

Spring 5-2013

Nursing Students' Attitudes Toward Science in the Nursing Curricula

Jill Deanne Maroo
University of Southern Mississippi

Follow this and additional works at: <https://aquila.usm.edu/dissertations>



Part of the [Higher Education Commons](#), [Nursing Commons](#), and the [Science and Mathematics Education Commons](#)

Recommended Citation

Maroo, Jill Deanne, "Nursing Students' Attitudes Toward Science in the Nursing Curricula" (2013).
Dissertations. 745.
<https://aquila.usm.edu/dissertations/745>

This Dissertation is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Dissertations by an authorized administrator of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.

The University of Southern Mississippi

NURSING STUDENTS' ATTITUDES TOWARD SCIENCE
IN THE NURSING CURRICULA

by

Jill Deanne Maroo

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

May 2013

ABSTRACT

NURSING STUDENTS' ATTITUDES TOWARD SCIENCE IN THE NURSING CURRICULA

by Jill Deanne Maroo

May 2013

The nursing profession combines the art of caregiving with scientific concepts. Nursing students need to learn science in order to start in a nursing program. However, previous research showed that students left the nursing program, stating it included too much science (Andrew et al., 2008). Research has shown a correlation between students' attitudes and their performance in a subject (Osborne, Simon, & Collins, 2003). However, little research exists on the overall attitude of nursing students toward science. At the time of my study there existed no large scale quantitative study on my topic. The purpose of my study was to identify potential obstacles nursing students face, specifically, attitude and motivation toward learning science. According to research the nation will soon face a nursing shortage and students cite the science content as a reason for not completing the nursing program. My study explored nursing students' attitudes toward science and reasons these students are motivated to learn science. I ran a nationwide mixed methods approach with 1,402 participants for the quantitative portion and 4 participants for the qualitative portion. I validated a questionnaire in order to explore nursing students' attitudes toward science, discovered five different attitude scales in that questionnaire and determined what demographic factors provided a statistically significant prediction of a student's score. In addition, I discovered no statistical difference in attitude exists between students who have the option of taking

nursing specific courses and those who do not have that option. I discovered in the qualitative interviews that students feel science is necessary in nursing but do not feel nurses are scientists. My study gives a baseline of the current attitude of nursing students toward science and why these students feel the need to learn the science.

COPYRIGHT BY
JILL DEANNE MAROO
2013

The University of Southern Mississippi

NURSING STUDENTS' ATTITUDES TOWARD SCIENCE
IN THE NURSING CURRICULA

by

Jill Deanne Maroo

A Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

Approved:

Director

Dean of the Graduate School

May 2013

ACKNOWLEDGMENTS

I would like to thank my dissertation committee, Drs. Kristy Halverson, Sheila Hendry, Kyna Shelley, Richard Mohn, and Jennifer Regan. A special thank you to Drs. Kristy Halverson and Sheila Hendry for their “forceful” encouragement; without this I would have never finished the dissertation process. In addition, I would not have been able to complete this process without Dr. Halverson agreeing to step in as my chair, even though I was doing a mixed methods study heavy in quantitative analysis.

I want to acknowledge the members of the Halverson lab. You were always there to give feedback and provide contact to potential participants. A special thank you goes out to my friends. I used you as sounding boards and cheerleaders throughout my graduate career and I never would have made it without you. I plan to return the favor to those of you still completing the process.

And a huge thank you to my family, who never stopped asking when (not if) I was going to graduate. I promise I am not moving my graduation date again. Thank you for understanding that I needed to complete this dream, even though it took me so far from home.

TABLE OF CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGMENTS.....	iv
LIST OF TABLES.....	vii
LIST OF ILLUSTRATIONS.....	viii
CHAPTER	
I. INTRODUCTION.....	1
Statement of the Problem	
Purpose of the Study	
Research Questions	
Limitations and Delimitations	
Rationale	
Definitions	
II. LITERATURE REVIEW	7
Theoretical Framework	
Learning Theory	
Review of Relevant Literature	
Nursing Students' Attitudes	
Nursing Student Curriculum	
Nursing Students in Science	
Students' Attitudes Toward Science	
Nursing Students' Attitudes in Science	
Gaps in the Literature	
III. METHODOLOGY	24
Setting	
Institutional Review Board	
Participants	
Researcher	
Data Collection	
Analysis	
Trustworthiness	
Ethical Considerations	

IV.	RESULTS	40
	Quantitative Results	
	Qualitative Results	
	Trends Across Profiles	
V.	CONCLUSION.....	78
	Discussion	
	Implications	
	Future Directions	
	Final Conclusions	
	APPENDIXES.....	86
	REFERENCES.....	93

LIST OF TABLES

Table

1. Data Matrix.....	25
2. Number of Participating Schools and Individuals by Region.....	27
3. Individual Demographics with Variable Levels.....	31
4. Institutional Demographics with Variable Levels.....	32
5. Descriptive Statistics for Variables of the Factors.....	47
6. Final EFA Structure.....	50
7. CFA Goodness-of-Fit Results	54
8. Attitude Scale Means and Ranges.....	56
9. One-Way ANOVA Comparing Nursing Specific Classes across Attitude Scales..	57
10. Coefficients from the Multiple Regression on Working in Science.....	60
11. Coefficients from the Multiple Regression on Science Answers All Questions....	62
12. Coefficients from the Multiple Regression on Scientific Ideas.....	64
13. Coefficients from the Multiple Regression on Science is Hard.....	66

LIST OF ILLUSTRATIONS

Figure

1. U.S. Map with Regions	26
2. Accepted into program verse school type.....	45
3. Sex verse classification in school.....	46
4. Final CFA model.....	55

CHAPTER I

INTRODUCTION

Statement of the Problem

University science departments are pushing to develop science classes specifically for nursing and pre-nursing students (e.g., Davies, Murphy, & Jordan, 2000; Thornton, 1997; Office of the Registrar, 2012). These classes are intended to focus on science content that students will later apply in their nursing programs. This push to reform science courses has also been supported by the need to improve retention rates in nursing programs (Cangelosi, 2006). There is a known correlation between the attitude, value placed on the subject, and performance (Hannafin & Hooper, 1993; Kaufman & Mann, 1997; Osborne, Simon, & Collins, 2003). In particular, attitude in this context can reference scientific attitude (a student's attitude regarding being a scientist) or attitude toward science (a student's view of how to use science in society), the latter being the focus of my study (Gardner, 1975; Weinburgh, 1995). Previously, students have expressed a disconnect in the content they are learning in the science class and what they expect they should know for the nursing field (e.g., Andrew et al., 2008; Courtenay, 1991). By focusing on how students apply science in their field, specialized courses are intended to help them recognize the value in learning science and perform better in their courses. In turn, this improved performance will help students successfully complete their nursing program leading to graduation. However, very little is known about the impact these specialized science classes are actually having on this subset of students or their attitudes toward science. Additionally, nursing educators do not have a good idea of their students' attitudes when entering the nursing program. Small scale studies show that students still have a difficult time with the content, even after an increase in content

presentation time and a decrease in content breadth (Cangelosi, 2006). Unfortunately, there are no large scale investigations on the views of nursing students' attitudes toward science in the U.S. In fact, the majority of the nursing attitude research toward science is done overseas in Europe or Australia (e.g., Andrew et al., 2008; McKee, 2002). As of 2012, I had not come across a single large scale attitude survey of nursing students.

Institutions are currently developing and implementing science courses geared toward nursing majors without exploring current students' attitudes, which can lead to problematic learning obstacles (Office of the Registrar, 2012). A link between motivation, attitude, and academic achievement has been established (Andrew, 1998; Ramsden, 1998). However, no one has conducted a large scale survey on nursing students' attitudes toward science, particularly looking across student and institutional demographics. In addition, articles that provide evidence for nursing students' reasons for devaluing science have only been conducted outside the U.S. If we can gain an understanding about nursing students' attitudes toward science and motivation for learning, we can begin developing informed implications for curriculum changes to develop science courses relevant to nursing education programs.

Purpose of the Study

The purpose of my study was to identify potential obstacles facing nursing student education, specifically focusing on attitude and motivation toward learning science. Understanding nursing students' attitudes toward science is important, as students going into the nursing profession are required to take science as part of their curriculum. Research has connected motivation and attitude with learning science content (Osborne et al., 2003). A mixed methods approach allowed me to explore the attitudes of nursing students across the nation toward science and conduct a more in-depth exploration of

motivation at a local level. I explored their attitudes, both quantitatively with a nationwide survey of nursing and pre-nursing students through a science attitudes inventory questionnaire (the Scientific Attitude Inventory II [SAI II]) (Moore & Foy, 1997), and qualitatively through semi-structured interviews (Patton, 2002). My study collected evidence on the current attitudes toward science of the students with a desire to go into the nursing field. In addition, the interviews gave insight into which demonstrations and teaching methods nursing students self-select as methods to which they responded.

Research Questions

I answered the following questions over the course of my study:

1. What are nursing students' attitudes toward science?
 - a. How do the attitudes of students in an institution with specialized classes for pre-nursing students compare to an institution without specialized classes for pre-nursing students?
 - b. How do nursing students view the role of science in their educational training?
2. How do demographic variables predict nursing students' attitudes toward science?
3. Why are nursing students motivated to learn science content for their pre-nursing science courses?

Limitations and Delimitations

The following limitations and delimitations apply to this study:

1. I looked only at institutions in the 48 contiguous U.S.
2. I surveyed only students attempting to earn a four year degree in nursing.

3. I looked at only students attending institutions that agree to participate and allow contact with their students.
4. Students had to self-select (volunteer) to complete the questionnaire.
5. Students had to self-select (volunteer) to participate in the interview.
6. By contacting students through nursing programs, I only could contact those students listed with the nursing program; students listed as undeclared but planning to apply to the program were not contacted.
7. Only students with internet access had the ability to participate.
8. Students had to complete the entire questionnaire to be included in the analysis.
9. Students had to check their email address registered with the nursing department and read it to receive the invitation to participate in the study.
10. I did not ask what courses the students have taken in science, or their grades.
11. I had to rely on the institution to send out the email invitation to both their current nursing students and the students listed as pre-nursing (an extra step in the process).
12. Interviews were only with local individuals for the sake of time and resources.

Rationale

In the U.S., nursing students must complete an examination before receiving their nursing license. This licensure test is taken after students complete their bachelor's degree and must be passed if they are to work as a licensed nurse. This board exam calls for nursing students to be competent on many areas of the nursing field, including areas

that form their basic foundation in science areas, e.g., Health Promotion and Maintenance (NCSBN, 2009). By understanding where the attitudes of nursing students are currently we have a chance to develop the nursing curriculum as the field is changing to improve students' attitudes toward science.

Previous studies have looked at how nursing students perform in science courses (e.g., McKee, 2002; Wong & Wong, 1999). Although it is important to uncover that nursing students are experiencing problems with the science in the nursing curriculum, these previous studies had few, if any, suggestions on what to do about the problems these pre-nursing students are having. The first step in increasing the positive attitudes of nursing students toward science is to find out the current status of their attitudes. The mixed methods approach to my investigation allowed me to assess the attitudes of the country's current population of nursing students toward science. In addition, my study allowed me to connect some of the factors of attitudes toward science, found in the quantitative portion, to the value students see in studying science, which I explored through the qualitative portion of my investigation.

Nursing requires a holistic understanding of patient care, which includes bedside manner as well as science content, explicitly chemistry and biology. For example, nurses need to understand how to convert microliters into milliliters so they do not administer an incorrect drug dosage to patients. Students also need to understand evolutionary processes in order to understand how bacteria can evolve into *superbugs*. Unfortunately, students within nursing programs underestimate the importance of biology in nursing professions (Clarke, 1995). "Nurses, like social workers rather than doctors, regard themselves as following a caring, not scientific, vocation and it cannot be assumed that nursing students will share the conceptual ecology of biologists" (Jordan, Davies, &

Green, 1999, p. 216). In addition, looking at the current literature, research has underestimated the importance of chemistry in the nursing profession. This depreciation of science can lead to poor attitudes toward science and, in turn, cause resistance to learning sciences in nursing programs.

Definitions

Attitudes toward science – includes students' interests in scientific ideas, their opinions on scientists, and the responsibility they feel about science in society (Gardner, 1975)

Confirmatory Factor Analysis (CFA) – A statistical analysis run in my study to determine if the factors found in the exploratory factor analysis are reliable when tested on a second sample (Garson, 2012).

Exploratory Factor Analysis (EFA) – A statistical analysis run to uncover connections between a set of variables, reducing the total number of variables to a smaller number of factors. In the case of my study it reduced 40 questions into five factors (Garson, 2012).

Multiple regression – A statistical analysis that compares the amount each independent variable predicts the dependent variable compared to the other independent variables in the model (Field, 2009).

Nursing specific – Classes that list in their catalogue description they are designed for nursing majors or students in health care profession majors.

