used to examine the relationship between the gender of students and their perceptions of their mathematical teacher's equity behavior. This calculation yielded a correlation of .107 while the p-value was calculated to be .012. The investigator, again, found a statistically significant positive correlation between the gender of students and their perception of their teacher's equity behavior in the mathematics classroom, r_{pb} $(545)=.107$, $p<.05$.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Discussion

As educators, everyone is responsible for creating a perception of gender equity in schools. The findings of this study indicated that no significant relationship exists between the students' perceptions of their mathematics teacher's gender equity behavior and the students' perceptions of their own mathematics ability; however, it found that a significant relationship exists between students' perceptions of their mathematics teacher's gender equity behavior and their own mathematical ability. These results are consistent with many of the more current studies.

In addressing the first research question, the answer is no. There is no statistically significant evidence that students' perception of their own mathematical ability is correlated with their perception of their mathematic teacher's gender equity behavior. This absence of correlation between the variables suggests that the perception of gender bias, as seen in the third, fourth, and fifth grade classrooms does not significantly impact the perceptions of students' own mathematical ability. This is consistent with some past research. Herbert (2005) reported that gender bias in mathematics classrooms has decreased over the last few decades. He also stated that females have lower perceptions of their mathematical competency even though their standardized math scores are generally equal to that of males. In his study, the results indicated that this was true only in that those math scores were equivalent between genders. However, females seemed not to have lower perceptions of their mathematical competency.

In addressing research question two, the researcher concluded that being male is associated with a higher perception of the student's own mathematical ability. There was a positive significant relationship between the gender of students and their perception of their

mathematics teacher's equity behavior. Therefore, being male is associated with higher scores on the survey measuring students' perception of their teacher's equity behavior. Both of these analyses yielded an answer of yes to the second research question. Being male is associated with both how students perceive both their teacher's gender equity behavior and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics. As the *p*-values were less than .05, the *r*-values were significant. A negative *r*-value would have indicated that students perceive their teachers to be more bias towards females. However, as the *r*-value was positive, students indicated that they believe that their math teachers are more bias towards males.

These findings in question two are commensurate with a great deal of previous research studies and concepts. Schunk (2012) stated that the teacher may model a certain feeling or personal belief in the classroom each day through grading assignments, calling on students to participate, as well as choosing students to lead the classroom in various activities. Results indicated that this occurs as students feel that there is gender bias present in the mathematics classroom, as demonstrated by teachers' actions. Since students observe their teachers' behaviors every day within the classroom, the students are subject to learning through observation. This is one of the three types of learning vicariously through one's environment.

As the current research study examined the final three academic years in elementary school, it seems as though students not only observe gender bias through the teacher's behavior in the mathematics classroom, but that this bias also has an effect on the student's perception of their own mathematical ability. This analysis confirms Fryer and Levitt's (2010) previous notion

that gender bias must be prevalent by the time the student attends middle school. The current study noted that findings indicated that it might begin as early as third grade, if not before.

The purpose of this correlational study was to investigate whether students perceive gender equity in mathematics classes and whether the perception of gender bias had a relationship to students' self-perceptions of their mathematical ability. The first null hypothesis researched was that there was not a statistically significant correlation between students' perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity beliefs in mathematics.

While this study analyzed the upper elementary school population, gender bias was noted to exist in 2006, when Johnson et al. reported the existence of gender bias in middle school mathematics courses. Zhao and Hoge (2005) concluded that the negative attitudes toward students in the classroom are a direct result of curricular content, various teaching methods, and the environment of the classroom.

As previously stated, Ryan and Ryan (2005) noted that females underperformed anytime the stereotype threat was activated. They asserted that even moderately well achieving females could experience stereotype threat. Stereotype threat can cause anxiety, apprehension, low self-esteem, low expectations for success, and result in lower test performance.

The second null hypothesis indicated that there was a statistically significant relationship between the gender of students and how students perceive their teacher's gender equity behavior The third null hypothesis also indicated that there was a statistically significant relationship between the gender of students and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey and a survey developed to measure students'

perception of their teacher's gender equity beliefs in mathematics. Many studies have demonstrated that teachers' attitudes and behaviors differ by gender in mathematics and science classes (Valentine, 1998). Warwick and Jatoi (1994) stated that teacher characteristics, in addition to teaching methods, can impact student performance. Teachers, in addition to the community, convey their personal biases every day to students. The impact on their students is either implicitly or explicitly expressed (Tiedmann, 2000).

