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Perceptions of Male Versus Female Students Enrolled in Science, Technology, Engineering and Mathematics Courses Regarding Peer Tutoring, a Component for Student Retention

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PERCEPTIONS OF MALE VERSUS FEMALE STUDENTS ENROLLED IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS COURSES REGARDING PEER TUTORING, A COMPONENT FOR STUDENT RETENTION

by

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This dissertation, submitted by Cheryl D. Kingsbury in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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PERMISSION

Title	Perceptions of Male Versus Female Students Enrolled in Science, Technology, Engineering and Mathematics Courses Regarding Peer Tutoring, A Component for Student Retention
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Signature Cheryl Kingsbury

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ABSTRACT

Academic departments in the areas of science, technology, engineering, and mathematics, strive to develop in students the ability to problem solve, analyze, and to critically think about solutions to problems. Academic departments are committed to success, yet retention rates are lower than would be expected for females in science, technology, engineering, and mathematics fields of study, where female students are underrepresented.

The purpose of the study was to explore the perceptions of male and female traditional and nontraditional students who participated in a science, technology, engineering or mathematics STEM course during the spring 2010 semester regarding peer tutoring, and to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering and mathematics STEM courses at the University of North Dakota.

The participants in this quantitative study were students enrolled at the University of North Dakota who voluntarily completed a peer tutoring usage survey. A total of 231 students enrolled in Concepts of Biology (Biol 111), Introduction to Chemistry (Chem 115), Advanced Applications of CADD (Tech 202), Material Properties and Selection (ME 313), and College Algebra (Math 103), completed a survey about their spring 2010 semester.

Five research questions searched for the differences between male and female perceptions regarding peer tutoring, a component of student retention. The independent variable was gender, the dependent variables were the factors regarding peer tutoring: academic preparedness, academic support and cost, and demographics.

Two significant differences were found: (a) females viewed themselves as less prepared for science, technology, engineering, and mathematics courses than did male students, and (b) females were more in favor of the costs of peer tutoring than were male students. These findings support Merton's Self-fulfilling Prophecy Theory. Female students perceived themselves as less prepared for a science, technology, engineering, or mathematics course than male students, and this perception has become a reality, since female students were not retained at the same level as male students in STEM courses.

CHAPTER I

INTRODUCTION

Background of the Study

Because it is a cost effective concept, nearly all universities implement some form of retention practices on their campus. Dr. Vincent Tinto's (1993) research has heightened the awareness about the costs affiliated with student attrition (p. 1). Most universities conduct ongoing institutional research in the area of retention. Strategic planning efforts to improve retention have accelerated, as tuition rates have increased in recent years. Efforts have been made by the institutions toward creating a student population prepared for the coursework needed to complete the general education requirements and to pursue careers in science, technology, engineering and mathematics (Halcrow, 2003). Academic support centers have been increasing in American institutions during the past two decades, but many challenges remain as college access has increased, including the retention of females in science, technology, engineering and mathematics (Halcrow, 2003).

One component in the retention process is peer tutoring (Evans, 2001). Historically, peer tutoring had been used predominantly by males, by the Greeks, Romans, Europeans, and in the country schools of America (Zaritsky, 1989). Considering that peer tutoring has been historically conducted on a small scale, the growth of peer tutoring today is impressive. This increase, in part, is due to the recent developments in technology that have demanded that institutions of higher education prepare students as leaders and decision makers which requires proficiency in the complex areas of science, technology, engineering and mathematics.

Need for the Study

Since 1991, there has been an increase in the awareness of the need for tutorial services at the college level for at risk students in the science, technology, engineering and mathematics (STEM) areas of study (Tinto, 1993). It is not known if there is a difference in the high school academic preparedness between male and female students, or whether there is a difference in the utilization of tutorial services by male and female students. There is also a shortage of information on student perceptions of cost as related to tutorial services. Something needs to be done to increase the retention of female students in the STEM areas of study. This study provided data to answer these questions, so that practices can be implemented to improve the retention of female students in the STEM career fields.

This study considered at risk students as defined by the United States Department of Education (United States Department of Education, 2004). At risk students included: a) first generation students whose parents did not attend college; b) low income students as defined as an individual whose family's taxable income did not exceed 150% of the poverty level amount (U.S. Department of Health and Human Services, 2009); c) students who have been out of the academic pipeline for a period of more than five years (United States Department of Education, 2004); d) students with ACT scores of 21 or lower; e) students with a documented learning disability; f) adult students who are 24 years of age or older; g) students below 2.5 grade point average in high school; and h) female students in STEM majors. These at risk students are both traditional and nontraditional students (Mortenson, 2004; Brookfield, 1986).

Retention has been emphasized in all higher education institutions (Young, 2007) and involves a triad of the student, the high school, and the institutions of higher education. The National Commission on Excellence in Education (1983) and the National Council for the Education of Teachers (1985) have concluded that there is a deficit in the connections among universities and other educational institutions. Suggestions have been made, but agreement on how to make changes and improve connections is elusive (Blain, 1991). Furthermore, there is a shortage of students being retained in the science, technology, engineering and mathematics areas of study (Stokes, 2010). Female students are underrepresented in these areas of study (Kalikole, 2010; Anderson, 2007; Anderson, 2002). Both male and female students from culturally diverse backgrounds and nontraditional students are also underrepresented in the STEM career fields (Mortenson, 2010). Researchers are studying the differences in the brain physiology of male and female students to shed light on these questions (Carter, 1999).

There are three areas in which change has occurred in academic standards that make it extremely difficult for at risk students to be successful. First, at risk students are much less prepared for college, particularly in the areas of college level science, technology, engineering and mathematics than traditional students (Kalilole, 2010). At risk students who are adult students have not taken the core mathematics curriculum in high school that traditional college students have taken (Stokes, 2010).

The second area of change is that the "at risk" students will be competing with traditional students who meet the new American College Testing requirement. In an effort to increase retention rates, many universities are increasing academic standards.

The third area of change is the increased use of technology and statistical analysis in decision making and problem solving. Thus, a high level of science, technology, engineering, and mathematic proficiency is required of college students. Many at risk students have worked at minimum wage jobs prior to entering college. It is the desire of at risk students to major in a field of study that pays well; however, these fields of study require a high level of science, technology, engineering and mathematics proficiency. The gap between the level of science, technology, engineering and mathematics preparation of at risk students and the academic requirements needed for graduation in their major area of study is wide (Stokes, 2010). Because these adult students did not take the core math science high school curriculum, have been away from academics for a period of time, and also have family and work responsibilities, the adult students are destined to failure before they begin their college career (Tinto, 2007). These risk factors are even greater for students of color, in part, due to lack of role models in science, technology, engineering and mathematics (Stanley, 2006). About 44% of adult students in higher education are over the age of 25 and the percent is rapidly rising (National Center of Educational Statistics, 2006, p. 1). This figure includes many students funded by the Servicemen's Readjustment Act (G.I. Bill).

Even though research has indicated that there is a shortage of college graduates in the fields of science, technology, engineering and mathematics, research has also indicated that universities everywhere are in crisis over the dilemma of how to teach and ensure the success of students in science, technology, engineering and mathematics (Tinto, 2007). Students are less prepared, enrollments have increased, academic requirements are greater, budgets are tight and pressure has increased for the United States universities to compete with China, India and Ireland in graduating mathematics and technology students (National Academy of England, 2006). This educational climate, in the wake of a decade of financial cutbacks in higher education is a "silent disaster" for all adult students, especially adult students of color (Dey, 1999, p. 298).

In existing studies, minimal research attention has been directed to the at risk population of college students. Even though they are very capable students, they are considered costly (Hock, 1999, p. 102). University departments choose to discourage these students rather than to look for ways to prepare them for success in science, technology, engineering and mathematics. Thus, students who desire to go into these fields of study in which there is a shortage are "weeded out." According to Senator Dorgan (2007), the United States depends on students from foreign countries to fill jobs in the STEM areas.

In a recent discussion this fall with Mr. Johnson, a mathematics instructor at the University of North Dakota Department of Mathematics, I learned that many students register for college algebra each semester either to fulfill a graduation requirement or as a prerequisite for a required class (Johnson, 2010). Many of these students are adult transfer students from community colleges who have taken beginning or intermediate algebra and have experienced an easier pass criteria. Unfortunately, two-thirds of the students who enroll in college algebra are unsuccessful (Stokes, 2010, p. 364). The University of North Dakota Mathematics Department has set standards as an academic discipline and upholds these standards. In the area of chemistry, 40% of the students enrolled in freshmen and sophomore chemistry classes fail, withdraw or receive a grade that is unsatisfactory (Stokes, 2010). The chemistry department has recently funded an in house tutor to improve retention in chemistry courses (Hoffman, 2010). Houston felt the bridge between these academic standards and the lack of preparation of students in the areas of science, technology, engineering and mathematics might be the support of peer tutoring (Houston, 1996). The lack of research in this area accompanied by the high need for research on the at risk population of female students is why I chose to do this study on the effects of peer tutoring of at risk students in science, technology, engineering and mathematics courses at the University of North Dakota.

Purpose of the Study

The purpose of this study was to explore the perceptions of male and female traditional and nontraditional students who participated in a science, technology, engineering or mathematics course during the spring 2010 semester regarding peer tutoring, and to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering and mathematics courses at the University of North Dakota.

Research Questions

Questions that this study examined were:

1. Is there a significant difference between the perceptions of males and females regarding academic preparedness?

1a. Is there a significant difference between the perceptions of males and females regarding their STEM professors preparing them for their current STEM course?

1b. Is there a significant difference between the perceptions of males and females regarding their ACT scores?

1c. Is there a significant difference between the perceptions of males and females regarding their high school GPA?

2. Is there a significant difference between the perceptions of males and females regarding academic support?

2a. Is there a significant difference between males and females in how they viewed peer tutoring in science courses?

2b. Is there a significant difference between males and females in how they viewed peer tutoring in technology courses?

2c. Is there a significant difference between males and females in how they viewed peer tutoring in engineering courses?

2d. Is there a significant difference between males and females in how they viewed peer tutoring in mathematics courses?

3. Is there a significant difference between the perceptions of males and females regarding the costs related to peer tutoring?

3a. Is there a significant difference between the perceptions of males and females regarding the money that is spent on peer tutoring?

3b. Is there a significant difference between the perceptions of males and females regarding the dropping of courses?

3c. Is there a significant difference between the perceptions of males and females regarding time away from family if students were to use peer tutoring?

4. Is there a significant difference between the perceptions of males and females with different demographics regarding peer tutoring?

4a. Is there a significant difference between the perceptions of males and females based on residence?

4b. Is there a significant difference between the perceptions of males and females based on parental education status?

5. What are the perceptions of male and female students' peer tutoring experience?

The rationale for this study was to investigate the perceptions of the participants regarding peer tutoring in order to increase peer tutor usage, and to increase retention and graduation rates in the STEM areas.

By exploring the differences between males and females regarding peer tutoring, this knowledge can be used to increase the retention and graduation rates of females in the STEM areas of study. This understanding might subsequently allow the development of models of success for mathematics; provide a foundation for science, technology, and engineering; and decrease the 67% failure rate. It is important to eliminate an academic barrier for at risk students and replace that barrier with the key to success (Evans, 2001).

Significance of the Study

This study is especially significant to the student support staff, academic advisors, faculty in the science, technology, engineering and mathematics departments, and administrators at the University of North Dakota. The challenge to increase retention and improve the gender disparity in the science, technology, engineering and mathematics career fields is of concern to the professionals who are trying to identify ways to increase the retention and graduation rates of females in the STEM areas of study. The acknowledgement of the disproportionately fewer females than males in the STEM areas of study has been expressed, yet little has been done to create changes.

Hypothesis

The opinions of female students in favor of peer tutoring in the STEM courses will be greater than that of male students. This study examined the hypothesis to determine whether a lack of consensus exists between males and females that may explain the lack of female retention in science, technology, engineering and mathematics courses.

Procedural Framework

This study utilized the Manova design to examine the opinions of male versus female students in STEM courses at the University of North Dakota on the usage of peer tutoring. The independent variable was gender with two conditions, male and female. The dependent variables were the three constructs of preparedness, support, and cost.

Delimitations

1. The study involved only the University of North Dakota.
2. Only the students enrolled in Introductory Chemistry (Chem 115), Concepts of Biology (Bio 111), Advanced Applications of CADD (Tech 202), Material Properties and Selection (Eng 313), and College Algebra (Math 103), were involved in the study.
3. The students participated in the study on a voluntary basis.

4. The male and female students were not numerically evenly distributed.

5. There was no intent to compare traditional to nontraditional students enrolled in these classes.

6. The population participants were drawn from 420 participants in the study.

7. Because the survey was anonymous, participants did not sign a statement of accuracy with regard to American College Testing scores or grade point average. The importance of accuracy was emphasized.

8. Because the survey was anonymous, participants did not sign a statement of accuracy with regard to demographic information. The importance of accuracy was emphasized.

9. The study depended upon the willingness of participants to answer the survey questionnaire.

10. The study depended upon the skill of the investigator as she wrote the survey questions.

11. The study depended upon the survey questionnaire's quality as to clarity of questions and consistency of interpretation.

12. The research was conducted over the course of one year, 2009-2010.

Definition of Terms

Perception

The American Educators' Encyclopedia (1982) defines perception as "the way in which an individual 'sees' things. The study of perceptions concerns the appearance of things. Perceptions may reflect accurately the object (veridical)...or they may not (illusion). Factors such as past experiences, the unknown, attitudes, values and misinformation may also help to develop and influence perceptions. One's perceptions of another person may dictate how that other person reacts to him/her (p. 388-389).

Traditional Student

A college student who is 18-23 years of age.

Nontraditional Student

A college student who is older than 24 years of age.

Academic Preparedness

The Random House Dictionary (1968) defines preparedness as readiness. Readiness to be admitted to the University of North Dakota requires a high school GPA of 2.5.

Learning Community

Dr. Vincent Tinto defined learning communities as groups of students who meet regularly with a peer tutor at a designated on campus location. Students in learning communities meet in residence halls, learning centers, and in academic departments (Tinto, 2007).

STEM

STEM is an acronym for science, technology, engineering and mathematics (Stokes, 2008).

Supplemental Instruction

A form of peer tutoring where the peer tutor attends class with the students and schedules regular bi-weekly or tri-weekly peer tutoring sessions.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to review the literature that is current and relevant to the study. An extensive review of existing literature in the areas of retention, gender, and educational practices was conducted and included governmental data, academic journals, dissertations, and a multitude of higher education resources. Topics addressed were: retention, rationale for peer tutoring, potential obstacles, gender, male and female brain differences, and educational strategies.

Background

The researcher's academic experience in a student support profession, and the need for improved retention statistics in the STEM courses, especially for females, provided the main inspiration for this study. Merton's (2008) theory of the self-fulfilling prophecy, the prophecy or prediction is false, but is made true by a person's unconscious or conscious actions that directly or indirectly causes itself to become true (p. 475); this theory raises questions about the perceptions of females regarding STEM courses and the low retention rates of females in the STEM career fields. Goldberg's (1993) research on male dominance, raised questions about the differences between males and females (p. 31). Despite the need for female graduates in the STEM career fields, the research on retention strategies in the STEM areas is quite limited (Connelly, 2005). Much of the current research addressed the barriers to retention, challenges, achievement predictors, self perception, and motivation. Research by Little (2009) between gender and rural policy found evidence to support Goldberg's research of male dominance in a rural society (p. 621).

Retention

It is clear by the emphasis that American universities are placing on retention that it will be a focal point in higher education in the future. According to Gray (2000), Director of the Office of Evaluation and Research Center for Instructional Development,

> Over the last five years individual institutions have conducted extensive studies regarding retention on their campuses (p. 91). Austin's Involvement Model (2002), Tinto's Student Integration Model (1993), and Bean's Student Attrition Model (1980), all recognize that students bring a number of characteristics, experiences, and commitments to their college experience, including: academic preparedness, parental educational attainment, aspirations, socio-economic levels, attitudes, and behaviors (Thayer, 2000, p. 4).

Austin (1996) studied 365 baccalaureate-granting institutions and examined the differentials in degree attainment by gender, racial group, high school grade point average, SAT scores and academic preparation. The study revealed that campus involvement was an important factor in retention. The study offered a method for individual institutions to predict the degree attainment rate from entering student data (p. 10).

Syracuse University has been studying student retention for the last several years and has also come to recognize the critical nature of the freshman experience (p. 91). In his article on student departure, Tinto (1998) writes:

Interest in the issue of student success, in particular student retention, has not waned. If anything it has grown over the years. So much so, that we have witnessed products that offer the promise of a quick-fix to the "retention problem." Though their work is invaluable to those programs, their effort alone does not account for institutional success. Instead it resides in the work of the faculty and in the institution's capacity to construct educational communities that actively engage students in learning. It lies not in the retention of students but in their education (p. 111). The question of choice: where does one invest scarce resources on behalf of student retention? (p. 121)

Mortenson (1998) examined the relationship between family income and educational attainment. Students from families in the lower income quartiles are far less likely to earn a bachelor's degree by the age of 24. Students in the top family income quartile were found to complete a baccalaureate degree at a 74% rate, as compared to 5% for those in the bottom income quartile (2000, p. 216).

Ottinger (1991) examined the relationship between retention and socioeconomic background. He found that high ability high school seniors from low socio-economic backgrounds were less likely to attain a bachelor's degree than high ability seniors from high income backgrounds (p. 216).

Reil (1994) found a correlation between SAT scores and high school grade point averages, and first generation students. His research indicated that academic preparation was but one of the many obstacles confronting first generation students (p. 216).

In his article *First Generation Adult Students: In Search of a Safe Haven,* Zwerling (1992) identifies the retention challenges that are faced by "nontraditional" students who attend intermittently and carry financial and family responsibilities (p. 308). Since these students are nontraditional, the traditional retention practices need to be modified (p. 308).

Hammer (2003) emphasized the importance of peer tutoring support. He implemented behavioral training for peer tutors as part of his retention program (p. 2).

Rationale for Peer Tutoring

Tinto (1998) describes a significant form of student departure using the term academic difficulty. "Simply put, some students leave because they are unable or unwilling to meet the minimum academic standards of the institution" (p. 112). To minimize attrition, Tinto (2000) recommends that universities use Learning Communities. "These Learning Communities, shared learning through peer tutoring support groups, can bridge the academic-social divide" (p. 130).

Thayer (2000) in his article, *Retention in Higher Education of Students from First Generation and Low Income Backgrounds,* writes: "The dual influence of entering student characteristics and the educational environment is the subject of a study by Mortenson (1997). The study predicted graduation rates based on a measure of academic preparedness (SAT scores). The difference between the predicted and actual graduation rates is at least in part a reflection of the quality of the educational environment (p. 4). Thayer (2000) also researched another rationale given to encourage peer tutoring, a structured first-year program: "Structured first-year programs do not require greater resources, but do require greater authority" (p. 196). He cites a greater focus on intentional advising, instructional activities, academic support through peer tutoring, and learning communities as part of the structured first-year program.

Markus (2000), in her article *Study Strategies and Academic Success*, writes: "If you have difficulties with a class, seek assistance from your instructor or the many academic support resources on campus. Tutoring is offered through the Office of Student Life, Adult Student Center, Student Educational Opportunity Center, and the math and physics departments by student honoraries" (p. 299).

Richardson (1987), the National Center for Post Secondary Governance and Finance, Arizona State University, in his article on the study of ten public universities, examined the preparation gaps that exist when minority students compete with better prepared Asians and whites. Special assistance is needed in the retention of these students (p. 180). "The Native American Program of the College of Engineering at the University of New Mexico provides special enrichment programs to strengthen the preparation of high school students in mathematics and the sciences, as well as providing special support services for those who subsequently enroll." (p. 180)

Noll (1995), in his article, *Savage Inequalities*, describes "best practices" for American Indian college student retention: a) develop an early alert student retention team and develop a form and system for tracking student attendance, grades, and a line of communication between the team member and the student; b) promote mentorship and provide mentorship training; c) involve the parents and elders in the recruitment and outreach efforts; d) develop additional support services that are sensitive to the cultural needs of students; e) explain the academic dialog during orientation, and f) with peer tutoring in place, hold high expectations (p. 15).