Pre-nursing students – These are students who are working on pre-requisites to apply for the nursing program.

Scientific attitudes – how a student thinks like a scientist (Gardner, 1975)

CHAPTER II

LITERATURE REVIEW

Theoretical Framework

Attitude is a large multifaceted variable, with a number of items adding to and/or altering a person's stance on a topic. There are multiple ways to explore students' attitudes about science, including scientific attitudes and attitudes toward science (Gardner, 1975). The lens used to measure attitude can offer vastly different perspectives. For example, scientific attitude is how a student thinks like a scientist, while attitudes toward science include a student's interest in scientific ideas, his or her opinion on scientists, and the responsibility he or she feels about science in society (Gardner, 1975). For the purpose of this project, I focused on measuring students' attitudes toward science.

A prevailing area of attitudes research discovered a link between students' attitudes toward a subject and their ability to succeed in a subject area (Osborne et al., 2003). As attitudes toward science become more positive, the motivation to learn the scientific content also increases (Wang, Wu, & Huang, 2007). According to Young (1998), attitudes toward science can be considered fairly stable; however, with intervention students can learn new items that alter their attitude stance. This malleability is important, as a person's attitude about a subject and his or her motivation are related to behavior. As seen in Osborne et al. (2003), studies have connected motivation with attitude in regards to science. As students perceived information as valuable, their attitudes toward the topic also became more positive (Dalgety, Coll, & Jones, 2003). Bishop (1990) proposes that perceived difficulty of a subject is related to the attitude

toward that subject. This perception of increased difficulty is expressed by nursing students toward the science topic in their first years of study (Andrew et al., 2008).

In January of 2012, van Aalderen-Smeets, Walma van der Molen, and Asma published a theoretical framework for looking at attitudes in both pre-licensure and practicing primary school teachers. I believe this framework could be expanded to work for nursing and pre-nursing students. Individuals in both occupations have to use and teach science, even though the individuals might not see themselves as scientists. In addition, both groups of students are required to take a licensure exam before beginning in their respective fields.

The pre-service primary education framework describes how attitude determines behavior, through behavioral intent. Mainly the framework discusses three areas of attitudes, and together these three areas influence behavioral intent which will affect the behaviors displayed. The literature describing the framework further divides a person's attitude toward science into a professional and a personal attitude. This allows for the idea that individuals understand they need science in their occupation. For primary teachers, this is the understanding that it is important they teach science to their students or their students will fall behind. For nursing students, it is the understanding that they need a basic understanding of the parts and functions of the body, both for understanding their profession and explaining things to patients. Although these different attitudes have been shown to have a positive correlation, individuals differ on which attitude (profession or personal) influences the other. In addition, a positive correlation does not mean both attitudes are positive or negative for an individual. An individual can see the importance for a certain level of science and have a positive professional attitude toward science, but have a negative personal attitude toward science at the same time.

Both elementary education and pre-nursing students are must fulfill a science requirement before entering or during their programs. These students know they will have to use some types of science on the job; whether they agree with the amount and type of science they have to take is a different story. This connection between being required to use science on the job but not liking science allows me to believe this theoretical framework on attitudes toward science developed for primary teachers will be appropriate to use on pre-nursing and nursing students. Knowing the current attitude of nursing students could help instructors work to influence their attitude, which could eventually affect a student's behavior (e.g, studying for learning versus memorization). This particular study is interested in the personal attitude that nursing students express toward science.

Learning Theory

My educational learning theory is constructivism, specifically the social/cognitive constructivism. The basis of constructivism entails a visual of students building knowledge on preexisting knowledge (Howe & Jones, 1998). In fact, one of the themes seen in the literature is that of scaffolding. Scaffolding is where students build a foundation in the subject before adding new or more detailed information to their knowledge structure. For instance, students learn the alphabet before they learn to spell, and they begin to spell with smaller, simpler words before slowly progressing to harder lexicons. The concept is to build knowledge by introducing students to new ideas but connecting those ideas to something familiar that they have a foundation on. This method allows them to know how to place this new information into their current world. Constructivists state that complete learning is when students add knowledge to their framework.

Jean Piaget is considered by most to be the father of the constructivist theory (Creswell, 2009). Through Piaget's research on developmental stages of learning, other constructivists have branched out to state how people learn in these stages. One of these is Lev Vygotsky, who is responsible for developing the theory on social development (Vygotsky, 1978). A central idea of his theory was the notion of the Zone of Proximal Development. This concept states that an individual has a current level in his or her understanding, and there is also a level of understanding the individual can reach through study. The area between the student's current level and the level he or she can achieve is the zone of proximal development. If, however, students have someone working with them who is at a higher level of understanding, that zone can increase in size and the students' ability to learn can also increase. Although the person other than the student has to have a higher level of understanding, it is not required that they have an immensely higher level. The second person could be a mentor, a teacher, or just as easily another student who has understanding of that concept (Vygotsky, 1978).

One main premise of this theory is increasing knowledge with hands-on experiences. The concept of hands-on learning is not new to science education. One newer constructivist who appears to be influenced by Vygotsky early work is Jerome Bruner. Bruner developed a theory called Discovery Learning decades ago (Bruner, 1963). In this constructivist theory, Bruner proposed the need for students to physically get involved with their learning in order to gain understanding. *Physically* includes students initiating the process of research through the literature as well. Bruner is not saying that everything has to be done in a lab for students to remember the idea, but that students need to take, and be given, the option to guide their own learning. This idea of students taking responsibility of their own learning is not unique in constructivism;

however, Bruner appears to be influenced by Vygotsky's social development theory because even if students do the current work on their own, they are building off the work of others who came before them.

I based my research project on a concurrent embedded design as described by Creswell (2009). The collection of the qualitative and quantitative data occurred concurrently with the data analysis taking place after the data collection. The quantitative data embeds the qualitative data, adding rich detail to answer the research questions. The majority of research questions call for a higher emphasis placed on the quantitative data; however, there was one that focused more on the qualitative data.

Review of Relevant Literature

At the time of my study, there was little literature of how nursing students viewed science in general. Much of the literature concerning the performance of pre-nursing students in science was focused on the problems these students showed in biology (e.g., McKee, 2002; Nicoll, 1996; Thornton, 1997). There was little written on how pre-nursing students do in chemistry, and when the research covered the topic it was in conjunction with a study on biology (Wong & Wong, 1999). This was surprising as, at least in the United States, chemistry is a required course needed in order to gain entry into many nursing degree programs (e.g., Office of the Registrar, 2012). Science was an integral part of nursing programs, and more research is needed on the attitude of nursing students toward science to help shape how educators present science in the nursing curriculum.

Nursing Students' Attitudes

The majority of the literature on nursing students' attitudes focused on the attitudes of these students toward a specific group of patients, for example, the elderly

(Aday & Campbell, 1995; Brown, Nolan, Davies, Nolan & Keady, 2008). The current literature showed that students expressed an increase in their positive attitudes toward treating elderly patients after completing their nursing program course work that required they interact with patients in this demographic. Students who participated in one research study showed a statistically significant relationship between exposure to the elderly and an increase in those students ranking elderly as their top three age demographics to work with (Aday & Campbell, 1995). These same students showed a decrease in believing stereotypes about their elderly patients. The particular topic of treating the elderly gathers more attention as the world's population grows older and the need for geriatric nurses increases (Brown et al., 2008).

Research that looked at the attitudes of nursing students toward science does not appear to be concerned with students' attitudes toward science, but mentioned attitudes as a side component of their study (e.g., Andrew et al., 2008). For example, Andrew et al. (2008) interviewed 17 students they termed as "discontinuers," that is, students who dropped out of the program before the financial drop date has passed (p. 866). These discontinuers are students who did not make it past their first year in the program. Although all these students are classified as freshman, they are not all traditional freshman. As a group, many of the students expressed their surprise at the amount of science required for the nursing program and their feelings of inadequacy with the subject. This sentiment was not just seen in the first semester discontinuers but also those who completed the first semester only to discontinue the program during the second semester (Andrew et al., 2008). Many of these students discussed reaching a point of no return; they explained that they made it through the first semester, but knew after the first couple days of the second semester they would not pass. Students who expressed

surprise in the amount of science were not only nontraditional students, but also traditional students who did not take courses in high school that would help them prepare for the science encountered in the first year (Andrew et al., 2008). This study missed the opportunity to look at the students' motivation to complete their science course work; my study took the chance to look into students' motivation. The surprise over science content was seen especially during the first year of nursing school. In many of the U.S. schools, this science content was required before nursing students apply to the nursing program.

It would stand to reason that students who continue in the nursing field start to give more scientific answers toward the end of their education. Ganum (2004) saw this trend when she compared the views of first year and third year students enrolled in a Norwegian nursing program. Although both student groups mention caring for patients, those students in their third year take the description of patient care to a different level. The care descriptions given by students in their third year appear to have a more scientific and holistic approach beyond the actual physical caretaking of the patient (Ganum, 2004). In addition to the more descriptive patient care, students in their third year of the program add administrative work to their descriptions.

One study in Sweden looked at how nursing students viewed themselves as nurses (Lyckhage & Pilhammar, 2008). The students who participated in the study expressed three different attitudes on why they wanted to become nurses. Some students wanted to help others, some stated they wanted the stable position and salary, and the third group had the desire to use nursing as a launching pad for future endeavors. These different attitudes could manifest into different attitudes toward science.

Thorpe and Loo (2003) looked at what values Canadian nursing students deemed valuable and socially desirable. Eleven values had scores that caused the authors to select them as important. Some of these included personal development, achievement, and social interaction. Five values showed up as slightly important, including advancement and authority. Physical prowess and risk were two of the four that came in as unimportant (Thorpe & Loo, 2003). The suggestions of the authors called for nursing educators to create a curriculum that allows students to work on quick thinking and critical decision-making skills. Some of these values showed a similar value system to that seen in Swedish nursing students (Lyckhage & Pilhammar, 2008).

A number of articles highlight in their literature the future shortage of nurses; one article discusses a possible solution (Ellis, Meeker, & Hyde, 2006). This solution included promoting nursing as a career choice for men, especially in light of the low male nursing population. Ellis et al. (2006) interviewed 13 men in their last semester of nursing school. The researchers strived to uncover the attitudes of these men toward nursing school and nursing as a whole through these interviews. Like the students in Sweden, some of these male students saw nursing as a stepping stone to other professions. Many of the males' attitudes showed frustration over the way they were taught. All the study subjects expressed both positive and negative attitudes toward the nursing program. Although Ellis et al. (2006) looked at the attitudes of male students, they did not specifically ask about the students' attitudes toward science.

Nursing Student Curriculum

Over the past 60 years, the nursing field assumed a curriculum much like what is seen in medical education. However, this curriculum model did not allow for education on the other aspects of nursing such as patient care (Webber, 2002). In recent years

nursing curriculum developers have started trying to find a balance between science content and patient care training (Davies et al., 2000; Thornton, 1997).

Recently, a further push has occurred to increase genetic content for nursing majors (Greco & Salveson, 2009; Cashion, 2009). Over the years the amount of genetic information in nursing has increased. This increase required nurses to understand more genetic information in their positions, and the need for the nursing curricula to examine genetic components, which include genetic testing, family inheritance, and the sheer increase in the number of tests available (Greco & Salveson, 2009). The information students are taught by professors must be relevant to the genetics the students will encounter in the nursing field, including the knowledge about the importance that family histories can play in diagnosing patients. According to Greco and Salveson (2009), nurses should hold ten competencies in genetics, including the idea of inheritance, how genetic techniques bring about treatments, and a working knowledge of genetic counseling.

An increased need for a working knowledge of genetics, to explain genetic counseling to patients, leads to a need for an increased focus on genetics in nursing curricula (Cashion, 2009). Nursing students need to understand associated genetic vocabulary and concepts in practice. Nurses are on the forefront of a profession that uses genetic techniques every day, and students are graduating from their programs without the degree of genetic knowledge needed (Cashion, 2009). Due to the increase in the availability and sheer number of genetic tests over the past decade (a 275% increase), current nurses were finding their understanding of genetics lacking (Cashion, 2009). This need expressed by current nursing professionals emphasizes the necessity to increase the level of genetics in the current nursing curriculum.

Nursing students view their field as a practical one that relies on a specific skill set. Students made connections with the relevance of certain subjects (anatomy is mentioned specifically), and they made their view clear that some of the curriculum did not fit with their idea of what they needed to learn as nursing students (Courtenay, 1991; Thornton, 1997). When interviewed, they voiced the opinion they were learning more theory than was necessary and felt it would be better to learn content that relates directly to what they will use in the future (Thornton, 1997).