However, even though the second portion of this study found a significant relationship between the variables of students' perception of gender bias and gender as well as gender and students' perception of their own mathematical ability, this study was only extended to a specific age group that were young students. It did not go beyond fifth grade. According to the College Board, 2012 SAT scores in math demonstrate a thirty-two point discrepancy between the two sexes, with females being lower (College Board, 2012). In addition, Berezow (2011) found that more undergraduate degrees, master's degrees, and Ph.D.'s were obtained by males than by females. In a study conducted in 2013 by Togila, research indicated that more female students were enrolled in cosmetology, childcare, and in health-related fields whereas they were largely absent from traditionally male courses such as those careers involving heating/air conditioning, refrigeration, welding, electrical and plumbing, and automotive. Also, he noted that females entered into more traditional female careers. Consequently, wages were substantially lower than fields that were more male-oriented.

Commensurate with these researchers previously mentioned, Ryan & Ryan (2005) denoted that mathematical ability is partially biological in nature; however, ability is equally dependent upon psychosocial, psychological influences on physiology, as well as in the teacher's modeling of instruction. Sommers (2008) specifically stated that "we don't accept biology as

destiny……We vaccinate, we inoculate, we medicate" p. 1). Therefore, teacher behavior is significantly influential in the perceptions of their students.

Females are at risk due to stereotype threats in academics. Stereotype threats do not necessarily lower women's expectations for success on mathematics exams; however, they make women evaluate themselves negatively, such as internalizing feelings of lower self-competency, lower self-esteem, a lower body image, and lower feeling of self-worth. In the study conducted by Leaper and Brown (2008), over half of the girls reported hearing discouraging comments about their own abilities in math, science, and technology.

Salkind and Rasmussen (2008) noted that socialization, as well as teacher attitudes and classroom resources, have an unequal effect on males and females. This current research study confirmed that notion as the students significantly identify gender bias in the mathematics classroom. A few years ago in 2009, Erden noted that teacher education regarding gender bias needed to occur in preservice trainings. The main purpose of those trainings was to increase awareness of potential difficulties, learn how to manage them, and to gain knowledge about content. However, teacher training may not have significantly addressed gender equity issues, as these perceptions of gender bias continue to exist in the mathematics classroom. As the results of the principle investigator's study noted correlation between students' perception of their own mathematics ability and their perception of their math teacher's equity behaviors, these gender sensitivity trainings that the teachers underwent during preplanning were not as successful as the school system had hoped in addressing gender bias in the classroom.

The current study is not commensurate with the study conducted by Spencer et al. in 2003, indicating that, when teachers demonstrated gender ideologies that were equal and fair, the students had less conventional gender ideologies as well. "Perceived teacher fairness is

positively related to scholastic competence, negatively related to reported acting out behaviors, and positively related to students' year-end grade point average" (Spencer et al, 2003, p. 1792). Teacher fairness was measured by teachers' actions as well as in gender equitable opportunities within the classroom. Derman-Sparks (1988) indicated that gender equality in the curriculum/classroom could only occur when the teachers evaluate their internal attitudes and classroom environments that they have created.

Conclusions

The purpose of this correlational study was to investigate whether students perceive gender equity in mathematics classes and whether the perception of gender bias has a relationship to students' self-perceptions of their mathematical ability. The relationship between student's perceptions of their math teacher's gender equity or inequity and the impact it has on their perceptions of their own mathematical ability was explored. The Math & Me Survey was used to measure students' perception of their own mathematical ability while the principle investigator's survey was used to examine students' perception of their teacher's gender equity beliefs in mathematics. First, permission was granted to use and alter the Math & Me Survey by Michelle Binur of SAGE Publications Inc. Permission was also granted for the school system that took part in this study as well as the individual principals of the schools.