MacGreger (2000) identified significant learning community reform efforts implemented by the Washington Center for Improving Undergraduate Education.

Competitive learning was replaced with cooperative learning utilizing peer tutoring. Predominantly passive modes of learning were replaced with active learning and experiential encounters. Procedural knowledge was replaced with "connected" and "constructed" knowledge (p. 1).

Muraskin (1997) identified peer tutoring as a best practice in her national longitudinal study of five exemplary sites of college freshmen. Under the focus area of academic support for freshmen, individual peer tutoring, peer tutoring in the form of supplemental instruction, and group peer tutoring were identified in the list of "what works" in university support services (p. 10).

Levitov (2000), Director, Office of Retention, University of New Orleans, developed a model of retention that implemented peer tutoring. This model identified the key to retaining students as a structured first year. Peer tutoring, including tutoring in the residence halls, and class attendance by the peer tutor was an integral part of the structured first year (p. 199). Martin, Washington University, presented research at a recent STEM Conference in San Diego that supported Levitov's research. Martin writes, College opportunity programs, such as Student Support Services, must take a more active role in providing specific interventions to assist students' progress in STEM majors; one of the specific interventions that was suggested was peer tutoring (Martin, 2010).

Mathews (2000), Southwest Texas State University, in his research on peer tutoring found:

> More students leave their college or university before receiving a degree than those who stay. The attrition rates demand the serious reexamination of traditional retention strategies. Tutoring has been an academic support strategy

essentially throughout history. Schools like Harvard, Yale, and others used tutoring in the 18^{th} century. Good tutoring can be effective when tutors are well trained. When tutors are taught how to look beyond the content of the tutoring session, they look at how the students learn, and suggest appropriate study skills, strategies. These sessions can teach students how to manage their time and develop self-motivation. Tutoring will always be an essential part of education, at every level. It is wise that colleges and universities invest in tutor training to meet the needs of all students (p. 232).

Brown (2000) found a significant relation between the degree of problem-solving displayed in the college tutoring session and the college class level of the tutors and tutees. "The closer the tutor and tutee were in college classes, the more problem-solving the tutee engaged in during the tutoring session." (p. 233)

Literature on college tutoring suggests that programs are diverse in nature. According to Boylan (2000), students participating in tutoring programs featuring a training component were more likely to have higher first-term grade point averages at both two-year and four-year institutions (p. 233).

Research by Hartman (1990) provided a better understanding of the purpose of tutoring. The results of his study indicated: "The purpose of tutoring goes beyond academic gain for the learners, and extends to the concept of facilitating academic gain and developing self-directed or independent learners." (p. 233)

Barrows (1988) identified the affective factors of tutoring as self-motivation, self-confidence, and persistence; the cognitive factors of peer tutoring are: comprehension, implementation, and improved performance. Finally, Barrows indicated that the long-term retention of knowledge and the achievement of goals are the outcomes of peer tutoring (p. 233).

Davis (1993) also identified motivation as an essential component of retention. He researched student analysis of motivation and found the following factors to be important to students: a) the instructor's enthusiasm; b) relevance of material; c) organization of the course; d) appropriate level of difficult material; e) active involvement, variety; f) rapport between teacher and student, and g) the use of appropriate, concrete, understandable examples (p. 196).

The pedagogy of high school educators has included the same fundamental skills for both male and female students, greater emphasis on teaching skills is recommended for both males and females, with special attention given to females. However, limited time and tight budgets continue to be challenges for both high schools and universities. During discussions about the increasing numbers of unprepared students, universities blame high schools, and high schools blame universities for not bridging the educational gap (Stokes, 2008, p. 1). Universities have looked to peer tutoring to alleviate retention challenges at the college level (Thayer, 2000, p. 196).

External Forces Encouraging Peer Tutoring

The history of one student support services tutoring program, a program that provides tutoring to at risk college students, dates back to 1965 when Title III of the Higher Education Act originated as part of President Johnson's War on Poverty Program. TRIO was funded for the first time in 1965. In 1970, peer tutoring began at the post secondary level under the name of TRIO Student Support Services Peer Tutoring Program (Mohr, 1991). Funding for this program came from the United States

Department of Education, to ensure that students who received educational loans could be successful college graduates who would pay taxes, repay loans, and strengthen society as a whole (United States Department of Education, 2007).

Mortenson's (1997) findings, published by the U. S. News and World Report for its annual report of "America's Best Colleges," indicated:

> Nationally, an average of 66.7% of the freshmen admitted to 2,554 colleges and universities were still enrolled the following fall. These persistence rates varied with the academic selectivity of the institution. Among highly selective institutions, the persistence rate averaged 90.7%. Among open admissions institutions, the persistence rate averaged 53.9%. National average persistence rates are highest among the highly selective institutions, and lowest among the open admissions institutions. A given student may have ten or twenty percent chance of persistence to the sophomore year in one institution compared to another institution. These differences are attributed to the differences in the supportive environment between campuses (p. 5).

Somers (1997) in her article, A*n Indentured Generation of Students,* identified educational debt as a serious concern: There has been speculation that high debt burden influences students to choose majors and careers with high expected incomes, for example, medically related careers that require a high level of academic preparedness for retention (p. 11). Somers' research also points out the economic cost of failure (Somers, 1997).

According to Richardson and Skinner (1992), "The experience of first generation students varies considerably depending on income background. First generation students from middle income backgrounds find the adjustment to college less difficult than first generation students from ethnic minority or low income backgrounds" (p. 6). Obstacles between college entry and degree attainment are compounded when a non-white is from a first generation family. These at risk students many times go into debt in order to attend college and they are seriously at risk for attrition (Rendon, 1995, p. 6).

According to research by Dr. Vincent Tinto (1993), tutorial programs in the form of learning communities have been very successful in insuring college retention among at risk students. Based on this research, student success centers developed on many college campuses, are places where all students can receive peer tutoring (Tinto, 2007). Retaining minority students in higher education is a challenge indicated in Tinto's longitudinal departure model (Tinto, 1993, p. 114). He cites peer tutoring is essential in the retention of at risk students. Historically, the concept of tutoring dates back to the Greeks and Romans; in England today, tutorial sessions are still an integral part of their educational system (Zaritsky, 1989).

Dewey (1900) writes, "Everyone must receive training to enable him to meet his responsibility" (p. 53). Informal peer tutoring took place in country schools all across America (p. 53). Our students should have the skills to become successful, productive citizens and develop stable, healthy families in a democratic society (p. 53).

Spring (1994) reminds us, "America's democratic ideology has promised opportunity for all citizens" (p. 81). Pulley, (2010), *Chronicle of Higher Education*, writes:

> As a nation we can no longer afford such inefficiencies. Global competition demands that more Americans enroll and succeed in higher education.

Chronically low levels of achievement exist among poor and minority students who represent the fastest growing segments of the population. Too often and far too long, financial resources and human potential have entered the educational pipeline at one end, and emerged at the other, as an insufficient trickle of human capital (p. 2).

In spite of a study by Rojstaczer (2003) showing evidence of grade inflation at the college level in the United States, the United States is now eighth among developed nations in the percentage of its population completing college (Council for Opportunity in Education Publications, 2007). Canada, Japan, Korea, Sweden, Finland, Norway and Belgium all boast of more college graduates (Council for Opportunity in Education Publications, 2007). Americans in the top income quartile are ten times more likely than young people in the bottom quartile to earn a college degree by age 24 (Opportunity, 2007). Universities in the United States have fallen behind in not only college completion, but in graduating students in the STEM areas of study (Stokes, 2010).

It is not uncommon for universities to write in their mission statements that their objective is to provide support services to "enhance overall development," or "help students accomplish their educational, career, and lifelong goals." As stated on the homepage of the University of North Dakota's Division of Student and Outreach Services, part of the mission statement is as follows:

The University of North Dakota's Division of Student and Outreach Services provides leadership through comprehensive and inclusive student support services and educational opportunities designed to enhance the overall development of lifelong learners, and by extending university resources to all constituents. We recognize that helping prospective, current and former students accomplish their educational, career, and life goals is the primary reason for our existence (University of North Dakota Catalog, 2009).

Thinking globally, and preparing graduates who have the necessary math, science and technology skills to promote the position of the United States, requires an improvement in retention rates (Boohard, 2004). Swail's (2007) research on retention discussed the balance among the cognitive, social, and institutional forces. Retention exists when these forces have equal presence. If a student is socially strong and academically weak, the institution must provide academic support (p. 3).

Bean (2000) researched "how to help visualize how individual psychological processes can be understood in the retention process" (p. 55). Peer tutors can be effectively trained to mentor at risk students and thus relieve psychological anxieties related to academic stress. There is a linear relationship between institutions, enrollment, and income, for this reason institutions should invest in retention (p. 55).

Peer Tutoring in Science, Technology, Engineering and Mathematics

As more community colleges originated, a college education became available to more at risk students. Non-restrictive enrollment policies (high school diploma or GED), increased the need for remediation in adult student populations (Roberts, 1994). The National Academy of Science published research indicating that the United States continues to fall behind China, India, Japan and Germany in the teaching of mathematics (National Academy of Science, 2005). Diekman's research indicated that females and adults are underrepresented in the STEM fields of study (Diekman, 2010). Equal opportunity means that all members of a society are given equal chances to enter an occupation or social class (Spring, 1994, p. 81). Roueche and Snow (1977) in a national study reported that 86% of community colleges surveyed had tutoring programs to support students in STEM areas. Science, technology, engineering and mathematics topped the list of tutorial services provided (Larson, 2010, personal communication).

Madayag (2007) in her article, *Minorities Need to Stay in STEM*, discussed the need for special intervention for minority students. Her recommendation included teaching minority students by forming a team of one faculty member and two upper classmen as peer tutors, preferably upper classmen who were from the same minority cultures as the students. These peer tutors would not only provide academic support, but serve as a role model to the students (p. 1). Dawd, University of Southern California, supported Madayag's findings in a recent presentation at a STEM Conference in San Diego. Dawd writes, "Unless colleges and universities are able to successfully enroll and graduate female Latino STEM majors, the country will face a shortage of skilled labor" (Dawd, 2010, p. 41).

Sostek (2009) in her article, *Negative Numbers: Universities Trying to Improve Retention Statistics*, writes: The National Science Foundation has funded Penn State University with a 2.4 million dollar grant to increase retention in the STEM career fields using peer tutoring. Only 65% of the students who begin an engineering program graduate in engineering (p. 1).

Busch (2007), Intel Vice President, discussed retention as a serious matter in a recent article: *Stem Retention for Underrepresented Students: Factors that Matter*, "Science and engineering capability will be the foundation of economic success for the

United States in the 21st century" (p. 1). Busch has provided Intel sponsorship for student research in STEM.

Hayes (2007) in his article published by the Center on Research and Work, writes: "National graduation data for STEM majors reveal that by the sixth year of college only 29% of ALANA (African, Latino, Asian, and Native American) students entering STEM majors graduate as compared to about 40% of all students entering STEM majors" (p. 1). Only 13% of these students graduated in engineering, and 14% in the physical sciences (p. 1).

Swale's (2007) research in the area of peer tutoring indicates that peer tutoring has produced three positive outcomes: greater proficiency, greater self-efficacy, and financial benefits for universities (p. 3). Studies have shown that peer tutoring has increased student proficiency in the area of mathematics (Xu, 2001). According to Bean, peer tutoring has also increased student proficiency in the areas of science, technology and engineering (Bean, 2000, p. 7).

At the college level, "improved academic self-efficacy and college persistence" exists when peer tutoring is used (Tinto, 2007). Students then gradually assume greater responsibility for their own learning. Their peer tutor serves as a "peer mentor" and positive role model. Students gain confidence and persist until they graduate (Mortenson, 2007). Thus, peer tutoring plays a positive financial role for universities. Lower attrition rates provide a great return on their tutoring investment. Mohr (1991) stated that peer tutors put a great amount of effort into teaching their peers. Oftentimes, student-tutors are preferred over faculty instructors.

Young (2007) found retention to be a problem in the field of nursing. Students in this study identified lack of guidance and quality teaching to be attrition factors. Immersing oneself in an academic support center where guidance and supplemental tutorial support is available can provide opportunities. Most tutors are successful students and can provide informal guidance along with the supplemental tutorial support (Stearney, 2000, p. 249).

The purpose of tutoring services is threefold: to help students with a present, specific problem; to assist in developing learning skills, and to aid in building a positive self concept. Adult students in college algebra courses would definitely benefit in these three areas. Students of color and female students are among the highest in need for peer tutoring in college algebra (House, 1990).

Even though very little has been written about the effects of peer tutoring on adult learners (25 and above), Frankel (1982) writes that faculty admissions personnel and peer tutors can be effective in reducing anxiety in adult students. Tutorial instruction works well because "the tutor does not hold the same position as the instructor in the eyes of the adult learner." (p. 9)

Tiberius (1989) supports pedagogy implementing small group interaction (p. 10). This pedagogy is usually not used in the teaching of STEM courses, but effective peer tutoring can implement small group interaction. According to Cross and Angelo (1993), effective problem-solving skills imply the previous mastery of necessary skills and knowledge (p. 213). STEM courses are often taught in a large lecture setting, so that the above research is disregarded. In fact, many college professors have never been required to take a teaching course. Davis' (1993) Specifics in Capturing a Quality Classroom

Experience would be helpful in improving the quality of teaching in college classrooms (p. 25). To improve undergraduate education, Chickering outlines the following seven principles for good undergraduate education: a) encourage contact between student and faculty, b) develop cooperation among students, c) encourage active learning, d) give prompt feedback, e) emphasize time on task, f) communicate high expectations, and g) respect diverse talents and ways of learning (Chickering, 1987). These practices are inherent to peer tutoring (Cahn & Cooley, 1978).

Vygotsky (1978), in his book Mind and Society, provided insight into his constructivist approach to learning:

> Good instruction must always be in advance of development, and a challenge is necessary for it to happen. We reach the speaking level of a concept only after we have mastered the meaning. The process is a movement of thought which constantly alternates from specific to general and from general to specific, in a sequence which moves from thought to meanings to words, and one which is only able to evolve with the aid of strenuous mental activity on the part of the student (p. 202).

Blanc, R. (2000), Assistant Professor of Medicine and Coordinator of Curriculum and Development, School of Medicine, in his article *Breaking the Attrition Cycle*, writes about a specific type of peer tutoring:

> In their efforts to reduce attrition, many colleges and universities now provide some form of academic support services. A well-designed learning assistance program can influence retention. The purpose of this article is to describe an academic support program found to be effective. Supplemental instruction, peer

tutoring by "a student of the subject" is designated to assist students in mastering course concepts and, at the same time, to increase student competency in reading, reasoning, and study skills. In order to do this, the specialist attends the course lectures where they take notes and complete assigned readings. The specialist also schedules and conducts three or four, fifty-minute Supplemental Instruction sessions each week at times convenient to the majority of students in the course (p. 328).

Stokes asks an alarming question, "What is happening to low-income college students in STEM?" He found the answer to this question in his research of first-year experience low-income students. Only 19.8% of students who have completed four years of mathematics are low income (Stokes, 2010). Only 16.6% of students who have completed calculus are low income (Stokes, 2010). Only 22% of students who took a remedial math course are low-income. The Lumina Foundation (2010) discusses the following results: "Educational erosion undermines our nation's future. Of every 100 ninth-graders in this country, 69% graduate from high school, 38% enter college directly after high school, 28% remain enrolled after their second year in college and only 20% graduate from college within six years." (p. 12)

Kalikole's (2010) STEM Summit recommendations include coordinating efforts to assure that students not only enroll in appropriate mathematics and science courses, but that they succeed in those courses. Many STEM professors have never taken an education course to develop teaching skills in these areas.

Gender Brain Differences to be Considered in Peer Tutoring

John Medina (2008), a developmental molecular biologist and director of the Brain Center for Applied Learning has conducted research indicating that there are differences in the male and female brain. "Men's and women's brains are different structurally and biochemically. Men have a bigger amygdala and produce serotonin faster. Men and women respond differently to acute stress. Women activate the left hemisphere's amygdala and remember the negative emotional details. Men use the right amygdala and get the gist."

Louann Brizendine, M.D. (2006), supports Medina's findings. In her book entitled, The Female Brain, Brizendine writes,

> It's not as if we all start out with the same brain structure. What if the communication center is bigger in one brain than the other? What if the emotional memory center is bigger in one brain than the other? What if one brain develops a greater ability to read cues in people than another? In this case, you would have a person whose reality dictated that communication, connection, emotional sensitivity, and responsiveness were the primary values. In essence, you would have someone with a female brain (Brizendine, 2006, p. 26).

The research by Medina, Brizendine, and Zull answer some questions, but generate further questions in regard to how male and female students learn and how teachers and peer tutors can prepare to teach male and female students to accommodate for these differences (Medina, 2008; Brizendine, 2006; Zull, 2002). McKeachie reminds us that learners always encounter many situations that are not adapted to their own learning preferences, but suggests that students be given help to develop the skills and strategies needed for learning effectively (McKeachie, 1995).

Carter (1999) discussed the main structural differences observed between the male and female brain and the biological roots of human behavior as it relates to learning:

> The corpus callosum, the band of tissue through which the two hemispheres communicate, is relatively larger in women than in men. This may explain why women seem to be more aware of their own emotions than men. The emotionally sensitive right hemisphere is able to pass more information to the analytical, linguistically talented left side. Men lose their brain tissue earlier in the aging process than women. Men are particularly prone to tissue loss in the frontal and temporal lobes. These areas are concerned with thinking and feeling, and the loss of tissue in them is likely to cause irritability. Women tend to lose tissue in the hippocampus and parietal areas. These are more concerned with memory and visuo-spatial abilities. Imaging studies show that men and women use their brains differently. When they do complex mental tasks there is a tendency for women to bring both sides of their brain to bear on the problem, while men often use only the side most obviously suited to it. This pattern of activity suggests that in some ways women take a broader view of life, bringing more aspects of the situation into play when making decisions. Men, on the other hand, are more focused (p. 71).

There are many questions that remain unanswered about the differences between the male and female brain (Belenky, 1985). Tracey Shores (2005) writes, "The hippocampus in males reacts differently to both acute and chronic stress than does the same structure in females" (p. 450).

According to Jill Goldstein (2005), Harvard Medical School, there are regions of the human brain that are proportionately larger in males than in females. There are other regions of the human brain that are larger in females. "The differences in cognitive ability between males and females are unknown" (p. 45). Continued research is needed in order to answer these questions (p. 45).

A recent article, *Gender and Science Learning,* in the American Educational Research Journal, discussed how females learn science concepts. Conlin (2003), reported that girls drop out of school less often and receive good grades in science (p. 71). This article points out that girls receive scant notice for their achievements (p. 71). The problem grows in size the further girls progress (p. 71). Furthermore, the National Academies reported that women who are interested in science and engineering careers are lost at every educational transition (National Academy of Science, 2007, p. 71). The report clarifies that it is not simply the educational pipeline:

> Women are likely to face discrimination in every field of science and engineering. A substantial body of evidence establishes that most people, men and women, hold implicit biases. Decades of cognitive psychology research reveals that most of us carry prejudices of which we are unaware, but nonetheless play a large role in our evaluations of people and their work. An impressive body of controlled experimental studies and examination of decision-making processes in real life show that on the average people are less likely to hire a woman than a man with identical qualifications, are less likely to ascribe credit to a woman than to a man

for identical accomplishments and, when information is scarce, will far more often give the benefit of the doubt to a man than to a woman" (National Academies, 2007, p. 3). The report stressed that these concerns are relevant not only to undergraduate education, to university faculty, and to k-12 education as well (National Academies, 2007, p. 3). "The barriers that girls face in engaging with and succeeding in school science range from school and societal attitudes that portray science as masculine and girls as incapable of meeting its challenges to a lack of equity-minded curricula, pedagogical strategies, and professional development tools" (National Academies, 2007, p. 3).

According to Bracey (2006), there are different ways to discuss, interpret and translate studies, but his findings support the above evidence that there is a shortage of STEM graduates overall, and an even greater shortage of females represented in the STEM career fields (p. 636). This shortage includes first-generation, low-income and minority females (p. 636). Additional barriers are faced by girls living in high poverty urban communities. In high-poverty urban schools many students lack access to rigorous science courses, equipment and appropriate role models, and certified teachers (American Educational Research Journal, 2008, p. 72).

