

THE RELATIONSHIP OF PARENTAL INFLUENCE ON STUDENT CAREER
CHOICE OF BIOLOGY AND NON-BIOLOGY MAJORS ENROLLED
IN A FRESHMAN BIOLOGY COURSE

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A Dissertation

Submitted to

the Graduate Faculty of

Auburn University

in Partial Fulfillment of the

Degree of

Doctor of Philosophy

Auburn, Alabama
December 15, 2006

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Mitzie Leigh Sowell, daughter of James Edward and Dianne (Bye) Sowell, was born October 25, 1971, in Lake Providence, Louisiana. She graduated from Kilbourne High School as an honor student in 1989. She graduated with honors with a Bachelor of Science degree in Physical Education from the University of Southern Mississippi in May, 1993. She then graduated from Northwestern State University with a Master's of Education in Physical Education in December, 1994 and with a Master's of Science from the University of South Alabama in Physical Education in August, 1997. After working in the area of physical fitness and cardiopulmonary rehabilitation, she obtained an additional Master's of Education degree from the University of South Alabama in Curriculum and Instruction with an emphasis in secondary biology in August, 2001. She then entered the Doctor of Philosophy program in Curriculum and Teaching with an emphasis in biology education at Auburn University.

DISSERTATION ABSTRACT

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Doctor of Philosophy, December 15, 2006
(M.Ed., University of South Alabama, 2002)
(M.S., University of South Alabama, 1997)
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123 Typed Pages

Directed by Charles J. Eick

Recent declines in science literacy and inadequate numbers of individuals entering science careers has heightened the importance of determining why students major in science or do not major in science and then choose a science-related career. Therefore, the purpose of this study was to examine the relationship between parental influences and student career choices of both males and females majoring and not majoring in science. This study specifically examined the constructs of parental occupation, parental involvement, and parental education levels. Aspects indicated by the participants as being influencers were also examined. In addition, differences between males and females were examined. A total of 282 students participated in the study;

122 were science majors and 160 were non-science majors. The data was collected through the use of a student information survey and the Modified Fennema-Sherman Attitude Scale. The findings suggest that students indicated the desire to help others, peers, salary, and skills as influencing their career choice. In regard to the various parental influences, mother's occupation was the only construct found as a statistically significant influencer on a student's decision to major in science. The results of this study can help educators, administrators, and policy makers understand what influences students to pursue science-related careers and possibly increase the number of students entering science-related careers. The results of the study specifically provide information that may prove useful to administrators and educators in the health science fields, particularly nursing fields. The findings provide insight into why students may choose to become nurses.

ACKNOWLEDGEMENTS

The author would like to thank Dr. Charles J. Eick for assistance with the entire writing process and Dr. David Shannon for assistance with statistical analyses. In addition, the author would like to thank Dr. William Deutsch and Dr. Octavia Tripp for serving as committee members and Dr. Margaret Ross for serving as the outside reader. Thanks are also due to all family members for their support during the course of this study. The author would like to specially thank her parents, Jim and Dianne Sowell, for their constant support during her entire educational experience. Thanks are also due to numerous friends, especially to Caroline for encouraging me, providing editorial assistance, and caring during this project.

Style manual or journal used: American Psychological Association. (2001). *Publication Manual of the American Psychological Association* (5th ed.). Washington, DC: American Psychological Association.

Computer software used: SPSS, Inc. (1997). *Statistical Package for the Social Sciences* (Version 8.0 for Windows). Chicago, IL.

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CHAPTER 1

INTRODUCTION

In 1957 the Russians launched Sputnik, the first spaceship to orbit the Earth. As a result, the United States of America realized that it was no longer first in science and technology (Pressley and Woloshyn, 1995). Consequently, numerous reform measures have been introduced in an attempt to improve science instruction in order to prepare students for careers in science, mathematics, and technology (Wang & Staver, 2001). However, according to the National Science Board's (NSB) *Science and Engineering Indicators 2006* report, students in the United States still lag far behind its international counterparts in science (2006). The NSB also reported that the number of individuals obtaining advanced degrees in science and producing scientific publications has decreased drastically over the years.

In 1996, the National Research Council (NRC) stated that science literacy was necessary in order to produce students that could successfully enter a workforce with the required skills. According to briefs developed by the National Science Foundation (NSF), such scientific and technical skills are needed due to the link between a nation's economic status and science and technology (Consortium for Policy Research, 1995; NSB, 2006). In order for a nation to progress and remain economically stable, scientifically skilled individuals must be available to employers (Munro & Elsom, 2000). In a letter to colleagues of the NSB, Chairman Warren Washington stated, "It is

absolutely essential for our Nation's long-term prosperity and security that we remain a world leader in science and technology" (NSB, 2006).

Science-related careers are in great demand in today's society and pay approximately 50% more than nonscientific careers having the same degree of educational requirements. However, the total number of people preparing to enter such careers is not enough to meet the increasing numbers of available jobs; even though the total number of professionals is increasing (NSB, 2006). In addition to the NSB, Gatta (2001) also reported that during the past thirty years, the percentage of the population of Americans entering science careers has continued to decrease. Furthermore, the NSB estimates that over 5 million new jobs will be created in science and technology fields by the year 2008.

A variety of reasons exist as to why the number of available jobs currently exceeds the number of employable individuals. The NSB (2006) suggested that the even though the total number of individuals entering the science workforce is increasing, the total number is still not adequate because students in the United States are not skilled in science. In addition, the organization also suggested that the number of individuals retiring from science-related careers is on the increase. Therefore, in the United States, a current trend exists where the total number of skilled people available to replace individuals leaving science careers is not adequate when combined with the total number of new jobs each year.

In order to increase the number of students majoring in science and choosing science-related careers, researchers must first understand what influences students to choose a major and a career. According to Dawson-Threat and Huba (1996), the first

college major declared is the greatest predictor of the degree a student obtains upon graduation and is also the greatest predictor on future occupation. Reid (2002) stated that college majors are chosen for a variety of reasons, such as potential earnings, educational institutions, teachers, peers, and parents. In other words, careers with higher salaries influence students to choose majors that would allow them to enter into such careers and obtain higher salaries. In addition, the strength of the individual departments, the professors within departments, and the goals of departments within educational institutions can influence students to select specific majors.

Reid (2002) also reported that teachers may influence students into selecting careers that are similar to the area of interest of the individual teacher. In addition, Reid stated that peers influence other students by providing advice about majors, professors, and educational departments. Regarding parents as an influencer, Reid acknowledged that the occupation of parents impacts the specific major choice. The researcher suggested that parents tend to influence their children into choosing a major that would lead to a career that is similar to the career of the parent. Regardless of the reason, Reid reported that college major choice generally leads to a career within the same field.

Statement of the Problem

DeSouza (2000) stated that the increase in world population has resulted in the need for an increase in science careers, particularly in biology-related careers. In order to meet the need for more scientists and biologists, an increase in individuals majoring in science and biology must coincide. However, according to Naizer (1993) and Gatta (2001) the number of science-based jobs and the number of skilled individuals available

for work is not equal, because the number of available jobs is greater than the number of individuals prepared to enter those jobs.

Purpose of the Study

Due to the unbalanced supply and demand of the current science-based job market, understanding factors that influence the student's career choice is necessary (Gatta, 2001). The purpose of this study is to determine the relationship between parental influences and student career choices of both males and females majoring and not majoring in science. This study specifically examines the constructs of parental occupation, parental involvement, and parental education levels. The purpose is to examine the relationships between the three constructs and the decision of students to major in science and possibly enter into a science-related career. This study also examines whether or not the above mentioned relationships differ between male and female students. Examining both science majors and non-science majors aids in determining why students do or do not major in science and could lead to interventions to increase the number of science majors.

In addition to examining various aspects of parental influence and gender differences, other aspects that were indicated as influencers by the students were examined. The purpose in examining student indicated influencers was to determine whether or not students identify their parents as being influencers on their career choice. In other words, parental influencers will be examined by looking at relationships between parents and whether or not the student chose science as a major. These relationships will be used to determine significance. Including influencers as indicated by the student could help to strengthen the results of the parental influence factors. For example, if statistically

significant relationships are found between the parents and the decision to major in science, and the students also indicate that parents are an influencer on their career choice, the results will be stronger.

Research Questions

The following research questions are posed for this study: (a) What is the relationship between parental occupation and the decision to major in science, (b) what is the relationship between parental involvement and the decision to major in science, (c) what is the relationship between parental education levels and the decision to major in science, (d) what are the relationships among student indicated influencers and the decision to major in science, (e) do science majors score higher on science attitude surveys than non-science majors, and (f) do gender differences exist in the number of male and female science majors, in attitudes in science, and in any of the other above listed influences?

Hypotheses

The following hypotheses are assumed to occur as a result of this study: (a) The occupations of mothers and fathers will influence whether or not students decide to major in science; (b) the more parents are involved in science-related activities with their children, the more apt the child will be to major in science; (c) higher levels of education of both mothers and fathers will influence students to choose science as a major; (d) students will indicate that their parents were major influencers in their decision to major in science; (e) science majors have more positive attitudes toward science than non-science majors do; and (f) the number of males majoring in science is greater than the

number of females majoring in science, males have more positive attitudes toward science than females, and influences on career choice differ between males and females.

Limitations of the Study

Various limitations existed in this study and could possibly influence the results. The sample was skewed in that it contained more biology/life science majors specifically majoring in the health sciences than other science fields. The sample was also skewed in that there were a significantly greater number of female participants than there were male participants. This could possibly be due to the fact the institution in which the study was conducted consists of a large variety of programs within the health field. In addition to the skewed sample, instruction in previous science courses most probably varied among participants and, therefore, could possibly have influenced their attitudes toward science. The results of the study could also be influenced by whether or not the participants answered the questions honestly. The results could also be influenced by the fact that the majority of the participants' parents had not graduated from college, suggesting that most of the participants' parents were working class members of society.

The current study is limited to students that volunteered to participate in this study. A total of 282 students participated in the study; 122 science majors and 160 non-science majors. Of the 146 students enrolled as biology majors, 122 surveys were returned. This is a return rate of 83.6%. However, it is not known if all students were present the day the survey was given. No administrators reported any students refusing to participate in the study. Three instructors were unable to administer the surveys to their non-majors classes. Of those, one instructor simply was unwilling to administer the surveys to the appropriate class. In addition, two of the instructors were part-time

employees and time constraints restricted them from being able to obtain the surveys. Therefore, of the 503 total students enrolled in the non-majors course, only 339 were potential participants, assuming they were present on the first day of class when the survey was administered. Of the 339 non-majors, 160 surveys were returned, suggesting a return rate of 47.2%. Again, none of the administrators reported any students refusing to participate in the study. The return rate reflects the number of absences and the number of individuals who may not have been registered for the first day of class when the survey was administered.

Definitions of Terms

Majors and Non-majors – For the purpose of this study, science majors are defined as those individuals in college that are majoring in a career option in the basic sciences, engineering, or health sciences. Science non-majors are defined as those individuals in college that are not majoring in the basic sciences, engineering, or health sciences.

Attitude – For the purpose of this study, attitude is defined as the degree to which students majoring or not majoring in science like or dislike science and science-related activities.

Parental Involvement – For the purpose of this study, parental involvement is defined as the extent to which parents or the parent participated in or provided experiences in science-related activities outside of formal schooling.

Student Indicated Influencers – For the purpose of this study, student indicated influencers are those influences that the participants stated as being most influential on their career choice.

CHAPTER 2
REVIEW OF LITERATURE

Science Majors

Reform programs such as Project 2061 have been implemented in order to ensure science literacy for all Americans (American Association for the Advancement of Science [AAAS], 2005). In addition, the NSB (1983) instituted programs aimed at increasing science ability of American students. The goal of the NSB was to increase science literacy in order for American students to be first internationally by the year 1985. In 2006, the NSB stated that science literacy and achievement must increase in order to provide enough individuals to work in science jobs. The board also stated that American students have to improve in science because the work-related skills are becoming more complex and analytical. However, according to recent reports by the NSB, American students are not the best in the world and they remain close to the bottom of all competing nations. The competing nations consist of the 30 nations that are members of the Organisation for Economic Co-operation and Development (OECD).

Naizer (1993) suggested that increasing science literacy and achievement is simply not adequate to increase the number of individuals entering into the science workforce. Naizer conducted a study and found that in order to increase the science workforce, those involved, particularly parents and teachers, must increase interest. Naizer continued to state that in order to increase interests, students must be allowed to

explore science by being introduced to science materials through hands-on activities. Naizer also stated that it is necessary that students attend more science-related field trips, participate in more science fairs, and read more science-related materials in order to increase science awareness. In addition, the researcher stated that it is equally important that all opportunities be equally provided to both males and females in order to increase the numbers of both genders entering science careers

Some researchers and organizations relate the decreasing number of scientifically skilled individuals to the fact that students are graduating or leaving American schools without the adequate knowledge required to be scientifically literate (NSB, 2006). Recently, the NSB reported that American fourth and eighth graders performed above the international average on tests measuring science knowledge and skills. However, the NSB also reported that Americans aged 15 years scored lower than the international average on the ability to apply science concepts. In other words, American students perform well in the area of learning facts and performing skills, yet are unable to apply that information later. Consequently, the ability to apply such information is necessary in order to perform complex science-related jobs.

Such decreases have concerned policymakers for decades due to the importance of science and scientific-related careers on society in general and the economic impact of science and science careers (Osborne, 2003). Therefore, measures have been initiated in order to recruit individuals into scientific fields. Such measures include enhancement money and undergraduate internships that promote hands-on activities and actual work experiences in science fields (Seymour & Hewitt, 1997). According to the authors, individuals become more interested in science when they perform more science

experiments. In a similar study, Phillips, Barrow, and Chandrasekhar (2002) also found that interest in science is increased when students are allowed to conduct more science experiments. The researchers conducted a study in which 32 female students entering grades 10, 11, and 12 were enrolled in a 10-day chemistry program. The goal of the program was to design a commercialized building in which bouncing balls could be made from polymers. The participants studied all aspects of production including the engineering of the building and the chemical properties of making the bouncing balls. The participants were allowed to design their facilities on paper and build models of their buildings. Phillips et al. indicated that the students reported that they enjoyed activities that allowed them to blow things up. The researchers also suggested that interest decreases when students' attention is directed toward the learning of facts.