The principle investigator calculated totals for each survey. Survey results were analyzed using SAS System to calculate the relationships between variables. Results indicated that the null hypotheses for research question one was accepted. There was not a statistically significant correlation between students' perception of their mathematics teacher's gender equity behavior and students' self-perceptions regarding mathematics as demonstrated by the Math and Me Survey and a survey developed to measure students' perception of their teacher's gender equity

beliefs in mathematics. However, research indicated that there was a not only a statistically significant relationship between gender and how students perceive their teacher's gender equity behavior, but also between gender and students' perceptions regarding their own mathematical ability as demonstrated by the Math and Me Survey.

These conclusion help to confirm the fact that gender bias was significantly present in the mathematics classroom approximately five to 10 years ago; but, while teacher training and knowledge of the possible inequity may have helped slightly, males continue to dominate the mathematics classroom. Students in the third, fourth, and fifth grades perceive a significant amount of gender bias in the mathematics classroom towards males. As self-perception is linked to performance, these findings indicate that a decrease in a student's mathematical performance, may, indeed, have a relationship with gender bias in the classroom. Performance deficits in the mathematics classroom can be attributed to other factors, as well, such as environment, economic status, a disability, etc. Performance deficits cannot solely be attributed to a feeling of inequity as it pertains to gender bias behaviors by the teacher; however, students continue to perceive that gender bias still exists.

The results of the principle investigator's study were partially expected as the perception of gender bias in the science, mathematics, technology, and engineering has been one of great research within the past decade. While it has shown that gender bias exists in middle school, according to the present study, it was also significantly present in upper elementary school mathematics classes, according to student perceptions. With a great amount of effort and concentration, gender bias, in the future, may be completely eliminated in the classroom in all grade levels. It is up to researchers and the educational system to work together to determine what can be done to make each child's educational career successful.

Implications

This study has educational implications, as this age group is one that precedes a time period in which we know gender bias exists in the mathematics classroom. School is a place in which children spend a majority of their time. In general, the less worries students have, the more they can focus on their academic career. Although educators cannot often control the home environment, they can absolutely regulate the school setting. Teachers, administrators, and other school faculty and staff unequivocally affect the perceptions of each child that walks through the school doors. With further knowledge comes the ability to control negative outcomes.

With a decrease in gender bias issues, the confidence of the students may improve, thus causing a decrease in cases where there may need to be some intervention. Evidence of a lack of gender bias in certain academic areas may help both genders to do well in an academic area, thus decreasing requests for assessment and diagnosis by the school psychologist because of poor performance. The need for special education services, in turn, may decrease. This decrease in special education services means that the school system is able to save monetary allocations that would normally be distributed to the special education department.

In addition, a decrease in gender bias and increase in gender equality can open many doors for females. Not only will it provide opportunities in the K-12 school system, but it will also offer various openings regarding secondary education. However, the benefits of equality will not solely be seen in the college classroom, but it would also permeate through the entire facility and effect hiring practices. The education system, no matter what level, would benefit from gender equality, but society would benefit as well. Hiring practices, in general, across society would be affected as well as career opportunities. Those careers that once seemed

impermeable for women may now be attainable and doors would open up numerous opportunities everywhere.

Limitations

Several limitations of this study may have affected the data. Environmental issues beyond the principle investigator's control include, but are not limited to, the health of the student, the teaching method of previous math teachers, the child's emotional state of mind, how the child felt the day that the surveys were distributed, parental pressure on the child, the interactions of the student and the teacher, culture of the students and their families, religion of the students and their families, as well as others. In this study, there was also the factor of the ability to conceptualize due to the younger age levels. Some students have significant difficulty understanding the concept of race. When explained further, the students would often understand; however, their initial conceptualization of ethnicity was often absent.

Due to the limited sample size in the study because of testing only students in two specific schools, this study precludes generalization of results to any other area where the student population may be different in socioeconomic status or in other ways. The principle investigator attempted to obtain a sample that was similar to the county in regards to demographics; however, there were variations between the two populations. While the county tended to be composed mainly of females, the sample was mainly composed of males. However, this discrepancy was not a significant difference, as the composition of the sample in comparison to the population varied approximately within four percent of each other. The county, as a whole, is composed of more Caucasians than was represented in the sample; however, this was also not a significant discrepancy. In both the sample and county population, there were more Caucasians than African Americans. However, there was a significant variation in demographics regarding those

in the "Other" category. This may be attributed to the difficulty that those in the sample had regarding ethnicity and the perceptions of race identity in that age group.