The American Educational Research Journal (2008) discussed the science learning environment. Hybrid spaces for science learning is grounded in the belief that despite differences in gender and culture, the science classroom is its own subculture with particular ways of knowing, talking and doing (p. 72). According to McMillan (2006), the Education Sciences Reform Act of 2002 has resulted in evidence based inquiry (p. 5). Students need to develop an awareness of scientific inquiry early in their educational experience. Hybrid spaces could provide this science learning environment (Barton & Tan, 2008). Peer tutor mentors could be used to develop an awareness of scientific inquiry.

Positive Aspects of Being a Peer Tutor

In addition to being of benefit to students in traditional classrooms as well as to students enrolled in online courses, peer tutoring is also of benefit to student-tutors. Benefits to student tutors include: financial benefits, a deepened understanding of the academic material, intrinsic satisfaction in helping others, and self-confidence as a scholar and mentor (Roberts, 1994; King & Staffieri, 1998; Magolda, 1997; Halcrow, 2003).

Even though budgets limit peer-tutors' wages, the academic experience is priceless. Future employers value the interpersonal and human relations skills that tutors acquire. Peer tutors are patient, empathetic, knowledgeable, and dependable leaders in their field of study (Roberts, 1994; Halcrow 2003).

Academic excellence is a by-product produced by a peer tutoring program. Roberts (1994) writes, "Tutors find that preparation for sessions and actual practice with material reviews their own knowledge, making it more accessible and usable." (p. 2)

The third benefit of tutoring is the intrinsic benefit and is oftentimes overlooked. Students who tutor show a sense of satisfaction when the students they have worked with are successful (Roberts, 1994; Halcrow, 2003).

The fourth benefit that is displayed by student-tutors is a subtle sense of self confidence as a scholar. These student scholars who give of their time and talent are respected by students, professional schools and future employers (Roberts, 1994; Cahn, 1978; Halcrow, 2003).

The Need for Peer Tutoring as a Component for Retention

Pulley (2010), Chronicle of Higher Education, writes, "As a nation we can no longer afford such inefficiencies" (p. 2). Austin (2002) further contends that, "Global competition demands that more Americans enroll and succeed in higher education. Chronically low levels of achievement exist among poor and minority students who represent the fastest growing segments of the population. Too often and far too long, financial resources and human potential have entered the educational pipeline at one end, and emerged at the other, as an insufficient trickle of human capital" (p. 2). Peer tutoring may be used to effectively utilize human capital in the STEM areas of study.

The Lumina Foundation (2010) states: "Educational erosion undermines our nation's future. Of every 100 ninth-graders in this country, 69% graduate from high school, 38% enter college directly after high school, 28% remain enrolled after their second year in college and only 20% graduate from college within six years" (p. 12).

The National Center for Higher Education Management Systems (2010) indicated that all participants perceive that peer tutoring could have a positive effect on retention in STEM courses (p. 12).

According to the National Academy of England (2006), more than 600,000 engineers graduated from institutions of higher education in China. In India, the figure was 350,000. In America the figure was 70,000 (p. 637).

There has been some discussion as to whether China was counting technology majors as engineers. However, the fact remains that there is a shortage of STEM graduates in the United States (Dorgan, 2007, p. 1).

CHAPTER III

RESEARCH METHODOLOGY

The purpose of this study was to explore perceptions of male and female traditional and nontraditional students who participated in a science, technology, engineering, or mathematics course during the spring 2010 semester regarding peer tutoring to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering or mathematics courses at the University of North Dakota. The following research questions guided this study:

1. Is there a significant difference between the perceptions of males and females regarding academic preparedness?

    1a. Is there a significant difference between the perceptions of males and females regarding their professor preparing them for their current STEM course?

    1b. Is there a significant difference between the perceptions of males and females regarding their ACT scores?

    1c. Is there a significant difference between the perceptions of males and females regarding their high school GPA?

2. Is there a significant difference between the perceptions of males and females regarding academic support?

2a. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in science courses?

2b. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in technology courses?

2c. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their engineering course?

2d. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their mathematics course?

3. Is there a significant difference between the perceptions of males and females regarding the costs related to peer tutoring?

3a. Is there a significant difference between the perceptions of males and females regarding the money that is spent on peer tutoring?

3b. Is there a significant difference between the perceptions of males and females regarding the dropping of courses?

3c. Is there a significant difference between the perceptions of males and females regarding time away from family if students were to use peer tutoring?

4. Is there a significant difference between the perceptions of males and females with different demographics regarding peer tutoring?

4a. Is there a significant difference between the perceptions of males and females based on residence?

4b. Is there a significant difference between the perceptions of males and females based on parental education status?

5. What are the perceptions of male and female students' peer tutoring experience?

In this chapter, the participants, instrument, settings and methodology of the study are described.

Participants

The participants in this quantitative study were sub populations of students enrolled at the University of North Dakota who voluntarily completed a peer tutoring usage survey during the spring semester, 2010. The students who participated totaled 420; 133 students enrolled in the Introduction to Chemistry (Chem 115), 159 students enrolled in Concepts of Biology (Biol 111), 29 students enrolled in Advanced Applications in CADD (Tech 202), 29 students enrolled in Material Properties and Selection (ME 313), and 70 students enrolled in two sections of College Algebra (Math 103). The University of North Dakota is a state-supported research institution enrolling 13,000 students per semester, 52.1% male and 47.9% female. Of the 13,000 students enrolled, approximately 2,300 are graduate students. The average age of the undergraduate population is 22.5 years of age. The University of North Dakota teaches courses on the semester system requiring 125 semester credits for graduation with a baccalaureate degree.

Instrument

After careful examination of other surveys and related articles, the survey questionnaire addressing peer tutor usage at the University of North Dakota was developed and administered by the principal investigator to five classes at the University of North Dakota. A total of 231 students, or 55% of the 420 enrolled in these classes, completed the survey. The independent variable was gender with two conditions, male and female. The dependent variables were the three constructs: preparedness, support, and cost. There were ten survey questions, and one open-ended question which allowed participants to make comments and write about their individual experiences. (See Appendix A.)

The survey questions were answered on a six point Likert scale (i.e., strongly agree, disagree, slightly disagree, slightly agree, agree, and strongly agree). Under the preparedness factor, the following statements were posed: 1) Since my college professor prepared me for coursework in STEM (science, technology, engineering, or mathematics), I do not need to use peer tutoring. 2) Because my ACT indicated proficiency, I do not need peer tutoring in STEM coursework. 3) Because my high school GPA indicated proficiency, I do not need peer tutoring in STEM coursework. Under the support factor, the following statements were posed: 4) It is a good idea that students utilize peer tutoring in science and science preparatory coursework. 5) It is a good idea that students utilize peer tutoring in technology coursework. 6) It is a good idea that students utilize peer tutoring in engineering coursework. 7) It is a good idea that students utilize peer tutoring in mathematics coursework. Using the cost factor, the following statements were posed: 8) Peer tutoring in the STEM coursework would be a waste of money. 9) The cost to students dropping courses would not be reduced if students would utilize peer tutoring in STEM courses. 10) The cost of time away from family would be reduced if students would receive peer tutoring in STEM. The last item on the survey was an open ended question: What can you tell me about your peer tutoring experience?

Validity and Reliability

A survey instrument's ability to measure what the investigator is intending to measure is referred to as validity. Validity generally refers to a concept, conclusion, or measurement that corresponds accurately to the real world to the extent that the measurement gives consistent results (Webster, 2002). Results of a study can be compared to the results of a similar study on the same topic to establish validity (Shirley, 2002). Findings by Kalikole, support the validity of this study (Kalikole, 2010). Reliability refers to the ability of the survey to yield consistent responses. The reliability of the instrument was tested using SPSS 17.0, where the Cronbach Alpha scale of .60 or above is considered reliable. (Kingsbury, personal communication, March 4, 2010

Data Collection

Students were given the survey questionnaire at the beginning of their science, technology, engineering or mathematics class, following a brief description of the research project. The students were instructed to complete the survey questionnaire on a voluntary basis. Access to the student population was obtained by discussion with and obtaining permission at the University of North Dakota, and the professors teaching Concepts in Biology (Biol 111), Introduction to Chemistry (Chem 115), Advanced Applications of CADD (Tech 202), Material Properties and Selection (ME 313), and College Algebra (Math 103). Prior to any research being conducted, permission for this study was obtained from the Institutional Review Board.

Prior to the collection of data, students were informed that the survey was voluntary and confidential. The participants were informed about the importance of the accuracy of information indicated on the survey. The study was of no risk to the students participating.

To obtain first hand information, the author developed a one page survey to gather their view points on this subject. With permission, the author administered the survey to participants enrolled in Concepts in Biology (Biol 111), the Introduction to Chemistry (Chem 115), Advanced Applications of CADD (Tech 202), Material Properties and Selection (ME 313), and College Algebra (Math 103). Following the administration of the survey, the author thanked all of the participants verbally during their class time.

Treatment of the Data

Descriptive statistical procedures were used in the analysis of data to determine (a) if there was a relationship between the genders regarding perceptions of academic preparedness, (b) if there was a relationship between the genders regarding perceptions regarding peer tutoring as a form of academic support in STEM courses, and (c) if there is a relationship between the genders regarding the costs related to peer tutoring. All of the data obtained was treated with the statistical procedures done using SPSS, to generate frequencies, descriptive statistics and analysis of variance (Creswell, 2005; Creswell 1998; McMillan, 2006; Newman & Benz, 1998).

To test research question number 1, "Is there a significant difference between males and females regarding academic preparedness," the null hypothesis was as follows: There is no significant difference between males and females regarding academic preparedness. The alternate hypothesis was as follows: There is a significant difference between males and females regarding academic preparedness. A multivariate test was performed to test the academic preparedness factor for each gender.

To test research sub-question number 1a, “Is there a significant difference between males and females in their perception that their professor prepares them for their current STEM course," the null hypothesis was as follows: There is no significant difference between males and females regarding their professor preparing them for their current STEM course. The alternate hypothesis was as follows: There is a significant difference between males and females regarding how well their professor prepared them for their current STEM course. A multivariate test was performed to compare the academic preparedness factor for each gender.

To test research sub-question number 1b, “Is there a significant difference between males and females regarding their ACT,” the null hypothesis was as follows: There is no significant difference between males and females regarding how well they were prepared for their STEM courses based on their ACT score. The alternate hypothesis was as follows: There is a significant difference between males and females indicating how well they were prepared based on their ACT score. A multivariate test was performed to compare the academic preparedness factor for each gender.

To test research sub-question number 1c, “Is there a significant difference between males and females regarding their high school grade point average,” the null hypothesis was as follows: There is no significant difference between males and females in their perception of how well they are prepared for their STEM courses based on their high school grade point average. The alternate hypothesis was as follows: There is a significant difference between males and females in their perception of how well they are prepared for their STEM courses based on their high school grade point average. A multivariate test was performed to compare the academic preparedness factor for each gender.

To test research question number 2, "Is there a significant difference between males and females regarding academic support," the null hypothesis was as follows: There is no significant difference between males and females regarding academic support. The alternate hypothesis was as follows: There is a significant difference between males and females regarding academic support. A multivariate test was performed to compare the academic support factor for each gender.

To test research sub-question number 2a, "Is there a significant difference between males and females in how they view peer tutoring in science courses," the null hypothesis was as follows: There is no significant difference between males and females in how they view peer tutoring in their science courses. The alternate hypothesis was as follows: There is a significant difference between males and females in how they view peer tutoring in science courses. A multivariate test was performed to compare the academic support factor for each gender.

To test research sub-question number 2b, "Is there a significant difference between males and females in how they view peer tutoring in technology courses," the null hypothesis was as follows: There is no significant difference between males and females in how they view peer tutoring in their technology courses. The alternate hypothesis was as follows: There is a significant difference between males and females in how they view peer tutoring in technology courses. A multivariate test was performed to compare the academic support factor for each gender.

To test research sub-question number 2c, "Is there a significant difference between males and females in how they view peer tutoring in engineering courses," the null hypothesis was as follows: There is no significant difference between males and females in how they view peer tutoring in engineering courses. The alternate hypothesis was as follows: There is a significant difference between males and females in how they view peer tutoring in engineering courses. A multivariate test was performed to compare the academic support factor for each gender.

To test research sub-question number 2d, "Is there a significant difference between males and females in how they view peer tutoring in mathematics courses," the null hypothesis was as follows: There is no significant difference between males and females in how they view peer tutoring in mathematics courses. The alternate hypothesis was as follows: There is a significant difference between males and females in how they view peer tutoring in mathematics courses. A multivariate test was performed to compare the academic support factor for each gender.

To test research question 3, "Is there a significant difference between males and females regarding the costs related to peer tutoring," the null hypothesis was as follows: There is no significant difference between males and females regarding the costs related to peer tutoring. The alternate hypothesis was as follows: There is a significant difference between males and females regarding the costs related to peer tutoring. A multivariate test was performed to compare the cost factor for each gender.

To test research sub-question number 3a, "Is there a significant difference between males and females regarding the money that is spent on peer tutoring," the null hypothesis was as follows: There is no significant difference between males and females in their perception of the money that is spent on peer tutoring. The alternate hypothesis was as follows: There is a significant difference between males and females in their perception of the money that is spent on peer tutoring. A multivariate test was performed to compare the cost factor for each gender.

To test research sub-question number 3b, "Is there a significant difference between males and females regarding the dropping of courses," the null hypothesis was as follows: There is no significant difference between males and females in their perception of dropping courses if students would use peer tutoring. The alternate hypothesis was as follows: There is a significant difference between males and females in their perception of dropping courses if students would use peer tutoring. A multivariate test was performed to compare the cost factor for each gender.

To test research sub-question number 3c, "Is there a significant difference between males and females regarding time away from family if students would utilize peer tutoring," the null hypothesis was as follows: There is no significant difference between males and females in their perception of time away from family if students would use peer tutoring. The alternate hypothesis was as follows: There is a significant difference between males and females in their perception of time away from family if students would use peer tutoring. A multivariate test was performed to compare the cost factor for each gender.

To test research question number 4, "Is there a significant difference between males and females regarding residence," the null hypothesis was as follows: There is no significant difference between males and females regarding residence. The alternate hypothesis was as follows: There is a significant difference between males and females regarding residence. A multivariate test was performed to compare gender and residence.

To test research question number 5, “Is there a significant difference between males and females regarding parent educational status,” the null hypothesis was as follows: There is no significant difference between males and females regarding parent educational status. The alternate hypothesis was as follows: There is a significant difference between males regarding parent educational status. A multivariate test was performed to compare gender and parent educational status.

To analyze research question number 6, “What are the perceptions of students’ peer tutoring experience,” qualitative methodology was used since a large number (231) of students were given an opportunity to respond to the single question.

Demographic data collected through this research can be found in the next chapter. Tests of descriptive statistics for each of the five questions, along with the analysis of the single qualitative question, are presented.

The application of the data in this study was used for the advancement of knowledge about the use of the TRIO Student Support Services Peer Tutoring Program located in McCannel Hall, the Student Success Center located in the Memorial Union, the Math Department Learning Lab, and the Chemistry Department Tutor Program, in educating students in Concepts in Biology (Biol 111), Introduction to Chemistry (Chem 115), Advanced Applications of CADD (Tech 202), Material Properties and Selection (ME 313), and College Algebra (Math 103). Since the above tutoring services are already in place, this knowledge is of great value to the author in improving services to students.

CHAPTER IV

PRESENTATION OF THE DATA

The purpose of the study was to explore the perceptions of male and female traditional and nontraditional students who participated in a science, technology, engineering or mathematics course during the spring 2010 semester regarding peer tutoring, to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering and mathematics courses at the University of North Dakota. This chapter includes a description of the demographic characteristics of the subjects along with analysis of reliability, frequencies, variance, correlations, and a subsequent analysis to answer the research questions. The analysis of reliability is the analysis of the internal consistency or homogeneity of the construct. Survey questionnaire items number 1-3 that related to academic preparedness were included in construct one, the academic preparedness construct; survey questionnaire items number 4-7 that related to academic support were included in construct two, the academic support construct; and survey questionnaire items number 8-10 that related to cost, were included in construct three, the cost construct. The frequency analysis is the analysis of the data to determine the means and standard deviations of the responses. Finally, the analysis of correlation uses a matrix to look at the individual questions that correlate or relate to one another because if the relationship between their mean values (Creswell, 2005, p. 175). The following research questions guided the study:

1. Is there a significant difference between males and females regarding academic preparedness?

   1a. Is there a significant difference between the perceptions of males and females regarding their professor preparing them for STEM courses?

   1b. Is there a significant difference between the perceptions of males and females regarding their ACT scores?

   1c. Is there a significant difference between the perceptions of males and females regarding their high school GPA?

2. Is there a significant difference between males and females regarding academic support?

   2a. Is there a significant difference between males and females in how they viewed peer tutoring in their science course?

   2b. Is there a significant difference between males and females in how they viewed peer tutoring in their technology course?

   2c. Is there a significant difference between males and females in how they viewed peer tutoring in their engineering course?

   2d. Is there a significant difference between males and females in how they viewed peer tutoring in their mathematics course?

3. Is there a significant difference between males and females regarding the costs related to peer tutoring?

   3a. Is there a significant difference between the perceptions of males and females regarding the university spending money on peer tutoring?

3b. Is there a significant difference between the perceptions of males and females regarding the dropping of courses if students would use peer tutoring?

3c. Is there a significant difference between the perceptions of males and females regarding time away from family if students were to use peer tutoring?

4. Is there a significant difference between the perceptions of males and females with different demographics regarding peer tutoring?

4a. Is there a significant difference between the perceptions of males and females based on residence?

4b. Is there a significant difference between the perceptions of males and females based on parental education status?

5. What are the perceptions of male and female students' peer tutoring experiences?

Demographic Characteristics of the Subjects

A total of 231 students representing five STEM (science, technology, engineering, or mathematics) classes enrolled at the University of North Dakota participated in the study. There were 133 respondents from Introduction to Chemistry (Chem. 115), 159 respondents from Concepts of Biology (Biol 111), 29 respondents from Advanced Applications of CADD Techniques (Tech 202), 29 respondents from Material Properties and Selection (ME 313), and 70 respondents from College Algebra (Math 103).

Reliability Analysis, Means, and Demographics

This section of Chapter IV contains the reliability analysis, the means, and the demographics of the survey that were used in this study. The findings regarding Cronbach's Alpha and a factor analysis is included in this section. The Cronbach Alpha, named as alpha by Lee Cronbach, 1951, is a measure of homogeneity. The Cronbach Alpha for construct one was .86. Since this reliability value is above the desired .60, the data for academic preparedness was reliable. Construct one, academic preparedness, consisted of survey questions number one, two, and three. Survey questions one, two and three yielded the following means and standard deviations: question number one (3.42, 1.4); question number two (3.06, 1.350); and question number three (3.13, 1.36).

For construct two, academic support, a reliability of .90 was found. Since this number is above the recommended .60 value, the data for academic support was reliable. Construct two consisted of survey questions number four, five, six, and seven. Survey questions four, five, six and seven yielded the following means and standard deviations: question number four (4.79, .93); question number five (4.73, .93); question number six (4.87, .95); and question seven (4.98, .88).

Construct three, relating to student perceptions of cost, did not have a Cronbach Alpha above the recommended .60; a reliability of .45 was calculated. One possible explanation could be that participants misread survey question number eight. Survey question number eight, nine and ten yielded the following means and standard deviations: question number eight (4.01, 1.06); question number nine (4.42, .99); and question number ten (3.38, 1.18). The individual questions relating to cost provided significant data that will be discussed in Chapter V.

The demographic frequencies for the independent variable gender are indicated in Table 1.

Table 1. Gender.

	Frequency	Percent
Male	100	43.3
Female	131	56.7
Total	231	100.0

N = 231

The study included 100 male participants (43.3%) and 131 female participants (56.7%), with a total response rate of 55%. The STEM participants included 84 participants from Concepts of Biology (Biol 111), 58 females, 26 males; 56 participants from Introduction to Chemistry (Chem 115), 35 females, 21 males; 26 participants from Advanced Applications in CADD (Tech 202), eight females, 14 males; 21 participants from Material Properties and Selection (ME 313), no females, 21 males; and 44 participants from College Algebra (Math 103), 30 females, 14 males. Of the 231 participants, 93 males (40%) and 123 females (54%) were 24 years of age or under. There were only seven males (3%) and eight females (3%) who were 25 or older.