Researchers suggest that the decision to major in science and then choose a career in science is influenced by a variety of factors. Wang and Staver (2001) suggested that the decision to choose a science-based career is dependent upon student aptitude and the quality of educational instruction in science. Mervis (2001) suggested that differences in career aspirations are different based on gender. A number of other researcher claim that gender greatly influences whether or not students major in science or do not major in science (NSB, 1989; Ware & Lee, 1988).

Other researchers have suggested that career aspirations in science are dependent upon prior achievement in science and subject matter confidence (Mau, 2003). Norby (2004) stated that individuals choose careers in general based upon a variety of sociological issues such as pleasure, convenience, and cost of training. Others suggest that parents are the number one influence upon whether a student chooses a career in

science (Bender, 1994). Still others imply that career aspirations result from previous experiences and interests (Jacobs, Finken, Griffin, & Wright, 1998). Additional research has suggested that career choice is related to implicit egotism, positive associations of one's self (Pelham, Mirenberg, & Jones, 2002).

Parental Influence

The influence of family and parents on career choice and interests has been suggested to be a result of the family systems theory (Kantor & Lehr, 1975). The family systems theory suggests that what happens within one aspect of the family affects all other aspects of the family. Laverty (2001) suggested that the family systems theory explains why student careers are influenced by family. However, according to Hotchkiss and Borow (1984), career choice is dependent upon the role of the family. In other words, a variety of aspects of the family influence career choice, including the occupations of the parents, education level, and socioeconomic status. The researchers stated that the social status of the family directly relates to the ability of an individual to attend college and attending college directly relates to achieving an occupation.

According to Hotchkiss and Borow (1984), students choose a career that will enable them to maintain the same socio-economic status of their family. In addition, a number of parental influences have been investigated over the years in a variety of research studies. However, for the purposes of this study, the parental influences of parental occupation, parental involvement, and parental education levels were examined.

Parental Occupation

According to Betz and Fitzgerald (1987) family members provide a tremendous amount of influence on student career choice. The researchers specifically suggested that

parental employment is a major influence on student career choice, specifically female career choice. Betz and Fitzgerald found that females whose mothers work will be more likely to develop careers outside the home than females whose mothers do not work. In addition, daughters of working females are more likely to develop careers outside of the realm of the occupations traditionally considered to be female careers.

Arsenovic, Timothy, and Zoleko (2005) surveyed 66 female students between the ages of 14 and 19 years old. The purpose of the study was to examine relationships between whether or not the females were schooled at home or attended a public school and career choice. Arsenovic et al. (2005) also examined the relationships between academic success and parental occupation on career choice. The researchers found that the occupation of mothers had more influence on the career aspirations of daughters. Arsenovic et al. suggested that this finding probably resulted because female students are able to identify with their mothers more than with their fathers.

Other research studies have also suggested that parents are the most influential factor in determining student career choice (Bender, 1994; DeRidder, 1994; Hairston, 2000; Small & McClean, 2002) and that such influence begins in children as early as age four (Clark & Horan, 2001). According to Small and McClean, parents provide encouragement and support in career decisions. Small and McClean also reported that teachers play a major role in identifying abilities and aptitudes of students; however, it is the parent that influences career choice by acting as a role model. The researchers continued to state that parents encourage their children to choose careers similar to their own. In other words, Small and McClean reported that parents influence their children to pursue careers in the same area as their own career simply by acting as a role model.

According to Conroy (1997), the father influences career choice more often than the mother. Conroy conducted a study on 750 students in grades 7-12. The students completed a survey consisting of questions about grade level, average grade, and gender. The survey also included questions concerning the families of each student. These questions included information about parental occupation, parental educational level, and family composition. Conroy concluded that the occupation of the father influences student career choice. In addition, Conroy suggested that the occupations of fathers correlate even stronger to female career choice than the career choice of males. Previous research by DeRidder (1994) also suggested that the father's occupation is the greatest influence on career choice of both male and female students. However, in a much earlier study, Holland (1963) reported that the occupation of the father is more closely related to the choice of sons.

In a qualitative study conducted by Norby (2004), one participant stated that the single most important influence on his interest in science was his father. The participant continued to state that his father influenced him the most because he was a nurse and was a good role model for individuals employed in a career that is not typical of gender. Norby contacted 100 female workers in the field of science and technology in order to examine the effect of role models on their career decision. Of those contacted, only 21% responded. Of the respondents, 90% stated that role models occupying jobs in science and technology fields are important influencers on career choice. However, only 19% of those responding reported that their mother's occupation was in science and technology.

Parental Involvement

Lankard (1995) suggested that family members provide the most influence on student career choice. The author suggested that family influence stems from family background and parental involvement. According to Middleton and Loughead (1993), parental involvement exists within three different categories. The authors suggested that parental involvement includes positive involvement, noninvolvement, and negative involvement.

Middleton and Loughead (1993) explained that positive involvement occurs when parents help students with their career decisions by providing information and allowing the student to make his/her own decision. In other words, the parent may discuss career options and guide the student in choosing a career, yet does not force the student into making a specific decision. The researcher also suggested that family can hinder career choice by not being involved in the student's career decision or by being negatively involved. Negative influences can influence student career choice as a result of noninvolvement or negative involvement by parents. For example, parents that are very demanding or attempt to control every aspect of their child may influence the child into choosing a career completely opposite from what the parent wishes.

According to Pearson and Dellma-Jenkins (1997), students whose parents encourage them to attend college are more likely to enter post-secondary institutions than students whose parents did not encourage them to attend college. Hairston (2000) stated that parents are the most influential factor in determining career goals due to several significant factors. Hairston suggested that parents help to establish the value that college is important and that they as parents expect their children to attend college. In addition,

Hairston suggested that students have a strong desire to imitate their parents and if their parents went to college, students will more likely attend college and choose the same profession or career as their parents.

Other researchers have also suggested that parents can influence their children by providing a variety of experiences at an early age. Naizer (1993) provided evidence that experiences such as hobbies, books, movies, television, nature observations, and field-trips that are related to science may help to increase the interests of children and correlate highly to students entering college and choosing science-related careers. The author reported that providing science-related equipment for hobbies such as microscopes, chemistry sets, fossils, rocks, bugs, and models can influence a child's future career ambitions. In addition, Naizer also suggested that taking children on science-related field trips, watching and discussing science-related movies and news articles, and taking children on nature observations will increase the likelihood that the student will attend college and choose a science-related career in the future.

In addition to Naizer (1993), other researchers have also reported that students are more likely to be interested in science and choose a science-related career if they have been introduced to science experiences at an early age (Joyce & Farenga, 1999; Kahle, Matyas, & Cho, 1985). According to Joyce and Farenga, parents and teachers must provide early experiences in science and science careers in order to increase the number of individuals choosing science as a career. Kahle et al. also reported that extracurricular activities such as looking through a telescope, touching a snake or lizard, or taking care of animals can greatly increase interests and career choice. However, the researchers suggested that the influence is greater in males than in females.

Not only are the above influences important, but the age at which the influence occurs is also a factor. Clark and Horan (2001) provided a summary of past research concerning parental influence and suggested that parental influence includes exposure, values, beliefs, socialization skills, skills training, future aspirations, opportunity, and a variety of other parental influences that influence a child's career choice. In other words, parents play a very important role in providing experiences that expose their children to different activities and help to provide a variety of skills. In addition, parents instill their own values and beliefs in their children. Clark and Horan also reported that the opportunities that parents provide or do not provide their children may have an effect on the future aspirations and career choice of the child. The authors stated that above factors begin becoming influential as early as age four.

Clark and Horan (2001) also reported that parental influences vary based on genders. For example, the authors suggested that daughters are faced with even greater challenges concerning career decisions when compared to their male counterparts. According to Clark and Horan, females are still exposed to sexist ideas that they cannot enter into traditionally male dominated careers such as science and engineering. In the past, stereotypical ideas suggested that females had to choose careers that would allow them to attend to the needs of their spouse, their children, and the daily activities within the household. Clark and Horan suggested that parents attempt to decrease stereotypical thoughts of females concerning their future careers by exposing their daughters to the same activities and experiences being provided to males. The authors continued to suggest that in order for parents to exert the most influence on student career choice, parents first must be educated on how to provide such influences.

In 1952, Roe conducted a study on 64 male scientists in order to determine what influenced them to choose science-related careers. Roe found that 53% of the scientists were children of professional men. The researcher suggested that this phenomenon is most likely due to the values and beliefs instilled upon learning. Another interesting conclusion that derived from this study was that more than half of the participants did not decide to become scientists until their junior or senior year in college. The participants stated that it was not until this time were they exposed to research and hands-on activities relating to science.

Parent Education

In addition to parental involvement, some researchers suggest that the level of parental education provides the most influence on student career aspirations (DeRidder, 1990; George & Kaplan, 1998; Kniveton, 2004; and Mortimer, Dennehy, & Lee, 1992). However, past research studies concerning the influence of parental education provide conflicting information. For example, DeRidder suggested that low levels of parental education were most closely related to low parental income and a decreased likelihood of the children attending college. The author reported that parents with lower levels of education usually are employed in lower level jobs. DeRidder continued to state that parents discuss their own jobs in front of their children or with their children and these discussions influence the child's career decisions. In other words, children are influenced when they hear their parents discussing the daily aspects of what job activities their jobs entail. In addition, children hear their parents discussing negative or positive aspects of their jobs. These discussions may peak a child's interest in a certain career or deter them from entering certain careers.

In 1998, George and Kaplan used data compiled from the National Educational Longitudinal Study of 1988 (NELS: 88) in order to examine parent and teacher influences on student attitude. The original NELS: 88 included 24,599 students and 10,868 science teachers. After deleting all missing data and only including students whose science teachers were also surveyed, the data for George and Kaplan's study included information from 7,980 participants. The results of the surveys indicated that the level of parent education and the level of teacher involvement is a statistically significant indicator of attitudes toward science. George and Kaplan specifically found that higher levels of parent education increases parental involvement and higher levels of parental involvement increase student attitudes toward science. In addition, the researchers also found that the activities provided by and conducted by teachers increased student attitudes. In other words, student attitudes toward science were more positive in classes where teachers provided teacher demonstrations and more student activities including participation in science fairs, science clubs, and student experiments. However, George and Kaplan did not examine the interaction between the influence of teachers and parents on student attitudes toward science.

George and Kaplan's (1998) study was designed to examine the influences of parents and teachers on science attitudes and did not specifically examine the influence of parent education on science career choice. However, according to previous research conducted by Mason and Kahle (1988) and the NRC (1996) students with more positive attitudes toward science have higher interests in science-related careers and tend to choose science-related careers. Therefore, the assumption could be made that higher

levels of parent education would influence interests in science-related careers through increased parental involvement.

In an earlier study Mortimer et al. (1992) specifically found that parental education is a significant influencer on the career decisions of students. Mortimer et al. conducted a longitudinal study in which 1,000 ninth grade students were randomly sampled. During the four year study, the participants completed a questionnaire in grades nine, ten, eleven, and twelve. The researchers examined a variety of aspects concerning influences on vocational career decisions. In one specific area of the study, Mortimer et al. examined the influence of parent education, family composition, mother's occupation, race, and family income. Of those five influencers, the only one that was found to be a significant influencer on the career choices of both male and female students was parent education. The researchers concluded that parents with higher levels of education influenced student career aspirations more than parents with lower levels of education.

Despite past research suggesting a relationship between parental education levels and career choice, recent research provided conflicting evidence concerning the influence of parental education levels on career choices of students. In 2004, Kniveton surveyed 384 students between the ages of 14 and 18 years. The researcher examined the education levels of parents by comparing students whose parents graduated from high school and students whose parents had obtained a degree from a university. Kniveton found that no differences existed between higher levels of parental education and lower levels in relation to influencing student career choice.

Student Indicated Influences

Parents, Teachers, and Mentors

Numerous research studies have been conducted in order to determine what students indicate as being the main influencers on their career choice. A number of research studies have suggested that parents are the major influence on student career choice (Bender, 1994; Dick & Rallis, 1991; Lindner, 2004; Mason & Kahle, 1988). According to Lindner, parents are a major influence on student interest in science and science-related careers. Lindner surveyed 402 middle school students concerning their beliefs about science and what influenced those beliefs. According to the results, the people who influence science beliefs included parents, teachers, friends, and other family members such as siblings. Participants that possessed more positive beliefs toward science and science-careers were those individuals that indicated family members, such as parents and siblings, as influencing their beliefs. Lindner reported that a variety of people influenced career choice; however, the author did not indicate who was the most significant influencer or the least. In other words, did parents influence the students more than teachers, friends, and other family members?

Bender (1994) conducted a study in order to examine the influences on the career choice of females. Bender surveyed and interviewed 409 students in the 12th-grade. The sample included 210 female participants and 199 male participants. The author found that students, regardless of gender, indicated that their parents were the main influencer on their career decisions. In addition, the students indicated that their parents were so influential in their career decisions that if their parents did not support their current career

choice, the student reported that they would change their career decision to meet the desires of their parents.

In a previous study, Dick and Rallis (1991) surveyed 2,213 male and female high school students in order to explore influences on career choice. Both males and females majoring in science reported that parents and teachers play a major role in influencing their decision to choose a science career more often than those individuals not majoring in science. In addition, the researchers found evidence suggesting that females not majoring in science are influenced by personal interests more often than other individuals. In other words, females do not major in science because they are not interested in science.

Mason and Kahle (1988) suggested that parents are the number one influence on student career choice. Mason and Kahle surveyed 550 ninth grade biology students in order to examine attitudes of students towards science and science-related careers. In addition to parental influence, the researchers found that teachers influence science attitudes. Teachers were divided into an experimental and control group. The teachers in the experimental group attended workshops and presentations aimed at improving science teaching strategies. The students in the experimental group classes scored higher on science attitude surveys than did the students in the control group classes.