Although this thought pattern lends itself to specialized classes, one value of nursing students taking the classes for the general audience includes learning critical thinking skills, a necessary skill set in the nursing profession. Thornton (1997) continues to discuss the need nurses have for a broad viewpoint and understanding of many topics. The most recent suggestion called for a collaboration between science teachers and nursing departments to create a new focused course curriculum that pays attention to the breadth of the topics, but does not sacrifice the critical thinking skills or the quality of the content (Thornton, 1997). I plan on exploring whether the ability to take nursing specific science courses caused an increase in positive attitudes of nursing students.

Both first and third year students had a difficult time connecting the theories they learned through the nursing curriculum to the practice of nursing (Ganum, 2004). Many of the first year students expressed surprise that the introductory information in the nursing curriculum was based in theory instead of practical application. Third year students expressed understanding that theory is needed; however, they too expressed displeasure with the amount of theory frontloaded onto the nursing curriculum (Ganum, 2004). Although these students expressed displeasure the authors did not request further information on students' attitudes toward science.

A couple of articles focused on the importance the biological sciences play in the nursing curriculum. At the time of this writing the nursing curricula of the United Kingdom (UK) focused not on the biological sciences, but more on the role nurses play in the behavioral sciences, including sociology and psychology (Courtenay, 1991; Trnobranski, 1993). Trnobranski (1993) discovered that many of the nursing students felt incompetent in biology. The instructors also expressed a lack of confidence in their ability to teach the information needed for the science portion of the curriculum. At that time, the UK tasked nursing teachers with teaching all the nursing curricula, including all aspects of science needed for the degree (Trnobranski, 1993). The same topics were covered in Clarke's (1995) article, which gave the suggestion to employ current nurses working in the field to explain the science needed in the workplace.

Students do not appear aware of the amount of science that is required, before entering the nursing program (Andrew et al., 2008), in spite of the fact that for a number of decades science held a central connection to the nursing program. As stated in other articles, introductory nursing students believe the nursing program is mostly an interactive, skill-based program (Ganum, 2004; Thornton, 1997). Students believed they would be learning skills useful in the physical portion of the profession and were surprised to learn the amount of theory that was required for the program. Many of those interviewed who left the program during the first semester were found to list the amount of science as a motivating factor for leaving (Andrew et al., 2008).

Students entering the baccalaureate program with registered nursing licenses have previous work experience and know what areas they need to focus on when learning content (Cangelosi, 2006). One suggestion for these students is to focus more on the context of how the content will be used in their profession to increase the student's

interest in extending learning past the RN license (Cangelosi, 2006). This goes hand in hand with suggestions made by Hofler (2008), who pointed out the shortage of nurses and gave two conflicting viewpoints. The first viewpoint requested limiting the locations that could license, but the second viewpoint wanted to ease the up on prerequisites. This goes with Cangelosi's (2006) idea to increase the number of RNs returning to school for a BSN or BN, by not making RNs take classes that focus on the basic skills they are already displaying proficiently. This idea of removing the requirements for students that have real life experience also cropped up in an article about graduate nursing students (McMillian, et al., 2007). This article expressed the idea that graduate students feel responsible for directing their own learning and these adult learners need to have the ability to have some control over their own curriculum.

A number of articles gave suggestions not only on what should be added to the curriculum but how the curriculum should be delivered (e.g., Casey, 1996; Clarke, 1995; Csokasy, 2002; Hannah, 2006; Johnson & McAllister, 2008; Sandstorm, 2006). A few of these articles encouraged the use of case studies to teach nursing students critical thinking and give students a real world feel to their classes (Hannah, 2006; Sandstorm, 2006). Both articles discussed how case studies allowed nursing students to feel they were learning skills they would use in the future. In addition, the use of case studies allowed students to see there could be more than one correct answer to a problem. Another article showed that, although many schools in Australia switched to computer-based lab education, students still preferred hands-on experiments (Johnson & McAllister, 2008).

One article focused more on the overall curriculum. Casey (1996) discussed the four levels of a model of teaching called bionursing. Each of these levels gave more detailed and complex information on the biological concepts taught with nursing. The

overall model attempted to teach biology to nursing students without using the medical component. Although the article suggested using this model, it did point out that there was little evidence on how well the model performed (Casey, 1996).

Diekelmann (2002) expressed a concern about the lack of literature that exists on nursing student education. The article brought up a point on how institutions do not lack creativity in dealing with nursing education issues, but those fixes were not based on research. Since there was no research done on many of these interventions, the schools cannot definitively state the intervention worked. In addition, the home institutions can not suggest other schools use these treatments and interventions, as the research is not generalizable or transferable (Diekelmann, 2002). Most of these interventions do not move past the institution in question. My research project strives to move past this issue and widely distribute information on nursing students' current attitudes toward science.

Nursing Students in Science

Nursing students placed a large importance on the biological knowledge nursing programs required before completion (Clancy, McVicar, & Bird, 2000). This was somewhat surprising due to the fact that nursing students comment on the overload of science theory found at the beginning of the nursing programs (Ganum, 2004). Although students understand the area of science was necessary for their work in the nursing profession, nursing students still expressed a lack confidence in their ability to understand science. Surprisingly, the instructors of these students also expressed a lack of confidence when it came to explaining scientific concepts (Clancy et al., 2000). This lack of confidence in both the instructors for the classes and the students completing the classes showed why Project 2000 is being implemented in the UK.

Project 2000 in the UK allows nursing departments to bring in specialists, biologists, and chemists to teach the science curricula needed for each nursing program (Trnobranski, 1993). Before this project's initiation and implementation in 1988, the scientific components of the nursing curricula appeared to be less emphasized. Trnobranski (1993) points out the importance of biological science to the nursing profession and cautions against the glossing over of the subject area.

Nursing students had a higher self-efficacy in science if they completed a science course in their final year of high school (Andrew, 1998). A higher self-efficacy could have seen fewer students leave the nursing program for feeling unprepared in science (Andrew et al., 2008). These same students expressed they felt the science of the program was heavy on the front end. McKee (2002) looked for correlations between a student's success and outside factors. She offered the suggestion to extend the time the science course was taught to over three years within the curriculum versus having an intense class during the first year. The author continued in a follow-up to a critique that her study looked only at a small subset of variables. Scott (2003) stated her conclusions seemed obvious, to which McKee (2003) replied these conclusion were not in previous research. McKee used only chi-squares (χ^2) to test her findings, and when Scott expressed a desire to see *t*-tests in the results, McKee brushed off comparing her two means with a "more sophisticated test" (McKee, 2003, p. 157). I had an issue with her statement, mainly because I would have preferred not only a *t*-test, or at least have the chi-square results published.

Pettersson (2005) looked at the idea of nursing students in science by comparing how their concept of science changes over the course of their instruction. The researcher compared medical students and nursing students three times during their educational

careers. These two groups showed no difference in what they thought of science until the third data collection. The main difference between these two groups at the end was how they viewed research. The author proposed the increase in positive ideas on research held by medical students could be due to their connection to professors who conducted their own research in the hospital, but nursing students did not see the connection of research to their future profession (Pettersson, 2005).

Students' Attitudes Toward Science

Student teachers in the UK must complete a required 100 hours of science, no matter what emphasis they are completing (Young, 1998). Although most of the students surveyed had a positive attitude toward science, they did not see science as anything other than an area students study in school. Young (1998) explored this attitude because previous research showed the attitude of a teacher may influence their students. Since this connection exists, studying the attitudes of student teachers is important.

Another article explored why and when students lost interest in going into a STEM field (Aschbacher, Li, & Roth, 2010). Although some loss of interest should be expected, this article showed that mentoring might have the largest influence on students staying interested in the sciences for a career. Students who experience a lack of encouragement from their home life showed a decrease in their interest in science. Aschbacher et al. (2010) also found some students were discouraged from continuing in science by teachers and mentors.

Students in Nigeria were questioned on their attitudes toward science (Banu, 1986). The researcher found a difference between students of different sexes and school type (science specific, same sex, and public). Female students showed a more positive attitude toward scientists in general. Males, on the other hand, showed a more positive

attitude toward science lessons and the social implications of science (Banu, 1986).

These differences in which type of science students like could have implications on what careers they select in the future. It might be expected, but the students who attended science specific schools had a more positive attitude toward science. I hope to explore this connection at the college level by requesting medical and health professional institutions participate in the study.

Nursing Students' Attitudes in Science

There is limited research in the area of nursing students' attitudes toward science. Much of the nursing curricula literature that mentions science focuses on the biology courses nursing students take in their first years (Andrew et al., 2008; McKee, 2002). In the UK students seem to enter postsecondary education as freshmen into the nursing program, with the biology courses taught by nursing faculty. Project 2000 is a movement for science courses to be taught by specialized faculty rather than requiring nursing professors to lead science content courses. However, there is literature to support how this shift has changed nursing students' attitudes toward science.

One study investigated students who returned to school for an advanced degree. These students documented how the science they learned helped them in their current jobs (Jordan & Hughes, 1998). These students expressed a positive attitude toward science because the science they learned helped them contribute to discussions and treatments at work. One problem they faced actually came from their supervisors when they displayed a more comprehensive knowledge of science (Jordan & Hughes, 1998). The articles written on graduate students and students returning to school for a second degree appeared to show a more positive attitude toward school in general. One variable in my study is age, and it will be interesting to explore if this trend continues.

In summary, although nursing students acknowledged that science, especially biology, was necessary information for the nursing profession, many articles discussed the fact that first year nursing students expressed surprise at the amount of science found in their course work. In addition, nursing students conveyed surprise that they began their course work not learning practical skills but scientific theory (e.g., Andrew et al., 2008, Ganum, 2004; Thornton, 1997).

Gaps in the Literature

The purpose of my study was to identify potential obstacles facing nursing student education, specifically focusing on attitude and motivation toward learning science. The current literature has a lack of information on the state of nursing students' attitudes toward science. Although literature existed on nursing curriculum, including how much of the curriculum should be science, there is little about how students feel about these requirements. Many of the articles focused on the retention of nursing students and why they leave the program. One thing the authors neglected to consider included the attitudes of the students they studied. My study provides a baseline to explain the current attitude of nursing students toward the subject of science. When we know the attitude of students staying in the program, it could help recruit students who will complete the nursing program.

CHAPTER III

METHODOLOGY

I conducted a nationwide research project using a mixed methods approach to identify potential obstacles nursing students face, specifically, attitude and motivation toward learning science. One area of particular interest was the possible group difference in attitudes of nursing (accepted to the program) and pre-nursing (working on their prerequisite classes) students toward science. In particular, I was interested in whether these students' inclinations are positive or negative toward the subject of science as a whole. I explored the reasons students gave for why they were interested in learning the content in their science classes. To answer these questions, I conducted a mixed methods study using a quantitative survey approach, employing a Likert-like questionnaire on a national scale and a qualitative interview approach with purposeful sampling for a richer detailed exploration. To discover the potential obstacles to a positive attitude toward science, I investigated three major questions and two sub-questions (see Table 1). For my investigation I collected data from three sources: demographics, questionnaires (SAI II), and interviews. Each data source was used to answer multiple research questions (see Table 1). Table 1 displays how each data source was used to answer or not answer each research question. A data source could be either a primary or a secondary source for a question. If the data source is a primary source, that source was critical for collecting information to answer the research question. If the data source is a secondary source, that source provides information to help answer the research questions but only in a supportive role.

Table 1

Data Matrix

Research Question	Demographic s	Data Source	
		Questionnaire	Interviews
What are nursing students' attitudes toward science?	S	P	P
How do the attitudes of students in an institution with specialized pre-nursing curricula compare to an institution without specialized pre-nursing curricula?	S	P	
How do nursing students view the role of science in their educational training?	S		P
How do demographic variables relate nursing students' attitudes toward science?	P	P	
Why are nursing students motivated to learn science content for their pre-nursing science courses?			P

Note: P= Primary source S = Secondary source.

Setting

For the quantitative portion of the study, I contacted 399 baccalaureate-granting nursing programs via email with the anticipation of 10% participation in the study. I obtained permission from 63 institutions across the U.S. as conduits for the dissemination of the questionnaire to the pre-nursing and nursing students at each institution. I limited participation to schools classified as doctoral/research university, masters program, bac/diverse, or special focus in either health professions or med schools, with a nursing program that grants the following degrees: bachelor's of nursing, a bachelor's of science in nursing, or both.

I recruited institutions from across the contiguous U.S. Following the format outlined in the U.S. Census I divided the contiguous U.S. into six regions (U.S. Census

Bureau Geography Division) (see Figure 1) including: Northeast, Southeast, East North Central, West North Central, West South Central, and West. The Northeast region encompasses nine states: ME, NH, VT, CT, RI, NY, NJ, MA, and PA. The Southeast region encompasses 12 states: FL, MS, AL, GA, SC, NC, TN, KY, VA, WV, MD, and DE. The East North Central region encompasses five states: MI, WI, OH, IN, and IL. The West South Central region encompasses four states: OK, TX, LA, and AR. The West North Central region encompasses seven states: MN, ND, SD, IA, NE, MO, and KS. Finally, the West region encompasses 11 states: WA, OR, ID, MT, WY, CO, NM, AZ, NV, UT, and CA. Table 2 shows a breakdown of schools by area.