Table 2. Participants Who Received Peer Tutoring.

	Frequency	Percent
Not Tutored	196	84.8
Tutored	35	15.2
Total	231	100.0

N = 231

Table 2 indicates the number of participants who received tutoring in the STEM courses surveyed. The number of participants who did not receive tutoring was 196, an alarming 84.8%. The number of participants who received tutoring was 35, a modest 15.2%.

Table 3. Participants Whose Parent Received a College Degree.

	Frequency	Percent
No College	28	12.1
College	203	87.9
Total	231	100.0

N = 231

Table 3 indicates the number of participants who had a parent who completed a bachelor's degree. Of the 231 participants in the study, 28 (12.1%) had a parent who did not receive a bachelor's degree. The number of participants who had a parent who did receive a bachelor's degree was 203 (87.9%). This indicates that the majority of the participants had at least one parent who was familiar with the academic requirements needed to complete a college degree in science, technology, engineering or mathematics.

Table 4. Residence of the Participants.

	Frequency	Percent
Urban	111	48.1
Rural	120	51.9
Total	231	100.0

N = 231

Table 4 indicates the residency of the participants. Of the 231 participants, 111 (48.1%) resided in an urban area, and 120 (51.9%) resided in a rural area. These numbers provided a relatively even distribution between urban and rural responses.

Table 5. High School GPA of the Participants.

	Frequency	Percent
2.9 or Less	187	81.0
Greater than 2.9	44	19.0
Total	231	100.0

N = 231

Table 5 indicates a high school grade point average greater than 2.9, or a grade point average of 2.9 or less. Of the 231 participants, 187, or 81%, earned a grade point average of less than 2.9. Forty-four participants, 19%, earned a grade point average that was greater than 2.9. Since the majority of the participants had earned a grade point average of less than 2.9 it is not surprising that these students indicated that they did not perceive themselves as prepared for college courses in science, technology, engineering, and mathematics. However, given these high school grade point averages it is surprising that only 15.2% of the participants utilized peer tutoring.

Table 6. ACT Scores of the Participants.

	Frequency	Percent
Below 22	172	74.50
22 or above	59	25.5
Total	231	100.0

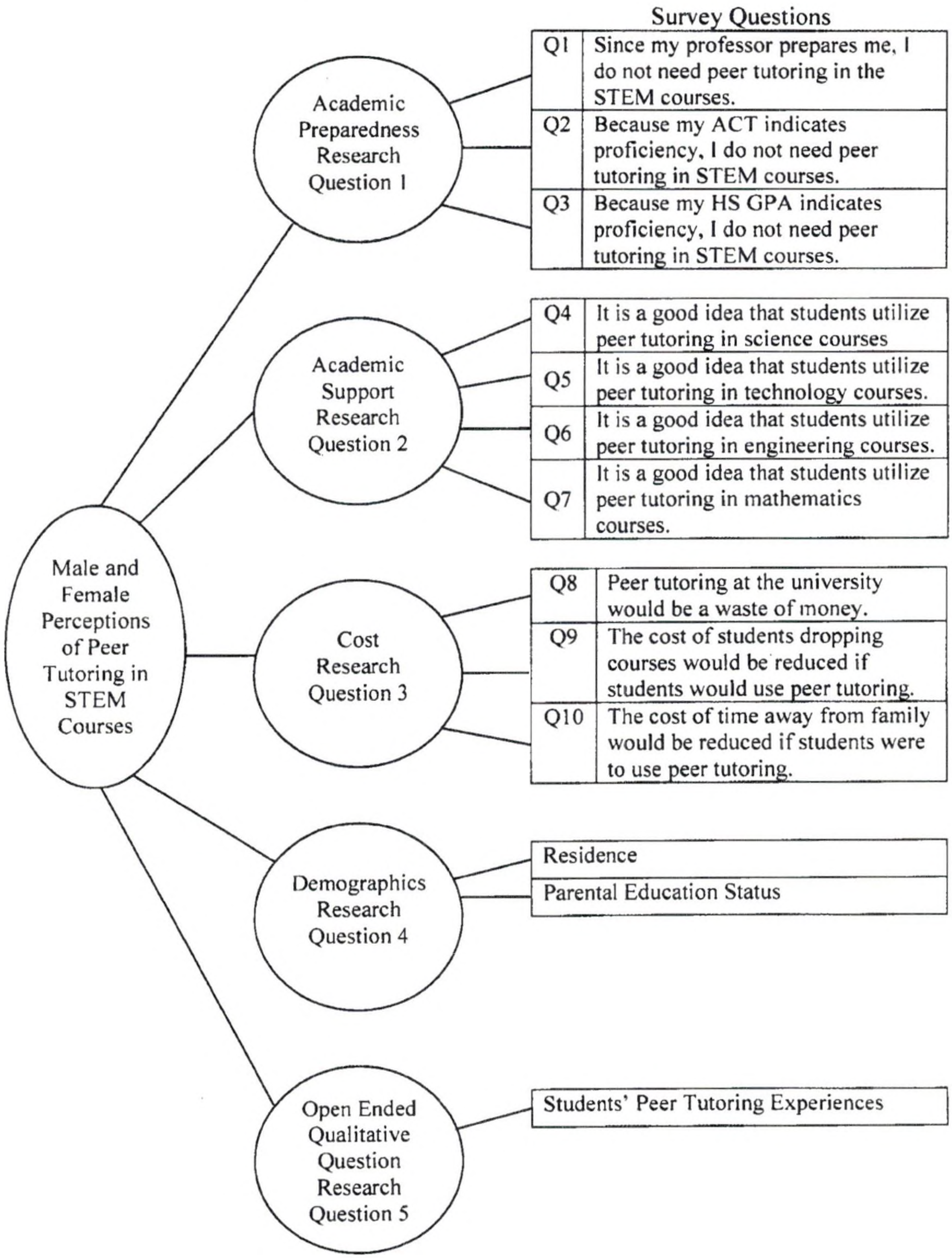
N = 231

Table 6 indicates the number of participants who received an ACT score of 22 or above and the number of participants who received an ACT score of below 22. Of the 231 participants, 172 scored below 22 and 59 scored above 22. These frequencies indicate that 74.5% of the participants scored below 22, and 25.5% of the participants scored 22 or above on their ACT examination. This data indicates that the majority of the participants had an ACT score that was the minimum requirement for admission at the University of North Dakota. The fact that a majority of the participants had a minimum ACT score for admission raises concern about potential success in majoring in a science, technology, engineering, or mathematics career field of study.

Table 7. Demographic Information of Sample.

	Overall Sample, N = 231	
	Count	%
History		
I have a parent with a college degree.	203	88
I do not have a parent with a college degree.	28	12
I did attend college immediately after high school.	195	84
I did not attend college immediately after high school.	36	16
I did receive peer tutoring.	35	15
I did not receive peer tutoring.	196	85
I am from a rural community.	120	52
I am from an urban community.	111	48
Gender		
Male	100	43
Female	131	57

Table 8. Constructs for Research Project.



(See Survey Questionnaire in Appendix A.)

Table 9. Percentage of Some Form of Agreement.

	N = 231	Percentage of Some Form of Agreement
Preparedness		
Q1. Since my professor prepares me, I do not need peer tutoring in the STEM courses.	119	52
Q2. Because my ACT indicates proficiency, I do not need peer tutoring in STEM courses.	83	36
Q3. Because my HS GPA indicates proficiency, I do not need peer tutoring in STEM courses.	78	34
Academic Support		
Q4. It is a good idea that students utilize peer tutoring in science courses.	218	94
Q5. It is a good idea that students utilize peer tutoring in technology courses.	210	91
Q6. It is a good idea that students utilize peer tutoring in engineering courses.	215	93
Q7. It is a good idea that students utilize peer tutoring in mathematics.	222	96
Cost		
Q8. Peer tutoring at the university would waste money.	20	08
Q9. The cost of students dropping courses would be reduced if students would use peer tutoring.	200	87
Q10. The cost of time away from family would be reduced if students were to use peer tutoring.	111	48

Research Question Number 1

Research question number one asked if there was a significant difference between the perceptions of males and females regarding the factor of academic preparedness. This research question was answered by sub-questions: 1a, 1b, and 1c, relating to college preparation, high school GPA, and high school ACT.

Research sub-question number 1(a) asked if the participants' college professor prepared the student for their science, technology, engineering or mathematics course. This was tested using the SPSS Manova procedure. This research sub-question was answered with Survey Question 1. Results indicated that males slightly agree and females slightly disagree that their professors academically prepared them to be successful in their science, technology, engineering or mathematics course, using the six point likert scale, strongly disagree to strongly agree. There were significant differences between males and females in their responses with regard to their STEM professor preparing them for STEM courses, since $p<.05$; therefore, the null hypothesis that there were no significant differences between males and females in their responses with regard to their STEM professor preparing them for STEM courses is rejected.

Table 10 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question one of the academic preparedness construct.

Table 10. Survey Question 1: Since my professor prepares me, I do not need tutoring in STEM courses (science, technology, engineering, and mathematics).

Likert Scale	Frequency	Percent
1	15	6.5
2	64	27.7
3	33	14.3
4	62	26.8
5	42	18.2
6	15	6.5
Total	231	100.0

N = 231

Research Sub-question Number 1(b)

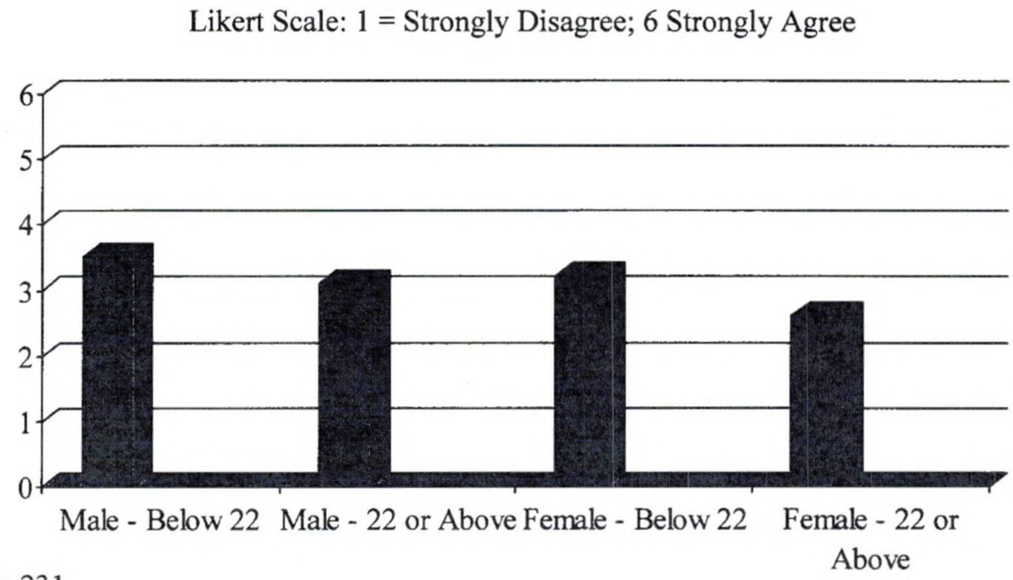
Research sub-question number 1(b) asked if the participants' ACT score indicated preparedness for their science, technology, engineering or mathematics course. This was tested using the SPSS Manova procedure. This research sub-question was answered with Survey Question 2 regarding academic preparedness. Results indicated that both males and females slightly disagreed with question number two using the six point Likert scale. It is important to note that there was a significant difference between males and females in the degree of disagreement in their responses with regard to their ACT score indicating preparedness, since $p<.05$, therefore, the null hypothesis that there were no significant differences between males and females in the degree of disagreement in their responses with regard to their ACT score indicating preparedness was rejected. Responses indicated that female students perceived themselves significantly less prepared than male students.

Table 11 indicates the number and percent of participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question number two of the academic preparedness construct.

Table 11. Survey Question 2: Because my ACT indicates proficiency, I do not need tutoring in STEM courses.

Likert Scale	Frequency	Percent
1	20	8.7
2	79	34.2
3	49	21.2
4	44	19.0
5	27	11.7
6	12	5.2
Total	231	100.0

N = 231



N = 231

Figure 1. Construct 1: Academic Preparedness – Gender and ACT.

Research Sub-question Number 1(c)

Research sub-question number 1(c) asked if the participants' high school grade point average indicated preparedness for their science, technology, engineering or mathematics course. This was tested using the SPSS Manova procedure. This research sub-question 1(c) was answered with Survey Question 3. The greatest percentage of responses (34.2%) disagreed with the survey question. Both males and females disagreed with question number three. It is important to note that there was a significant difference between males and females in the degree of disagreement in their responses with regard to high school grade point average indicating preparedness, since $p<.05$. Therefore, the null hypothesis that there was no significant difference between males and females in the degree of disagreement in their responses with regard to high school grade point average was rejected. Responses indicated that female students perceived themselves as being less prepared than male students. The Component Analysis Table in Appendix B indicates correlations among survey questions one, two, and three.

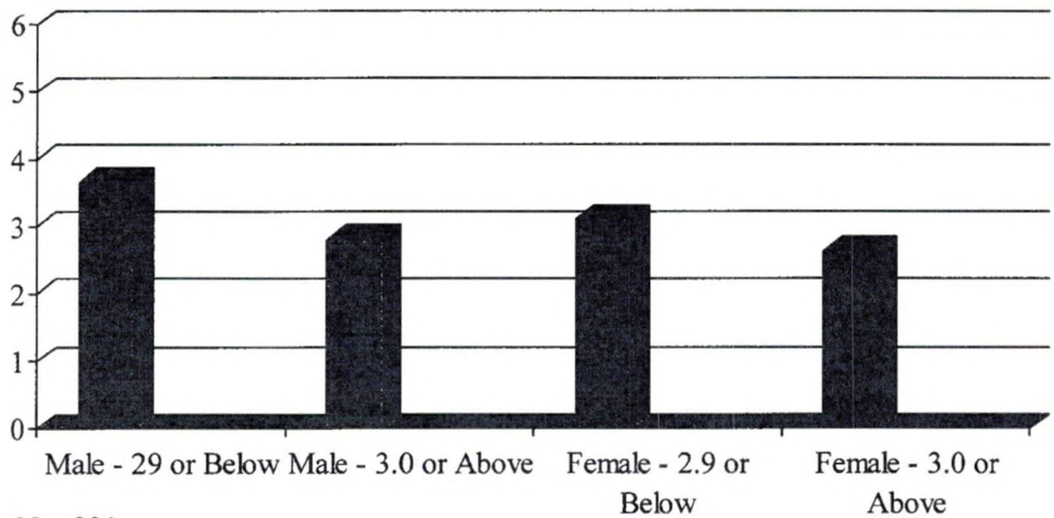
Table 12 indicates the number and percent of the participants indicating their response on the six point Likert scale (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question three under the academic preparedness construct.

Table 12. Survey Question 3: Because my high school GPA indicates proficiency, I do not need tutoring in STEM courses.

Likert Scale	Frequency	Percent
1	18	7.8
2	72	31.2
3	63	27.3
4	34	14.7
5	29	12.6
6	15	6.5
Total	231	100.0

N = 231

Likert Scale: 1 = Strongly Disagree; 6 Strongly Agree

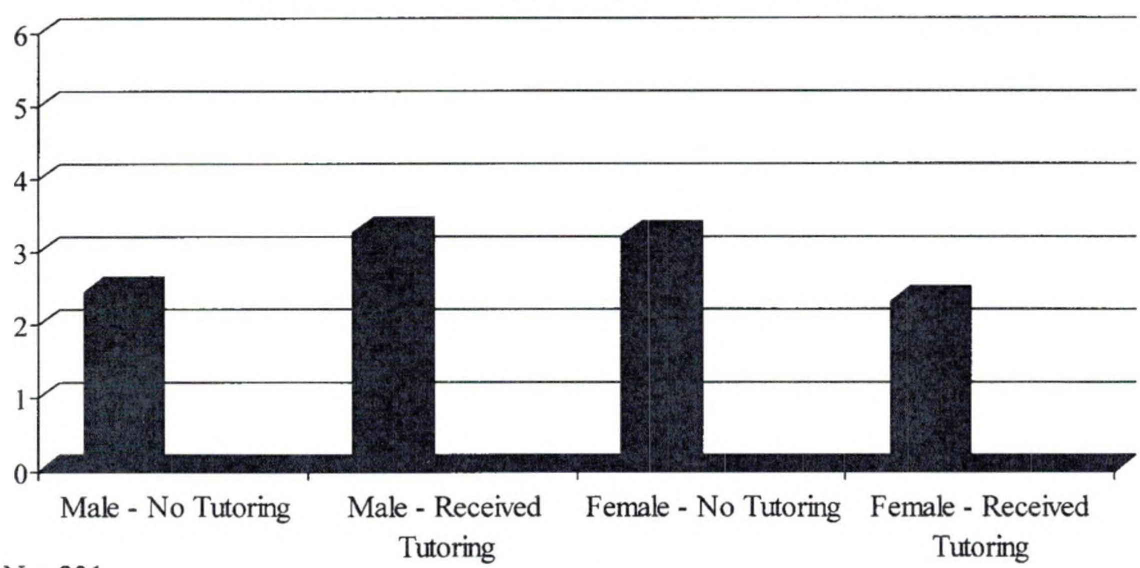


N = 231

Figure 2. Construct 1 (Survey Questions 1-3): Academic Preparedness - Gender and High School GPA.

Figure 2 indicates that females with a 3.0 or above considered themselves least prepared for STEM courses.

Likert Scale: 1 = Strongly Disagree; 6 Strongly Agree



N = 231

Figure 3. Construct 1 (Questions 1-3): Academic Preparedness – Gender and Peer Tutoring.

Figure 3 indicates that females who received peer tutoring considered themselves least prepared for STEM courses.

Research Question Number 2

Research question number two asked if there was a significant difference between males and females regarding the academic support factor. This research question was answered by sub-questions 2(a), 2(b), 2(c), and 2(d), relating to students' utilizing peer tutoring in science, technology, engineering, or mathematics respectively.

Research Sub-question Number 2(a)

Research sub-question number 2(a) asked if students thought that it was a good idea to utilize peer tutoring in their science course. This was tested using the SPSS Manova procedure. This research sub-question was answered with Survey Question 4. Results indicated that both males and females were in agreement with survey question number four, females to a greater degree. The majority of the responses (67.5%) were in the areas of agree or strongly agree. Results indicated that there was no significant difference between males and females with regard to peer tutoring in science since $p>.05$. Therefore, the null hypothesis that there was no significant difference between males and females with regard to peer tutoring in science is accepted. This means that both males and females think it is a good idea to utilize peer tutoring in their science course.

Table 13 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question number 4 of the academic support construct.

Table 13. Survey Question 4: It is a good idea that students utilize peer tutoring in science courses.

Likert Scale	Frequency	Percent
1	3	1.3
2	2	.9
3	8	3.5
4	62	26.8
5	109	47.2
6	47	20.3
Total	231	100.0

N = 231

Research Sub-question Number 2(b)

Research sub-question number 2(b) asked if students thought it was a good idea to utilize peer tutoring in their technology course. This was tested using the SPSS Manova procedure. This research sub-question was answered with Survey Question 5. Results indicated that both males and females agree with survey question number five. Results indicated that there was no significant difference between males and females with regard to peer tutoring in technology, since $p>.05$. The majority (77.3%) of the responses were clustered in the slightly agree to agree response areas. Therefore, the null hypothesis that there was no significant difference between males and females with regard to peer tutoring in technology is accepted. This means that both males and females think it is a good idea to utilize peer tutoring in their technology course.

Table 14 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question number 5 of the academic preparedness construct.

Table 14. Survey Question 5: It is a good idea that students utilize peer tutoring in technology courses.