In a recent study conducted by Downing, Crosby, and Blake-Beard (2005), female science majors indicated that mentors or guides were influential in their career decision to major in science and choose a science-related field. The authors surveyed female undergraduate science majors in order to determine what influenced them to pursue a career in science. Of those surveyed, 90% stated that mentors provided positive support

in increasing their interest and helping them to decide to major in science. However, the participants also reported that even though most of the mentors were female, the most influential mentors were male.

Interests and Skill

Naizer (1993) conducted a qualitative study in which interests and career choices of 300 professors of science and engineering were examined. The author found that career choice is directly related to both student ability and student interests. Naizer also reported that ability and interests develop early during the primary school years. Based on these findings, Naizer suggested that education and activities during elementary school should stress natural curiosity including field trips, hands-on activities, and unstructured exploration.

Morgan, Isaac, and Sansone (2001) found that interest is an attribute an individual achieves when he/she becomes competent and has the ability to dominate an activity or environment. Other researchers have suggested that interests are determined by the ability to obtain expectations (Lent, Lopez, & Bieschke, 1991). Wiens, Depping, Wallerich, Van Laar, and Juhl (2003) studied sophomore, junior, senior, and master's level biology majors at a University in Northern Iowa. Wiens et al. found that interests develop early in life, usually before the age of twenty years old. The authors also reported that interest in science was most often a result of curiosity, school experience, and teacher influence. Males reported interest due to curiosity more often than females and females reported teacher influence as being a contributing factor of interest in science more often than males. According to Levin, Sabar, and Libman (1991), females do not perform as well in science classes as males because female students lack self-confidence, are not

interested in science, and females do not aspire to perform science-related activities; therefore, females do not choose science-related careers as often as males choose careers involving science.

In addition to interest, student aptitude has been shown to influence student career choice. According to Wang and Staver (2001), student aptitude includes student ability, motivation, and developmental level or age. Student ability includes both current and previous academic abilities. Traditionally, research has provided evidence that students possessing high skill levels and high levels of academic achievement in science courses will continue to enroll in higher level science courses and will be more apt to choose careers in science (Hill, Pettus, & Hedin, 1990). Hill et al. continued to state that individuals with a high level of academic ability in science will be more likely to major in science and choose a career in science.

Reeve and Heggstad (2004) analyzed data collected during a previous research study titled Project TALENT (PT). PT was a longitudinal study which examined the relationships between ability and interests and career choice among a sample of high school seniors across the United States. Follow-ups were conducted five years and 11 years after the participants graduated high school. The five-year sample included 9,695 males and 16,620 females. The 11-year sample included 8,884 males and 7,283 females. Reeve and Heggstad found that ability is positively associated with interests and career choice.

In a more recent study, Jacobs (2005) analyzed information from the past 25 years concerning career choice. The authors specifically examined why not enough individuals are employed in the sciences and why some begin careers in science and switch to other

areas. According to Jacobs, individuals choose careers in science if they believe that have the abilities and skills necessary for those careers. The researchers continued to state that females do not believe they possess the necessary skills required for science careers; therefore, females are less likely than males to choose a career in science. However, Jacobs did suggest that these differences are most often in the field of physical sciences, not biological science.

Salary

In addition to the previously mentioned influencers, Lupart, Cannon, and Telfer (2004) found that students, regardless of gender, are influenced by salaries. The researchers surveyed 1,419 seventh and 10th-grade students in order to examine gender and age differences on future career aspirations and academic performance. Lupart et al. found one of the top career choices of females was in the area of health care while males choose careers in the sciences, law, and computers. The authors also reported that even though salary is important to males and females, higher salaries are more important to males than females. Females reported a desire to help others in order to ensure that the world is a better place. Therefore, salary influences the career choice of males more than females, and males felt that they could achieve higher salaries in careers related to the fields of computers, law, or science.

Morgan et al. (2001) examined the influence of interest on the career goals of college students. The study included 61 female and 55 male college students between the ages of 18 and 36 years old. Morgan et al. reported that male students were more likely to report choosing careers based on salary expectations than female students.

Dick and Rallis (1991) also found that salaries influence career choice. The results were similar to that of Lupart et al. (2004) in that Dick and Rallis found that male students reported that salaries are a significant factor influencing their choice of careers more often than female students. In addition, other researchers have also found salaries to be significant influencers upon career choice. Mariani (1997) suggested that salaries do indeed influence career choice. However, the researcher stated that salary is only an influencer in careers in computer science, business, and engineering.

Peer Influence

In addition to the above mentioned influencers, students also indicate that their peers influence their career decisions (Adams, 1980; Lindner, 2004; Reitzes & Mutran, 1980). Lindner reported that students gain information concerning future careers from a variety of sources. Although the researcher did indicate that the most influential providers of career information included parents, teachers, and other family members, Lindner did suggest that students are also influenced by information gained from their peers.

In addition to Lindner (2004), Adams (1980) also reported that students are influenced by their peers when making career decisions. However, in Adams' book, the author suggested that peer influence is not equal between males and females. Adams reported that females are typically more often influenced by their peers than male students.

Reitzes and Mutran (1980) also suggested that peers influence student career plans. The researchers surveyed 396 college students in order to examine factors that motivate students to make future decisions. Reitzes and Mutran found that peers, particularly significant others, do directly and indirectly influence future career

aspirations and other future plans. The researches suggested that significant others influence student career choice by encouraging them to attend college and pursue a particular career path. However, Reitzes and Mutran also revealed that significant others can hinder educational and career plans by discouraging their mate to attend college or choose a specific career. Reitzes and Mutran further suggested that such encouragement or discouragement is reflected through the use of praise which, in turn, influences a student's self-esteem and affects student career choice.

Helping Others

A number of past researchers also reported that students are influenced in their career decisions by the desire to help others (Career Institute for Education and Workforce Development [CIEWD], 2002; Hemsley-Brown & Foskett, 1999; Jones, Howe, & Rua, 2000; LeGrand & Shelledy, 2002; Morgan et al., 2001). The CIEWD surveyed 809 students enrolled in high-schools across the United States as juniors and seniors. Of those surveyed, half were male and half were female. According to the researchers, the number one career choice in their study was health care. In addition, the overall influencer on the students' career decisions was the desire to help others.

Morgan et al. (2001) concluded that women are more likely to enter careers in health care than careers in physical science and math. The researchers suggested that females choose health-related careers because they want to be involved with people and help people. In addition, Morgan et al. reported that a significant number of males in their study also reported choosing careers based on the desire to help others; however, females were more likely to base their career choice on the ability to help others than males.

LeGrand and Shelledy (2002) conducted a study in which 64 respiratory care students were given a survey in order to determine why they choose a career in the health field. The authors concluded that one of the most important factors was the desire to help others. In a previous study, Hemsley-Brown and Foskett (1999) surveyed 410 students between the ages of 10 and 17 in order to examine their perceptions of nursing careers. The researchers found that both male and female students perceive nursing to be a gender specific occupation. In other words, nursing is an occupation to be held by females. Hemsley-Brown and Foskett also found that female students reported that they aspire to be a nurse because they want to help others.

Science Attitudes

Daniel House (2001), one of the leading researchers examining student attitude and science achievement, suggested that student attitudes, including expectancy of success and self-concept, are significant predictors of science success. The author also suggested that student attitude has shown to be even more significant as a predictor of science success than previous academic performance. Earlier work by House (1995) suggested that attitude directly influences the choice to enroll in and attend future science courses as well as choosing majors that include science courses. In addition, Mason and Kahle (1988) suggested that students possessing more positive attitudes toward science also possess higher interests in science-related careers and are more likely to choose a science related career.

Gender Issues

In 1989, the NSB reported that women made up only 26% of the scientists in the USA. The number of individuals majoring in science and entering a science career has

traditionally been dominated by the male gender. However, the number of females majoring in science and entering science careers has begun to increase (Ware & Lee, 1988). In 2004, the NSF reported that the number of females entering science careers has continued to increase in number each year since 1966. According to the NSF, the total number of females occupying science careers in 2001 was reported to be 783,500 while the number of males occupying those same careers was reported to be 1,562,200. In other words, males hold 66.6% of all science-related jobs, compared to 33.4% of females. In contrast, the NSF reported that females occupy more jobs outside science and engineering fields than their male counterparts.

Parental Influence

Early researchers suggested that the lower number of females entering science careers could be due to the assumption that parents relay messages to their daughters that may discourage them from choosing careers in science (Roe & Siegelman, 1964). According to Mau (2003) females are not as likely as males to continue their career plans in science. Males are more persistent in scientific careers as a result of achievement and self-confidence. Mau stated that self-confidence is a direct influence of parent expectations and that parents influence career persistence.

Family Issues

Often, females are discouraged from obtaining careers due to their desire to marry, have children, and raise a family (deWet, Ashely, & Kegel, 2002; Mervis, 2001). Mervis concluded that females are less likely to engage in science-based careers due to issues including discrimination, marriage, and family. Mervis suggested that men hold more science jobs than females because females desire to marry, birth children, and raise

their children. According to de Wet et al. biology stipulates that females become pregnant and give birth; however, it is society that discriminates against females. The researchers suggested that many females leave science-related careers or never start them because discriminating behaviors of society place the demands of raising children on the female. In addition, Ware and Lee (1998) reported that females choose their careers based on their future plans to raise a family.

Science Attitude

Previous studies have suggested that greater numbers of males in science result from attitudes toward science (Breakwell & Robertson, 2001; Morgan et al., 2001). According to Koballa (1989), it is important to examine attitudes toward science in order to determine measures that could be taken to improve attitudes toward science and increase science literacy. A number of studies have been conducted in order to examine attitudes toward science.

According to Breakwell and Robertson (2001), males exhibit more positive attitudes toward science than females. The researchers found that females do not like science classes as much as males because they feel that they do not perform well in science. Breakwell and Robertson also suggested that females do not participate in non-school activities relating to science as often as males do and females simply have more negative attitudes toward science than males.

Morgan et al. (2001) reported that women continue to be underrepresented in science due to their attitudes toward science. The authors conducted a study involving 88 college females and 63 college males. Morgan et al. reported that women are less likely than males to choose science careers because women tend to believe that they are less

competent in science than men. The authors also reported that males find science more interesting than females. Both findings add to the unbalanced nature of the two genders majoring in science and choosing science-related careers.

Most studies have indicated a gender difference concerning attitudes toward science, with males having more positive attitudes than females (Breakwell & Robertson, 2001; Morgan et al., 2001). However, in a research study conducted by Mason and Kahle (1988), the results suggested that no statistical significance difference existed between male and female attitudes toward science. The researchers surveyed a total of 550 students enrolled in 24 different general high school biology courses. Of the 550 participants, 282 were assigned to a control group and 248 were assigned to an experimental group. The experimental group was taught by teachers who had recently participated in a teacher intervention program designed to improve attitudes toward science and career interest in science. Although no statistical differences were found between the male and female participants concerning science attitudes, males did score significantly higher on the career interest survey than females.

In an earlier study, Kahle, Matyas, and Cho (1985) found no significant differences between male and female attitudes toward science. The researchers surveyed a total of 297 high school biology students from seven different states. The sample was part of a previous study concerning the analysis of teaching strategies. Even though no statistically significant differences were found between males and females concerning attitudes toward science, the researchers' findings suggested that males still exhibit higher levels of interests in science careers. Therefore, the number of females entering science careers continues to be lower than the number of males entering science careers.

Although, the number of females in science lags behind the number of males in science and female attitudes toward science have been found to be less positive than their male counterparts in many research studies, specific branches of science are more evenly matched when comparing the two genders. For instance, biology is said to be a neutral science related to gender. In other words, no statistically significant differences exist between the number of male and female students majoring in and choosing biology-related careers.

Science Experiences

According to Jones et al. (2000) career choices of both males and females are related to life experiences; however, the experiences are different for the different genders. The authors suggested that females are more often exposed to activities including cooking, healthy eating, and gardening. Such experiences have resulted in females choosing biology-related careers. According to Jovanovic and King (1998), girls simply believe that they are better in other subjects than they are in science; therefore, females choose careers related to other subjects. Ware and Lee (1988) suggested that females do not complete as many mathematics and science courses in high school as males; therefore, females do not participate in the same science experiences as males.

In contrast, males are more often exposed to tools, equipment, and electronic toys. Exposures such as these often lead males into careers involving physical science (Jones et al., 2000). The authors reported that males tend to choose these careers for notoriety, power, and financial wealth. In addition, past researchers suggest that boys like science more than girls and that boys like science more than they like other subjects (Lightbody & Durndell, 1996).

Mau (2003) suggested that educators need to identify males and females aspiring to have careers in science and employ methods that increase achievement and confidence for both males and females. According to a more recent study conducted at the Massachusetts Institute of Technology (MIT), females are less likely to enter a science-related career due to the lack of science experiences during their early childhood. The researchers, Snover and Harris (2003), stated that females do not receive adequate science experiences which, in turn decreases their self-confidence, their abilities, and their preparedness.

Role Models

Hill et al. (1990) found that the main effect on whether or not students choose a career in science is directly related to and dependent upon the amount of time spent with an actual scientist, regardless of gender. The researchers conducted three separate studies within their investigation. The participants in the investigation included 522 students in middle school and high school. In addition, 185 students from a university were also included. The results suggested that personal contact with scientists increased the probability that the student will choose science as a major. Hill et al. also found that on average females simply do not like science as much as males and that college major is influenced by what students like.

As a result of their study, Hill et al. (1990) suggested that efforts should be made to increase the number of females entering science. The authors stated that male teachers should introduce well-known female scientists as part of curricula. Hill et al. also stated that efforts must begin during the primary school years prior to the development of attitudes and interests.