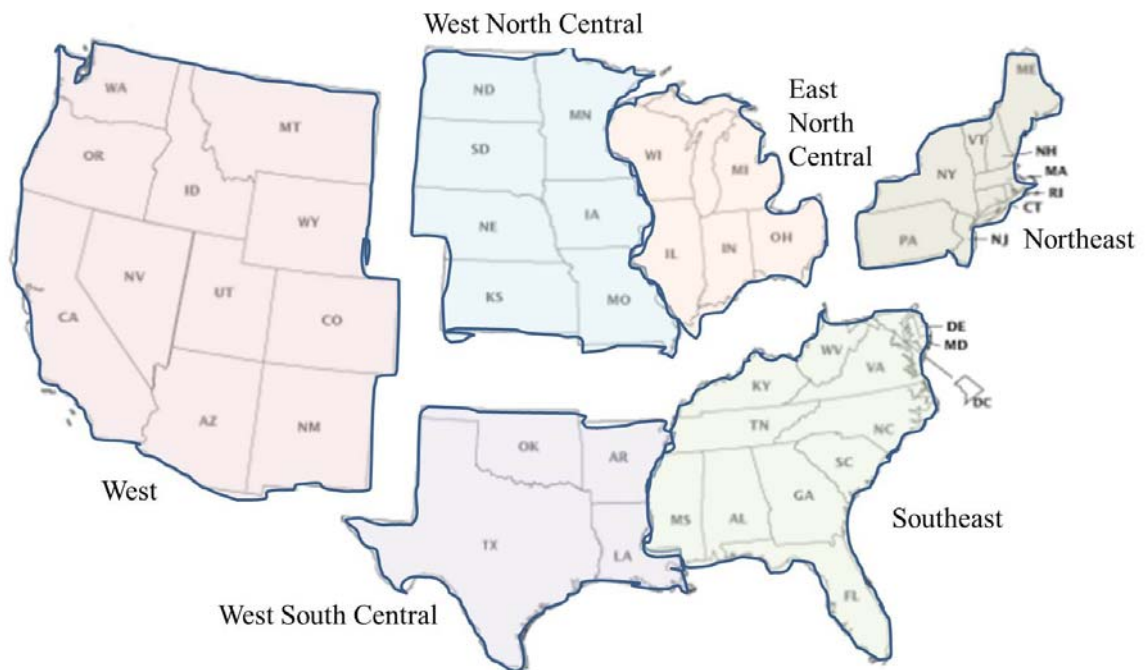


Figure 1. U.S. Map with Regions. (U.S. Census Bureau Geography Division).

Table 2

Number of Participating Schools and Individuals by Region

Region	No. of Schools completed questionnaires	No. of Participants who provided institution names
ENC	4	184
NE	12	251
SE	24	562
W	4	65
WNC	8	221
WSC	4	91
Total	56	1374

For the qualitative portion of my investigation I recruited students enrolled in a large southern research institution with a specialized nursing and pre-nursing degree program in order to conduct individual interviews (see Appendix A for protocol). I conducted four semi-structured interviews each between 30-60 minutes long.

Institutional Review Board

I obtained permission from the large southern research university's Institutional Review Board (IRB). I provided evidence of IRB approval by emailing the approval letter when requested. In addition I provided the completed IRB application upon request of participating institutions (see Appendix B). As there were two separate methods to data collection, I had two separate informed consent forms: one for the quantitative and one for the qualitative participants (see Appendixes C and D).

Participation in the quantitative portion of the investigation was anonymous. Individuals who participated in the qualitative portion remained confidential through the use of a pseudonym on all documentation and data. All participants had the option to

stop contributing at any time during the investigation process without penalty or prejudice. The web servicer SurveyMonkey housed the quantitative data until I downloaded them onto a password protected computer. I uploaded all the audio recordings from the qualitative portion of my investigation onto a password protected computer.

Participants

For the quantitative portion of the investigation, all pre-nursing and nursing students at participating institutions were potential participants for the questionnaire. After obtaining permission from the university's Human Subjects Review Board, I sent qualifying institutions an introductory email, which included an explanation of the investigation and a copy of the recruitment email. The recruitment email included the link to the questionnaire on SurveyMonkey. I provided an electronic copy of my home institution's IRB acceptance letter and IRB application upon request. Each institution's nursing program contacted the potential participants through email. These participants self-identified as either pre-nursing (currently working on prerequisites for the nursing program) or nursing (currently accepted by the nursing program) students. I assumed that the nursing programs identified students who showed an interest in the nursing program and that they could contact those students as well as the current nursing students in the program. All participants had to be 18 years of age or older and currently on their institution's emailing lists.

For the qualitative portion of the investigation, I recruited students from a southern high research activity university's nursing program. Originally, I attempted to contact the possible participants through the nursing school. However, this attempt at an email connection did not come to pass. In reality, when I chose participants to interview,

I selected individuals that exhibited a cross section of the demographics seen in the quantitative pool. I contacted students through intermediate sources and requested they become key informants for my study.

Researcher

As an educator, I view learning as an ongoing process that builds upon previous knowledge and experiences. As a researcher, I have a background in both qualitative and quantitative analysis. This background allowed me to see the need for a mixed method approach in my study. The quantitative portion provided a snapshot of measured (positive or negative) attitudes of both pre-nursing and nursing students. By pairing this with qualitative interviews I developed implications for nursing curriculum development based upon what students reported as helpful to learning science content and course enjoyment. Over the last eight years I have taught a variety of anatomy and physiology lectures and laboratory courses at both four-year university and community college levels. My past interaction with pre-nursing students has given me a glimpse of these students' attitudes toward science. These interactions gave me insight I felt was needed for conducting my investigation.

Data Collection

Demographic Data

Demographic data was a large component of my investigation. The study contained two levels of demographic data: individual and institutional. I gathered individual demographics from participants either at the end of the quantitative questionnaire or at the beginning of the qualitative interviews (see Table 3). The placement of the demographic questions to participants was purposeful, both to increase investment in questionnaire completion and to put interview participants at ease. I

collected the institutional demographics to create a profile for each institution based on the information gathered from the institution's website, the institution's undergraduate bulletin or catalog, the Carnegie Foundation's webpage and/or contacting the institution (see Tables 3 and 4) (Clyburn, 2010).

The demographic variables of age, sex, race, institution, and institution's location do not need any further explanation beyond the levels of the variables which are found in Table 3. The participants were asked for both the institution name and location (state), as there were a few instances of multiple institutions with the same or similar names participating in the investigation. Participants were also asked for their acceptance status to the nursing program. Many nursing programs in the U.S. require students to complete a list of prerequisite courses before formally applying to the nursing program (NCSBN, 2009). This allowed me to classify students as either pre-nursing students or nursing students. I verified the degree students were currently seeking in order to ascertain that the participant was seeking a BN or a BSN. Students that selected other degrees were removed from the analysis. I requested participants tell me the highest degree they are planning to obtain in order to ascertain if the attitudes of students currently planning to extend their education past their bachelor's degree were different than those attitudes of students who are terminating at the BSN or BN. As students are entering universities for second degrees, the question of current school rank was a separate question from year in school for current degree to give a better explanation of the participant. Finally there were three questions on the amount of science the participant had taken. The first two questions in this series included an overall number of classes taken in science; one requested the number of lecture classes and one the number of lab courses the student had taken. The instructions preceding these three questions requested students answer with

the total number of classes they had taken in the subjects of biology, chemistry, and physics. The final question requested students give the total number of college credits they had completed in biology, chemistry, and physics. Because lecture and laboratory classes have a varying number of credit hours depending on the class and institution, it was not possible to compute this total number of credit hours accurately on my own.

Table 3

Individual Demographics with Variable Levels

Variable	Levels
Categorical Variables	
Formally accepted into a nursing program	yes, no
Highest degree you intend to earn in the future	BS or BSN, MSN, PhD, other
Institution name	Removed for confidentiality
Race	Caucasian, African American, Hispanic/Latino(a), Native American, Pacific Islander, Inuit/Eskimo, Asian, Other
Rank in school	Freshman, Sophomore, Junior, Senior, Other
Current degree you are seeking	BS, BSN
Location of your institution	48 contiguous U.S.
Sex	Male, Female
Continuous Variables	
Age	
Number of college credits in science	
Number of labs taken in science	
Number of lectures taken in science	
Year in school	1-8

For the institution profile I used the Carnegie Foundation's webpage (carnegiefoundation.org) to obtain the following information: the Carnegie ranking of the institution, the official location of the institution's main campus, the total population of the institution, and the institution's classification as public or private (Clyburn, 2012). I

determined the region of the institution depending on what state the Carnegie Foundation's webpage gave as the official location. I obtained the information to answer the institutional demographic questions on the nursing program requirements and if the institution had any specific science courses for nursing students (e.g., Chemistry for Nursing Majors) through the institution's undergraduate bulletin or catalog. If the bulletin or catalog did not list the required courses, I checked the department's webpage. I identified the total enrollment for the nursing program through each program's webpage or by contacting the department. Science courses were classified as nursing-specific if they were listed as nursing or health profession specific or if this was stated in the course description.

Table 4

Institutional Demographics with Variable Levels

Variable	Levels
Categorical Variables	
Area of the country	Northeast, Southeast, West South Central, East North Central, West North Central, West
Carnegie ranking of the institution	RU/VH, RU/H, DRU, Master's L, Master's M, Master's S, Bac/Diverse, Spec/Med, Spec/Health,
Nursing-specific science courses offered	Yes, No
Type of institution	Private, Public
Continuous Variables	
No. of science courses required to apply	
No. of science courses required total	
Total enrollment in institution	
Total enrollment of the nursing program	

Quantitative Instrument Selection

Due to the importance of students' attitudes toward a subject area, multiple instruments have been designed to attempt to measure the strength and direction of a

student's attitude toward a specific topic. I originally selected the Students Attitudes Toward Statistics with a subject modification as the instrument for my study (Schau, 1996). I received permission from the author of the instrument to alter the subject topic of the questionnaire from statistics to science. Replacing the term statistics with science and statistical with scientific were the only alterations made to the questionnaire items. Because this changed the focus of the questionnaire, I ran a pilot study to test for reliability and validity of the instrument. After distributing the instrument to 182 nursing and pre-nursing students as a pilot study, it was determined that changing the subject of the questionnaire and its audience did not result in questionnaire items grouping into the original intended factors. Therefore, I changed my original instrument in favor of an instrument specifically designed for measuring the attitudes of students in science, the Scientific Attitude Inventory II (SAI II).

The SAI II is a reformatting of the original Scientific Attitude Inventory (SAI) (Moore & Sutman, 1970). Moore reformatted the questionnaire to clarify and simplify the language of some items. In addition, the gender bias that existed in the SAI, which implied that all scientists were male, was removed. The original questionnaire contained 60 items that supported 12 different positions regarding students' attitudes toward science. Six of these positions were positive in nature, and six were negative in nature. The 60 items were equally divided between the 12 positions, with five items contributing to the score of each position. The SAI II narrowed the questionnaire to 40 items. With the exception of the sixth pair of positions, one positive and one negative position, the items contributing to each position's score was narrowed to three items. The authors of the SAI II ran an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) on the revised instrument; however, the results did not support the 12 positions

proposed by the authors so they published the instrument without factor analysis support (Moore & Foy, 1997).

Lichtenstein et al. (2008) conducted a reevaluation of the instrument using both an EFA and a CFA. They found that 30 items loaded on three factors after running an EFA; however, only two of these factors could be confirmed during the subsequent CFA, and then only after each latent variable was run separately (Lichtenstein et al., 2008). Both studies ran the EFA using part of a convenience sample with under 300 individuals. As will be discussed in the methods section, a more appropriate sample size for this instrument is closer to 400 individuals (or at least over 300). Each of the studies split their original sample into two groups, running an EFA on one grouping and a CFA on the remaining group. Each study had a sample of approximately 550, and by splitting the sample the number of respondents measured by the CFA was similar to the number used on the EFA (Lichtenstein et al., 2008; Moore & Foy, 1997). My study will reevaluate the SAI II with a larger nationwide sample, using both an EFA and a CFA.

Quantitative Data

To assess the attitudes of nursing and pre-nursing students, I used the SAI II (see Appendix B) (Moore & Foy, 1997). The questionnaire was completely anonymous as there was no need to trace completed questionnaires back to specific participants. Participants had the opportunity to quit the questionnaire at any time during the process without penalty or prejudice. The questionnaire was administered via the website SurveyMonkey and distributed to possible participants as a link through an email from their nursing program. The email contained a short letter explaining the study and the link to the online questionnaire. Data was downloaded from SurveyMonkey

approximately once each week after the participant solicitation emails were distributed. Responses were downloaded into an excel file and then uploaded into SPSS.