Even though the principle investigator assisted students that had any questions, some students may have identified their own race with the actual color of their skin. For instance, students might be of mixed ethnicity; however, they may have identified their race by only what they externally saw on their body. Likewise, a couple of the questions gave examples of careers to demonstrate the different occupations associated with males versus those with females. For instance, one question specifically noted gender in relation to being an engineer, policeman, or scientist. While these were just examples of a broader concept regarding careers stereotypically associated with males, the students may have seen this as a more finite list and not identified the broader concept. Another limitation were the grade levels of the students. The current study only addressed third, fourth, and fifth grade students. These conclusions may or may not apply to students in lower or higher grades.

For future studies in this area, in-depth discussion is needed with each principal to assure that the data collection method will be equivalent at each school. More planning needs to occur related to how data should be collected based upon the principals' requests. When possible, data collection methods should be uniform from school to school. In some classrooms, the teacher did not feel comfortable leaving the class while the students took the surveys. Even though the principle investigator explained to students that the surveys were going to be stored at the principle investigator's home, the surveys were anonymous, and that their teacher would never see the results of each individual survey, teacher attendance in the classroom was a significant factor. For instance, because the students completed the survey in front of the mathematics teacher, they may not have felt completely comfortable stating that there is gender bias in

mathematics, especially as it pertained to their teachers' thoughts and actions. However, the other children may have completed the survey in complete absence of the teacher, as the teacher was outside, so they did not feel anxiety associated with the teacher. It is ideal that teachers know and understand that their presence is a significant factor that affects the way a student answers the survey questions. Therefore, the teacher consent form needs to address this matter, in addition to discussion between the principle investigator and the teacher immediately prior to the distribution of the surveys in each classroom.

One significant fault of the study was the principle investigator's survey. As she could find no other survey that measured these concepts in elementary school children, specific reliability and validity data was not previously established. The principle investigator had guidance on writing questions such as viewpoints and beliefs of the committee, a partially similar survey with established validity, as well as someone from an existing testing validation company; however, she was unable to establish solid validity with her survey, as there was no previous pilot study and the survey had never been used in the school environment. No concrete statistical data was available to the principle investigator before disseminating the surveys in the classroom.

Another improvement on this study may be the wording of the questions on the principle investigator's survey. The principle investigator was asked many questions regarding a few statements on the survey itself. The wording of questions three and six confused many students and often needed clarification as to the content of what the question was asking. On number ten, the question uses more complex vocabulary than the students were used to, such as the word "encourages." The other significant topic regarding survey questions were specifically regarding questions four and eight. These two questions asked about careers in relation to teacher

behaviors. The students seem to conceptualize the careers listed as a finite and absolute list rather than more broad concepts. As an example, each question listed three careers as examples. The careers used in those questions were just examples of the concept being portrayed. However, the students might have believed that the question was specifically about those careers and not the overall category into which each of those jobs fit. A suggestion for future researchers might be to conduct a pilot study of a few students to see if the confusion came up before the data is collected. The current inventory used needs to be analyzed and rewritten accordingly.

A panel of six experts reviewed the principle investigator's survey. The content of the questions were analyzed and rated. For future research in this area, if a survey is created, there should be more than six experts, including a few children of that age group. This will allow the researcher more guidance into the various views that come with each question. The questions could be simpler in nature as well as written to the vocabulary level of the students. Even though the principle investigator read the questions to the students as reading levels differ among individuals, the conceptualization piece of each question and their associating concepts should be considered when writing the survey.

Recommendations for Future Research

This study has educational implications, as this age group seemed to be aware of any gender bias occurring in the mathematics classes. Future researchers need to determine at what age or what grade level the gender bias seems to occur so that it can be dealt with accordingly. There must be additional research studies conducted and research regarding this time period and gender bias. Once society has substantial evidence to determine the point in time gender bias is

established in school, the teacher at that grade level and previous grade levels can then begin to address gender issues in relation to school subjects.