Jacobs et al. (1998) stated that a mother's attitude towards science is influential in female students choosing careers in science. The authors conducted a study on 220 girls ranging in age from 15-18 years old. The participants completed a questionnaire containing questions about interests, perceptions, science courses taken, abilities in science, extracurricular activities, and college major plans. Jacobs et al. concluded that girls displaying talents in science were more likely to choose science-related careers if their mothers possessed positive beliefs and values about women choosing science careers and if their mothers possessed positive attitudes towards their daughter's ability in science.

Luzzo and McWhirter (2001) reported that female students are not as likely, compared to males, to choose a career in a science field because females are discouraged from doing so. The researchers suggested that the lack of encouragement is a result of various psychosocial aspects such as an inadequate number of female role models employed in science careers and a lack of information concerning science careers. Luzzo and McWhirter continued to state that sex role stereotypes are major discouragers that have decreased the number of females entering science careers.

According to Otto (2000), regardless of gender, both males and females are guided by their mothers more than they are guided by their fathers when making career plans. Otto conducted a study to determine students' perception of the influence that their parents have on their career choice. The participants included 203 female and 159 male high school students. The results suggested that students do perceive that their parents, particularly their mothers, can assist them when making career plans.

Family Constraints

Past research has focused on determining predictors of science majors and individuals choosing science as a career. Individuals that choose to enroll in science courses have been shown to be traditional indicators of persons who will major in science. In addition, both males and females with high educational goals and higher records of prior achievement in science have traditionally chosen science-related degrees (Ware & Lee, 1988). Ware and Lee also stated that only 14% of the females in their study chose science as a major. The authors stated that the most prevalent reason that females did not choose to major in science was due to the future family plans of female students. In other words, females believe that they cannot have careers in science and raise a family.

Implicit Egotism

Despite claims concerning gender differences and other influence, recent research has suggested that major decisions in life may simply be a result of implicit egotism (Pelham et al., 2002). The researchers defined implicit egotism as the relationship between positive feelings about oneself and social behavior. In other words, the behavior of individuals is directly related to how good the individual feels about themselves. Pelham et al. continued to state that these positive feelings lead to making major life decisions based on connections to the individual. For example, the authors hypothesized that career choice is not really based on rational decisions, but is more closely related to the first three letters of a person's name.

Pelham et al. (2002) conducted ten separate studies as part of a single investigation in order to examine the relevance of implicit egotism. In study seven, the

researchers conducted searches for dentists whose first name began with the letters *den* and for lawyers whose first name began with the letters *la* or *law*. The results suggested that females whose name begins with the letters *den* are likely to become dentists. Pelham et al. conducted numerous statistical measurements resulting in statistical significance ($p < .05$) and concluded that the findings were most likely a result of implicit egotism.

Summary

According to the literature, it seems evident that attitudes toward science are significant indicators of whether or not students will major in science and become interested in selecting a science-related career (House, 1995; House, 2001; Mason & Kahle, 1988). According to House, individuals with more positive attitudes toward science are more likely to enter into science-related careers than individuals possessing less positive attitudes toward science. In addition, a great deal of the literature also suggests that parents are the major influencer on career choice (Bender, 1994; Hairston, 2000; Small & McClean, 2002). Not only does the literature suggest that parents are the greatest influencer on career choice, but parents also report that they feel that they are the main influencers. In a recent study conducted by Taylor et al. (2004), the parents that were surveyed stated that they perceived themselves as the most influential aspect in determining the career choice of their child. However, the parents went on to state that skill and interest do play a role but it is the responsibility of the parent to make sure their children are provided with the information that they need when choosing a career field.

The occupation of the parent (Conroy, 1997; Holland, 1963) has also been suggested to influence the career choice of students. In addition, the extent or type of

parental involvement has an influence on science career choice (Hairston, 2000; Naizer, 1993; Pearson & Dellma-Jenkins, 1997). Other studies have suggested that education levels of the parent influence what career the student may or may not decide upon (DeRidder, 1990; George & Kaplan, 1998; Mortimer et al., 1992) However, conflicting results have suggested that the education level of the parent is not an influencer of student career choice (Kniveton, 2004).

A large number of studies have also examined the various factors that students indicate as being influential upon their career decision. According to some researchers, students indicate that parents are the number one influence on their career decision (Bender, 1994; Dick & Rallis, 1991; Lindner, 2004; Mason & Kahle, 1988). In addition, Lindner also found that teachers play a major role in influencing student career choice. Still, other studies state that students make their career decisions based on interest (Lent et al., 1991; Naizer, 1993; Morgan et al., 2001; Wand & Staver, 2001; Wiens et al., 2003), salary (Dick & Rallis, 1991; Lupart et al., 2004; Mariani, 1997), peer influence (Adams, 1980; Lindner, 2004; Reitzes & Mutran), and helping others (Hemsley-Brown & Foskett, 1999; Hurley & Thorp, 2002; Jones et al., 2000; LeGrand & Shelledy, 2002).

Since females comprise a mere 26% of the scientists in the US (NSB, 1989), a number of studies have reported that gender differences exist between male and female students as to why they chose the careers that they do. According to Mau (2003) and Roe and Siegelman (1964) parents influence their male and female children differently by relaying messages that influence self-confidence towards selected careers. Some researchers suggest that females lag behind in the sciences due to attitude differences. Male students possess more positive attitudes toward science than female students

(Breakwell & Robertson, 2001; Morgan et al., 2001). Jones et al. (2000) suggested that differences in attitudes could be due to the difference in science-related experiences that males and females receive in school. Snover and Harris (2003) suggested that these differences also occur at home during their early childhood. According to Hill et al. (1990), Luzzo and McWhirter (2001) and Otto (2000) role models, including scientists and parents, influence male and female students differently. For example, females need role-models that are female or they need to learn about female role-models. Females also need to be taught about scientist and prominent leaders in science that were female. Females also need to be taught that science occurs in the everyday world, not just in a lab by male scientist. Furthermore, females tend not to decide upon a science-related career due to the constraints of raising a family (Ware & Lee, 1988).

As presented in the review of literature, a number of studies provide evidence as to what influences the career decisions of students. However, some research studies provide conflicting results and may be somewhat dated. In addition, the research has been conducted on a variety of different age ranges in a variety of different settings. Due to the fact that an inadequate number of individuals are available for science-related careers (NSB 2006), it is important to continue research in order to gain a better understanding of what currently influences students to major in science and enter into a science-related career.

CHAPTER 3

METHODS

The purpose of this chapter is to provide an in-depth explanation of the research design and variables measured. In addition, the instrumentation, sampling, and data collection procedures are described. Finally, data analyses as it pertains to each research question are discussed. A significance level of $p < .05$ was used for all statistical procedures. All analyses were performed using the Statistical Program for Social Sciences (SPSS), a statistical software program for Windows XP. The results of all examined variables, demographic data, and reliability are provided in the results section.

Overview

This study is important in order to better understand factors that influence interest in science which in turn influences the decision to major or not major in science and enter into a science-related career. In addition to simply understanding influences on career choice, this study is also important in being able to apply the information learned in an attempt to increase the number of scientists and individuals entering into careers related to science.

Individuals entering science fields of study have been in increasing demand for more than three decades (NSB, 2006). The NSB also reported that the number of individuals entering into science-related careers has increased from 3.3 million to 4.6 million since the 1990's; however, the number of jobs available has increased at a faster

rate. Therefore, the number of available jobs in science fields exceeds the number of individuals available to fill the positions. Furthermore, the NSB suggested that the number of trained and educated individuals entering into science-related careers will continue to increase at a rate slower than the rate of job availability. This trend suggests a continued imbalance between the number of jobs available in science fields and the number of skilled individuals entering the workforce.

Numerous factors could contribute to decreases in enrollment, including money, time, academic demand, and family constraints. In order to increase the number of individuals entering science-related careers, one must first understand what influences individuals to choose a science career. Early research conducted by Roe (1952) suggested that interests developed early in life affect career decisions made later in life. Wiens et al. (2003) suggested that science-related interests begin to develop as early as age eight years. Therefore, the importance of exploring what influences individuals to select science as a major is vital in order to be able to influence early interests and increase the number of individuals entering science careers. Such information could be applied at an early age to foster interests in future students to major in science and steps could be implemented in order to increase the number of potential science majors. In addition, programs could be developed and implemented which could foster more individuals choosing science-related careers.

Research Questions

In order to determine the overall relationships that exist between parental influences and the decision to major or not major in science and then enter into a science-related career, six different research questions were examined. The first aspect of parental

influence that was examined and, subsequently, the first research question was the relationship between parental occupation and the decision to major in science. The second research question examined the relationship between parental involvement and the decision to major in science. Research question three was designed to determine the relationship between parental education levels and the decision to major in science. The fourth research question examined the relationships between student indicated influencers and the decision to major in science. Again, this research question will help strengthen results concerning the various parental influences if students indicate parents as being a major influencer on their career choice. Research question five was implemented in order to determine whether or not science majors achieve more positive scores on science attitude surveys than non-science majors. For the purposes of exploring gender differences, the sixth and final research question examined whether differences existed between the number of male and female science majors. In other words, do more males major in science than females? Research question six also examined whether or not males have more positive attitudes toward science than females and whether or not gender differences existed between other influences on career choice. For example, do differences exist between student indicated influences and gender and between all other influences on career choice and gender.

Instrumentation

The data was collected through the administration of two separate surveys. The first survey included the Student Information Survey (Appendix A). This survey was developed by the researcher and included close-ended questions used to obtain information concerning demographic data, student major choice, and information

concerning parental influences. The second survey administered was the Science Attitude Scale (Fennema & Sherman, 1976).

Alkhateeb (2004) performed reliability analyses on the 47 items of the Science Attitude Scale. Alkhateeb concluded that internal consistency estimates of the reliability of scores were within acceptable limits. The coefficient alpha ranged from .72 to .89. Therefore, the Science Attitude Scale was suggested to be a reliable and valid measure in assessing attitudes toward science. Cronbach's alpha coefficient was utilized to determine the reliability of the Science Attitude Survey between students majoring in science and not majoring in science in order to ensure that the survey consistently measures attitudes toward science in the present study.

Participants

The participants in the study included 282 volunteer students conveniently sampled from a junior college located in the Southeast United States. The institution serves an average of 30,000 students per year at five different campus sites. The average student age is 28.8 years. In regard to gender, 61.1% of the students are female and 38.9% are male. The institution offers more than 100 programs of study including a variety of associate degrees, certificate programs, and high school diplomas. Of the students attending this institution, 25% attend full-time, 23.2% attend half-time, and 51.8% attend less than half-time. Included within the various programs of study are 23 health-related programs which represent the specialty area of the institution. In order for students to be admitted into associate degree programs, the students must possess a high school diploma from an accredited institution and must have taken either the American College Test (ACT), the Scholastic Aptitude Test (SAT), or the College Placement Test

(CPT). Admission requirements into other programs vary; however, all participants in this study would have been admitted on the basis of obtaining an Associates degree.

All participants were enrolled in either a biology for majors course or a biology for non-majors course. Of those sampled, 122 (86 female and 36 male) participants were science majors and 160 (98 female and 62 male) participants were non-science majors. For the purpose of this study, participants labeled as science majors included all students majoring in biological, physical, or earth sciences and all students majoring in a health-related or allied-health field in which biology is a required subject. Students majoring in health-related fields included nursing majors, pre-med, pre-dental, pre-veterinary, and pre-pharmacy students. The allied-health majors included students in physical therapy, occupational therapy, sonography, radiography, or exercise science. Participants labeled as non-majors included all other fields of study. Those fields identified by the participants as non-science included business, history, education, computer science, pre-law, art, mathematics, English, psychology, and sociology. The participants indicated on a survey which field of study they were currently enrolled. The data presented in Table 1 represents the various fields of study, the frequencies of each, and the percentages of each.

Table 1

Comparison of Fields of Study

	Frequency	Percentage
Science-related		
Biology/Life Sciences	16	05.7%
Chemistry/Physics	03	01.10%
Health Sciences	64	22.7%
Allied Health	23	08.2%
Other	16	05.7%
Total	122	43.3%
Non-science		
Pre-Law/Political/English	20	07.1%
Business	39	13.8%
History	03	01.1%
Education	19	06.7%
Computer Science	08	02.8%
Art/Music/Theatre	12	04.3%
Psychology/Sociology	16	05.7%
Math/Statistics	03	01.1%
Undecided/General	37	13.1%
Total	160	56.7%

With regard to gender, 184 (65.2%) of the total participants were female and 98 (34.8%) were male. The ethnicity of those surveyed included 206 (73.3%) Caucasians, 31 (11.0%) African Americans, 12 (4.3%) Hispanics, 11 (3.9%) Asians, and 21 (7.4%) responding as other. Of those responding as other, 10 participants did not supply a specific response, and the remaining 11 consisted of a variety of interrelated ethnic groups. In addition, 1 (0.4%) participant did not answer the question.

Regarding the year in college, 118 (41.8%) participants were sophomores, 117 (41.5%) were freshmen, 34 (12.1%) were dual enrollment, 12 (4.3%) indicated other, and 1 (0.4%) did not respond to the question. Dual enrollment students include junior and senior high school students also enrolled in college courses. Participants that checked other were either taking the course to satisfy a requirement to enter graduate school or were taking the course as a transient student.

Regarding age, 22 (7.8%) were younger than 18 years old, 63 (22.3%) were 18 years old, 60 (21.3%) were 19 years old, 51 (18.1%) were 20 years old, and 86 (30.5%) were over 20 years old. In addition, 43 (15.2%) of the participants had taken more than four science courses in high school, 126 (44.7%) had taken four science courses in high school, 66 (23.4%) had taken three science courses in high school, 36 (12.8) had taken two science courses in high school, and 10 (3.5%) indicated that they had only taken one science course in high school.

In reference to parental upbringing, who actually raised the participant, 195 (69.1%) of the participants responded that both their mother and father were responsible for their upbringing. In addition, 7 (2.5%) of the participants stated that they were raised by their father only and 53 (18.8%) stated that their mother raised them. Also, 25 (8.9%)

reported that someone other than their mother or father raised them. Of those responding to this category, the participants were either raised by grandparents, aunts, uncles, or siblings. In addition to those responding to the question regarding parental upbringing, two (0.7%) of the participants did not respond.