The SAI II, a 40 item questionnaire, used a five-point Likert scale. All possible responses on the instrument were the same for each question: strongly disagree, mildly disagree, neutral/undecided, mildly agree, or strongly agree. After participants completed the questionnaire, I replaced the response choices with numbers, ranging from strongly disagree at one to strongly agree at five. Half of the items on the SAI II were negatively worded and, therefore, originally reverse scored.

Qualitative Data

In the qualitative portion of the study, I collected data using semi-structured interviews (Patton, 2002) (see Appendix A for interview protocol). Four participants were purposely chosen after a short conversation that determined if they were current nursing students. I chose one student who just started working on prerequisite courses for nursing, one who was recently accepted into the nursing program, one senior nursing student currently doing clinicals in her senior year, and one student who graduated during the study. I selected two female participants and two males, and three Caucasian students along with one African American student. I used prompts to explore how the participants felt toward their science courses and the content they learned in those classes. At the end of each interview I did a summative member check with each key informant to make sure I was clear on their views.

The rich detail from these key informants helped supplement the quantitative data. These interviews allowed for a deeper exploration of what students found engaging when learning science content for classes. Additionally, I prompted participants to discuss motivational factors during the interview.

Analysis

Statistical Analysis

I used two statistical packages over the course of my investigation, SPSS and SPSS AMOS (SPSS AMOS). I uploaded all the data previously downloaded from SurveyMonkey into SPSS. This allowed me to clean the data, explore the demographic factors, and reduce the questionnaire data categories through an exploratory factor analysis (EFA). I used SPSS to randomly split my participants into two equal groups. These two groups were saved as two separate files. One file was designated as the group on which I ran an EFA. This random sample contained approximately 700 individuals from the total participant population. Previous studies have used the original version of the SAI II, the SAI I, to test the attitudes of college students (Welch, 1972). Therefore, I randomly selected my EFA sample post collection, rather than conduct a separate pilot study. I ran a confirmatory factor analysis (CFA) on the remaining participants using the factors discovered in the EFA.

Data clean-up included removing both incomplete questionnaires and questionnaires completed by participants outside the focus of this project (e.g., doctoral students). I categorized a questionnaire as incomplete if more than 10% of the items, four questions, on the SAI II were missing (Lichtenstein et al., 2008). Missing demographic data did not exclude the questionnaire response from the factor analysis. I replaced missing responses with a best estimate dependent on the individual's responses to the other questions (Lichtenstein et al., 2008). I used SPSS to determine this best estimate of the response by having the program use a linear trend line to replace missing values on the SAI II.

The EFA allowed me to group questionnaire items that were related to each other based on correlation matrices. As attitude is a multifaceted construct, there were a number of aspects to take into account when calculating an attitude score. Conducting an EFA allowed me to reduce the 40 items on the questionnaire into groupings of related items that correlate closely to one another, called factors. These factors each measured a construct of a nursing student's attitude toward science (Field, 2009). I ran this analysis on approximately 700 questionnaires which met the latest accepted threshold for stability of the factors uncovered by an EFA at 300 subjects in a sample (Tabachnick & Fidell, 2007). This also more than met the expectation of a minimum of 10 subjects for every item in the analysis; in the case of this study, 10 responses for 40 items of questionnaires (Field, 2009).

I used SPSS AMOS version 17 to run a CFA using the factors uncovered in the EFA. The CFA allowed me to test the validity of these factors. After I tested the EFA using the CFA I used SPSS to test which of my demographic variables had a significant influence on my attitudes score. I did this through multivariate multiple regressions, running the demographic scores against the factor scores from the SAI II.

Qualitative Analysis

I gathered information from both the audio recording and researcher notes to create a profile for each key informant. These profiles contained a rich description of the interviewee's attitudes and experiences with science as a part of the nursing curriculum (Patton, 2002). For each participant in the qualitative portion I started the profile with a demographic description of the individual. The profiles continued to explore the answers interviewees gave to the semi-conducted interviews. The researcher notes provided the framework; however, I used the audio recordings to transcribe the quotes for each key

informant. After completing profiles on all interviewees I looked for trends that appeared across the profiles.

Trustworthiness

I employed multiple tactics to ensure the four major elements of trustworthiness: credibility, transferability, dependability and confirmability (Lincoln & Guba, 1985). I received participant permission to record the interviews and to take notes during the interview process. Key informants watched me take notes, and after finishing the interview portion I completed a member check with the information the participants provided. I gave each key informant a copy of the informed consent form that contained my contact information and encouraged them to contact me if they wished to elaborate on any response. These procedures ensured credibility. I achieved transferability by creating rich descriptions from the interviews. I confirmed my qualitative methods and analysis with a senior research advisor to achieve dependability and confirmability.

Ethical Considerations

All participant involvement in this investigation was voluntarily. Individuals who participated in the quantitative questionnaire through SurveyMonkey were anonymous. The information given by the participants in the interviews has been and will continue to be kept confidential. All names were changed to pseudonyms to protect the identity of the key informants. Each institution had the opportunity to request that I obtain approval from their Human Subjects Board prior to dissemination of the questionnaire, or that I provide the information required by The University of Southern Mississippi's IRB panel. Prior to seeking permission from external institutions I went through IRB at my home institution (IRB Approval #12051001, see Appendix B). My current students were

excluded from my investigation because the institution I teach for is a two year institution and, thus, does not meet the classification criteria for inclusion in this investigation.

CHAPTER IV

RESULTS

Quantitative Results

Data Analysis

After downloading completed questionnaires from Survey Monkey into Excel, I started to clean the data. This download included 1,962 questionnaires; however, two individuals selected no on the first question and did not start the questionnaire, causing their removal. The second round of removal included individuals who stopped answering questions after the first or second page. A third look at the data excluded the questionnaires of students who listed their current degree as something other than BSN or BS. The remaining data were inputted into SPSS for further cleaning and analysis.

A count for missing data was run on the first 40 questions of the questionnaire. The first 40 questions were the questions to be used in the exploratory and confirmatory factor analysis. Individual questionnaires were removed if more than four questions were missed (Lichtenstein et al., 2008). This lowered the total number of questionnaires to 1,402. Missing data points in the first 40 questions were replaced through linear trend at point replacement. Three questionnaires had three values replaced, 10 questionnaires had two values replaced, and 118 questionnaires had one value replaced. No question had more than nine missing responses.

For each individual questionnaire, the other column was explored to see if the individual wrote in an option that was provided. This occurred three times for the institution attended and 12 times for race. If the question asking “What state is your school in?” went unanswered, I entered the state that matched the institution; this occurred 21 times. In two cases the opposite occurred, the institution was changed to

match the state as the institution chosen was either just above or below an institution in the selected state.

In some instances the number of total lecture classes added to the total lab courses did not match the total number of credits in a science course. For some, the total number of classes added up to more than the total credit number. For these cases I changed their original values to missing.

I collected information on the 2010 school enrollment, Carnegie Rankings, and type of institution from the Carnegie website (Clyburn, 2010). To determine the number of total science courses required, the number of science courses students had to complete before applying, and whether any of these courses had a nursing specific option, I read the appropriate information in the institution's catalog or bulletin. The state of the institution determined the variable area of the country. In order to have a consistent measurement of setting, I used the U.S. NEWS webpage (<http://colleges.usnews.rankingsandreviews.com/best-colleges/search>). Although I collected the total number of students in the nursing school from a majority of institutions, I could not be assured each institution was giving me the same information. Some schools gave me only traditional BSN students, some gave me spring semester totals, others gave me fall semester totals, and still others were not forthcoming with their nursing population. For this reason, I decided to remove this demographic from my analysis.

I dummy coded each nominal categorical variable in preparation for the linear regression analysis. These variables included race, Carnegie ranking, highest degree desired, area of the country, and type of institution. I did not dummy code ordinal categorical variables. The variable listing the institution's name and the state of location

were not used for analysis but to have a reliability check point in the demographics. The institution variable also allowed me to add the institutional variables to individual questionnaire. I determined the area of the country through the state variable.

Demographic Information

A total of 1,402 participants completed the attitudes portion of the questionnaire. Of the 1,387 who responded to the question “what is your sex”, over 90% listed female, 9.4% listed themselves as male. The age of participants ranged from 18 to 61 years of age. In the age category the upper ages were not outliers; in fact, at least one person selected each age except for 57. The majority of participants (69.7%) selected their age as 23 years or younger, while 1.8% of participants did not provide an age.

Participants had the opportunity to select multiple options for race. The highest percentage selected Caucasian (85.8%); African American and Hispanic/Latino had a similar selection of participants each with 5.3% of the sample. Asians accounted for 4.1% of the sample and the participants selected Native American 1.8% of the time. The smallest portion of the sample selected Pacific Islander (0.6%), and no one selected Inuit. Fifty-five individuals selected multiple races and were removed from the multiple regressions analysis in order to removed uneven weighting in the analysis.

The majority of participants selected their classification level as Senior (38.2%), Junior was selected 27% of the time, Sophomores accounted for 13.9%, and 16.7% of the sample selected Freshman. A small percentage of the questionnaires did not select a classification (4.1%). The majority of students who completed the questionnaire selected they had been accepted into their school’s nursing program (84.8%). Participants who completed the question “what is the highest degree you hope to earn in nursing?” selected MSN the majority of the time (50.3%). The rest of the sample was split among BS

(20.5%), PhD (21.8%), or Prefer not to answer (2.7%). Most students who filled out the questionnaire were working on a BSN degree (91%) versus a BS degree (6.4%). The majority of students, over 90%, stated they were in their first four years of their current degree. The highest percentage of them (25.4%) had just started.

The majority of students (91.7%) entered a number of 10 or lower when asked how many lecture courses they had taken in science; however, the total range had a low of 0 and a high of 140. The participants who answered 50, 100, and 140 were changed to missing because their numbers suggested a misunderstanding of the question. The final range became 0 to 48 for this variable. The question of lab courses had a similar problem. The original range started with 0 and ended with 50. After changing three participants to missing, the final range had a low of 0 and a high of 30, with the majority selecting eight or under (93.1%). After changing 27 participants to missing, the range of total science course credits had a low of 0 and a high of 190. I only changed the participants' total credits to missing if their lab and lecture courses added up to more than their total credits in science courses. The majority of students (52%) entered 16 or under for their total number of science credits.

The rest of the demographics were collected on the institutions themselves, and I matched the individual to this information based on the selected institution. I collected total enrollment from 2010 and ended up with a range of 634 – 68,064 students enrolled in the institutions. The majority of these institutions were listed as having a setting in the city (36.7%), followed closely by suburban with 32.4%. Participants from rural institutions accounted for 12.2% of the sample, and 17% of participants attended an urban institution. The percentage of participants who attended schools with nursing specific classes accounted for 51% of the sample.

Only one person attended a Bac/Diverse institution (0.1%). The majority attended a Masters L institution (33.2%). The second and third lowest, respectfully, were Spec/Med (2.6%) and Masters M (2.9%). RU/H and RU/VH had similar percentages at 16.3 and 17.8, respectfully. DRU accounted for 12.3% of the sample, 8.2% attended a Masters S institution, and 4.9% went to a Spec/Health. The majority of the participants (69%) attended a public institution. For the most part, participants attended institutions in the southeast (40.2%). The lowest two groups, west and west south central, tied for their percentage of the sample at 4.6%. The northeast provided the second highest population at 19.9%. The east north central and the west north central had 13.1% and 15.8%, respectfully.

Thirty-three percent of the sample attended institutions that admitted freshmen directly into the nursing program. For the rest of the sample, the highest percentage of participants had to complete three courses before they could apply to the nursing program (28.9%). Fifteen point four percent had to complete two courses before applying, 10% had to complete four classes, and 4.8% had to complete one class. One point one percent did not have to complete any courses but had to be admitted into the college and taking courses before they could apply. Finally, 0.1% were required to complete five courses and 0.6% were required to complete six. In addition to the traditional programs, 4% of the participants attended institutions that required an RN license before they could apply.

Overall, 45.1% of participants attended institutions that required them to complete four science courses. The second highest percentage attended schools that required five science courses (32.4%). Thirteen point one percent of participants attended schools that required they complete six science courses. A small percentage of participants (2.2%)

are required to complete two courses, whereas 3.5% are required to complete three courses.

The majority of students who had not been accepted into a nursing program attended public institutions (see Figure 2). As seen in Figure 3, the males who completed the questionnaire are spread fairly evenly across the classification years.