This study may be repeated and data could be separated based upon grade levels. Once known at what point in school the gender bias occurs, the teacher at that grade level and grade levels before that can start addressing gender issues in relation to school subjects.

The principle investigator is a school psychologist; therefore, in relation to school psychology, the educational implications of gender bias can easily be handled. With a decrease in gender bias issues, the confidence of the students may improve, thus causing a decrease in cases where there may need to be some intervention. Evidence of a lack of gender bias in certain academic areas may help both genders to do well in an academic area, thus decreasing requests for assessment and diagnosis by the school psychologist because of poor performance.

A suggestion for future research is to repeat the current study upon after all suggested editing of the surveys is complete. Another possible study could be completed regarding teacher training and key concepts presented regarding the elimination of gender bias in the classroom. For instance, the types of training may be investigated, such as the model of instruction used by the school system. There are multiple programs available to address gender sensitivity in training. Does one program demonstrate a stronger indication of gender equality than others? Also, the length of training can be investigated along with the delivery method of the program. Is gender sensitivity training delivered through an online method more effective for teachers when compared to a face-to-face training session? Teacher training is definitely one area that future studies should explore.

Another possibility for future research studies involves special populations. The demographic portions for the surveys did not specifically address special education and

supplemental instruction. For each of the students in the classroom, information can be obtained from the teacher regarding the level of intervention the student is receiving, specifically in mathematics. Is the student receiving any supplemental interventions? If so, what level of interventions are they receiving? Are they tier two interventions or on a tier three level? The duration of these interventions can also be explored by noting how long the child has been receiving those interventions. In addition, is the student in special education? Does the child have a learning disability specifically effecting mathematics?

The current research study is also very specific in relation to academic subjects. It solely addressed mathematics. This study could be expanded to other academic areas, as the research suggests. Future studies can investigate science, technology or engineering. These areas may be broken down further to identify specific areas of science (i.e.-biology, physiology, meteorology, etc.). Does the type of technology have a significant impact regarding gender and a student's perception of bias? If a school offers communications technology classes versus information technology courses, does one class tend to lend itself to its students perceiving more gender bias than the other?

With a great amount of effort and concentration, gender bias, in the future, may decrease as the perceptions of female students may not affect academics. The more students recognize any sort of bias occurring in the school setting, the harder it becomes to concentrate solely on academics. It is up to researchers and the education system to work together to determine what can be done to make each child's educational career successful.

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APPENDIX A: Liberty University IRB Approval

October 20, 2014

Debra Jacobson

IRB Approval 1979.102014: Elementary Students' Perceptions of Gender Equity in Mathematics Classes

Dear Debra,

We are pleased to inform you that your above study has been approved by the Liberty IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

Fernando Garzon, Psy.D.

Professor, IRB Chair

Counseling

(434) 592-4054

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APPENDIX B: Parent Recruitment Letter

Dear Parent:

As a graduate student in the Graduate School-School of Education at Liberty University, I am conducting research as part of the requirements for a Doctoral Degree. The purpose of my research is to determine not only whether students perceive teacher gender equity/bias in mathematics, but also whether this perception may affect the students' beliefs about his or her own math ability. I am writing to invite your child (with your permission) to participate in my study.

All 3rd, 4th, and 5th grade students are invited to participate with your permission as well as their own willingness to complete information required. If you are willing to allow your child to participate, he or she will be asked to complete 2 surveys, which are approximately 20 questions in length, together. One survey is 7 questions while the other is 11 questions. It should take approximately 30 minutes for him or her to complete the procedure listed. Your child's participation will be completely anonymous, and no personal, identifying information will be required.

An implied consent document will be sent home with your child at least one week before the research takes place. The implied consent document contains additional information about my research, but you do not need to sign and return it should you want your child to participate. Just to reiterate, for your child to participate, the implied consent form SHOULD NOT be returned.

Only those who DO NOT wish for their child to participate in this study will sign and return the form.