Data Collection

The two surveys, the Student Information Survey and the Science Attitude Survey, were administered at the beginning of the first class meeting of the 2006 spring semester. Anonymity was ensured by using a neutral third party, the course instructor, to administer and collect all surveys. Course instructors were asked to distribute the survey packets to each student present on the first day of class. The packets were distributed to five science majors classes and 11 non-majors classes by simply passing the correct number of packets down each row. In addition to containing the two surveys, the packets also included a cross-word puzzle that the students could complete if they did not want to participate in the survey. Once the packets were distributed, the instructors were asked to advise the students to read the consent form and complete the surveys if they choose to participate in the study. The participants were asked to complete both surveys and return them to a neutral location before leaving the classroom.

None of the instructors reported any students leaving and refusing to participate in the survey. Of the 282 participants completing the research packets, only one participant failed to complete any questions included in the Student Attitude Survey. In addition, five participants failed to complete the final page of the Student Attitude Survey, omitting questions 31 through 47 of the science attitude survey.

A total of 146 students were enrolled in the biology course for science majors. Of those enrolled 122 surveys were returned; therefore, 83.6% of the surveys were returned. A total of 503 students were enrolled in the non-majors course. Since three instructors were unable to administer the surveys to their classes, only 339 students were potential participants. Of the potential participants, 160 surveys were returned, indicating a return rate of 47.2%. The return rate reflects the number of absences and the number of individuals who may not have been registered for the first day of class when the survey was administered.

The Science Attitude Scale was administered to each participant to measure attitudes toward science (Appendix B). The Science Attitude Survey used was a 47 item Likert-type 5-point scale. For each statement, the individuals were instructed to circle a response on an answer sheet according to their feelings about the statement. Possible answers included strongly agree, agree, not sure, disagree, and strongly disagree. The purpose of administering the attitude scale was simply to ensure that this research study was consistent with other studies concerning science attitudes and choice of science major. Previous studies concerning science-related attitudes suggested that a positive correlation exists between student attitudes toward science and majoring in science and choosing science as a career (Koballa, 1989). This consistency in the data is important in order to ensure that the current study is reliable and valid in its findings. Since other studies have suggested that students majoring in science have more positive attitudes toward science than students not majoring in science, and the results of the present study suggest the same, the present study does seem to be reliable. In addition, this helps to

ensure that the two groups, majors and non-majors, are indeed two distinct groups based on career choice.

Data Analysis

Data were analyzed using frequency distributions, measures of central tendency, chi-square tests for contingency tables, and independent samples t-tests. Frequency distributions were performed on the demographic data obtained from the Student Information Survey. The demographic data obtained from each student included the student's current major, specific major field, gender, race, classification in college, age, and number of science courses completed.

Chi-squares or cross tabulations were performed to determine the relationships between each independent and dependent variable. The independent variables in the study included parental occupation, parental involvement, parental education levels, and student indicated influences. The dependent variable was whether the student was enrolled as a science major or not.

In addition, chi-squares were computed for the multiple variables of parental involvement. The parental involvement variables included participating in field trips with the student, encouraging the student to enroll in more science classes, providing additional science materials to the student, watching science-related television shows with the student, watching science-related movies with the student, attending zoos and wildlife areas with the student, allowing the student to visit occupation sites, providing guidance in helping the student make career decisions, and student desire to imitate their parents. Chi-squares were also computed for the multiple variables that students indicated as influencing their career choice decisions. The following variables were examined as

student indicated influencers: parents, salary, helping others, peers, teachers/counselors, skills, interests, and prior achievement.

Parental Occupation

The first research question examined the relationship between parental occupation and the decision to major in science. Parental occupation was determined by each student checking the occupation of their mother and father independently. Separate subheadings, one labeled mother and one labeled father, were included. Under each subheading 11 occupational categories were listed. The following categories were listed: none, science, healthcare, teacher, service, skilled labor, professional, business, homemaker, secretary, and other. However, during the statistical tabulations, two other categories were added, military and sales. In addition to checking the career category, the survey asked the students to specify the specific career of each parent.

In order for the chi-squares to be computed, a minimum cell size of five was necessary. The cell size reflects the number of individuals in each category. In order to meet the cell size requirements, a number of the categories were combined. In determining the significance of the mother's occupation on the student's career choice, science careers, healthcare careers, science teachers, and military fields specifying science-related careers were collapsed into one category. In addition, service fields and skilled labor were combined. Business and sales careers were also collapsed into one category. In addition to specific categories of occupations, a category listed as "none" was also included. The students were asked to specify their answer if they chose the "none" category.

When computing cross tabulations between the father's occupation and career choice, categories were also combined in order to meet the minimum cell size requirement. Science careers were collapsed with healthcare careers, science teachers, and military fields specifying science-related careers just as they were within the mother's occupation. In addition, education and professional careers were collapsed together as well as were service careers and skilled labor, and business and sales. A number of cells were also deleted due to a reported frequency of 0. Deleted cells included the secretarial and homemaker categories.

Parental Involvement

The second research question was designed in order to examine the relationship between parental involvement and the decision to major in science. When determining the level of parental involvement, a five question Likert-type scale was used that asked the participants to indicate the extent to which they believed their parents were involved in their career choice. The choices ranged from strongly agree to strongly disagree. The responses were analyzed by computing cross tabulations by crossing each response with the current major, science or not science.

Participants were also asked to indicate how their parents were involved in various aspects of their education and upbringing. A list was provided and the students were asked to check all ways in which their parents were involved. The list included participating in science field trips, encouraging more science classes, providing science educational material, watching science television shows, watching science-related movies, visiting zoos and wildlife areas, visiting the occupation sites of parents, providing guidance in career choice decision, and imitating the career of parents. An area

was also provided allowing participants to specify any other ways in which their parents were involved. Again, the responses were analyzed by computing crosstabulations for each variable with the current major.

Parent Education

The third research question was implemented in order to examine the relationship between the level of parental education and the decision to major in science. Parental education levels were determined simply by asking participants to check which level of education each of their parents had achieved. Two separate categories were listed, one for the mother's level of education and one for the father's level of education. The subcategories for each included attended high school, GED, graduated from high school, some college, graduated college, and other. The other subcategory also included an area in which the participant could specify their response.

Again, chi-squares were computed in order to determine the relationships between the level of education of each parent and the decision to major or not major in science. However, a number of the cells contained less than five responses and the subcategories were collapsed from six to three. The subcategories integrated in the cross tabulations included did not graduate high school, graduated high school, and graduated college.

Student Indicated Influences

Research question four examined the relationships between what students indicated as most influential on their career choice and the decision to major in science. In order to determine what students indicate as being influencers on their choice of college major and career choice, the students were asked to rank the top three influencers provided in a list. The list included the following influencers: parents, salary, leisure

time, helping others, peers, teacher/counselors, skill, interests, and prior achievement. The participants were instructed to rank the top three by numbering the influences one, two, or three, with one being the most influential and three being the least. However, over half of the participants did not read the specific instructions. Those participants placed a check mark by any responses that were influential. Therefore, the analysis was changed. Each response was coded into SPSS as either checked or not checked. Chi-squares were then performed in order to determine relationships between the influences indicated by the student and their decision to major or not major in science. In addition, chi-squares were computed to examine which specific science fields were more closely related to the influences indicated by the students.

Science Attitude

The fifth research question was implemented in an attempt to examine the relationship between attitudes toward science and the decision to major in science. An independent samples t-test was computed to examine attitudinal differences between science and non-science majors. Student attitude towards science was used because student attitude is a known predictor of whether or not students choose to enroll in science courses (Koballa, 1989). Therefore, the significance of performing an independent t-test is to ensure that this study is consistent with past research studies concerning the relationship between student attitude towards science and the decision to major in science and possibly choose a career in a science-related field. In addition, this will help to ensure the validity of two distinct populations of science and non-science majors.

Gender Differences

The final research question was utilized to determine whether males have more positive attitudes toward science than females. In addition, the final research question examined whether the number of male science majors was greater than the number of female science majors. This question also examined whether gender differences existed between gender and the student indicated influences and between gender and other influences on career choice. Gender was determined by asking the participants to check whether they were male or female. Attitude scores were determined by computing the total attitude score from the Science Attitude Survey. All other influencers had been previously determined in questions concerning parental occupation, parental involvement, parental education levels, and top influencers on career choice.

An independent samples t-test was computed in order to conclude if differences exist between genders and attitudes toward science. In addition, individual chi-squares were computed in order to examine differences between male and female science majors and all other influencers concerning career choice. Cross tabulations were computed against gender: parental occupation, parental involvement, parental education level, and influencers indicated by the student. All categories of parental involvement were individually computed against gender, including attending science field trips, encouraging more science classes, providing additional science materials, watching science-related television shows, watching science-related movies, visiting zoos and wildlife areas, taking students to occupation sites, providing career decision guidance, and the desire to imitate the career of parents. In addition all influencers indicated by

students were computed against gender. Such influencers included parents, salary, leisure time, helping others, peers, teacher/counselors, skill, interests, and prior achievement.

CHAPTER 4

RESULTS

Based on responses obtained from the Student Information Survey and Science Attitude Survey, various statistically significant predictors were found to be related to whether or not a student will or will not major in a science-related field and choose a science-related career. All of the analyses were interpreted according to Shannon and Davenport's (2001) self-instruction guide.

Reliability

First, reliability of the Science Attitude Scale was computed using Cronbach's Alpha in order to assess the internal consistency of the items within the survey. All of the correlations among the various subscales were positive, suggesting that the items were consistent in measuring attitudes toward science. Most of the inter-item correlations were at least .50, with the total being .8866. The highest correlation ($r = .8352$) existed between personal confidence of the subject matter and total attitude scores. The lowest correlation ($r = .3730$) existed between attitudes and the usefulness of the subject matter and suggesting science is perceived as a male domain. This suggests that the correlation between these two items is weak. In others words, the participants in this study did not view science as being useful only in the male domain. In addition, a coefficient alpha of .8081 was reported, suggesting the Science Attitude Survey possesses a high degree of internal consistency.

Next, chi-squares for contingency tables were performed to analyze the relationships between the independent variables and the dependent variables. Relationships were determined by examining the level of significance. An alpha level of $p < .05$ was used to assess the significance of each relationship. Once significance levels were established, standard z scores were examined in order to determine whether the relationship existed between the independent variable and science majors or non-science majors. In addition, phi scores were examined to determine the strength of significant relationships. Phi coefficients were used to measure the strength of the relationships between two dichotomous variables while contingency coefficients were used as a measure of magnitude for variable exceeding two categories.

Parental Occupation

The first research question examined the relationship between parental occupation and the decision to major in science. The chi-square results, including cell frequencies and percentages of parental occupations for both science and non-science majors are summarized in Table 2. Mother's occupation was suggested to be statistically significant, $p = .015$. In general, mothers of science majors were more likely to be employed in the service industry or in a field requiring skilled labor while the mothers of non-science majors were more likely to be homemakers. In addition, science majors were more likely than non-science majors to have mothers who were employed in administrative or secretarial positions ($z = 2.1, p < .05$). Although significance was found between mother's occupation and career choice, father's occupation was similar for both science and non-science majors.

In addition to the various categories of occupations, 40 of the total participants reported “none” as the occupation for their parents. The participants were asked to be specific if they choose the “none” category; however, only nine of the participants did so. As a result, six of the participants reported their parent had no occupation because they were retired, three stated that their parent had no occupation because they were no longer living, and the remaining participants did not specify why their parent fit the category.

Table 2

Comparisons of Parental Occupation

	Science Majors	Other Majors	Statistical Test
	N (%)	N (%)	Chi-Square
Mother Occupation			17.330*
None	14 (11.5%)	26 (16.3%)	
Science/Health	23 (18.9%)	40 (25.0%)	
Education	15 (12.3%)	19 (11.9%)	
Service/Skill	19 (15.6%)	13 (08.1%)	
Professional	07 (05.7%)	11 (06.9%)	
Business/Sales	19 (15.6%)	21 (13.1%)	
Homemaker	09 (07.4%)	24 (15.0%)	
Admin/Secretary	16 (13.1%)	06 (03.8%)	
Father Occupation			.967
None	17 (13.9%)	27 (16.9%)	
Science/Health	29 (23.8%)	42 (26.3%)	
Service/Skill	41 (25.6%)	35 (28.7%)	
Professional/Ed	12 (07.5%)	09 (07.4%)	
Business/Sales	38 (23.8%)	32 (26.2%)	

* $p < .05$

Parental Involvement

Research question two was designed to explore the relationship between parental involvement and the decision to major in science. Chi-square results, frequencies, and percentages presented in Table 3 reflect the degree of influence of parental involvement and the various ways in which the participants indicated that their parents were involved. Parental involvement as a whole was determined to be a statistically significant predictor of career choice, $\chi^2 = 9.596$, $p = .048$. The question of the degree to which students felt their parents were involved with their career choice was analyzed individually from the various aspects of parental involvement on the survey. The individual question was correlated with whether each participant was a science major or not a science major.

When asked to determine the degree to which students felt their parents were involved in their career choice, science majors were more likely to either strongly agree or strongly disagree that their parents were involved in their career choice. On the other hand, non-science majors were more likely to respond as “not sure” to this statement. Even though the overall chi-square test suggests statistical significance between parental involvement and the decision to major in science or not major in science, the standardized residual scores (z scores) failed to reach statistical significance for any specific category of response to this statement.

When comparing the various ways in which parents are involved in student career choice on the student survey, the only statistically significant relationship existed between whether or not parents participated in science field trips with the students, $\chi^2 = 8.276$, $p = .004$. According to these results, the highest relationship, $\phi = -.171$, existed

between parents attending science field trips. Surprisingly, more non-science majors reported that their parents attended science field trips with them (36.3% vs. 20.5%).