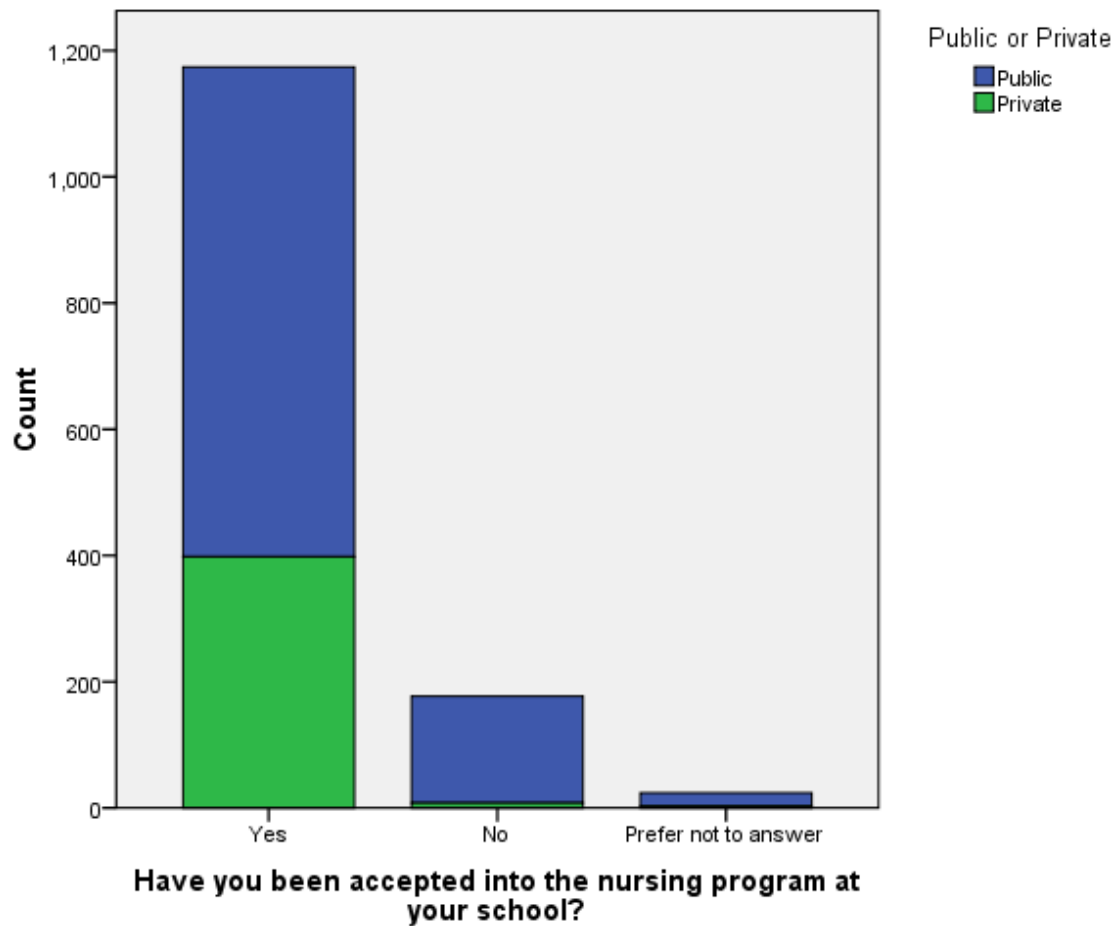


Figure 2. Accepted into program versus school type.

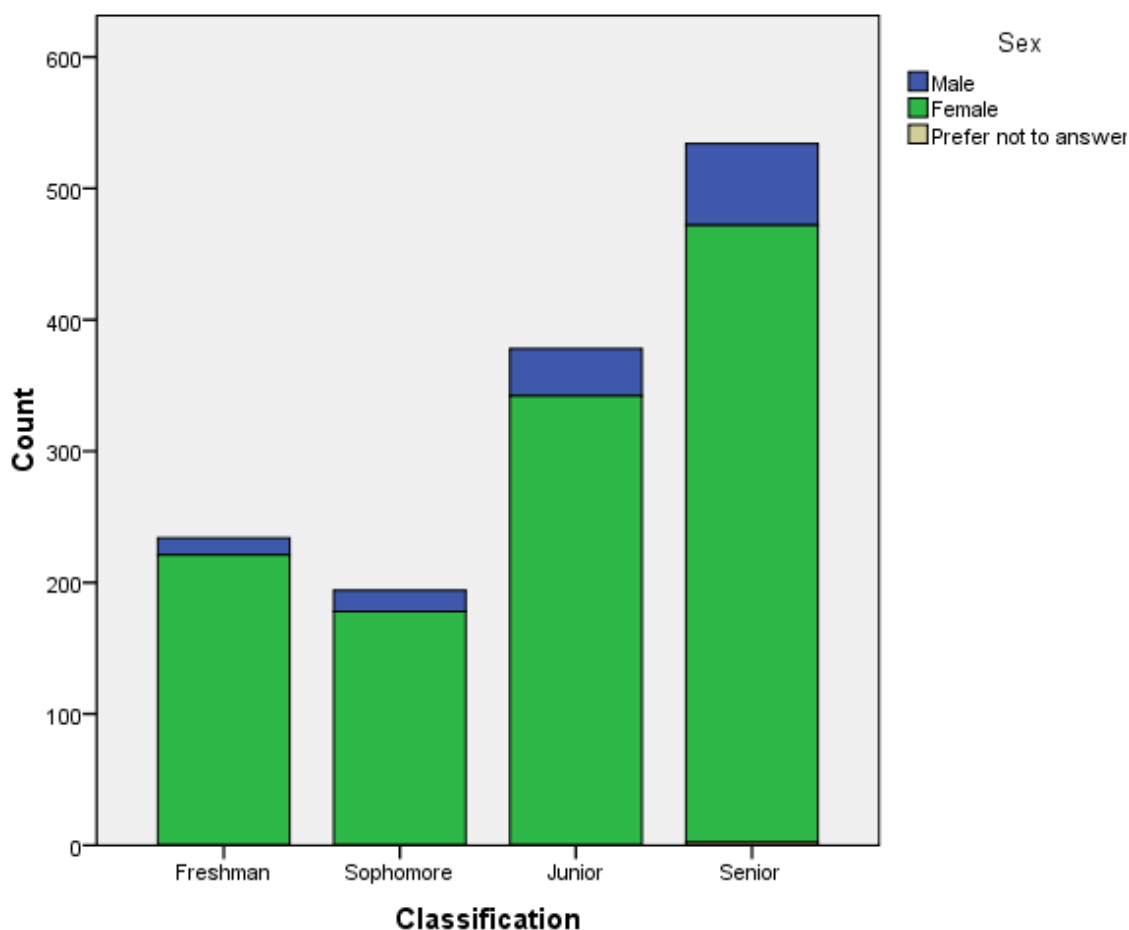


Figure 3. Sex versus classification in school.

Exploratory Factor Analysis

All 40 questions on the questionnaire from the SAI II were analyzed in an exploratory factor analysis (EFA). Before beginning the EFA, I used SPSS to randomly split the total sample of 1,402 questionnaires into two equal groups. One group of 701 questionnaires was used in this analysis. Although the SAI II is a published instrument, this analysis was run as a principle component analysis. This was done for two reasons: the questionnaire had previously been given to college students, and it had never been given exclusively to nursing students. In addition, the original alteration of the questionnaire from the SAI to the SAI II stated they ignored, and did not report, the

results of an unfavorable confirmatory factor analysis. For this reason, I treated this as a true exploration. A series of EFAs were run, but only the final model will be discussed here.

I treated my EFA as truly exploratory with no preconceived idea of what questions would group together, so I ran the principle component analysis with a varimax rotation. The correlation range was $<.001=.804$. Table 5 contains the descriptive statistics on the 40 questions. The Kaiser-Meyer-Olkin (KMO) was .856 and the Bartlett's test of Sphericity had a statistically significant result. The original EFA was run with 11 factors that had Eigenvalues over 1.0 and explained 56.584% of the total variation. I ran the original EFA to acquire a scree plot in order to limit the number of factors. The first scree plot suggested a six factor model. On the second run of the EFA, question 11 did not load on any factor and was removed from the model. The third run was also limited to six factors. The structure of the model looked promising after this run, so factors were run through a reliability test, Cronbach's alpha. The Cronbach's alphas of two factors fell below .600 and only one factor was above .700.

Table 5

Descriptive Statistics for Variables of the Factors

Question	M	SD
1. I would enjoy studying science.	4.330	.8079
2. Anything we need to know can be found out through science.	3.244	1.1543
3. It is useless to listen to a new idea unless everybody agrees with it.	1.406	.7446
4. Scientists are always interested in better explanations of things.	3.991	.9117
5. If one scientist says an idea is true, all other scientists will believe it.	1.316	.6308
6. Only highly trained scientists can understand science.	1.559	.7562
7. We can always get answers to our questions by asking a scientist.	1.983	.9226
8. Most people are not able to understand science.	2.256	.9908

Table 5 (continued).

Question	M	SD
9. Electronics are examples of the really valuable products of science.	3.675	1.0805
10. Scientists cannot always find the answers to their questions.	4.250	.8679
11. When scientists have a good explanation, they do not try to make it better.	1.830	.8458
12. Most people can understand science.	3.481	.9901
13. The search for scientific knowledge would be boring.	1.951	.9564
14. Scientific work would be too hard for me.	2.029	.9910
15. Scientists discover laws which tell us exactly what is going on in nature.	3.283	1.0730
16. Scientific ideas can be changed.	4.454	.6980
17. Scientific questions are answered by observing things.	4.016	.7567
18. Good scientists are willing to change their ideas.	4.444	.7395
19. Some questions cannot be answered by science.	4.328	.8535
20. A scientist must have a good imagination to create new ideas.	3.738	1.0036
21. Ideas are the important result of science.	3.364	.9697
22. I do not want to be a scientist.	3.074	1.2819
23. People must understand science because it affects their lives.	3.729	.9184
24. A major purpose of science is to produce new drugs and save lives.	3.905	.9870
25. Scientists must report exactly what they observe.	4.411	.7794
26. If a scientist cannot answer a question, another scientist can.	2.632	1.0177
27. I would like to work with other scientists to solve scientific problems.	3.264	1.1552
28. Science tries to explain how things happen.	4.362	.6181
29. Every citizen should understand science.	3.578	.9445
30. I may not make great discoveries, but working in science would be fun.	3.879	.9606
31. A major purpose of science is to help people live better.	4.176	.7185
32. Scientists should not criticize each other's work.	2.118	1.1181
33. The senses are one of the most important tools a scientist has.	4.046	.8146
34. Scientists believe that nothing is known to be true for sure.	3.380	1.1319
35. Scientific laws have been proven beyond all possible doubt.	2.597	1.2398
36. I would like to be a scientist.	2.996	1.2160
37. Scientists do not have enough time for their families or for fun.	1.919	.8622
38. Scientific work is useful only to scientists.	1.456	.7364
39. Scientists have to study too much.	2.579	1.1252
40. Working in a science laboratory would be fun.	3.485	1.1064

According to the analysis, the only deletion that would improve one of the factor's Cronbach's alpha was question 32. The fourth run of the model had 38 items forced onto six factors. In the fourth run, question 28 double loaded above .350 on two factors, and for this reason it was removed from future runs. Following the scree plot the fifth run increased to nine factors. No items were removed after run five; however, a sixth run was completed using five factors. Question 25 double loaded below .30 on two factors and was removed from the model. Run seven was the final run to determine the model. The EFA contained 36 items across five factors (see Table 6). Questions 11, 25, 28, and 32 were removed from the model. The total variance explained by the final model was 41.991%.

Factor one, *working in science*, consisted of eight questions (1, 13, 14, 22, 27, 30, 36, & 40). This factor had the highest Cronbach's alpha at .899. The following four factors had Cronbach's alphas under .700. Ten questions (4, 9, 20, 21, 23, 24, 29, 31, 33, & 34) made up factor two, *how science works*. This factor recorded a Cronbach's alpha of .673. Factor three had a Cronbach's alpha of .631 and contained six questions. Six questions (3, 5, 16, 17, 18, & 38) loaded onto the factor *scientific ideas*. *Science answers all questions* was factor four. Seven questions (2, 7, 10, 15, 19, 26, & 35) loaded onto the fourth factor, which had a Cronbach's alpha of .643. The final factor contained questions in the area of *science is hard* and contained five questions (6, 8, 12, 37, & 39). This factor had a Cronbach's alpha of .661.

The range of responses for *working in science* was 1.00 – 5.00, which was the widest range of all the scales. *Science answers all questions* had a range of 1.57 – 5.00. The range for *scientific ideas* was 1.50 – 5.00. *Science is hard* had a range of 1.80 – 5.00. The range of *how science works* had the smallest range of 1.90 – 5.00.