Likert Scale	Frequency	Percent
1	2	.9
2	4	1.7
3	15	6.5
4	55	23.8
5	112	48.5
6	43	18.6
Total	231	100.0

N = 231

Research Sub-question Number 2(c)

Research sub-question number 2(c) asked if students thought that it was a good idea to utilize peer tutoring in their engineering course. This was tested using the SPSS Manova procedure. This research question was answered with Survey Question 5. Results indicated that both males and females were in agreement with survey question number six; 72.8% of the responses were in the response areas of agree or strongly agree. Results indicated that there was no significant difference between males and females with regard to peer tutoring in their engineering course, since $p>.05$. Therefore, the null hypothesis that there was no significant difference between males and females with regard to peer tutoring in their engineering course is accepted. This means that both males and females think it is a good idea to utilize peer tutoring in their engineering course.

Table 15 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question six of the academic preparedness construct.

Table 15. Survey Question 6: It is a good idea that students utilize peer tutoring in engineering courses.

Likert Scale	Frequency	Percent
1	2	.9
2	4	1.7
3	10	4.3
4	47	20.3
5	111	48.1
6	57	24.7
Total	231	100.0

N = 231

Research Sub-question Number 2(d)

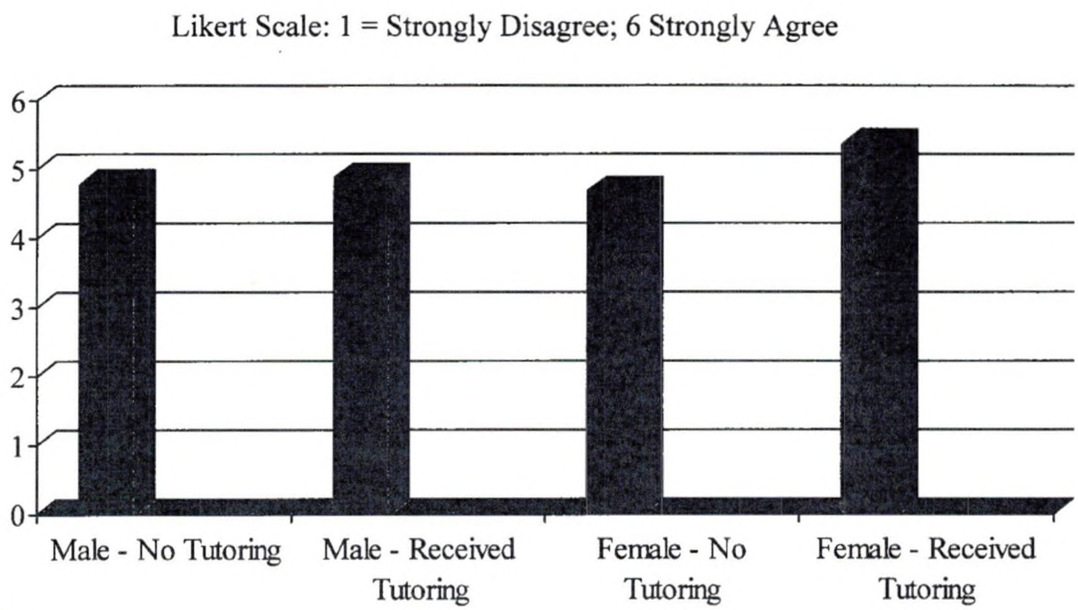
Research sub-question number 2(d) asked if students thought that it was a good idea to utilize peer tutoring in their mathematics course. This was tested using the SPSS Manova procedure. This research question was answered with Survey Question 7. The majority (96.1%) of the responses clustered in the slightly agree to strongly agree response areas. Results indicated that there was no significant difference between males and females with regard to peer tutoring in mathematics, since $p > .05$. Therefore, the null hypothesis that there was no significant difference between males and females with regard to peer tutoring in mathematics is accepted. This means that both males and females think it is a good idea to utilize peer tutoring in their mathematics course. See Correlations Matrix in Appendix B.

Table 16 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question number seven of the academic support construct.

Table 16. Survey Question 7: It is a good idea that students utilize peer tutoring in mathematics courses.

Likert Scale	Frequency	Percent
1	2	.9
2	2	.9
3	5	2.2
4	43	18.6
5	116	50.2
6	63	27.3
Total	231	100.0

N = 231



$p > .05$

Figure 4. Construct 2 (Survey Questions 4-7): Academic Support – Gender and Peer Tutoring.

Females who had received peer tutoring indicated the greatest support for peer tutoring.

Research Question Number 3

Research question number three asked if there was a significant difference between the perceptions of males and females regarding the costs related to peer tutoring. This research question was answered with sub-questions 3a, 3b, and 3c, relating to money spent on peer tutoring, the cost of students dropping courses, and the cost of time away from family respectively.

Research Sub-Question Number 3a

Research sub-question number 3a asked if students thought it was a good idea for the university to spend money on peer tutoring. This was tested using the SPSS manova procedure. This research question was answered with Survey Question 8. The majority

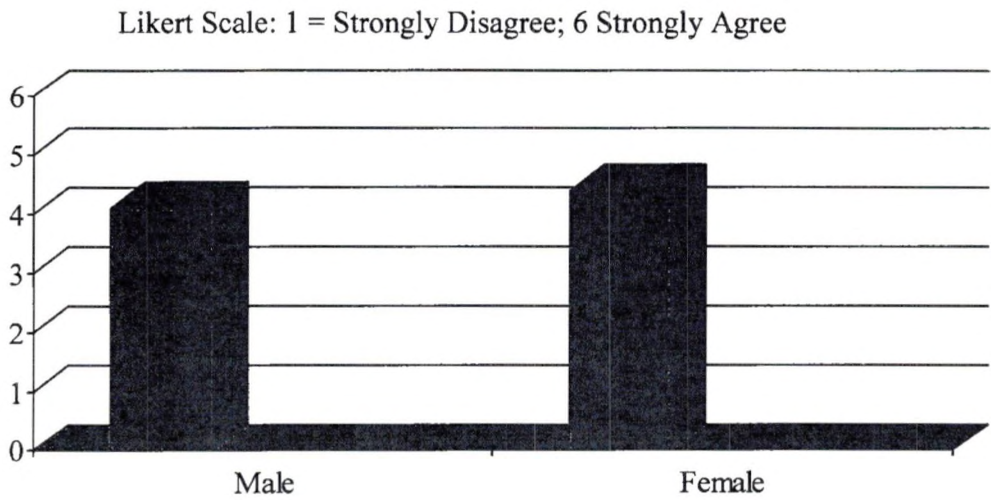
(96.1%) of the responses clustered in the slightly agree to strongly agree response areas. Results indicated that there was a significant difference between males and females with regard to the university spending money on peer tutoring, since $p<.05$. Therefore, the null hypothesis is rejected that there was no significant difference between males and females with regard to the university spending money on peer tutoring. This means that females think it is a good idea to spend money on peer tutoring to a greater degree than the males.

Table 17 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question eight of the cost construct.

Table 17. Survey Question 8: Peer tutoring at the university would be a waste of money.

Likert Scale	Frequency	Percent
1	86	37.2
2	93	40.3
3	32	13.9
4	11	4.8
5	7	3.0
6	2	.9
Total	231	100.0

N = 231



$p<.05$

Figure 5. Construct 3: Cost – Gender and Peer Tutoring.

Figure 5 indicates that females who received peer tutoring were the most in favor of the cost of peer tutoring.

Research Sub-Question Number 3b

Research sub-question number 3b asked if students thought that dropping courses would be reduced if students would use peer tutoring. This was tested using the SPSS Manova procedure. This research question was answered with Survey Question 9. Results indicated that there was not a significant difference between males and females with regard to dropping courses if students would use peer tutoring, since $p>.05$. This means that both males and females think that dropping courses would be reduced if students would use peer tutoring. Therefore, the null hypothesis is accepted that there is no difference between males and females regarding their perception of the cost of dropping courses being reduced if peer tutoring was used.

Table 18 indicates the number and percent of the participants who chose 1-6 for their response on survey question nine of the cost construct.

Table 18. Survey Question 9: The cost of students dropping courses would be reduced if students would use peer tutoring.

Likert Scale	Frequency	Percent
1	3	1.3
2	7	3.0
3	21	9.1
4	82	35.5
5	94	40.7
6	24	10.4
Total	231	100.0

N = 231

Research Sub-question Number 3c

Research sub-question number 3c asked if students thought that time away from family would be reduced if students were to use peer tutoring. This was tested using the SPSS Manova procedure. This research question was answered with Survey Question 10. Results indicated that there was not a significant difference between males and females with regard to dropping courses if students would use peer tutoring, since $p>.05$. This means that both males and females slightly disagreed that time away from family would be reduced if students were to use peer tutoring. These results can be explained, since many college students are excited about being away from home for the first time, and do not see time away from family as a cost. It is interesting to note that the majority of the responses (60.1%) were in the middle range of the Likert scale. Therefore, the null hypothesis is accepted that there is no difference between males and females in their perceived time away from family if peer tutoring was used.

Table 19 indicates the number and percent of the participants who indicated their response on the six point Likert scale, (i.e., strongly disagree, disagree, slightly disagree, slightly agree, agree, and strongly agree) for survey question ten of the cost construct.

Table 19. Survey Question 10: The cost of time away from family would be reduced if students were to use peer tutoring.

Likert Scale	Frequency	Percent
1	13	5.6
2	42	18.2
3	65	28.1
4	74	32.0
5	29	12.6
6	8	3.5
Total	231	100.0

N = 231

(See the Correlation Matrix in Appendix B, and the Component Analysis in Appendix C.)

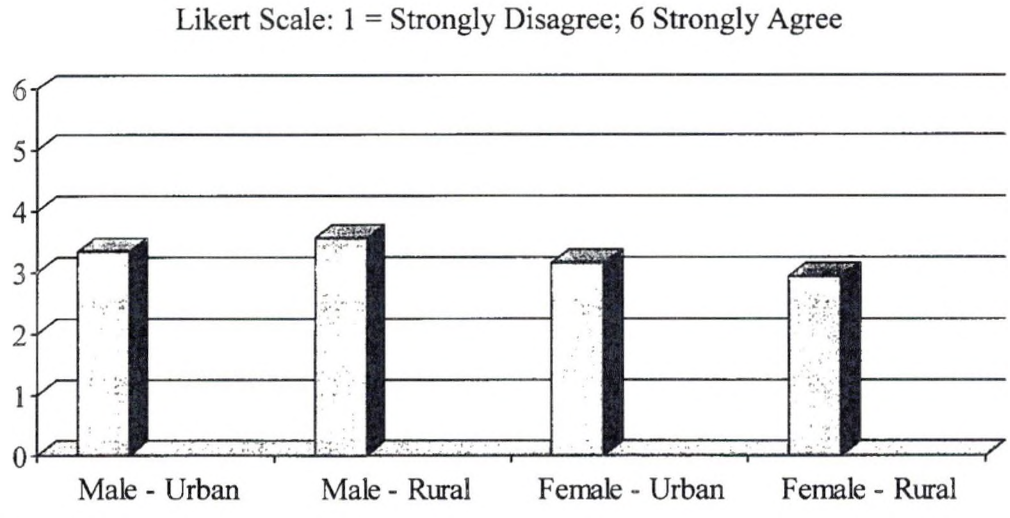
Research Question Number 4

Research question number 4 asked if there was a significant difference between males and females with different demographics regarding peer tutoring. This research question was answered with sub-questions 4a, and 4b relating to residence and parental education status respectively.

Research Question Number 4a

Research question number 4a asked if there was a significant difference between males and females based on residence. This was tested using the SPSS Manova procedure, with residence information obtained from the demographic section of the survey. The results indicated there were significant differences between males and females regarding residence, since $p<.05$. This means that in the preparedness factor, females from a rural residence perceived themselves as the least prepared, followed by females from an urban residence. Both rural and urban females perceived themselves as being less prepared than rural and urban males. The rural males perceived themselves as being the most prepared for courses in science, technology, engineering, and mathematics. The results can be explained since males from a rural residence have been historically a dominant figure (Goldberg, 1993, p. 31).

Figure 6 indicates the results of gender and residence in the preparedness factor of peer tutoring.



$p<.05$

Figure 6. Construct 1: Academic Preparedness – Gender and Residence.

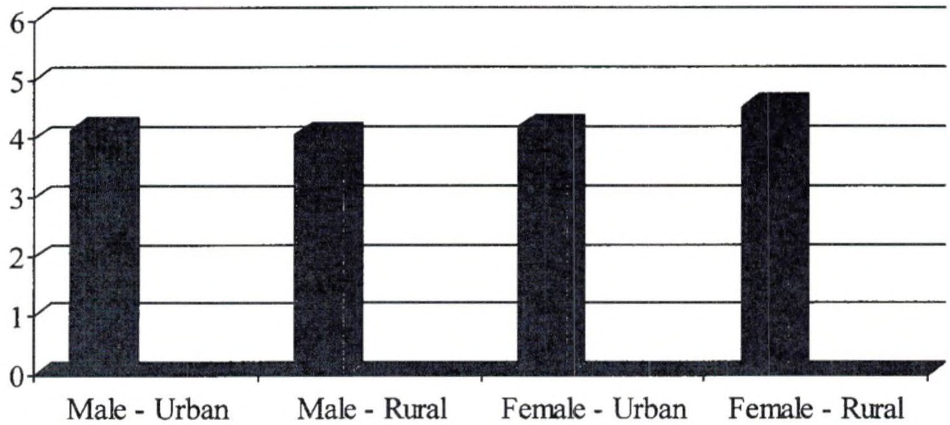
Figure 6 indicates that rural females perceived themselves as least prepared for STEM courses.

In the academic support factor, which was tested using the SPSS Manova procedure, there was not a significant difference between males and females based on residence, since $p > .05$. This means that in the academic support factor, males agreed that they were also in need of peer tutoring. The results indicated there were no significant differences between males and females based on residence and academic support. Therefore, the null hypothesis is accepted that there is no difference between males and females based on residence.

In the cost factor, which was tested using the SPSS Manova procedure, there was a significant difference between males and females regarding cost, since $p < .05$. This means that in the cost factor, rural females were the most in favor of the costs of peer tutoring, followed by urban females. Both rural and urban females were more in favor than males. Therefore, the null hypothesis is rejected that there is no difference between the perceptions of males and females regarding the cost of peer tutoring.

Figure 7 indicates the results of gender and residence in the cost factor of peer tutoring.

Likert Scale: 1 = Strongly Disagree; 6 Strongly Agree



p<.05

Figure 7. Construct 3: Cost – Gender and Residence.

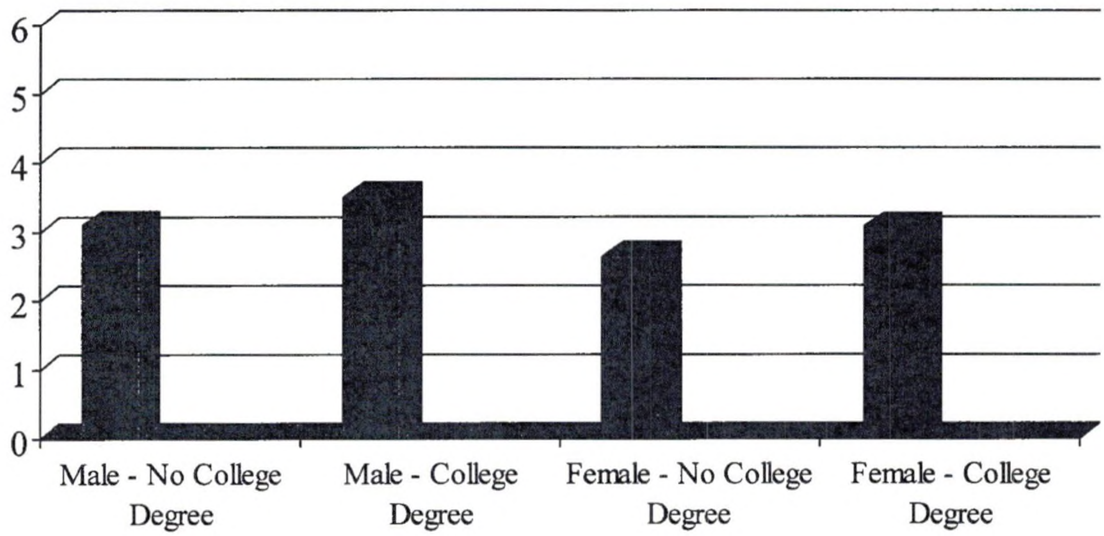
Figure 7 indicates that rural females were most in favor of the costs related to peer tutoring.

Research Question Number 4b

Research question number 4b asked if there was a significant difference between males and females based on parental education status. This was tested using the SPSS Manova procedure, with parental education status information obtained from the demographic section of the survey. Results indicated there were significant differences between males and females based on parental education status, since p<.05. This means that in the preparedness factor, females who did not have a parent with a college degree perceived themselves as being least prepared, followed by females who had a parent with a college degree. Both groups of females perceived themselves as being less prepared than the males. Therefore, the null hypothesis is rejected that there is no significant difference between males and females based on parental education status regarding peer tutoring.

Figure 8 indicates the results of gender and parental education status regarding the preparedness factor of peer tutoring.

Likert Scale: 1 = Strongly Disagree; 6 Strongly Agree



p<.05

Figure 8. Academic Preparedness Factor – Gender and Parental Education Status.

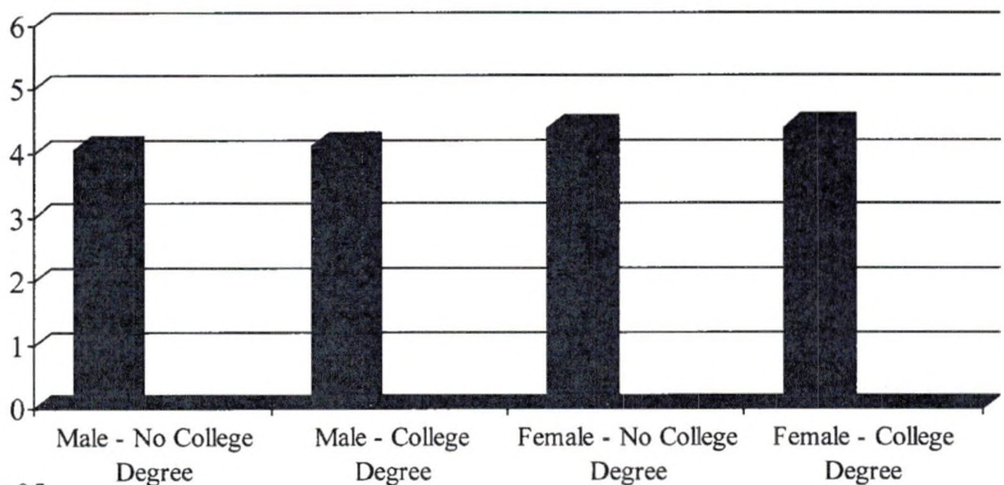
Figure 8 indicates that females who did not have a parent with a college degree perceived themselves as being the least prepared for STEM courses.

In the academic support factor of question 4b, which was tested using the SPSS Manova procedure, there was no significant difference between males and females regarding academic support, since p>.05. This means that in the academic support factor, males agreed that they were also in need of peer tutoring. Therefore, the null hypothesis is accepted that there is no significant difference between males and females based on parental education status regarding peer tutoring.

In the cost factor of question 4b, which was tested using the SPSS Manova procedure, there was a significant difference between males and females regarding cost, since $p<.05$. This means that in the cost factor, females who had a parent with a college degree were more in favor of the cost of peer tutoring, followed by females who did not have a parent with a college degree. Males who had a parent with a college degree were more in favor of the cost of peer tutoring than were males who did not have a parent with a college degree. Therefore, the null hypothesis is rejected that there is no significant difference between males and females based on parental education status regarding peer tutoring. Mortenson's first generation research supports these findings (Mortenson, 2007, p. 1).

Figure 9 indicates the results of gender and parental education status regarding the cost factor of peer tutoring.

Likert Scale: 1 = Strongly Disagree; 6 Strongly Agree



$p<.05$

Figure 9. Construct 3: Cost – Gender and Parental Education Status.

Figure 9 indicates that females who had a parent with a college degree were most in favor of the costs related to peer tutoring.