Table 3

Comparison of Parental Involvement

	Science Majors	Other Majors	Statistical Test
	N (%)	N (%)	Chi-Square
Involvement			9.596*
Strongly disagree	23 (19.2%)	17 (10.6%)	
Disagree	20 (16.7%)	40 (25.0%)	
Not sure	11 (09.2%)	24 (15.0%)	
Agree	43 (35.8%)	59 (36.9%)	
Strongly agree	23 (19.2%)	20 (12.5%)	
Field Trips			8.276*
Yes	25 (20.5%)	58 (36.3%)	
No	97 (79.5%)	102 (63.8%)	
Encouragement			2.265
Yes	25 (20.5%)	22 (13.8%)	
No	97 (79.5%)	138 (86.3%)	
Provided Materials			.005
Yes	27 (22.1%)	36 (22.5%)	
No	95 (77.9%)	124 (77.5%)	

TV Shows				.008
Yes	36 (29.5%)	48 (30.0%)		
No	86 (70.5%)	112 (70.0%)		
Movies				.060
Yes	20 (16.4%)	28 (17.5%)		
No	102 (83.6%)	132 (82.5%)		
Zoos				.775
Yes	89 (73.0%)	124 (77.5%)		
No	33 (27.0%)	36 (22.5%)		
Occupation Site				2.053
Yes	62 (50.8%)	95 (59.4%)		
No	60 (49.2%)	65 (40.6%)		
Guidance				.280
Yes	64 (52.5%)	89 (55.6%)		
No	58 (47.5%)	71 (44.4%)		
Imitate				.743
Yes	03 (2.5%)	07 (04.4%)		
No	119 (97.5%)	153 (95.6%)		

*p < .05

Parent Education

The third research question examined the relationship between the level of education of the mother and the father and the decision to major in science or not. Chi-square results, frequencies, and percentages presented in Table 4 reflect the influence of the education levels of both parents. After computing the chi-square, no statistically significant relationships were found among the variables. The results indicated that an overall majority of the participants' parents did not graduate from college. This finding could indicate that most of the parents were working class instead of professionals.

Table 4
Comparisons of Parental Education Levels

	Science Majors	Other Majors	Statistical Test
	N (%)	N (%)	Chi-Square
Mother's Education			1.676
Grad College	38 (31.1%)	61 (38.6%)	
Did Not	84 (68.9%)	97 (61.4%)	
Father's Education			.642
Grad College	46 (40.0%)	70 (44.9%)	
Did Not	69 (60.0%)	86 (55.1%)	

*p < .05

Student Indicated Influences

The fourth research question examined relationships between what students indicated as being influences on their career choice and the decision to major or not major in science. The chi-square results, frequencies, and percentages presented in Table 5 include the influences that the students stated impacted in their career choice. Of those examined, statistically significant relationships existed between salary ($\chi^2 = 4.747$, $p = .029$), peer influence ($\chi^2 = 7.312$, $p = .007$), helping others ($\chi^2 = 26.036$, $p < .001$), and skill ($\chi^2 = 14.709$, $p < .001$).

Table 5

Comparison of Student Indicated Influences

	Science Majors	Other Majors	Statistical Test
	N (%)	N (%)	Chi-Square
Salary			4.747*
Yes	72 (59.0%)	73 (45.9%)	
No	50 (41.0%)	86 (54.1%)	
Parents			1.389
Yes	37 (30.6%)	59 (37.3%)	
No	84 (69.4%)	99 (62.3%)	
Leisure Time			.463
Yes	08 (06.6%)	14 (08.8%)	
No	114 (93.4%)	146 (91.3%)	
Helping Others			26.036*
Yes	111 (69.4%)	49 (30.6%)	
No	48 (39.3%)	73 (59.8%)	
Peers			7.312*
Yes	02 (01.6%)	15 (09.4%)	
No	120 (98.4%)	145 (90.6%)	

Teachers/Counselor				.011
Yes	14 (11.5%)	19 (11.9%)		
No	108 (88.5%)	141 (88.1%)		
Skill				14.709*
Yes	30 (24.6%)	75 (46.9%)		
No	92 (75.4%)	85 (53.1%)		
Interest				.250
Yes	97 (79.5%)	131 (81.9%)		
No	25 (20.5%)	29 (18.1%)		
Prior Achievement				.037
Yes	12 (09.9%)	17 (10.6%)		
No	109 (90.1%)	143 (89.4%)		

* $p < .05$

In general, science majors were more influenced by salary, than non-science majors. Furthermore, a significantly greater number of science majors indicated that they were influenced by the desire to help others ($z = 2.8, p < .01$) than non-science majors ($z = -2.4, p < .01$). However, fewer science majors indicated that they were influenced by their peers ($z = -2.0, p < .05$). Non-science majors also indicated that skill influenced their career choice ($z = 2.0, p < .05$) more than science majors ($z = -2.3, p < .05$). The response choice was listed only as “skill”; therefore, it is not known whether individuals made their decisions based on the possession of a certain skill or the lack of a certain skill. Of

the four statistically significant influencers on career choice, the strongest relationship was displayed between the desire to help others and major in science, $\phi = .304$.

Chi-squares were also computed between the student indicated influencers and the different majors in science. According to the results, the influence of helping others is a statistically significant influencer on the decision to major in science or not major in science. $p = <.001$. Of the various majors, all were comparably influenced by the student indicated influencers with the exception of health science majors, $r = 1.8$, and the influencer of helping others. Of the 64 science majors indicating health science as their specific field, 49 (76.6%) indicated that they were influenced in choosing their major because they wanted to help others. In other words, all of the different majors in science were influenced by the desire to help other; however, the influence was greater among those students majoring in the health sciences. Of those 64 health science majors, 32 (50%) indicated they were majoring in nursing.

In order to examine the fourth research question concerning student indicated influencers, participants were asked to rank the top three influencers on their choice of college major. However, most of the participants checked three influencers instead of ranking the top three influencers. One of the categories that the participants could have chosen was parents. The results suggested that parents were not a statistically significant influencer on career choice. However, previously, the participants had stated that their parents were involved in the career choice, $p = .048$. The computed chi-squares for this research question produced conflicting results from the computations previously reported in this study.

Science Attitudes

In order to answer the fifth research question concerning attitudes toward science, an independent samples t-test was performed to determine that the mean attitude score for majors and non-majors were not equal. The t-test results presented in Table 6 suggested that a relationship exists between science majors and attitude towards science. At a significance level of $p < .05$, the relationship between attitudes toward science and the decision to major in science was statistically significant, $p < .001$. Therefore, the results suggested that science majors have higher positive attitudes toward science than non-science majors and the two populations were indeed consistent with past research results.

Table 6

Comparison of Total Attitude Scores

	Science Majors	Other Majors	Statistical Test	Effect Size
	Mean (SD)	Mean (SD)	t-test	η^2
Score	195.88 (21.23)	165.39 (26.92)	-10.30**	.275

** $p < .001$

Gender Differences

The purpose of the sixth and final research question was to examine gender differences among attitudes toward science, the number of male and female science students, and the parental influencers and student indicated influencers. In order to determine whether or not differences existed between male and female attitude scores, an

independent samples t-test was performed. The t-test results presented in Table 7 suggested that no statistically significant difference existed between attitudes toward science of males and females. Therefore, attitudes toward science are similar for both males and females.

Table 7
Comparison of Gender and Attitude

	Males	Females	Statistical Test	Effect Size
	Mean (SD)	Mean (SD)	t-test	η^2
Score	178.08 (28.02)	178.85 (29.38)	.213	.000

** $p < .001$

In order to examine whether or not gender differences existed among the number of science students, chi-squares were computed. The chi-squares, frequencies, and percentages presented in Table 8 reflect the number of male and female science students. At first glance, it may seem that females tend to choose science as a major more often than males. However, in this study, the majority (65.2%) of the participants were female. According to the results, no significant difference was found. This suggests that males and females, from the present sample, are equally apt to choose science as a major.

Table 8

Comparison of Male and Female Students

	Male	Female	Statistical Test
	N (%)	N (%)	Chi-Square
Science Students	36 (36.7%)	86 (46.7%)	2.607
Other Students	62 (63.3%)	98 (53.3%)	

* $p < .05$

In order to examine whether or not gender differences existed between males and females and previously mentioned parental influencers and student indicated influencers, chi-squares were computed individually between gender and each influence. The chi-squares, frequencies, and percentages presented in Table 9 reflect the influences on career choice separated by gender. The only two influencers that were suggested to be statistically significant were helping others, $p = .002$, and skill, $p < .001$. Females, in general, were more likely to indicate that the desire to help others influenced their career choice than males ($z = -2.1, p < .05$). However, males in general ($z = 2.7, p < .01$) were more likely to indicate that they were influenced by skill.

Table 9

Comparison of Male and Female Students Influencers

	Male	Female	Statistical Test
	N (%)	N (%)	Chi-Square
Helping Others			12.261*
Yes	29 (29.6%)	94 (51.1%)	
No	69 (70.4%)	90 (48.9%)	
Skill			18.242*
Yes	53 (54.1%)	52 (28.3%)	
No	45 (45.9%)	132 (71.7%)	

* $p < .05$

Summary

In summary, the results suggested that the occupation of mothers tends to influence the career decisions and major choices of students more than the occupation of fathers. Furthermore, students whose mothers are employed in the secretarial or administrative field or the service and skilled labor industry are more likely to major in science and choose a science-related career. Regarding education levels, neither the mother's level of education nor the father's level of education were influencers of career choice.

Science majors both strongly agreed and strongly disagreed that their parents were involved in their choice of major. However, the only statistically significant influencer of parental involvement was found when parents attended science-related field trips with students, but only for non-majors. Of the student indicated choices, parents were not considered to be a statistically significant influencer. This finding contradicted the results found when analyzing research question three concerning parental involvement. In other words, students strongly agreed that their parents were involved in their career decisions, yet when asked to rank the top three influencers on their career choice, parents were not found to be statistically significant. Possible reasons for these contradictory findings will be addressed in the discussion section.

The only student indicated influences that were statistically significant were salary, helping others, peer influence, and skill. According to the results, salary and the desire to help others were found to be statistically significant influencers on the career choices of science majors. In addition, peers and skill were found to be statistically significant influencers on the career choices of non-science majors.

With regard to attitudes toward science, the results suggested that science majors have more positive attitudes toward science than non-science majors. No statistical significance was found between male and female science attitude scores or between the number of female science majors and the number of male science majors. This finding is possibly due to the large number of female participants majoring in a biology field, particularly health-care. However, differences were found among two of the student indicated influencers and gender. Females, regardless of major, were found to be

influenced more often by the desire to help others. Males, regardless of major, were found to be influenced more often by skill.

CHAPTER 5

DISCUSSION

The purpose of this research study was to help identify parental variables that influence student career choices for science-related careers. The importance of this study lies in the previously mentioned fact that the number of individuals entering into science-related careers is far less than the number of science-related careers available. In addition, this imbalance directly correlates to a nation's economy and advancements in science and technology (NSB, 2006). Therefore, in order for the United States to be top ranked in science and technology, it is important to examine and understand why students choose science as a career or do not choose science as a career. The purpose of this chapter is to examine statistical results and attempt to discuss the meanings and outcomes according to each research question.

Parental Occupation

Regarding the relationship between parental occupation and the decision to major in science, it was hypothesized that occupations of both mothers and fathers would influence student career choice. However, the results suggested that mother's occupation was more likely to influence career choices than father's occupation. These results were consistent with previous research conducted by Arsenovic et al. (2005) and Betz and Fitzgerald (1987). However, the findings differ from the results of some previous

studies in which the father's occupation was found to influence career choice more than the occupation of mothers (Conroy, 1997; Holland, 1963; Norby, 2004).

Even though the occupations of mothers were suggested to be a statistically significant influencer on career choice, the specificity of the influence was not what was originally hypothesized. It was hypothesized that the specific occupations of the parents would correlate with the career decisions of the student. In other words, a student's decision to major in science or not major in science would be directly related to whether or not their parents were or had been employed in science-related careers or not. However, this was not the case. These results were inconsistent with previous research findings conducted by Small and McClean (2002) suggesting that parents encourage their children to pursue careers similar to their own.

The strongest relationships existed between administrative and secretarial positions and the decision to major in science, service industry and skilled labor positions and the decision to major in science, and being homemakers and the decision to major in fields not related to science. Specifically, students whose mothers held a secretarial or administrative position were more likely to major in the health sciences ($r = 1.8$) than any other science. In addition, students whose mothers were employed in the service or skilled labor industry were more likely to choose an allied health career ($r = 1.3$) than any other science career. Students whose mothers were homemakers were more likely to major in English ($r = 1.1$) than science or any other non-science field.

The results did provide some general information concerning career choice and the influence of parental occupation. When examining the three strongest relationships, it seems mothers may encourage their children to choose better careers than the mothers

had chosen. In others words, mothers encouraged their children to achieve more than they had achieved. The results are probably due to the student population of the institution. The majority of the student's reported that their parents were not college graduates. Therefore, regardless of their career choice, simply going to college and choosing a career more advanced than a secretary, homemaker, skilled labor, or service personal would be suggestive of a more positive career choice. This finding is consistent with the findings of Betz and Fitzgerald (1987) which suggested that females are more likely to develop careers outside the home if their mothers also worked outside the home. Betz and Fitzgerald also reported that females are more likely to choose careers that have traditionally been thought of as female careers. This finding is consistent with the current study in which the majority of the female science majors were majoring in the health sciences and 50% of those were majoring in nursing. According to Hemsley-Brown and Foskett (1999) nursing is thought of by most as being a female career.

Parental Involvement

The second research question examined the relationship between parental involvement and career choice. It was hypothesized that the more parents are involved in science-related activities with their children, the greater the chance the student would major in science and enter into a science-related career. The results were inconclusive as to whether or not parental involvement was really statistically significant. According to the p value, $p = .048$, parental involvement as a whole was suggested to be a statistically significant influencer on student career choice. However, no statistical significance for any specific category was reached. Therefore, no determinations can be made concerning the extent to which students state that their parents were involved with the career

decisions. This could be due to the finding that 30.5% of the students in the present study were over the age of 20 years old and the influence of parental involvement may no longer be perceived as an influence by the older student.