Sincerely,

Debra Jacobson

School Psychologist

APPENDIX C: Implied Consent Form

CONSENT FORM

ELEMENTARY STUDENTS' PERCEPTIONS OF GENDER EQUITY IN MATHEMATICS CLASSES

Debra Jacobson

Liberty University

School of Education

Your child is invited to be in a research study of elementary students' perceptions of gender bias in the math classroom. Your child was selected as a possible participant because your student is in 3rd, 4th, or 5th grade. I ask that you read this form and ask any questions you may have before agreeing for your child to be in the study. This study is being conducted by Debra Jacobson, School of Education.

Background Information:

The purpose of this study will be to determine not only whether students perceive teacher gender equity/bias in mathematics, but also whether this perception may affect the students' beliefs about his or her own math ability.

Procedures:

If you agree for your child to be in this study, **I will ask the student to complete 2 surveys**: one about their perceptions of their own mathematical ability while the other survey asks about what they feel that their teacher perceives about gender in relation to math. The 2

surveys will consist of approximately 15 questions. The researcher will read the questions out loud and each student will circle either a happy, sad, or neutral face (indicating agreement with the statement, disagreement, or a neutral/unsure feeling). No identifying information will be on the survey. The student will be asked to circle their grade, gender, and ethnicity. No other identifying information will be asked such as names, birthdates, social security numbers, etc. These surveys should take about 15-30 minutes to complete.

Risks and Benefits of being in the Study:

The study has several risks; however, the risks are very minimal and are no more than the student would encounter in everyday life.

There are possible benefits to society. The benefits to society include additional knowledge regarding gender bias in the later elementary school education system and what effects the perceptions of the teachers have on student beliefs about their own mathematical ability.

Compensation:

There will be no compensation for participation. Benefits include knowledge; however, no class points, grades, reinforcements, or monetary payment will be distributed.

Confidentiality:

The records of this study will be kept private and confidentiality will be strictly enforced. The researcher will take many measures necessary to secure safety of the data as well as of the participants. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely in a

locked file cabinet my home and only I will have access to the records. Research must be stored for a minimum of three years after the end date of the study, as required by federal regulations. After this time, the records will be shredded.

I would like to reiterate that the data will be stored in a file cabinet at the researcher's home and she will shred these surveys after 3 years. In addition, only the researcher as well as a statistician will have access to these surveys. Information will be confidential. Other students as well as other school personnel in the classroom may see an individual's answer to each question by looking at a students' piece of paper while he/she is filling it out; however, this is very unlikely.

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University nor with Savannah-Chatham School District. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Debra Jacobson. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at djacobson2@liberty.edu. The advisor for this study is Dr. Michelle Goodwin and she can be reached at 434-582-2265. Her email address is mbgoodwin@liberty.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 or email at irb@liberty.edu.

Please keep a copy of this for your records.

If you sign this form and return it to his or her teacher, this is an indication that you *DO NOT* want your child to participate in this study. Please do not return this form if you give permission for your child to participate in this study.

I have read and understood the above information. I have asked questions and have received answers. I understand that this form is one of implied consent, meaning that **if I sign and return this form, I am choosing for my child to NOT participate in this study.** However, if I do not return this form, it indicates that I consent for my child to participate in the study.

Signature of parent/guardian: _____Date: _____Phone: _____

Electronic Signature of Investigator: _____Date: _____

I, the undersigned, verify that the above consent procedure has been followed and I DO NOT give permission for my child to participate in this study.

_____ _____ _____

Participant's Parent/Guardian Signature Date Phone Number

APPENDIX D: Child Assent Form

Assent of Child to Participate in a Research Study

What is the name of the study and who is doing the study?

I am Debra Jacobson, a graduate student at Liberty University and I am doing a study on 3rd, 4th, and 5thgraders' view on gender differences in math class.

Why am I doing this study?

I am interested in studying how different genders feel about their math classes in relation to gender bias in math.

Why am I asking you to be in this study?

You are being asked to be in this research study because I specifically want to look at 3rd, 4th, and 5th graders. This is the time right before you go to middle school. Middle school is when we know that gender bias exists, so I want to look at the grades right before that. You are being asked to help in my project that will allow me to learn about differences in boys and girls in math.

If you agree, what will happen?

If you are in this study I'm going to have you fill out 2 surveys about your math class. The questions on those surveys talk about your feelings and how you think about your math, as it specifically relates to your math class.

Do you have to be in this study?