This study was designed to assess the opinions of male versus female students enrolled in a science, technology, engineering or mathematics course during the spring 2010 semester, regarding peer tutoring as a component of retention, to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering or mathematics courses at the University of North Dakota. There was evidence to support the hypothesis: It is predicted that the opinions of female students will be stronger in favor of peer tutoring usage than that of male students in the areas of science, technology, engineering and mathematics. The results of the independent variable gender on the dependent variable academic preparedness had a mean of 2.427 with a standard deviation (measure of the dispersion in a frequency distribution) of 1.261 for males. The mean for females was 2.039 with a standard deviation of 1.14. The F value designates the degree of freedom, the number of respondents less the number of groups, therefore, $F(1, 229) = 2.98$. When the p value is greater than .05, the null hypothesis is accepted, and when the p value of less than .05 the null hypothesis is rejected and the research factor is significant. The p value in the academic preparedness factor was $p<.05$. This means that the results for the academic preparedness factor indicated that there was a significant difference between males and females in their perceived view of academic preparedness.

The main effect of the independent variable gender, on the dependent variable of academic support, had a mean of 4.77 with a standard deviation (measure of the dispersion in a frequency distribution) of .894 for males. The mean for females was 4.812 with a standard deviation of .874. The F value designates the degree of freedom, the number of respondents less the number of groups, that indicate the number of values free to vary: F (1, 229) = 2.98. The p value was greater than .05, therefore, the null hypothesis is accepted. This means that there was no significant difference between males and females in the academic preparedness factor of the study. Both the male and female responses indicated that they were in favor of peer tutoring in science, technology, engineering, and mathematics courses.

The main effect of the independent variable gender on the dependent variable cost had a mean of 4.11 with a standard deviation (measure of the dispersion in a frequency distribution) of .777 for males, and a mean of 4.40 with a standard deviation of .650 for females. The F value designates the degree of freedom, the number of respondents less the number of groups, that indicate the number of values free to vary: F (1, 229) = 2.98. Since p<.05, this means that there were significant differences between males and females in their responses to the survey questions relating to the cost factor of the study.

The Cronbach Alpha results indicated that the instrument was reliable with strong internal consistencies of .86 for the academic preparedness construct, .90 for the academic support construct and .45 (below the .60) for the construct of cost. This means that the cost factor was not homogeneous, but significant information was obtained from the individual questions in the cost factor. There was a significant difference between males and females in their perceived view of the cost factor of the study.

To summarize the results, males indicated that they agreed they were academically prepared for science, technology, engineering, and mathematics courses. Females indicated that they slightly disagreed that they were academically prepared for science, technology, engineering, and mathematics courses. Male students slightly agreed that obtaining a peer tutor for science, technology, engineering, and mathematics courses was a good idea. Female students agreed that obtaining a peer tutor for STEM courses was a good idea. Both male and female students slightly agreed that spending money on peer tutoring would be a good idea. Both male and female students agreed that the cost of dropping classes could be saved if students were to obtain peer tutoring. Neither males nor females indicated that the cost of time away from family could be reduced by obtaining peer tutoring.

The results of quantitative data indicated that students felt the use of peer tutoring was a good idea, however both the results of the quantitative data showed that only 15.2% of the students utilize peer tutoring. Results also indicated that there were no female respondents (0%) in Material Properties and Selection (ME 313) and 30% female respondents in Advanced Applications of CADD (Tech 202) even though there were 70% female respondents in Concepts of Biology (Biol 111), 63% female respondents in Introduction to Chemistry (Chem 115), and 61% female respondents in College Algebra (Math 103). These numbers indicate that even though there were a majority of female students at the introductory levels of math and science, the females were in a clear minority by the second year and third year of study. Moreover, there were 47.9% female students enrolled at the University of North Dakota, so 0% females in Materials and Properties (ME 313) and 30% females in Advanced Applications of CADD (Tech 202) is considerably lower than 47.9% females enrolled at the University of North Dakota. These results indicate that the status quo is not working for many female students who desire to major in a STEM field of study. (See Summary Charts in Appendix D.)

Table 20. Qualitative Data Analysis Chart.

-Nice option -Repetition -Recommend it -Great -Helpful -Learned a lot -Higher grades -Own age is nice	→ CATEGORY 1 Both male and female STEM students had positive perceptions about peer tutoring.	→ THEME 1 The skills gained through peer tutoring help students cope with challenges.
-Lazy, use friend -Didn't need it -I should use it -Professor should take mandatory teaching classes, but I haven't used it -I don't know if it would help -Plan to use it	→ CATEGORY 2 The majority of both male and female STEM students had never utilized peer tutoring.	→ THEME 2 Students need to be educated about the benefits of peer tutoring in order for them to utilize peer tutoring.
-Math Learning Center is understaffed -I prefer my teacher -Scheduling is a problem with my job -I have never had a peer tutor - I don't think it would help	→ CATEGORY 3 A few male and female STEM students had negative perceptions about peer tutoring.	→ THEME 3 Improved staffing, availability, flexible scheduling, and relationship building is necessary.

(See Qualitative Results in Appendix E.)

Research Question Number 5

Qualitative Results

The qualitative data was rich in detail and provided answers to the outcomes of the quantitative data. Of the 231 participants in the study, only 5.6% were twenty five years of age or above. There were 112 (48.5%) participants who made one or more comments in the space provided on their survey. The qualitative data obtained from the study included comments from twenty-three (23) participants who responded to the survey in Concepts of Biology (Biol 111); there were 58 females and 26 males who completed the survey. There were twenty-two (22) comments from participants in Introduction to Chemistry (Chem 115); there were 35 females and 21 males who completed the qualitative portion of the survey. There were twenty (20) comments from participants who were enrolled in Advanced Applications of CADD (Tech 202); eight females and 18 males completed the survey in technology. Twenty one (21) comments were made by participants who were enrolled in Material Properties and Selection (ME 313); no females and 21 males completed the survey in engineering. Twenty-six (26) comments were from participants who were enrolled in College Algebra (Math 103); 30 females and 14 males completed the survey in mathematics. The opportunity to respond was given to 131 (56%) females and 100 (44%) males. The three categories appeared with some consistency in these comments. The data was obtained from the open-ended qualitative question "What can you tell me about your peer tutoring experience?" The data was transcribed and responses that appeared frequently were coded. The study generated the following coded responses: "nice option," "repetition is good," "I recommend it," "great," "helpful," "learned a lot," "higher grades," "own age," "is nice."

These codes generated category one: Both male and female students had positive perceptions about peer tutoring. A greater number of female students responded positively and with greater detail then did male participants. This category generated theme one: The skills gained through peer tutoring help students cope with challenges.

The following codes obtained from the study generated category two: "lazy," "use friend," "don't need it," "I should use it," "my professor should take mandatory teaching classes, but I haven't used it," "I don't know if it would help." The majority of male and female STEM students in category two had never utilized peer tutoring. Category two generated theme two: Students need to be educated about the benefits of peer tutoring in order for them to utilize peer tutoring.

The following codes were identified to generate category three: "the math learning center is under staffed," "I prefer my teacher," "scheduling is a problem with my job," "I have never had a peer tutor," "I don't think it would help." Four female and no males students had negative perceptions about peer tutoring. Theme three was: improved staffing availability, flexible scheduling, and relationship building is necessary.

These themes can be used to improve peer tutoring services. To do this, students should be better educated about benefits, many locations, better staffing and scheduling, and that peer tutoring is provided free of charge on campus.

Both male and female respondents had perceived peer tutoring as a positive component to improve retention in STEM courses. The rich data derived from the single qualitative question in this study and the potential use of this data will be discussed in Chapter V.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The data collected in this research study indicate that there are significant differences between male and female views regarding peer tutoring as a component for retention in science, technology, engineering and mathematics courses. The quantitative study consisted of three constructs: academic preparedness which consisted of responses to survey questions 1-3; academic support in the form of peer tutoring which consisted of responses to survey questions 4-7; and the costs related to peer tutoring, which consisted of responses to survey questions 8-10. Discussion of the individual research questions further highlight the differences in responses from survey participants. Discussion of research question number five, the open-ended question: "What are the perceptions of male and female students' peer tutoring experiences?" This qualitative question supported the findings of the four quantitative research questions in the study.

Currently, the allocation of resources for peer tutoring within the United States system of higher education is at an all-time high. Student services personnel, as well as other university personnel, have recognized the positive impact that peer tutoring can have on retention. However, the simple fact remains that there is still a shortage in the number of female students being retained in the STEM areas of study. The findings in this research study supported Merton's Self-Fulfilling Prophecy Theory. Merton's Theory suggests that the prophecy or prediction is false, but is made true by a person's unconscious or conscious actions; thus, some females believe falsely that they cannot be successful in science, technology, engineering or mathematics, and this belief becomes their truth.

The purpose of this study was to examine the perceptions of traditional and nontraditional males and females who participated in a science, technology, engineering or mathematics course during the spring 2010 semester regarding peer tutoring, to understand why females are underrepresented and not retained at the same level as males in science, technology, engineering or mathematics courses at the University of North Dakota. The data collected indicated that there were significant differences between males and females in their views of peer tutoring regarding the academic preparedness factor and the cost factor. Thus, factors one and three supported the hypothesis: It is predicted that the opinions of female students in favor of peer tutoring in the science, technology, engineering or mathematics courses will be greater than that of male students. The data collected under factor two, academic support, found that female students considered themselves more in need of academic support than did male students, however, the differences in their perceptions was not enough to be significant. Thus, there were no significant differences between males and females in their views of peer tutoring as a form of academic support in their science, technology, engineering, and mathematics courses. Both genders perceived a need for peer tutoring in their science, technology, engineering, and mathematics courses. Moreover, data collected indicated that only 15.2% of the student (11% of the male students and 23% of the female students) participated in peer tutoring. This data indicates that student perceptions and practices were inconsistent.

The following research questions guided the study:

1. Is there a significant difference between the perceptions of males and females regarding academic preparedness?

    1a. Is there a significant difference between the perceptions of males and females regarding their professor preparing them for their current STEM course?

    1b. Is there a significant difference between the perceptions of males and females regarding their ACT scores?

    1c. Is there a significant difference between the perceptions of males and females regarding their high school GPA?

2. Is there a significant difference between the perceptions of males and females regarding academic support?

    2a. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in science courses?

    2b. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in technology courses?

    2c. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their engineering course?

2d. Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their mathematics course?

3. Is there a significant difference between the perceptions of males and females regarding the costs related to peer tutoring?

3a. Is there a significant difference between the perceptions of males and females regarding the money that is spent on peer tutoring?

3b. Is there a significant difference between the perceptions of males and females regarding the dropping of courses?

3c. Is there a significant difference between the perceptions of males and females regarding time away from family if students were to use peer tutoring?

4. Is there a significant difference between the perceptions of males and females with different demographics regarding peer tutoring?

4a. Is there a significant difference between the perceptions of males and females based on residence?

4b. Is there a significant difference between the perceptions of males and females based on parental education status?

5. What are the perceptions of male and female students' peer tutoring experiences?

The respondents consisted of 231 college students who were enrolled in Introduction to Chemistry (Chem 115), Concepts of Biology (Biol 111), Advanced Applications in CADD (Tech 202), Material Properties and Selection (ME 313), and

College Algebra (Math 103) at the University of North Dakota during the spring semester, 2010. All 231 students responded to a variety of questions that focused on the academic preparedness, academic support, and cost factors related to peer tutoring.

Conclusions

Research Question 1

The study examined the effect of the independent variable gender with two conditions, male and female, on the dependent variables of academic preparedness, academic support, and cost. The study also examined multiple independent variables of gender and residence, gender and ACT, gender and high school GPA, gender and peer tutoring support, and gender and parent educational level on the dependent variable of academic preparedness, academic support, and cost.

There was a significant difference between males and females on research question number 1: "Is there a significant difference between males and females regarding academic preparedness?" The female students perceived themselves as less prepared for science, technology, engineering and mathematics courses. Both males and females perceived themselves as unprepared, but females to a greater degree than males. The academic preparedness factor supports the hypothesis: "It was predicted that the opinions of female students in favor of peer tutoring in STEM courses will be greater than that of male students."

There were significant differences between males and females regarding gender and those who participated in peer tutoring; the peer tutoring experience opened their eyes about the depth of preparation that is necessary in order to be successful in their STEM coursework. Females receiving peer tutoring perceived themselves as least prepared for STEM courses, followed by the females not receiving tutoring. Males receiving peer tutoring were third, and males not receiving peer tutoring considered themselves most prepared.

The conclusion that can be drawn from this data is: there were significant differences between males and females with regard to academic preparedness. The study supports the hypothesis: "It was predicted that the opinions of female students will be stronger in favor of peer tutoring usage than that of male students. The results indicated that both genders perceived themselves as being unprepared for college, but females to a significantly greater degree. The general conclusion that can be drawn from the data indicates academic need for tutoring for females enrolled in science, technology, engineering and mathematics courses.

Research Question Number 1a

There was a significant difference between males and females on research question number 1a: "Is there a significant difference between males and females regarding their professor preparing them for STEM courses?" Regarding their professors preparing them for STEM courses, female students felt significantly less prepared than did male students. However, the male students also indicated that their professors did not significantly prepare them for STEM courses. This means that, without intervention, the self-fulfilling prophecy may occur. Female students who do not think they will do well, do not do well in STEM courses (Merton, 2008, p. 1). While no other studies address this question specifically, Hammer and Tinto discuss approaches to retention in general. According to Hammer (2003), "Award winning approaches to retention recognize the importance of educational support from tutors" (p. 2). Research by Noel-Levitz (2003) indicated that peer tutors increased retention rates by 5% (p. 2). Tinto (1993) cited peer tutoring as an essential component in the retention of at risk students (p. 114). On this study, peer tutoring in the form of supplemental instruction, combined with remedial coursework, is recommended for female students who perceive themselves as unprepared for STEM courses. The supplemental Sci-math curriculum materials are examples of materials that will enrich the current junior and senior high school curriculum (Goodstein, 2002). These materials could also be used in a support services center by peer tutors to strengthen female STEM preparation.

Research Question Number 1b

There was a significant difference between males and females on research question number 1b: "Is there a significant difference between males and females regarding their ACT, indicating preparedness?" Female students did not feel adequately prepared for STEM courses, based on their ACT scores, to a greater degree than male students. Neither male nor female students felt prepared for STEM courses. Based on the results of question 1b, a stronger mathematics and science curriculum is highly recommended to prepare the female students for the competitive global economy. Fareed Zakaria, in his book *The Post-American World*, describes a world where the United States will no longer dominate the global economy. He sees the growth of countries like China, India, Brazil, Russia and many others as reshaping the world. He reminds us that the tallest buildings, biggest dams, largest-selling movies, and most advanced cell phones are all being built outside the United States (Zakaria, 2008). Many international students have applied to institutions of higher education in the United States, having come from competitive backgrounds and boast of high ACT scores. The United States has been happy to admit these prepared students. Upon graduation, many of the male and female students chose to relocate in their home country, thus economic growth has produced political confidence and national pride in the foreign countries that are our competitors in the global economy (Zakaria, 2008). The STEM female problems seem to be a cultural phenomenon, not a gender problem. Providing tutoring that supports female success sends an explicit and implicit message that this is important.

Research Question Number 1c

There was a significant difference between males and females on research question number 1c: "Is there a significant difference between males and females regarding their high school GPA, indicating proficiency?" Female students did not feel adequately prepared for STEM courses, based on their high school grade point average. Male students also revealed that they felt unprepared and needed peer tutoring. Thirty-four percent of the respondents indicated some form of agreement with question number three. Some female students choose not to outperform males in high school classes. While studies that addressed the relationship between gender and GPA as they relate to STEM retention are limited, Kalikole (2010) has made general predictions of attrition based on current underrepresentation of females in STEM fields (p. 2). Studies by the Council for Opportunity in Education referred to many females in STEM majors as a "double minority," because they are not only underrepresented, but many come from first-generation, low-income, or minority families. They see a STEM career as a "way out" of poverty.

Research Question Number 2

There was no significant difference between males and females on research question number 2: "Is there a significant difference in the perceptions of males and females regarding academic support?" The data indicates that females perceived themselves as being in greater need for academic support than did males in the STEM courses, but since males also perceived themselves to be in need of academic support, the difference in male and female perceptions was not enough to be significant. These results did not support the hypothesis: "It was predicted that the opinions of female students in favor of peer tutoring in the STEM courses will be greater than that of male students."

There were no significant differences between males and females in the academic support construct. The data indicated that females perceived it was a good idea to utilize peer tutoring in the STEM areas of study at a slightly higher rate than did the males. Both genders perceived that it was a good idea to utilize peer tutoring. The consensus was so strong that the difference between the genders was too small to be significant on construct two.

Research Question Number 2a

There was no significant difference between males and females on research question number 2a: "Is there a significant difference between males and females in how they viewed peer tutoring in science courses?" Female students were slightly more in favor of peer tutoring in science courses. Male students were also in favor of peer tutoring in science courses. Ninety-four percent of the participants indicated they were in favor of peer tutoring in their science course. However, it is notable that only 15.2% of the students, 11% male and 23% female, utilized peer tutoring. Young's (2007) research specifically cited retention to be a problem in the field of nursing, a STEM field of study in which the majority are females (p. 275). Young (2007) also reported that students cited lack of guidance and quality teaching to be attrition factors (p. 275). Tiberius (1989) supports small group interaction, but this pedagogy is usually not used in STEM courses (p. 10).

Research Question Number 2b

There was no significant difference between males and females on research question number 2b: "Is there a significant difference between males and females in how they viewed peer tutoring in their technology course?" Data from question 2b indicated that both female and male students were in favor of peer tutoring in technical courses at an almost equal level. It is important to note that both genders were strongly in favor of peer tutoring in their technology course; 91% of the participants indicated some form of agreement with question number five. This finding is in agreement with Rose (2010) who contends that continual changes in technology have made this field of study a challenge for both genders. He further notes that an inherent strength of the female brain is the ability to remember details, a necessity in technology (p. 243). Medina (2008), Director for Applied Learning, found that: "Men's and women's brains are different structurally and biochemically" (p. 243).

Research Question Number 2c

There was no significant difference between males and females on research question number 2c: "Is there a significant difference between males and females in how they viewed peer tutoring in their engineering course?" Both genders supported peer tutoring. The outcome of this question could be skewed by the lack of female students in the engineering class surveyed; there were 231 participants in the study, and there were no female students in the engineering class. (The female mean for this question was derived from the 131 females responding to the survey questionnaire.) It is important to note that 93% of the participants indicated that they were in favor of peer tutoring in their engineering course. According to Medina (2008), men and women learn differently (p. 243). Felder & Spurlin (2005) provide a good basis for peer tutors to capture the most important learning style differences among engineering students which could provide a distinct form of support for female engineering students (p. 103). Most universities have allocated resources for peer tutoring; however, the utilization of the support services provided by these resources is not always fully utilized. The challenge for the University of North Dakota is to bridge the gap between the 93% of the participants who favored peer tutoring, and the 15.2% of the students, 11% male and 23% females, who actually utilized peer tutoring.

Research Question Number 2d

There was no significant difference between males and females on research question number 2d: "Is there a significant difference between males and females in how they viewed peer tutoring in their mathematics course?" The female students were stronger in favor of peer tutoring in mathematics; however, male students were also in favor of utilizing peer tutoring. It is important to note that 96% of the participants indicated that they were in favor of peer tutoring in mathematics. According to Thayer (2000), intentional advising and peer tutoring is necessary for retention (p. 4).

Research Question 3

There were significant differences between males and females on research question number 3: "Is there a significant difference between males and females regarding the costs related to peer tutoring?" These findings support the hypothesis: "It was predicted that the opinions of female students in favor of peer tutoring in the STEM courses would be greater than that of male students." The females were in greater agreement than males in support of the cost for peer tutoring. When asked if peer tutoring would be a waste of money, female students strongly disagreed, and male students slightly disagreed with this statement.

In the cost factor of the study, females perceived that money should be spent on peer tutoring at a higher rate than male participants. Both males and females were in favor of spending money on peer tutoring. Female students perceived at a higher rate than males that the cost of dropping courses would be reduced. Males did not perceive time away from family as a cost. Since 95% of the participants were college freshmen below the age of 25, participants did not perceive time away from family as a cost. Students from this age group are oftentimes very happy to be away from their families.