When examining each category of parental involvement, the only specific parental involvement indicator was participating in science field trips with parents and this was only significant in non-science majors. These results were inconsistent with previous research conducted by Naizer (1993) suggesting that parents help to influence their children to choose science-related careers by attending science-related field trips with their children and by watching science-related television shows and movies. These results could be due to the findings that suggested a greater percentage of the mothers of science majors were working class when compared to the mothers and fathers of non-science majors. According to the results, a total of 50 (17.7%) parents of non-science majors indicated they were either homemakers or had no occupation. Only 23 (8.2%) of the parents of non-science majors indicated that they were homemakers or had no occupation. Therefore, it seems a higher percentage of the parents of the science majors in the current study worked outside the home. This could have prevented the parents of the science majors from being able to attend science-related field trips as often as the parents of the non-majors. This could also have prevented the parents from watching science-related television shows or watching science-related movies with their child.

Parent Education

The third research question examined the relationship between levels of parent education and the decision to major in science or not major in science. It was hypothesized that higher levels of parent education would influence the student's

decision to major in science. According to the results, this was not found to be true. However, the results were supportive of previous research conducted by Kniveton (2004). Kniveton reported that parental education levels are not suggested to be statistically significant influencers on career choice. The researcher suggested that this could be due to the idea that the students further their education or aspire to achieve higher levels of education than their parents. This does seem to be consistent with the present study because the majority of the parents did not graduate college; however, all of the participants were attending college.

In addition to supporting current research concerning levels of parent education, the results also differed from various past research studies. DeRidder (1990) suggested that low levels of parental education decrease the likelihood of students attending college at a 4-year institution or 2-year institution. This was not found in the current study. Levels of education were not correlated with college attendance in the present study because all of the participants in the current study were attending a 2-year community college. However, the majority of the parents of the participants in the current study did not graduate from college, suggesting lower levels of education. So, it would appear that the lower levels of parent education did not negatively affect the decision to attend college or major in science or not major in science.

The results of the current study also conflicted with past research conducted by George and Kaplan (1998). Although the researchers did not specifically examine the influence of parental education levels on career choice, they did examine the influence of parental education on parental involvement and student attitudes toward science. This in turn has been found to increase interests in science careers (Mason & Kahle, 1988).

According to the results of the present study, the majority of the parents of both science and non-science majors had only achieved low levels of education. Consequently, parental involvement findings were inconclusive. Therefore, mixed findings concerning parental involvement could have been due to the low levels of parental education.

The findings of the current study could also have been due to the overwhelming number (61%) of the mothers and fathers of the participants that had not graduated from college. Not graduating from college is suggestive of low levels of education for the purposes of this study. Since the relationship between mother's occupation and career choice suggested that mothers were encouraging their children to obtain better careers, it would seem that a similar relationship would exist between education levels and career choice. However, this was not found. Nevertheless, most of the parents of the participants of the present study were employed in technical positions; therefore, the levels of education and career choices of the participants would be an improvement or step-up from what their parents had achieved. This could be due some aspect of parental motivation. Parents not graduating from college and employed in skilled labor jobs may motivate their children to attend college in order to better themselves.

Student Indicated Influencers

The fourth research question examined the relationship between a variety of aspects that students indicated influenced them in choosing a college major. It was hypothesized that students would choose the number one influencer to be their parents. In addition, it was also hypothesized that salary, leisure time, helping others, peers, teachers/counselors, skill, interest, and prior achievement would all be found to be statistically significant influencers on career choice. However, the only statistically

significant influencers on career choice, as indicated by the students, were salary, peer influence, helping others, and skill. Science majors were more influenced by salary and the desire to help others, while non-science majors were more influenced by their peers and skill.

Most past research studies suggest that parents are the greatest influence on student career decision. According to CIEWD (2002) 78% of students stated that one or both parents were involved in their career choice. However, when asked what influenced the career choices of the students in their study, the top three choices included interests, helping people, and things they liked to do. In addition, one of the questions of the study specifically asked who influenced their career decisions the most. The number one response then was parents. This could be the reason the participants in the current study did not indicate their parents as being an influencer. If the question had specifically asked who influenced their career decisions the most, parents may have been a top influencer on career choice. The students may also have felt they had indicated their parents as being involved when they answered question five. In other words, the ordering of questions on the survey could have influenced the students' responses.

The results could have been an artifact of asking the participants to pick only three influencers. Parents could have been a major influencer on career choice, just not one of the top three. In addition, the question in the survey did not emphasize whether the influencers were previous, current, or future influencers. Research question three asked about parental involvement which could be suggestive of influences from the past. This could be the reason research question three and four produced conflicting results. Students could have perceived that their parents were involved in their career decisions in

the past, yet did not feel that they helped in their decision to choose a specific college major. Although a number of research studies have suggested that parents are the number one influencer on student career choice, current researchers have suggested that this influence is beginning to decline (Kniveton, 2004). The results of the present study are consistent with Kniveton's.

According to Hochschild (1997), the influence of parents on career choice is less when the parent or parents work more hours. The author suggested that working parents simply do not have the time to spend with their children in order to discuss future career aspirations. This could be another reason why the participants of the current study did not report their parents as being a top influencer on their career choice. Most of the participants' parents in the current study were working class.

According to Bender (1994) teachers are significant influences on career choice. However, Bender reported that this is true only during the elementary grades. The author stated that as students become older, the influence of teachers becomes less. This could explain why the participants of the current study did not report that their teachers were influencers on their career choice. The greatest percentage of the participants of the current study stated that they were above 20 years old; therefore, the influence of teachers may no longer exist.

The results concerning the influence of salary on career choice were consistent with previous research suggesting that students tend to choose careers with high salaries (Cannon & Lupart, 2001; Dick & Rallis 2001; Spetz & Given, 2003), yet also differed from earlier research studies (Mariani, 1997). Although Mariani found that higher salaries influence career choice, the researchers suggested that this is only the case with

careers such as computer science, business, and engineering. In the present study, participants suggesting salary as an influence on career choice were more likely to be science majors than non-science majors. According to the NSB (2006) science careers provide salaries that are approximately 50% higher than non-science careers. Therefore, for the purposes of this study, science careers are assumed to be high salary careers. According to Spetz and Given, nursing jobs do provide salaries that are relatively high, particularly for careers that only require a two-year degree.

Hemsley-Brown and Foskett (1999) examined the beliefs of young people on nursing careers. The researchers did not find salary to be an influencer on why students would or would not choose a career in nursing. Most of the students believed that nurses received an average income. Even though the majority of the science majors in the present study indicated that they were majoring in the health-sciences, they may perceive that nurses and other health-science workers earn higher than average salaries. Since most of the parents of the participants in the present study were working class, the participants could be relating future earnings as being higher than the salaries of their parents. When examining the other majors and programs offered at the institution in which the present study was conducted, careers in the health sciences may have provided higher salaries than any of the other programs or majors available to obtain in two years.

Another student indicated influence that was found to be a statistically significant influencer on career choice was the influence of peers. The results concerning peer influence were consistent with previous research suggesting that peers influence each other in their career decisions (Adams, 1980; Lindner, 2004; Reitzes & Mutran, 1980). Lindner reported that students gain information from friends concerning careers in

science and that such information influences their career choices. Reitzes and Mutran found that peers do influence each other, either directly or indirectly, in decisions such as major choice. Adams also reported that peers are influencers of career choice. However, Adams continued to state that the career choices of girls are more often influenced by peers than boy's career choices. This could explain the findings of the present study, since the majority of the participants in the study were female.

In addition to peer influence, the desire to help others was also found to be a statistically significant influence on career choice in the present study. This finding is consistent with previous studies concerning career choice (Hurley & Thorp, 2002) and studies specifically concerning influences on health careers (Hemsley-Brown & Foskett, 1999; LeGrand & Shelledy, 2002). The number one career choice of those surveyed by the CIEWD was reported to be healthcare which is consistent with the majority of the participants in the present study. In addition, one of the overall influencers on career decision was helping others. Again, this is consistent with one of the major influences found in the present study. These results are probably due to the fact that the majority of individuals in the current study reporting to be majoring in a science-related field were majoring in the life sciences, specifically in health science fields. This finding is consistent with previous research suggesting that individuals choose health-related careers due to the desire to help others (Hemsley-Brown & Foskett, 1999; Hurley & Thorp, 2002; LeGrand & Shelledy, 2002).

Skill was also found to be a significant influence on the career choice of individuals not majoring in science and also those choosing a science-related career. Previous research studies have suggested that skill does influence career choice (Jacobs,

2005; Jones et al., 2001; Jovanovic & King, 1998; Reeve & Heggstad, 2004). Reeve and Heggstad found that skills are positively associated with career choice. According to Jovanovic and King, female students usually do not believe that they perform as well in science as they do in other subjects; therefore, females choose careers related to other subjects. Since the majority of the students in the current study were females this could explain why the results suggested individuals not majoring in science were more influenced by skill. However, the majority of the science majors were also female and according to Jacobs, females are less likely than males to enter science careers because they do not believe they possess the required skills. The authors also suggested that females are more likely to enter into health-related careers because they do believe they possess adequate skills for those careers.

The findings concerning skill produced mixed results. This could have occurred because skill as an influencer could have been interpreted as the lack of skill or possessing a skill or skills. The first question on the survey asked participants to check whether they were a science major or other. The second question asked the participant to indicate the specific area of science. The third question then asked the participant to indicate the top three influences on their career choice. The order of the questions could have influenced the answers of the non-science majors. The ordering could have produced some negative thoughts in participants indicating they were non-science majors and positive thoughts in participants indicating they were science majors. The first two questions contained the word science within the question. If negative feelings were produced when a non-science major read the first two questions, this could have influenced their answer to the third question. Positive feelings or thoughts produced when

reading the first two questions could also have influenced the participant's answer to the third question.

Science Attitudes

The purpose of the fifth research question was to determine whether or not science majors possessed more positive attitudes toward science than non-science majors. It was hypothesized that science majors do have more positive attitudes toward science than non-science majors. According to the results of this study, science majors do possess more positive attitudes toward science than non-science majors. This finding is supported by previous studies in which House (1995) and Koballa (1989) determined that individuals with more positive attitude scores towards science are more likely to major in science and choose a science-related field. This is important in order to determine that the participants of the current study were representative of each distinct group, science majors or non-science majors, and thus increases the validity and reliability of the study.

The results of the present study also suggested that the attitudes of the participants do not believe that science is strictly a male domain. This is consistent with previous research in which Lindner (2004) found that students do not believe that males are the only individuals that can possess careers in science. This result could again be due to the overwhelming number of female participants in the current study. The results could also suggest that ideas concerning science and science careers are beginning to change in relation to gender. However, the results are most probably due to the fact that the number of males and females in biology fields are equal and most of the science majors in the present study indicated being in the health sciences, which is a biology field.

Gender Issues

The purpose of the sixth research question was to examine gender differences in attitudes toward science, the number of male and female science students, and whether or not differences existed between males and females and the parental influencers and the student indicated influencers. It was hypothesized that gender differences would exist. Previous researchers have indicated that fewer females major in science and enter into science-related careers (NSB, 1989; NSF, 2004; Ware & Lee, 1988). However, the results of this study suggested that the number of male and female science majors is not statistically significantly different. This finding could possibly be a result of the number of female participants in the study. According to Wiens et al. (2003), biology is a gender neutral science and an overwhelming number of both genders in the present study were majoring in a biological field of study.

Previous researchers have also indicated that females are not as likely to enter science careers because they feel that they are not as competent in science as their male counterparts (Morgan et al., 2001). However, in this study no differences were found between male and female attitudes toward science. Again, this finding could be due to the large number of females in the sample that reported majoring in an area of the biological sciences and the biological sciences have been suggested to be gender neutral (Wiens et al., 2003).

The only statistically significant influences on career choice between male and female participants in this study were helping others and skill. Females in this study suggested that their career choice is influenced by the desire to help others, while males suggested that they choose their career based on skill. These findings are supported by

previous research studies in which it was found that women are more likely to report that their career choice was based on the ability to help others (Gatta, Dixon, Hebbbar, Dickerson, & Qian, 2002; Hurley & Thorp, 2002). The results of the present study are probably a result of the sample which contained a large number of female participants majoring in the health sciences that were influenced by the desire to help others.

Past research studies have also indicated that females are more often influenced by mentors and role models than males (Downing et al., 2005) and teachers (Dick & Rallis, 1991; Mason & Kahle, 1988). Arsenovic et al. (2005) reported that females are more often than males to be influenced by their mother's occupation and often portray more stereotypical beliefs about career choice. According to the Arsenovic et al., females are influenced into entering careers traditionally dominated by females instead of entering into male dominated careers. According to Hemsley-Brown and Foskett (1999), nursing is still thought of as being a female career.

The only significant finding concerning males was that males reported that they were influenced by skill more often than females. Regardless of major, both male science majors and non-science majors indicated that they choose their career based on skill. However, females not majoring in science indicated they choose their careers for other reasons than skill. These findings are supportive of early research conducted by Jovanovic and King (1998). The researchers suggested that girls do not believe that they possess adequate science-related skills; therefore, girls choose fields other than science. In addition, Jones et al. (2000) reported that males have been exposed to more science-related equipment and toys and possess more science-related skills than females. These

results are probably due to the number of female science majors indicating health-science as a career choice.

CHAPTER 6

IMPLICATIONS AND FUTURE RESEARCH

The purpose of this study was to determine the relationship between parental influences and student career choices of both males and females majoring and not majoring in science. Specifically, this study was designed to examine the relationships between parental occupation, parental involvement, and parental education levels and the decision to major or not major in science. In addition, influences indicated by the students were also examined. The importance in determining such information lies in the imbalance between the number of individuals entering the science-related workforce and the number of science-related jobs available.