Table 6

Final EFA Structure

Questions	Factor				
	1	2	3	4	5
I would like to be a scientist.	.843				
I do not want to be a scientist.	-.837				
I would like to work with other scientists to solve scientific problems.	.833				
I may not make great discoveries, but working in science would be fun.	.799				
Working in a science laboratory would be fun.	.719				
The search for scientific knowledge would be boring.	-.675				
I would enjoy studying science.	.657				
Scientific work would be too hard for me.	-.603				
A major purpose of science is to help people live better.		.602	.305		
People must understand science because it affects their lives.		.571			
Every citizen should understand science.		.545			
A major purpose of science is to produce new drugs and save lives.		.529			
The senses are one of the most important tools a scientist has.		.458			
Scientists believe that nothing is known to be true for sure.		.457			
A scientist must have a good imagination to create new ideas.		.450			
Electronics are examples of the really valuable products of science.		.438			
Ideas are the most important result of science.		.361		.325	
Scientists are always interested in better explanations of things.		.305			
Good scientists are willing to change their ideas.			.663		

Table 6 (continued).

Questions	Factor				
	1	2	3	4	5
Scientific ideas can be changed.			.609		
Scientific work is useful only to scientists.			-.496		
It is useless to listen to a new idea unless everybody agrees with it.			-.482		
Scientific questions are answered by observing things.			.465	.318	
If one scientist says an idea is true, all other scientists will believe it.			-.417		
Scientists discover laws which tell us exactly what is going on in nature.				.650	
Anything we need to know can be found out through science.				.597	
Scientific laws have been proven beyond all possible doubt.				.594	
We can always get answers to our questions by asking a scientist.				.553	
Some questions cannot be answered by science.				-.542	
Scientists cannot always find the answers to their questions.			.311	-.382	
If a scientist cannot answer a question, another scientist can.				.366	
Most people are not able to understand science.					.759
Most people can understand science.					-.706
Scientists have to study too much.					.528
Scientists do not have enough time for their families or for fun.					.490
Only highly trained scientists can understand science.			-.319		.473

Confirmatory Factor Analysis

I used SPSS AMOS to draw my confirmatory factor analysis. This analysis allowed me to verify the validity of the structural model I found in my EFA (Garson, 2012). I linked my SPSS AMOS drawing to the SPSS file containing the attitude questionnaire data from the 701 participants not used in the EFA. The original model contained the 36 questions from the questionnaire and their error terms. These questions represented the observed variables. The questions were then all loaded onto one of five factors, the same factors determined by the EFA. These factors are unobserved variables and can only be measured through the observed variables. I ran the original model and examined the goodness-of-fit model numbers. These measurements I looked at included the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). Models with a good fit would have a RMSEA of $<.05$, a CFI of $>.95$, and a TLI of $>.95$. CFI and TLI of $>.90$ would be considered adequate and RMSEA of $<.08$ would be a reasonable fit. The original model had inadequate goodness-of-fit numbers, which prompted me to improve the overall model (see Table 7 for goodness-of-fit numbers for all models).

After running the original model I started correlating error terms of question pairs that had modification indices over 40.00. I only correlated error terms if the questions were reverse ordered or asked similar questions. Model 1 is the second run of the CFA model, and in addition to the original model the error terms of questions 8 and 12 were correlated. The two questions in this case were reverse ordered, asking if most people could or could not understand science. The χ^2 difference test showed a statistically significant result so I retained Model 1. There remained high modification indices for more than one question pair. Because of this, I correlated the error terms of questions 36

and 22; these questions were also contained reverse wording and asked similar questions. The χ^2 difference test again showed a statistically significant result, so I retained Model 2. For Model 3, I correlated the error terms of questions 29 and 23. These questions asked similar information concerning the need to understand science. Again I found the χ^2 difference test showed a statistically significant result, so I retained Model 3. Model 4 added a correlation between the error terms of questions 13 and 14. When reading these questions, the same outside influences of individuals finding science boring and hard could attribute to the correlation. The χ^2 difference test showed a statistically significant result, so I retained Model 4.

After Model 4, I did not see any extreme modification indices. However, the goodness-of-fit results for the CFI, TLI and RMSEA were still not at the level of a good model. For this reason I looked at the remaining questions and determined if any additional questions paired together, either from reverse wording or similar outside factors. I determined seven pairs met my criteria from the standpoint of similar questions. When I looked to see the modification indices to determine if any of these pairs showed a mathematical correlation, I found five of the pairs had a listing in the indices. I continued on and ran Model 5 after correlating the pair with the highest modification indices. In this case the two questions, 37 and 39, concerned the idea that science took too much time. As before, the χ^2 difference test showed a statistically significant result so I retained Model 5. I ran Model 6 after correlating two error terms, from questions 16 and 18, which made reference to ideas in science need to have the ability to change. This model also showed a statistical significance in the χ^2 difference test.

The error terms of questions 10 and 19 were correlated before running Model 7. These two questions both referred to the idea that science cannot answer all questions. The χ^2 difference test showed a statistically significant result, so I retained Model 7. The next model was run after I correlated the final pair of questions due to similar phrasing, questions 40 and 30. Both these questions asked about how working in science would be fun. The χ^2 difference test showed a statistically significant result, so I retained Model 8 as my final model. Although the CFI and TLI measurements came in below adequate for the final model, the RMSEA measurement attended a respectable level, especially when the 90% confidence intervals are taken into account. For this reason, I continued to use the factors found in the EFA when I compared students' attitudes toward science.

Table 7

CFA Goodness-of-Fit Results

Model No.	χ^2	χ^2_{diff}	df	χ^2_{diff} <i>p</i>	CFI	TLI	RMSEA	90% CI Low, High
Initial	2128.398		584		.758	.738	.061	.059, .064
Model 1	2025.831	102.567	583	<.05	.774	.755	.059	.057, .062
Model 2	1918.406	107.425	582	<.05	.790	.773	.057	.054, .060
Model 3	1839.024	79.382	581	<.05	.803	.786	.056	.053, .058
Model 4	1794.650	44.374	580	<.05	.809	.793	.055	.052, .058
Model 5	1721.128	73.522	579	<.05	.821	.805	.053	.050, .056
Model 6	1694.399	26.729	578	<.05	.825	.809	.053	.050, .055
Model 7	1671.616	22.783	577	<.05	.828	.812	.052	.049, .055
Model 8	1650.607	21.009	576	<.05	.831	.816	.052	.049, .055

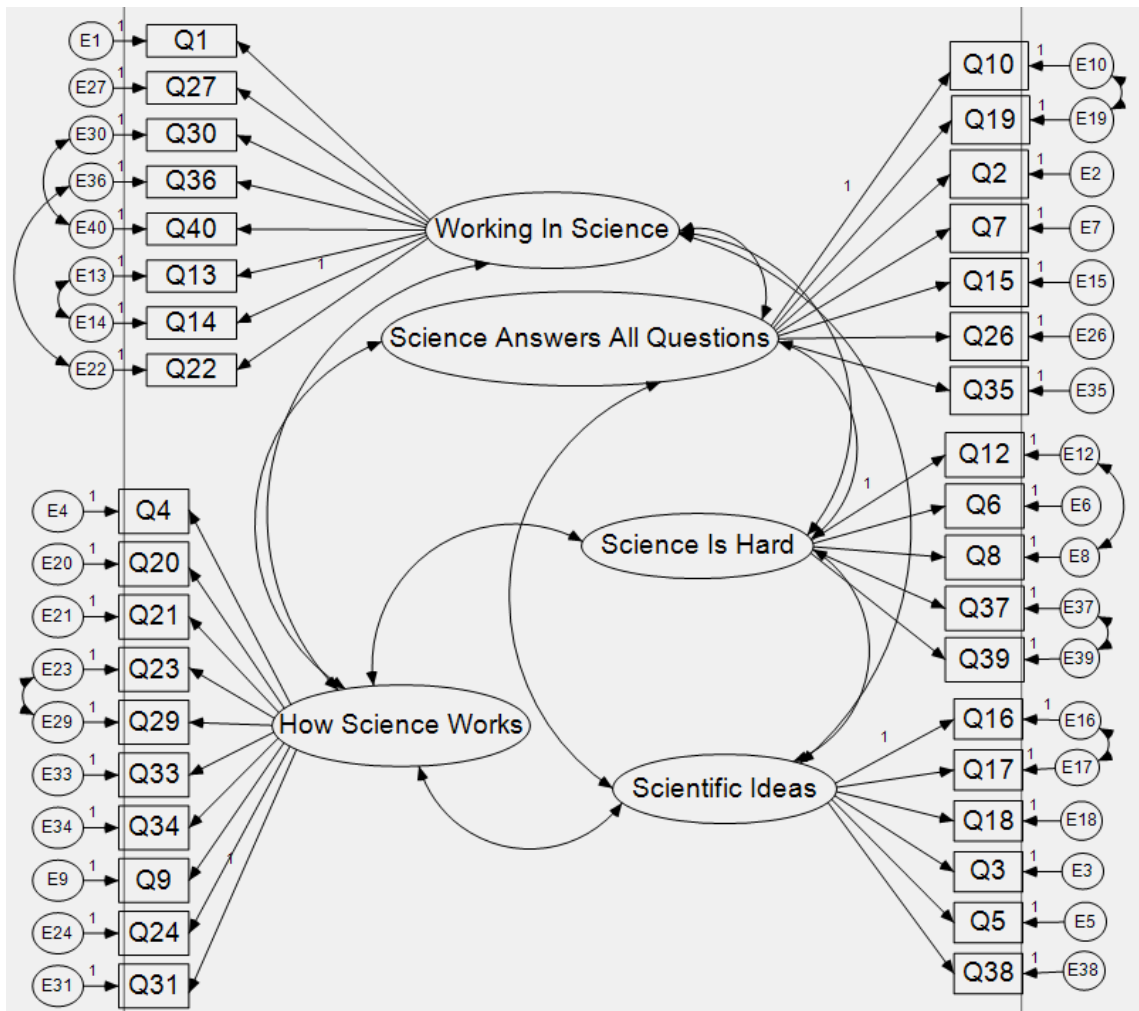


Figure 4. Final CFA model.

Attitude Scales

The final model contained five attitude scales. Each of these scales had a possible range from a low of one to a high of five. The scale *working in science* contained questions that determined if the participant wanted to work in science. A higher score on this scale indicated the participant had a more positive outlook on working in science. The scale *science answers all questions* measured the participants' attitudes on if science can answer all questions. Higher scores on this scale indicated that participants understood that science cannot answer all questions. The scale *scientific ideas* contained questions that revolved around the understanding that ideas in science change. Higher

scores on this scale indicated the participant understood this concept. The scale *science is hard* measured the participants' attitudes on if the general public could learn science. Participants with higher scores on this scale indicated that everyone could learn science. The final scale, *how science works*, contained questions that determined if the participants understood that scientists are always asking questions and using observations to answer those questions. Participants who scored higher on this scale understood that science continually gathers information to answer questions. Overall, the five mean attitude scores fell between three and four (Table 8).

Table 8

Attitude Scale Means and Ranges

Attitude Scale	Mean	Range
Working in Science	3.64	1.00 – 5.00
Science Answers All Questions	3.536	1.57 – 5.00
Scientific Ideas	3.94	1.50 – 5.00
Science is Hard	3.85	1.80 – 5.00
How Science Works	3.76	1.90 – 5.00

ANOVA

I ran a one-way ANOVA that compared institutions offering specific prerequisite classes for their pre-nursing students against institutions that did not provide this opportunity. The ANOVA compared these two groups across the five attitude scales of the questionnaire to see if there was a significant difference in the students' attitudes toward science. The ANOVA found no significant difference on any of the five attitude scales (see Table 9).

Table 9

One-Way ANOVA Comparing Nursing Specific Classes across Attitude Scales

Attitude Scale		Sum of Squares	df	Mean Square	F	<i>p</i>
Working in Science	Between Groups	1.899	1	1.899	2.865	.091
	Within Groups	891.587	1345	.663		
	Total	893.486	1346			
Science Answers All Questions	Between Groups	.024	1	.024	.072	.789
	Within Groups	448.222	1345	.333		
	Total	448.246	1346			
Scientific Ideas	Between Groups	.151	1	.151	1.345	.246
	Within Groups	150.528	1345	.112		
	Total	150.678	1346			
Science is Hard	Between Groups	.106	1	.106	.276	.600
	Within Groups	518.275	1345	.385		
	Total	518.381	1346			
How Science Works	Between Groups	.058	1	.058	.281	.596
	Within Groups	278.763	1345	.207		
	Total	278.821	1346			

Multiple Regression

I ran five separate multiple regressions individually, comparing the five attitude scales from the factor analysis against the 18 demographic variables. I did this to determine which variables explained the majority of the variability in the sample. Before running the five multiple regressions, I ran checks for homoscedasticity, linearity, and normality. All the scales showed no signs of homoscedasticity. Because I ran five multiple regressions, I did a Bonferroni correction to determine if the ANOVA results showed statistical significance. For one multiple regression, the *p* value cut-off for statistical significance was $<.05$; after the Bonferroni correction, the *p* value for statistical significance was $<.01$.