Research Question Number 3a

There was a significant difference between males and females on research question number 3a: "Is there a significant difference between males and females regarding the university spending money on peer tutoring?" Data from question 3a indicated that female students were more in favor of spending money on peer tutoring than were male students; however, the male students indicated they were also in favor of spending money on peer tutoring. Only eight percent of the respondents perceived the university spending money on peer tutoring as a waste of money. The fact that 92% of the students were in favor of spending money on peer tutoring, and only 15.2% of the students, 11% male and 23% female, actually utilized peer tutoring, raises an interesting question: "What can universities do to close this gap?" Simply providing the service is not enough to change the retention and graduation rates in the science, technology, engineering and mathematics fields of study. According to Thayer (2000), intentional, mandatory strategies are necessary to effectively utilize the human capital in the STEM areas of study (p. 2).

Research Question Number 3b

There was a significant difference between males and females on research question number 3b: "Is there a significant difference between males and females regarding the dropping of courses, if students were to use peer tutoring?" Female students were stronger in support of the concept that the cost of students dropping courses would be reduced if students would use peer tutoring than were male students; however, 87% of the participants were in support of the concept. Overwhelmingly, the participants were in favor of peer tutoring and the benefits that it would provide, but the fact remains that only 23% of the female participants utilized peer tutoring. The results might be explained, since the amygdala of the female brain remembers the negative emotional events (Medina, 2008, p. 243). Dropping a course is emotional and the cost of dropping a course is an important financial detail. Research by Stokes (2008) revealed a link between students dropping classes and their income status. Only 19.8% of first-year low income students had completed four years of high school mathematics. Only 16.6% of students who have completed calculus are low-income (p. 3). Moreover, low-income females would be seriously at risk for dropping courses in science, technology, engineering and mathematics (p. 3). Because of the importance of retaining and graduating students in the science, technology, engineering, and mathematics fields of study, recommendations will be made to improve current practices later in this chapter.

Research Question Number 3c

There was a significant difference between males and females on research question number 3c: "Is there a significant difference between males and females regarding time away from family, if students were to use peer tutoring?" The reduction of time away from family was not supported by either females or males. Females, however, disagreed to a lesser degree than did males. Forty-eight percent of the participants indicated some form of agreement that time away from family would be reduced if students were to use peer tutoring.

Research Question Number 4

There was a significant difference between males and females on research question number 4, "Is there a significant difference between males and females with different demographics regarding peer tutoring?" These results support the hypothesis, "It was predicted that the opinions of female students in favor of peer tutoring in the STEM courses would be greater than that of male students." Research question number four was answered with research questions number 4a and 4b regarding residence and parental education status respectively.

Research Question Number 4a

There was a significant difference between males and females on research question number 4a: "Is there a significant difference between males and females based on residence?" Fifty-two percent were from a rural community, and forty-eight percent were from an urban community. Forty-three percent were males, and fifty-seven percent were females. Rural males perceived themselves as most prepared for STEM courses; urban males followed. Rural females perceived themselves as being the least prepared for STEM courses; urban females followed. Little (2010), in her book *Rural Sociology*, discussed the gender roles inherent to males and females who reside in a rural setting. Males are masculine and dominant and females take pride in being supportive and pleasing the males (p. 2). This may explain why some females are uncomfortable competing with males in STEM courses.

Research Question Number 4b

There was a significant difference between males and females on research question number 4b: "Is there a significant difference between males and females based on parental education status?" Females whose parent did not have a college degree perceived themselves the least prepared for STEM courses, followed by females whose parent had a college degree. Males whose parent did not have a college degree perceived themselves less prepared for STEM courses than males whose parent did have a college degree. Females, overall, perceived themselves as less prepared than males. These findings might be explained, by the fact that females who did not have a parent with a college degree, did not have a role model or "built in" advisor. Moreover, academia has a language all its own, and the STEM vocabulary can be overwhelming. Understanding the process can be a challenge for first-generation students of both genders. Research regarding the relationship between gender and parental education status is limited. Pulley (2010), reminds us that chronically low levels of achievement exist among poor and minority students who represent the fastest growing segments of the college population (p. 2). Currently, the Council for Opportunity in Education's research indicates that first-generation students are seriously at risk for attrition from college (Council for Opportunity in Education, 2010, p. 1). Research by the Stokes Institute cites females in the STEM areas of study as being most at risk (Stokes, 2010, p. 4). The Council for Opportunity in Education has scheduled a National Conference with the theme: Fitting STEM into the College Opportunity Equation, since research indicates that there is a serious need to support first-generation female students in the science, technology, engineering, and mathematics areas of study (Kalikole, 2010, p. 363; Sloan Foundation, 2009).

Research Question Number 5

Research question number 5 was an open-ended question: "What are the perceptions of students' peer tutoring experience?" Forty-eight percent, (50 males, 62 females), of the participants responded to question number five. Qualitative research methodology was used to analyze the responses; however, further research would need to be done since the data was obtained from a single qualitative question. The qualitative data suggests that science, technology, engineering and mathematics students feel that peer tutoring would improve their skills and allow them to meet the goals in these courses. To do this, students should be better educated about locations, staffing, scheduling, and cost of peer tutoring. A majority of the participants perceived that peer tutoring would improve retention in science, technology, engineering, and mathematics courses. A more extensive qualitative study is recommended to confirm these findings.

The data generated by the qualitative question number five of the study clearly indicates that retention strategies should be reevaluated by the university and the STEM academic departments. Responses indicated that both female and male students perceived peer tutoring as being beneficial, with female students responses slightly more in favor of peer tutoring. However, students are not receiving peer tutoring. Ignorance, scheduling difficulties, limited staffing, and the negative stigma of peer tutoring were cited as reasons for not utilizing peer tutoring.

The qualitative question supported the quantitative data in this study. Both sets of data indicated that students need to be retained in STEM areas of study. Participants have perceived peer tutoring as a valuable resource to accomplish this goal. Only 15.2% of the students who answered research question number five, (11% male and 23% female), have taken advantage of peer tutoring. This qualitative data will provide a starting point for improved services in the area of peer tutoring.

Limitations

Three limitations of this research study were evident: The first limitation of this study related to demographics. Participants in this study were from the University of North Dakota. This limited the number of participants who were from geographic areas other than the Midwest. Conducting a larger study using participants from more universities throughout the United States is indicated to further explore the topic and support the conclusions drawn in this study.

A second limitation related to the number of STEM classes surveyed; participants in this study were from five STEM courses at the University of North Dakota. Participants from a larger number of STEM courses could be surveyed in a future study.

A third limitation related to the survey instrument that was used. The instrument did not address all possible constructs that might have been included in the study. Constructs relating to minorities and adult students might also have been included in the study.

A fourth limitation involved the use of a self-directed survey questionnaire. There is always a risk that participants may not interpret a question as it was intended.

Recommendations

The first recommendation is to implement the recommendation of Tiberius (1989) who supports pedagogy implementing small group interaction (p. 10). The small group interaction might be in the form of a well-trained peer tutor who is one year older working with students in elementary and junior high school. This student might also benefit from the peer tutoring experience as well. University students majoring in education might serve as peer tutors for the high school students as part of their curriculum. This recommendation is simple, cost effective, and has the potential to strengthen the math and science program. Support for this concept and coordination between the university and the elementary and high school teachers is necessary in order to make scheduling and the economic factors possible. Monetary support, similar to the support provided for athletics, is recommended.

Expansion of Tutorial Locations

The second recommendation to increase female retention in science, technology, engineering and mathematics, would be to use current research to provide extensive on campus tutoring in learning centers, dorms and in academic departments. Tinto discusses pre-entry attributes, commitments and goals as well as a sense of integration as part of the institutional experience that is positive for retention (Tinto, 2007). Peer tutoring by science, technology, engineering, and mathematics students would be available everywhere on campus, as well as by scheduled appointment in a public location. The students doing the peer tutoring might receive free board for the entire semester and could use it as evidence of a strong educational experience on their resumes. The peer tutors would be available not only in learning centers, but at the library, at academic departments, and in the dorm rooms. Students registering for the STEM courses would be required to use the supplemental instruction peer tutor at least twice a week as part of the course curriculum. Students would not be allowed to continue in the course if they had not used peer tutoring. The peer tutors and students might also benefit from this experience, not only academically, but socially, as well.

Peer tutors would be trained extensively, so they could provide supplemental instruction, developmental instruction, and serve as a peer mentor to female students enrolled in STEM courses. Some peer tutors would be female students who could serve as positive role models for struggling female students enrolled in STEM courses.

Until an intentional campus wide peer tutoring program can be implemented, an intensive educational program advising students of the many locations on campus where free peer tutoring is available, as well as the statistics showing success in STEM courses when peer tutoring is used is recommended (Thayer, 2000, p. 7). TRIO students utilize peer tutoring at a 58% tutoring rate, and even though they are more at risk academically, show high retention and graduation rates (Council for Opportunity in Education, 2009).

Attention to Tutorial Methods

The third recommendation to increase female retention in science, technology, engineering and mathematics, would be to use the work of Davis, Gagne, Cross and Angelo, and Levin, to train peer tutors to capture a quality classroom experience: 1. careful preparation, 2. explaining clearly, 3. personalizing the quality lecture, 4. encouraging students participation, and 5. maintaining quality with limited resources (Davis, 1993, p. 25).

Peer tutors might be trained in Gagne's nine components of instruction: 1. the peer tutor would be creative in gaining the student's attention, 2. inform students of the objectives or goals, 3. review prior related learning, 4. carefully present the content, 5. carefully guide students through the material, 6. elicit positive performance from students, 7. feedback will be provided to the students, 8. student performance will be assessed, 9. students will work with mentors, and 10. the retention and transfer of knowledge should be the final objective (Driscoll, 2005, p. 312). Cross and Angelo (1993) provided meaningful ways to assess students, and peer tutors might utilize their suggestions to focus on an assessable question and collect feedback from students after the tutoring session has been completed (p. 35).

APPENDICES

Appendix A

Student Perceptions of Peer Tutoring: Do Male and Female Students Differ in their Perceptions of Peer Tutoring in STEM Courses?

Survey

Student Perceptions of Peer Tutoring: Do Male and Female Students Differ in their Perceptions of Peer Tutoring in STEM Courses?

Does peer tutoring affect retention in STEM courses? **Science Technology Engineering Mathematics** Household income: $30,000 or lower $31,000 -$50,000 $51,000 - $70,00 $71,000-and above ____ **Gender** ___ Male___ Female	**____24 and under ____25 and over** **My parent did/ did not graduate from college.** **I do/do not receive peer tutoring.** I did/did not attend college immediately after High School. I am from a rural/urban community. High school GPA 3.0-4.0/ 2.9 or lower. ACT 22 or above/ 21 or lower. **I do / do not have a documented disability.**

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1.	Since my professor prepares me, I do not need tutoring in STEM courses (science, technology, engineering, math).	1	2	3	4	5	6
2.	Because my ACT indicates proficiency, I do not need tutoring in STEM courses.	1	2	3	4	5	6
3.	Because my HS GPA indicates proficiency, I do not need tutoring in STEM courses.	1	2	3	4	5	6
4.	It is a good idea that students utilize peer tutoring in science courses.	1	2	3	4	5	6
5.	It is a good idea that students utilize peer tutoring in technology courses.	1	2	3	4	5	6
6.	It is a good idea that students utilize peer tutoring engineering courses.	1	2	3	4	5	6
7.	It is a good idea that students utilize peer tutoring in math.	1	2	3	4	5	6
8.	Peer tutoring at the university would not be a waste of money.	1	2	3	4	5	6
9.	The cost of students dropping courses would be reduced if students would use peer tutoring.	1	2	3	4	5	6
10.	The cost of time away from family would be reduced if students were to use peer tutoring.	1	2	3	4	5	6

What can you tell me about your peer tutoring experience?
(Please answer on the back side of the paper.)

Appendix B
Correlation Matrix for Survey Questions Number 1 – 10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1	1.000	.625	.554	-.274	-.183	-.240	-.190	-.245	-.164	.087
Q2	.625	1.000	.830	-.254	-.213	-.227	-.206	-.248	-.151	.044
Q3	.554	.830	1.000	-.255	-.219	-.246	-.183	-.267	-.253	.005
Q4	-.274	-.254	-.255	1.000	.748	.661	.673	.390	.294	.098
Q5	-.183	-.213	-.219	.748	1.000	.824	.573	.340	.251	.076
Q6	-.240	-.227	-.246	.661	.824	1.000	.588	.391	.161	.052
Q7	-.190	-.206	-.283	.673	.573	.588	1.000	.428	.305	.048
Q8	.245	.248	.267	-.390	-.340	-.391	-.428	-1.000	-.240	.004
Q9	-.164	-.151	-.253	.294	.251	.161	.305	.240	1.000	.292
Q10	.087	.044	.005	.098	.076	.052	.048	-.004	.292	1.000

$p<.05$

This table indicates the correlations among the individual survey questions number 1-10. The correlations range from +1 to -1. The greater the number, the stronger the correlation.

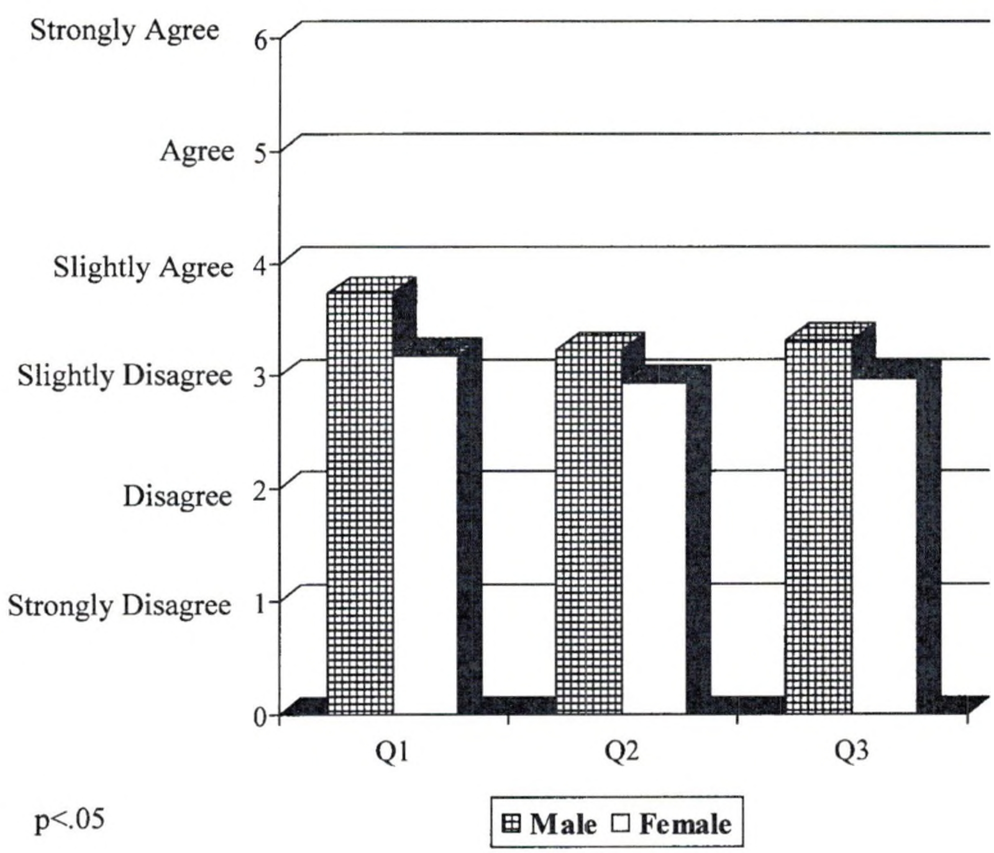
Appendix C
Component Analysis.

	Factors		
	Academic Preparedness	Academic Support	Cost
Q1	-.538	.601	.049
Q2	-.587	.715	-.016
Q3	-.613	.660	-.107
Q4	.811	.325	-.069
Q5	.786	.403	-.149
Q6	.782	.346	-.223
Q7	.748	.300	-.052
Q8	.586	.046	-.039
Q9	.431	.058	.674
Q10	.088	.235	.811

$p<.05$

Appendix D
Summary Charts

The Significance of Females over Males in their Perceptions of Academic Preparedness



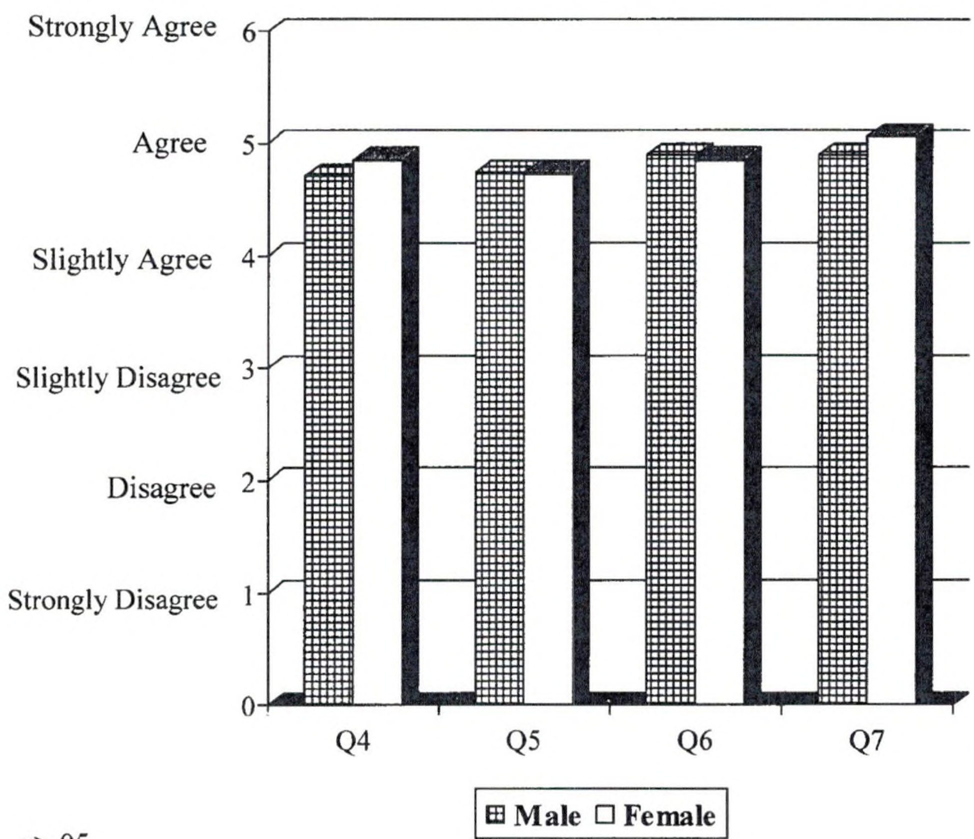
$p<.05$

Q1. This shows that female students with a mean of 3.18 feel less prepared than male students with a mean of 3.73 on survey question one, "Is there a significant difference between the perceptions of males and females regarding their professors preparing them for their current STEM course?

Q2. This shows that female students with a mean of 2.94 feel less prepared than male students with a mean of 3.23 on survey question two, "Is there a significant difference between the perceptions of males and females regarding their ACT?"

Q3. This shows that female students with a mean of 2.98 feel less prepared than male students with a mean of 3.32, on survey question three, “Is there a significant difference between the perceptions of males and females regarding their high school GPA?”