No, you do not have to be in this study. If you want to be in this study, then tell the researcher. If you don't want to, it's OK to say no. The researcher will not be angry. You can say yes now and change your mind later. It's up to you.

Do you have any questions?

You can ask questions any time. You can ask now. You can ask later. You can talk to the researcher. If you do not understand something, please ask the researcher to explain it to you again.

Please raise your hand if you would like to participate.

APPENDIX E: Math & Me Survey Permission

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Dear Debra Jacobson,

This document can be considered as permission to publish the adapted version of the Math and Me Survey in your upcoming dissertation to be published in Liberty University's open access institutional repository. Please note that this permission does not cover any 3rd party material that may be found within the work. We do ask that you properly credit the original source, Measurement and Evaluation in Counseling and Development. Contact us again for any further usage of the material.

Best regards,

Michelle Binur

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Material to be used in the dissertation: Math & Me Survey

Source: Adelson, Jill L. and D. Betsy McCoach. Material Requested: Development and Psychometric Properties of the Math and Me Survey:

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APPENDIX F: Math & Me Survey

PLEASE CIRCLE THE GRADE YOU ARE IN: 3RD 4TH 5TH

ARE YOU A BOY OR A GIRL? BOY GIRL

WHAT IS YOUR RACE? BLACK WHITE ASIAN HISPANIC OTHER

Tell me how you feel about each sentence.  = agree  = not sure  = disagree

1. I am really good at math. agree  not sure   disagree
2. I understand math. agree  not sure   disagree
3. I can solve difficult math problems. agree  not sure   disagree
4. Math is very hard for me. agree  not sure   disagree
5. Math is confusing to me. agree  not sure   disagree
6. I can tell if my answers in math make sense. agree  not sure   disagree
7. Doing math is easy for me. agree  not sure   disagree

APPENDIX G: Perceptions of Teacher Equity Survey

PLEASE CIRCLE THE GRADE YOU ARE IN: 3RD 4TH 5TH

ARE YOU A BOY OR A GIRL: BOY GIRL

WHAT IS YOUR RACE? BLACK WHITE ASIAN HISPANIC OTHER

Tell me how you feel about each sentence.  = agree  = not sure  = disagree

1. My teacher calls on girls more than boys in math class. agree  not sure   disagree
2. My teacher uses more boys than girls in the examples he/she uses when she talks about math. agree  not sure   disagree
3. My teacher gives more points for the same answer when the work is by a girl than when it is by a boy in math. agree  not sure   disagree
4. My teachers use more examples of boys than girls in jobs like scientists, policemen, and engineers than girls. agree  not sure   disagree
5. My teacher says boys are better at math than girls. agree  not sure   disagree

6. My teacher says that boys are wrong in math and girls are right.

agree  not sure   disagree

7. My teacher doesn't care if girls do something wrong in math class but cares when boys do something wrong.

agree  not sure   disagree

8. My teacher says that boys can be anything they want to be when they grow up but girls can only be nurses or teachers or flight attendants.

agree  not sure   disagree

9. My teacher encourages boys to speak out more than girls.

agree  not sure   disagree

10. My teacher gives boys more time when they answer questions in math when compared to girls.

agree  not sure   disagree

11. Girls are more likely to be called up to the front of the room to do math on the board than boys.

agree  not sure   disagree

APPENDIX H: Survey Script

"Hi everyone. Today we are going to take a few minutes to fill out a questionnaire/survey." [Read the child assent form and ask those who would like to participate to raise their hand. Then, from those that raised their hands, call names from teacher's file of returned consents and ask those children to put their hands down and explain that their parent would rather them not. They should read quietly at their desk, draw, or put their head down for the next 15 or so minutes.] Once everything is situated and everyone that wants to/is able to participate is ready, direct the students to circle either the happy face if they agree with the sentence, the middle face if they don't have any opinion toward the sentence, or the sad face if they disagree with what the sentence says. Begin reading the survey to the class and give the students ample time to answer each question before moving on to the next. Once all questions are read and completed by the students, make an announcement to the students to make sure they have put their grade and gender on the upper right portion of the survey, but not their names. Lastly, ask everyone to make sure all questions are completed.