In regard to the first research question concerning the influence of parental occupation on career choice, the results suggested that mother's occupation influences career choice. However, mothers are not encouraging their children to enter into the same careers that they choose. Nevertheless, the results did suggest that mothers are encouraging their children to enter into careers that are better than the mother's current career. Further studies could explore the relationships between parental occupation and career choice by examining parents employed in science fields and the career decisions of their children. Since the results of the present study suggested a link between the specific occupations of mothers employed as secretaries or administrators and skilled laborers,

future studies could also explore how skilled laborers and secretaries and administrators view college and why their children prefer health science careers

Concerning parental involvement, the results were mixed and did not suggest a specific relationship between parental involvement and career choice. When examining the various aspects of ways that parents are involved in science activities, the results again provided some insight into what students indicate their parents are doing or not doing. For example, the results suggested that science majors do not indicate that their parents are participating in science field trips with them. The results also suggested that in general students do not indicate that their parents are encouraging them to take more science classes in school, providing additional science educational materials to their children, watching science-related television shows or movies with their children, taking their children to zoos or wildlife areas, taking children to their work site, or providing career guidance.

Future research is needed in order to examine the results obtained concerning parental involvement. It would be extremely interesting to examine why students did not indicate more parental involvement. Examination is needed to determine whether parents are or are not involved in the career decisions of their children and attempt to determine why. Do parents not take the time, not want to be involved, or simply do not know how to help their children? It could be that parents are working fulltime or more and simply do not have time. In addition, research involving intervention programs aimed at providing parents with career guidance skills could also provide insight into relationships between parental involvement and career choice.

Maybe parents are really involved in activities that influence career decisions and this study did not address those aspects. For example, Naizer (1993) reported that children are more apt to major in science and choose a science-related career if their parents provided a variety of science-related equipment such as telescopes or microscopes. In addition, Naizer suggested that parents influence student career choice not just by watching television shows or movies, but by discussing movies and television shows with their children. In addition, Mason and Kahle (1988) reported that interests in science-related careers increase if parents provide opportunities to care for animals or touch animals. In the present study, it was asked if parents took the student to zoos or wildlife areas, but did not address the aspect of animal care. Therefore, future studies should address additional aspects of parental involvement in order to get a better understanding of whether or not parents really are involved in science-related activities that could influence the student's decision to major in science or not major in science.

Regarding the student indicated influencers; students indicated that salary and helping others influenced their decision to major in science. Students not majoring in science indicated peers as being the major influencer on career choice. However, the majority of the science majors were majoring in the health sciences. This implies that students enter into health related careers because they want to help people and they believe that that they will earn higher salaries. This information could be used in order to increase the number of health science majors in particular. This information could be especially useful in promoting the two year health science programs as a means of obtaining a quicker way to earn good salaries. These programs could be marketed to individuals from working class parents and to older students returning to school in search

of a better career path. Intervention programs could also be implemented which increase student awareness of other science related fields that help others. Also, these programs could increase student awareness of prospective salaries in all fields of science.

The results of the present study also suggested that males tend to choose careers based on skill. According to research conducted by Jovanovic and King (1998) boys receive more hands-on experiences in the science classroom than girls. Therefore, girls report a lower level of science-related skills than males. Future research studies could examine the influence of programs aimed at increasing the skill levels or perceived skill levels of females in science. Since previous research has suggested that females are influenced by mentors and role-models (Dick & Rallis, 1991; Downing et al., 2005; Mason & Kahle, 1988) intervention programs and future studies could examine what influence mentoring programs have on the attitudes, interests, and skill levels of female science students.

The findings of this study provided some evidence that individuals entering careers in the health sciences are influenced by salaries and the desire to help others. Of those majoring in the health sciences, 50% were majoring in nursing. A number of recent researchers have suggested that a current shortage exists among health care workers, specifically nurses (Sigma Theta Tau International [STTI], 1999; Trossman, 2002). According to STTI, nursing shortages are at the highest rate ever reported and the enrollment rates into nursing programs in college are decreasing. Trossman suggested that in order to increase the number of individuals entering nursing programs, recruitment strategies were mandatory. According to the findings of the current study, nursing

education programs could be marketed to females interested in helping others and obtaining good salaries for minimum higher education.

The results of the present study also suggested that males choose careers based on skill more often than females do. The results also suggested that males desire to help others, but not as much as females. According to STTI (1999), not only are nurses needed, but skilled nurses are in extremely high demand. In addition, Trossman (2002) reported that a high demand also exists for more male nurses. Considering the results of the current study, nursing education programs could market their programs to males in a manner that stresses the ability to use high level skills in order to help others.

In addition to the findings concerning health care careers, it is evident that the number of science majors and individuals entering science careers is not adequate to meet the needs of society (NSB, 2006). It is also evident that the importance in increasing the number of individuals entering science-related careers lies in the link between science and the economic status of the US (Consortium for Policy Research, 1995; Washington, 2006). In order to increase the number of science majors and the number of individuals skilled enough to enter science careers, it must first be understood what influences students to enter those fields of study and career choices. Therefore, future studies are needed that specifically address why students choose science careers or do not choose science careers.

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APPENDIX A

Student Information Survey

1. What is your current major?
 Science
 Other (Please specify): _____

2. If you are majoring in science, please specify which field of science.
 Biology/Life Sciences
 Chemistry
 Physics/Physical Science
 Earth Science
 Health Sciences (Please specify): _____
 Allied Health Sciences (Please specify): _____
 Other (Please specify): _____

3. Rank the top three influences on your choice of college major (1 being the most influential and 3 being the least influential).
 Parents
 Salary
 Leisure time
 Helping others
 Peers
 Teacher/Counselors
 Skill
 Interests
 Prior achievement
 Other (Please specify): _____

4. Please indicate which scenario best describes your childhood upbringing.
 Mother and father at home
 Single parent/father
 Single parent/mother
 Other (Please specify): _____

Please indicate the extent to which you agree with the following statement using one of the five response options described below:

SA = strongly agree, A = agree, NS = not sure, D = disagree, SD =strongly disagree.

	SA	A	N	D	SD
5. My parent(s) were very involved in my career choice.					

6. Please indicate with a checkmark all that apply concerning parental involvement:
- My parent(s) participated in science field trips with me.
 - My parent(s) encouraged me to take more science classes in school.
 - My parent(s) provided additional science educational materials for me.
 - My parent(s) watched science shows on television with me.
 - My parent(s) took me to see science-related movies.
 - My parent(s) took me to zoos or wildlife areas.
 - My parent(s) took me to their occupation site.
 - My parent(s) provided guidance in my career decision.
 - I choose my career because I wanted to imitate the career of my parents.
 - Other (Please specify): _____

Questions 7 and 8 are designed in order to gain information about your parent(s) level of education and occupation.

7. Level of Education

- | Mother | Father |
|--|--|
| <input type="checkbox"/> attended high school | <input type="checkbox"/> attended high school |
| <input type="checkbox"/> GED | <input type="checkbox"/> GED |
| <input type="checkbox"/> graduated from high school | <input type="checkbox"/> graduated from high school |
| <input type="checkbox"/> some college | <input type="checkbox"/> some college |
| <input type="checkbox"/> graduated college | <input type="checkbox"/> graduated college |
| <input type="checkbox"/> other (Please specify): _____ | <input type="checkbox"/> other (Please specify): _____ |

8. Parental Occupation

Mother	Father
<input type="checkbox"/> None	<input type="checkbox"/> None
<input type="checkbox"/> Science _____	<input type="checkbox"/> Science _____
<input type="checkbox"/> Healthcare _____	<input type="checkbox"/> Healthcare _____
<input type="checkbox"/> Teacher _____	<input type="checkbox"/> Teacher _____
<input type="checkbox"/> Service _____	<input type="checkbox"/> Service _____
<input type="checkbox"/> Skilled Labor _____	<input type="checkbox"/> Skilled Labor _____
<input type="checkbox"/> Professional _____	<input type="checkbox"/> Professional _____
<input type="checkbox"/> Business _____	<input type="checkbox"/> Business _____
<input type="checkbox"/> Homemaker _____	<input type="checkbox"/> Homemaker _____
<input type="checkbox"/> Secretary _____	<input type="checkbox"/> Secretary _____
<input type="checkbox"/> Other _____	<input type="checkbox"/> Other _____

The remaining questions are demographic questions that will be used for classification purposes.

9. What is your gender?

- Female
- Male

10. What is your race?

- African/American
- Asian
- Caucasian
- Hispanic
- Other (Please specify): _____

11. What classification are you in college?

- Dual enrollment
- Freshman
- Sophomore
- Other (Please specify): _____

12. What is your age?

- under 18
- 18
- 19
- 20
- Over 20 (Please specify): _____

13. How many science courses did you complete in high school?

_____ 0

_____ 1

_____ 2

_____ 3

_____ 4

_____ more than 4

14. Can you think of any other aspects that influenced your career choice that was not mentioned in this survey? If so, please explain.

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

APPENDIX B

Modified Fennema-Sherman Attitude Scales

Using this scale will help you and me find out how you feel about yourself and science.

On the following pages is a series of sentences. You are to mark your answer sheets by telling how you feel about them. Suppose a statement says:

Example 1: I like mathematics.

As you read the sentence, you will know whether you agree or disagree. If you strongly agree, circle A next to Number 1. If you agree, but not so strongly, or you only "sort of" agree, circle B. If you disagree with the sentence very much, circle E for strongly disagree. If you disagree, but not so strongly, circle D. If you are not sure about a question or you can't answer it, circle C. Now, mark your sheet, then go on and do Example 2.

Do not spend much time with any statement, *but be sure to answer every statement.*

Work fast, but carefully.

There are no "right" or "wrong" answers. The only correct responses are those that are true *for you*. Whenever possible, let the things that have happened to you help you make a choice.

Science Attitude Scale as Modified from the Fennema-Sherman Attitude Scale

1. I am sure that I can learn science. A B C D E
2. My teachers have been interested in my progress in science. A B C D E
3. Knowing science will help me earn a living. A B C D E
4. I don't think I could do advanced science. A B C D E
5. Science will not be important to me in my life's work. A B C D E
6. Males are not naturally better than females in science. A B C D E
7. Getting a teacher to take me seriously in science is a problem. A B C D E
8. Science is hard for me. A B C D E
9. It's hard to believe a female could be a genius in science. A B C D E
10. I'll need science for my future work. A B C D E
11. When a woman has to solve a science problem, she should ask a man for help. A B C D E
12. I am sure of myself when I do science. A B C D E
13. I don't expect to use much science when I get out of school. A B C D E
14. I would talk to my science teachers about a career which uses math. A B C D E
15. Women can do just as well as men in science. A B C D E
16. It's hard to get science teachers to respect me. A B C D E
17. Science is a worthwhile, necessary subject. A B C D E
18. I would have more faith in the answer for a science problem solved by a man than a woman. A B C D E
19. I'm not the type to do well in science. A B C D E
20. My teachers have encouraged me to study more science. A B C D E
21. Taking science is a waste of time. A B C D E
22. I have a hard time getting teachers to talk seriously with me about science. A B C D E
23. Science has been my worst subject. A B C D E
24. Women who enjoy studying science are a little strange. A B C D E
25. I think I could handle more difficult science. A B C D E
26. My teachers think advanced science will be a waste of time for me. A B C D E
27. I will use science in many ways as an adult. A B C D E
28. Females are as good as males in science. A B C D E
29. I see science as something I won't use very often when I get out of high school. A B C D E
30. I feel that science teachers ignore me when I try to talk about something A B C D E

- serious.
31. Women certainly are smart enough to do well in science. A B C D E
 32. Most subjects I can handle OK, but I just can't do a good job with science. A B C D E
 33. I can get good grades in science. A B C D E
 34. I'll need a good understanding of science for my future work. A B C D E
 35. My teachers want me to take all the science I can. A B C D E
 36. I would expect a woman scientist to be a forceful type of person. A B C D E
 37. I know I can do well in science. A B C D E
 38. Studying science is just as good for women as for men. A B C D E
 39. Doing well in science is not important for my future. A B C D E
 40. My teachers would not take me seriously if I told them I was interested in a career in science and mathematics. A B C D E
 41. I am sure I could do advanced work in science. A B C D E
 42. Science is not important for my life. A B C D E
 43. I'm no good in science. A B C D E
 44. I study science because I know how useful it is. A B C D E
 45. Science teachers have made me feel I have the ability to go on in science. A B C D E
 46. I would trust a female just as much as I would trust a male to solve important science problems. A B C D E
 47. My teachers think I'm the kind of person who could do well in science. A B C D E

Key to Modified Fennema-Sherman Scale for Math and Science

Key:

C = Personal confidence about the subject matter

U = Usefulness of the subject's content

M = Subject is perceived as a male domain

T = Perception of teacher's attitudes

+ = Question reflects positive attitude

- = Question reflects negative attitude

Question #	Category of Question	Attitude
1	C	+
2	T	+
3	U	+
4	C	-
5	U	-
6	M	+
7	T	-
8	C	-
9	M	-
10	U	+
11	M	-
12	C	+
13	U	-
14	T	+
15	M	+
16	T	-
17	U	+
18	M	-
19	C	-
20	T	+
21	U	-
22	T	-
23	C	-
24	M	-
25	C	+
26	T	-
27	U	+
28	M	+

29	U	-
30	T	-
31	M	+
32	C	-
33	C	+
34	U	+
35	T	+
36	M	-
37	C	+
38	M	+
39	U	-
40	T	-
41	C	+
42	U	-
43	C	-
44	U	+
45	T	+
46	M	+
47	T	+

Scoring Directions:

Each positive item receives the score based on points

$$A = 5 \quad B = 4 \quad C = 3 \quad D = 2 \quad E = 1$$

The scoring for each negative item should be reversed

$$A = 1 \quad B = 2 \quad C = 3 \quad D = 4 \quad E = 5$$

Add the scores for each group, T, C, U, M, to get a total for that attitude.

The highest possible score for each group of statements is 60 points.