The Significance of Females over Males in their Perceptions of Need for Peer Tutoring



p>.05

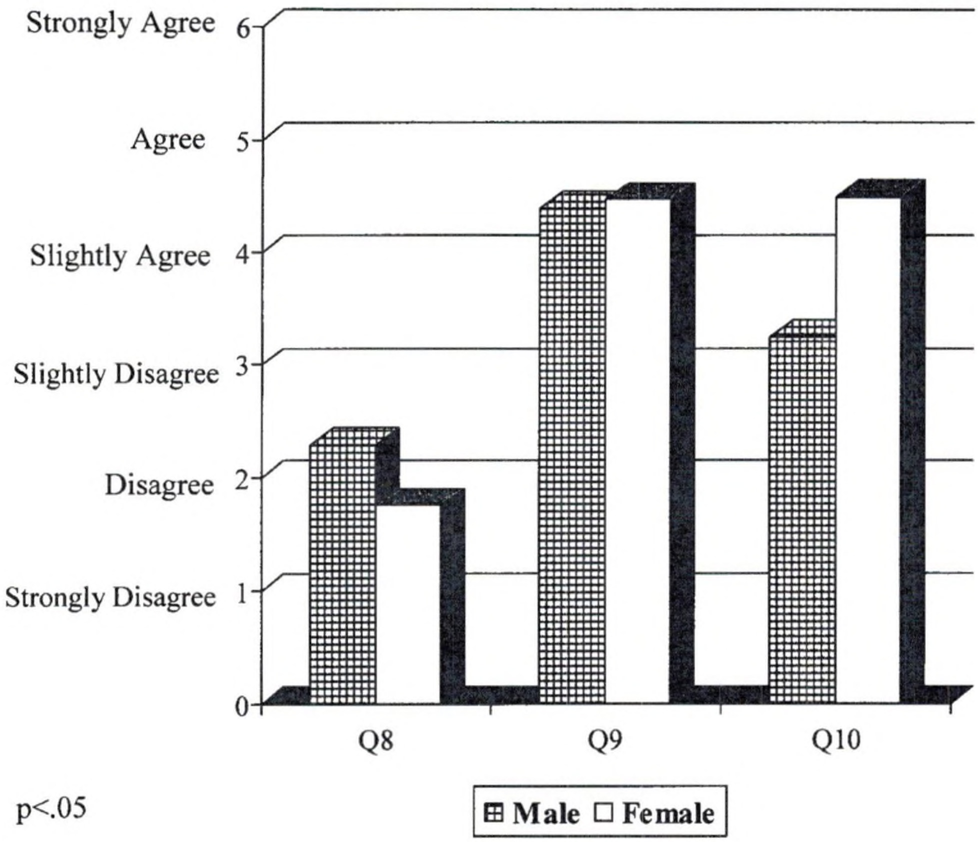
Q4. Shows that female students with a mean of 4.85 feel a stronger need for peer tutoring in science than male students with a mean of 4.70, on survey question four, "Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in science courses?"

Q5. This shows that female and male students feel an almost equal need for peer tutoring in technology, on survey question five, "Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their technology course?"

Q6. This shows that male students feel a slightly greater need for peer tutoring than female students with a mean of 4.89. This can be explained by the fact that there were no female engineering students in the class, on survey question six, "Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their engineering course?

Q7. This shows that female students with a mean of 5.06 feel greater need for peer tutoring than male students with a mean of 4.89, on survey question seven, " Is there a significant difference between the perceptions of males and females in how they viewed peer tutoring in their engineering course?

The Significance of Females over Males in their Perceptions of Cost



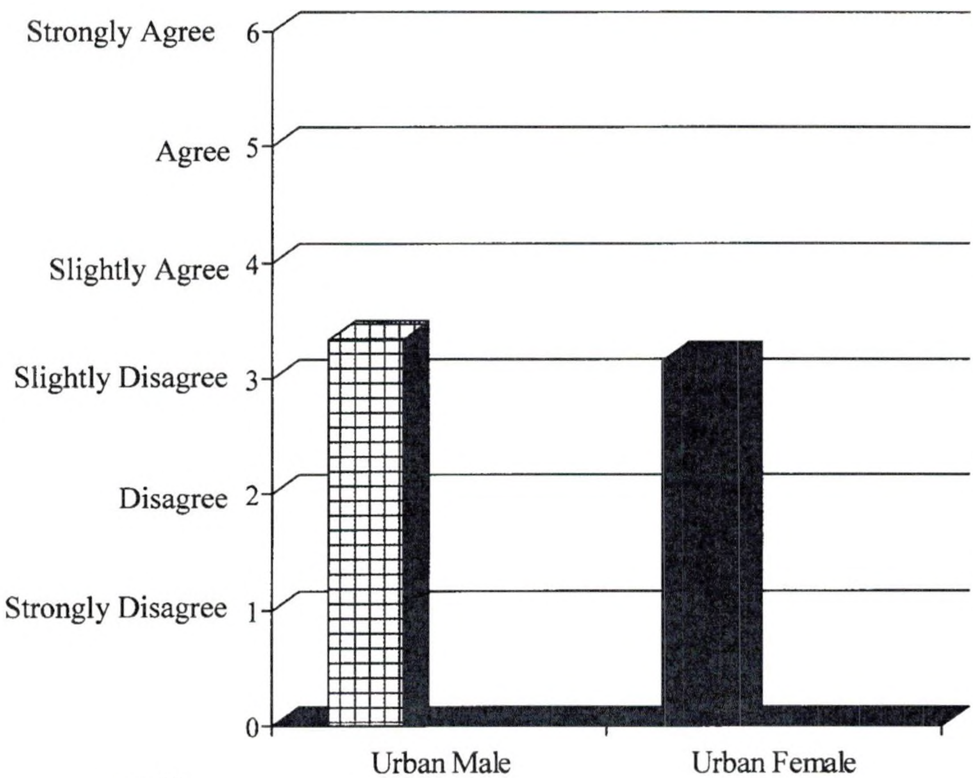
p<.05

Q8. This shows that female students with a mean of 1.76 disagree that peer tutoring would be a waste of money as compared to male students with a mean of 2.29, on survey question eight, "Is there a significant difference between the perceptions of males and females regarding the money that is spent on peer tutoring?"

Q9. This shows that female students (4.46 mean) felt the cost of dropping classes would be reduced to a greater degree than male students (4.38 mean), from survey question nine, " Is there a significant difference between the perceptions of males and females regarding the dropping of courses?"

Q10. This shows that female students (4.49 mean) felt that the time away from family would be reduced to a greater degree than male students (3.24), from survey question 10, " Is there a significant difference between the perceptions of males and females regarding time away from family if students were to use peer tutoring?"

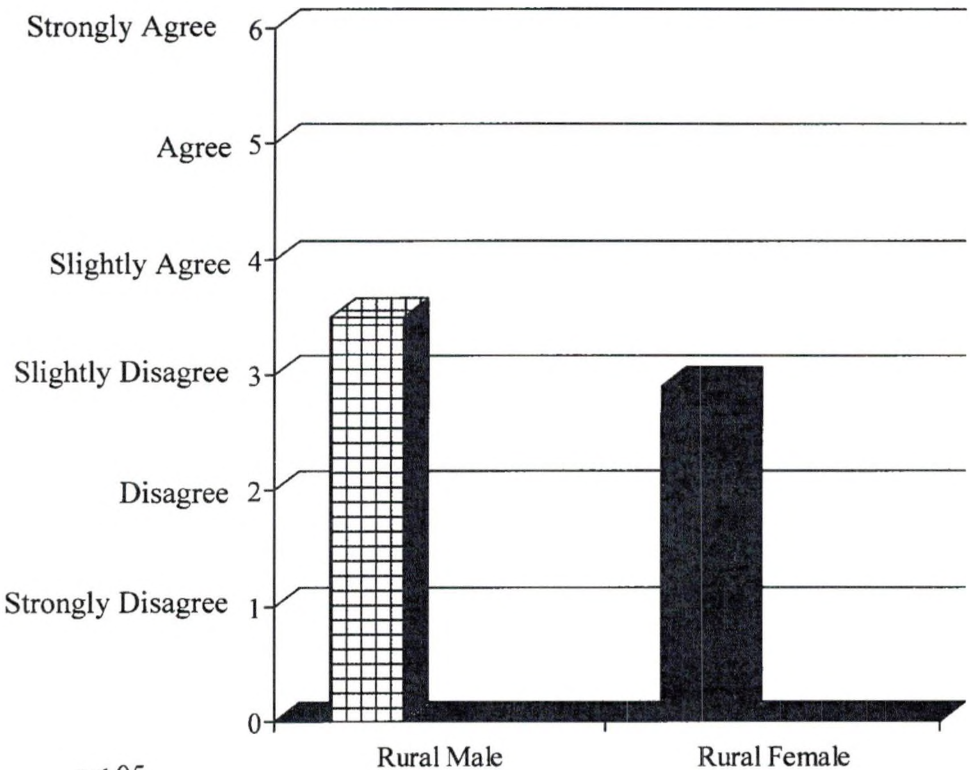
Perceptions of Females Over Males Regarding Peer Tutoring and Residence



$p<.05$

This means that female students with a mean of 3.15 perceived themselves as being less prepared than urban male students with a mean of 3.33.

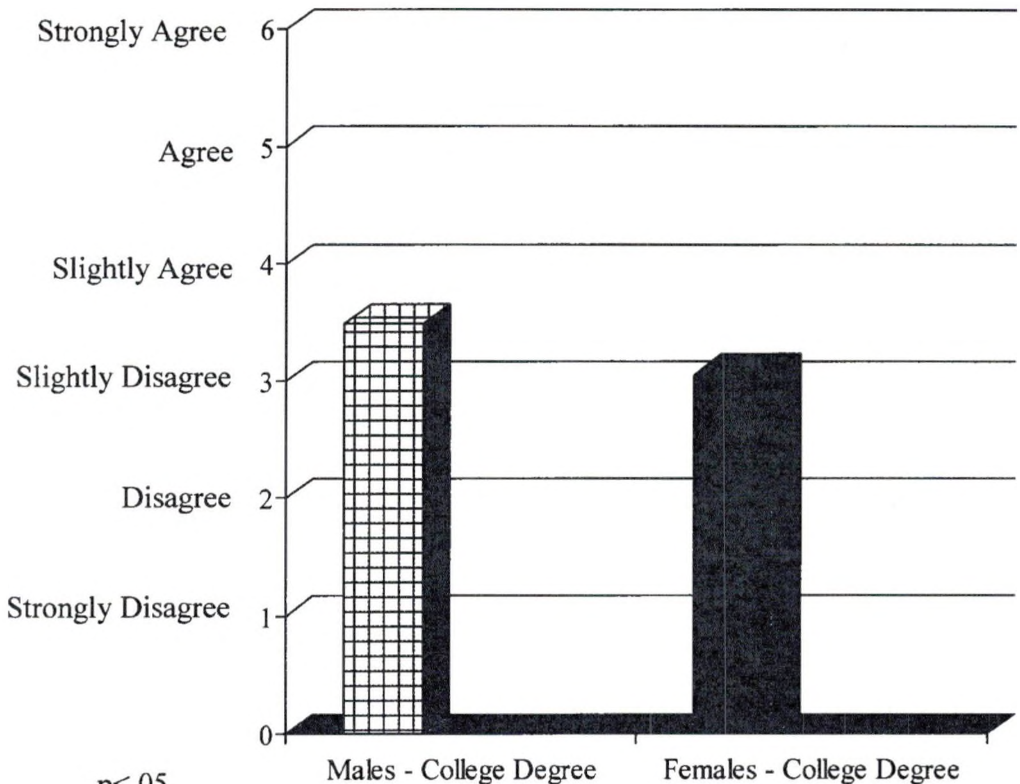
Perceptions of Females Over Males Regarding Peer Tutoring and Residence



p<.05

This means that rural female students with a mean of 2.9 perceived themselves as being less prepared than rural male students with a mean of 3.5.

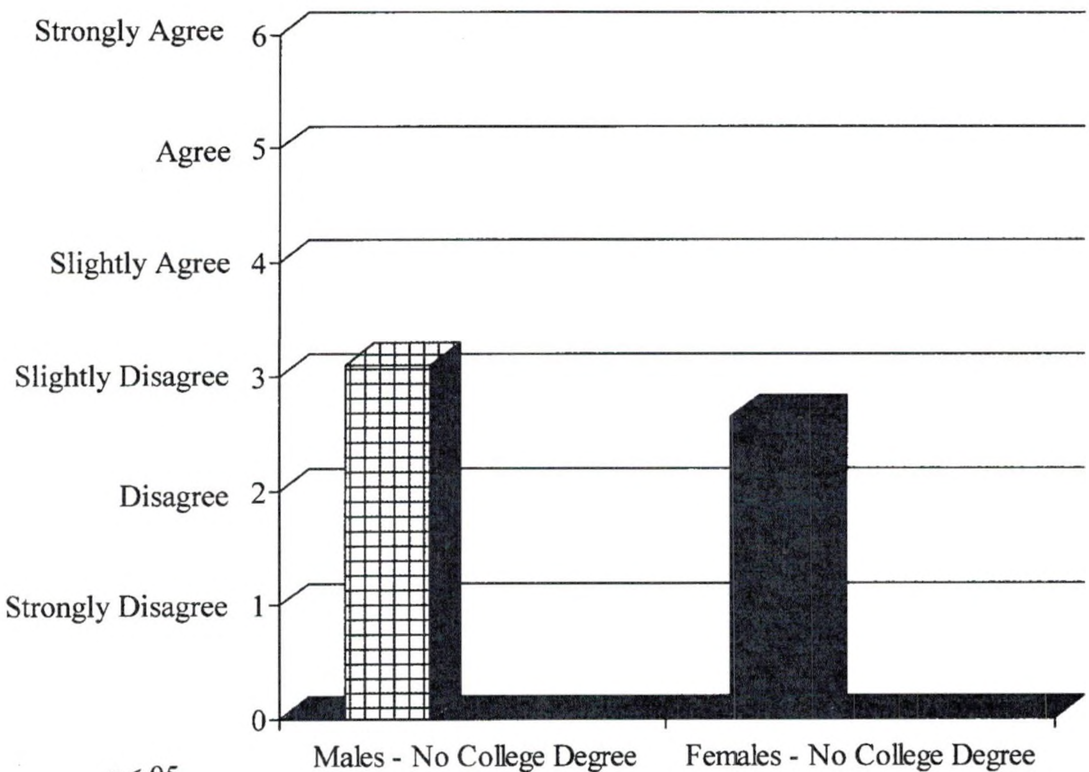
Perceptions of Females over Males Based on Parental Education Status



p<.05

This means that females whose parent had a college degree (3.06) felt less prepared than males whose parent had a college degree (3.49).

Perceptions of Females Over Males Based on Parental Education Status



$p<.05$

This means that females whose parent did not have a college degree (2.65 mean) felt less prepared than males whose parent did not have a college degree (3.10 mean).

Appendix E
Qualitative Data Responses.

N = 231 Males = 100 Females = 131	Comment:
Science: Males	No Response. (53) These males indicated that they did not utilize peer tutoring on the survey checklist. I haven't used it. (6) I cannot tell you about peer tutoring. It is not applicable since I have not used it. I want to have peer tutoring, but I'm too lazy to actually go and get tutoring. I'd rather be tutored by my friends. I have only been to one session for chemistry, but I found it helpful. I believe peer tutoring affects retention in STEM courses. (3) I do not receive peer tutoring, and I have no idea if peer tutoring affects retention in STEM courses. I have not done any peer tutoring courses, but I think peer tutoring affects retention in STEM courses.
Technology: Males	I have never had it. (2) I have never done peer tutoring, so I am not sure if it would affect retention in STEM courses. I have never done peer tutoring, so it is not applicable to me. I am sure that peer tutoring affects retention in STEM courses. Peer tutoring does affect retention in STEM courses.
Engineering Males:	I haven't ever used it, and I am unsure about whether peer tutoring affects retention in STEM courses. I am not sure, I have never been involved. I haven't utilized peer tutoring while at UND. (9) I am not sure if peer tutoring affects retention in STEM courses. I don't know what peer tutoring involves. I have been a peer tutor for 6 years. I don't have peer tutoring experience, I don't have an opinion. The peer tutoring that I use has an R.A., which hosts a study session in my dorm. He is a mechanical engineer who is one year ahead of

	me, and has taken all the classes I am taking and often he can better explain material to me better than professors. He works with me one on one and works through any problems I have, step by step to help me understand them. I've visited physics tutoring center to get help with physics homework. It helped. Professors should be forced to take mandatory teaching courses. Just because you're a professor does not mean you're a teacher. I think peer tutoring affects retention in STEM courses, yes, I would say so. I used peer tutoring for math and physics a lot. Without it I would have never made it through. But, UND has no such tutoring for the engineering department…so, I don't know. I do know that I would have never made it through without friends to help me. The professor never has time or doesn't care enough to spend the time with the students. Peer tutoring does affect retention in STEM courses. I have tutored my younger sisters. That's about as far as my exposure to tutoring goes. Peer tutoring is good. Peer tutoring for me is one word, none. Teach study habits, then allow those students who need "tutoring" to learn on their own.
Mathematics Males:	I get a better understanding from what I learn because it is one-on-one tutoring. I have never had the need to utilize peer tutoring, but I do believe it is highly useful. Students I'd tutored in high school got substantially higher grades due to help they'd received. I've never had peer tutoring. (2) In high school, if I was ever stuck on math homework, I would just go and get help from tutors, but I have not done so in college. The tutoring in the math department is under staffed! Yes, I do think peer tutoring affects retention in STEM courses.
Science Females:	I have been tutored for my chemistry class, and it has helped a lot. I am learning much better in the tutoring environment!

	I appreciate student tutoring, yet prefer to have teacher one on one help. I have not had peer tutoring. I used to be a peer tutor in high school and use it here at UND. I have never had peer tutoring before. I've never done peer tutoring, but will start with chemistry. It sounds like it would help a lot. The study sessions in chemistry really help me understand the concepts better, because they give me a chance to talk about things and work them out on my own. I think peer tutoring affects retention. It seems to improve retention. Not applicable, I have not received peer tutoring. Peer tutoring is very helpful and efficient. Peer tutoring is very helpful! It is essential for some courses. Maybe it will improve retention in STEM courses. Peer tutoring will probably improve retention, but I haven't heard much about it. The peer tutor I had for Chemistry 115 was helpful. Sometimes tutors are only offered when I have class or work, so I would like to attend but cannot. I have no tutoring experience in STEM courses. I plan to utilize it in Chemistry 115, as I am struggling with some concepts. I really should do it, I need to, I struggle in chemistry class. I think that perhaps sometimes peer tutoring improves retention in STEM courses, but not always. It helped me to better understand the material. One-on-one teaching makes a big difference. Peer tutoring is wonderful! I think peer tutoring improves retention in the STEM courses because of the repetition. I believe that tutoring has gotten me where I am today, and I will continue to come to peer tutoring. My roommate is really good at math and so is my dad, so they really help me when I don't understand. It helped me with my previous math courses.
Technology Females:	No Response. (66) These females indicated that they did not receive peer tutoring on the survey checklist. No Response. (10) These females indicated that they do receive peer tutoring on the survey checklist.

	I have never used the peer tutoring program. (9) I have never used tutoring, but I probably should. I believe it would help my academic success. I don't know if it would improve retention in STEM courses. I have never had a peer tutor, but I would think peer tutoring would improve retention in STEM courses. I haven't gone, and I am not sure if it would improve retention in STEM courses. I never have done it, but I am sure it would help. It's good to learn in different ways. I've previously used math tutoring for technology courses. I believe peer tutoring affects retention in STEM courses. I've never used this service. Peer tutoring is greatly helpful. I also tutor and know it can help to hear the same information from someone at the same level as you who gets it. I am new to UND and have not been informed of where or how to utilize this. What is a STEM course? I do not believe peer tutoring is helpful in retention. I have tutored others in high school, but have never really needed a tutor myself. Sometimes they can explain things in ways you will understand better than your teacher. This professor should not be teaching… I did not receive peer tutoring. I have never had peer tutoring experience, but if I need help in a class, it would be a good resource to use. I've never needed tutoring assistance. I don't know what this really even is. Not applicable. (2) I am currently receiving tutoring and it has been such a wonderful experience. I would recommend it to anyone who needs it. I have not used tutoring myself, but I am a tutor in Norwegian language.
Engineering Females:	There were no females registered in Engineering 313.

Mathematics Females:	I have never used the service provided by UND, but I do work on difficult classes like STEM classes with my friends and that helps me enormously. I have used the math learning center. GREAT! I learned a lot and found it very helpful. I recommend it to everyone. It was useful when there was a tutor available. I have not had any experience with peer tutoring. I think peer tutoring improves retention. I haven't had much, but what I have participated in was helpful. It is nice to know that tutoring is an option, even if it isn't always needed. My experience with peer tutoring has only been positive and beneficial. However, I have heard others say tutors were too busy with other students to help much. I have not had any peer tutoring experience, but it would probably have been helpful in some of my courses. Peer tutoring really helps! In high school I have always seemed to struggle in math, so taking a math class in college was something and is something this is a bit frightening to me.

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