A few of the continuous variables showed issues with linearity. The scale *working in science* against age showed a slight arc down, the lower ages show lower scores with a sharp increase in the early 20s before leveling out. When compared to the number of lecture courses taken in science a similar shape was seen with a sharp increase between 0 and 10 courses. Similar curves were seen when compared to the number of total credits taken in the sciences, and when compared to number of lab courses taken in the sciences. The scale *science answers all questions* graphed against number of total credits taken in the sciences had lower scores when the total number of credits were low and increased until the total number of credits reached 50. After this point the scores lowered. *Science is hard* showed a downward arc when compared to the number of total credits taken in the sciences, meaning the scores increased then decreased. The scale *how science works* showed a downward curve when compared to the variable age. The scores increased until the age reached 30 years old, when the scores began to decrease. When graphed against the total number of credits taken in the sciences, the scale *how science works* showed an increase in scores for lower number of credits and a decrease of scores starting at 50 credits.

I checked for normality by computing a pseudo z score for skewness. If the calculated score was over an absolute value of 3.00, the sample was skewed. The scales *working in science*, *scientific ideas*, and *science is hard* were all skewed according to the pseudo z score. However, when I explored the normality in graph form, the histograms looked to be moved positively without much skewness. The only scale that showed an issue with the pseudo z score for kurtosis was *scientific ideas*.

For each of the regressions, I entered all the continuous variables listed previously and all the dummy coded variables, except for the categorical variable levels that

contained the majority of the sample. For example, the category for race became six different variables, each one stating if the participant said yes to that race category. Five of these variables were entered into the regression model; Caucasian was left out as it contained the highest number of participants. The constant variable was the measure of the attitude score if all the variables were 0. However, the constant variable also contained the information from the dummy coded variable levels left out of the regression, which included the levels that the majority of participants selected: Caucasian, attended a Masters Large institution, attended an institution in the southeast region, and those who planned to return for a master's degree in the future. After removing participants of mixed race, the variables of bac/diverse and Masters M did not contain any participants and were not run in the regression.

The first multiple regression compared the attitude scale *working in science* against the following 18 overall variables: sex, age, race, classification, how long have you been working on this degree, number of lecture courses taken in sciences, number of lab courses taken in sciences, number of total credits taken in science, school enrollment from 2010, setting, nursing specific classes available, number of science courses required before applying, number of science courses required total, school type, formally accepted into a nursing program, highest degree wanted, Carnegie ranking, and area. When the models were run they included the dummy coded variables, increasing the total number of variables in the model to 33.

The model explained 17.9% of the variability in the sample according to the R^2 value. According to the ANOVA, the model tested was statistically significant. The coefficients results are listed in Table 10. Although the variable of age had a statistically significant result in the regression, the difference as participants increased in age was

minimal. The variable number of lab courses taken in the sciences was also statistically significant but had an increase that was too small to be considered meaningful. Two of the other variables that explain a significant amount of the variability in this attitude scale both asked for the highest degree wanted. Students who answered they wanted to earn a PhD had a score 0.338 higher than students who wanted to earn a master's, controlling for all other variables. The opposite occurred for students who indicated they wished to end their academic career with a BSN or BS; these students showed a lower score on this attitude scale of 0.187 compared to students who wanted to earn a master's, controlling for all other variables. Students who attended a special focus-med school had significantly lower scores in their attitude by 0.606 compared to Master L, controlling for all other variables.

Table 10

Coefficients from the Multiple Regression on Working in Science

Variable	Unstandardized Coefficients		Standardized Coefficients	
	B	SE	Beta	<i>p</i>
(Constant)	3.652	.503		.000
Race African American	.016	.133	.005	.905
Race Asian	.014	.202	.003	.944
Race Hispanic/Latino	.044	.167	.012	.793
Race Native American	.613	.434	.054	.159
Race Pacific Islander	.095	.764	.005	.901
Sex	-.148	.108	-.055	.169
Age	.012	.004	.124	.004
Classification	-.053	.053	-.069	.312
Year in school	.013	.024	.027	.598
No. of lecture courses taken in science	.008	.011	.051	.482
No. of lab courses taken in science	.034	.017	.150	.048
No. of total credits taken in science	.002	.002	.045	.467

Table 10 (continued).

Variable	Unstandardized Coefficients		Standardized Coefficients	
	B	SE	Beta	<i>p</i>
School enrollment from 2010 CR	-4.140E-6	.000	-.065	.498
Setting (rural, suburban, urban)	-.017	.073	-.018	.820
Nursing specific classes available	.121	.101	.076	.228
No. of science courses required to apply	-.070	.057	-.084	.218
No. of science courses required total	.006	.083	.006	.941
Public versus Private	-.110	.183	-.049	.551
Formally accepted into a nursing program	-.086	.113	-.046	.449
Highest degree wanted – PhD	.338	.078	.179	.000
Highest degree wanted - BS or BSN	-.187	.081	-.098	.022
Preferred not to answer degree wanted	.097	.256	.015	.704
East North Central Region	-.234	.164	-.113	.156
West South Central Region	.250	.214	.079	.243
West North Central Region	-.154	.186	-.069	.408
North East Region	-.061	.349	-.009	.861
West Region	.122	.166	.033	.463
Doctoral/Research University	-.047	.161	-.022	.770
Masters Smaller Programs	-.078	.259	-.020	.763
Special Focus – Health professions	.190	.244	.057	.437
Special Focus - Med schools	-.606	.269	-.139	.025
Research Universities High Research	-.084	.160	-.038	.600
Research Universities Very High Research	.323	.193	.145	.095

The second multiple regression compared the attitude scale *science answers all questions* against the same 33 variables used in the first multiple regression. This model explained 12.8% of the variability in the sample according to the R^2 value. Again the ANOVA showed a statistically significant result. The coefficients results are listed in Table 11. This model had four variables that showed a statistical significance on the influence they had predicting the variability in the model. Two categories involved race, which showed statistically significant results for African American and Hispanic/Latino.

If participants selected African American, their scores on the attitude scale of *science answers all questions* was 0.298 lower than students who selected Caucasian, controlling for all other variables. This pattern also appeared in students who selected Hispanic/Latino as race; their scores were 0.286 lower compared to students who selected Caucasian. However, as students increased in their classification (e.g., from freshman to sophomore) their scores on the attitude scale increased by 0.138. Students who attended an institution in the northeast had lower scores by .593 compared to students who attended an institution in the south east.

Table 11

Coefficients from the Multiple Regression on Science Answers All Questions

Variable	Unstandardized Coefficients		Standardized Coefficients	
	B	SE	Beta	p
(Constant)	3.034	.387		.000
Race African American	-.298	.103	-.120	.004
Race Asian	-.025	.155	-.006	.874
Race Hispanic/Latino	-.286	.128	-.104	.026
Race Native American	-.179	.334	-.021	.593
Race Pacific Islander	-.048	.588	-.003	.935
Sex	.110	.083	.054	.185
Age	-.002	.003	-.023	.610
Classification	.138	.041	.241	.001
Year in school	-.029	.018	-.083	.122
No. of lab courses taken in science	-.023	.013	-.136	.081
No. of total credits taken in science	-.002	.002	-.056	.380
School enrollment from 2010 CR	5.349E-6	.000	.112	.255
Setting (rural, suburban, urban)	.052	.056	.076	.356
Nursing specific classes available	-.036	.077	-.030	.645
No. of science courses required to apply	.059	.044	.094	.179
No. of science courses required total	-.032	.064	-.043	.619
Public versus Private	.243	.141	.145	.086

Table 11 (continued).

Variable	Unstandardized Coefficients		Standardized Coefficients	
	B	SE	Beta	<i>p</i>
Formally accepted into a nursing program	.057	.087	.041	.515
Highest degree wanted – PhD	-.072	.060	-.051	.227
Highest degree wanted - BS or BSN	.052	.063	.036	.411
Preferred not to answer degree wanted	-.243	.197	-.049	.219
East North Central Region	.057	.127	.037	.650
West South Central Region	.011	.164	.005	.945
West North Central Region	.001	.143	.000	.996
North East Region	-.593	.269	-.114	.028
West Region	-.088	.128	-.032	.491
Doctoral/Research University	-.116	.124	-.071	.348
Masters Smaller Programs	.075	.200	.026	.706
Special Focus - Health professions	-.135	.188	-.054	.472
Special Focus - Med schools	.159	.207	.049	.442
Research Universities High Research	-.032	.123	-.019	.793
Research Universities Very High Research	-.194	.149	-.117	.192

The third multiple regression compared the attitude scale *scientific ideas* against the previously listed 33 variables. This model explained 11.4% of the variability in the sample according to the R^2 value. According to the ANOVA, the model tested was statistically significant. The coefficients results are listed in Table 12. The model showed seven variables of statistical significance, including age, race African American, if nursing specific classes were available, the number of science courses required, West North Central region, West region, and Research University Very High.

Age, although again a statistically significant variable, had a minimal increase in scores as the age increased. Students who selected African American had an attitude score 0.198 lower than Caucasian students, controlling for all other variables. The two regional variables saw decreases in their attitudes scores. Students attending institutions

in the west north central had scores 0.212 lower and students in the west has scores 0.168 lower than students attending southeast institutions, controlling for all other variables. The Research University Very High scored 0.175 lower than Masters L institutions, controlling for all other variables. The number of science courses required before a student can apply to the nursing program saw higher scores by 0.072 in this attitude scale for each additional class they were required to take, controlling for all other variables. The final statistically significant variable was students attending institutions that provided opportunities for nursing specific classes, which had lower scores by 0.090 compared to students who did not have that opportunity.

Table 12

Coefficients from the Multiple Regression on Scientific Idea

Variable	Unstandardized Coefficients		Standardized Coefficients	<i>p</i>
	B	SE	Beta	
(Constant)	3.881	.218		.000
Race African American	-.198	.058	-.142	.001
Race Asian	-.092	.087	-.043	.293
Race Hispanic/Latino	-.096	.072	-.062	.185
Race Native American	-.056	.188	-.012	.765
Race Pacific Islander	-.068	.331	-.008	.837
Sex	-.054	.047	-.048	.243
Age	.005	.002	.137	.002
Classification	.012	.023	.037	.600
Year in school	-.013	.010	-.069	.199
No. of lecture courses taken in science	.003	.005	.042	.584
No. of lab courses taken in science	.007	.008	.074	.344
No. of total credits taken in science	-.001	.001	-.083	.201
School enrollment from 2010 CR	2.187E-6	.000	.082	.408
Setting (rural, suburban, urban)	-.016	.031	-.042	.617
Nursing specific classes available	-.090	.044	-.135	.040

Table 12 (continued).

Variable	Unstandardized Coefficients		Standardized Coefficients	<i>p</i>
	B	SE	Beta	
No. of science courses required to apply	.072	.025	.205	.004
No. of science courses required total	-.029	.036	-.071	.416
Public versus Private	.078	.079	.083	.326
Formally accepted into a nursing program	.039	.049	.049	.433
Highest degree wanted – PhD	.058	.034	.073	.088
Highest degree wanted - BS or BSN	-.040	.035	-.051	.252
Preferred not to answer degree wanted	-.007	.111	-.002	.952
East North Central Region	.099	.071	.114	.167
West South Central Region	-.109	.093	-.083	.240
West North Central Region	-.212	.081	-.227	.009
North East Region	-.251	.151	-.086	.098
West Region	-.168	.072	-.109	.020
Doctoral/Research University	-.115	.070	-.127	.099
Masters Smaller Programs	-.144	.112	-.088	.200
Special Focus - Health professions	.150	.106	.108	.157
Special Focus - Med schools	.190	.116	.104	.103
Research Universities High Research	.016	.069	.017	.815
Research Universities Very High Research	-.175	.084	-.189	.037

The fourth multiple regression compared the attitude scale *science is hard* against the previously listed 33 variables. This model explained 15.9% of the variability in the sample according to the R^2 value. According to the ANOVA, the model tested was statistically significant. The coefficients results are listed in Table 13. The model showed four variables of statistical significance, including three race variables, African American, Asian, and Hispanic/Latino and one Carnegie ranking of special focus–health professional. Three of the race variables showed lower scores on the attitude scale *science is hard* compared to Caucasian students. Students who selected African American had scores 0.458 lower. Asian participants showed scores 0.623 lower, and

Hispanic/Latino students showed scores 0.280 lower, controlling for all other variables.

The last statistically significant variable involved students who selected they attended a special focus–health professional institution. These students showed higher scores on this attitude scale of 0.385 compared to students attending a Masters L, controlling for all other variables.

Table 13

Coefficients from the Multiple Regression on Science is Hard

Variable	Unstandardized Coefficients		Standardized Coefficients	<i>p</i>
	B	SE	Beta	
(Constant)	3.685	.394		.000
Race African American	-.458	.105	-.177	.000
Race Asian	-.623	.158	-.157	.000
Race Hispanic/Latino	-.280	.131	-.098	.032
Race Native American	.526	.340	.060	.123
Race Pacific Islander	.047	.599	.003	.938
Sex	.163	.084	.078	.053
Age	-.001	.003	-.009	.831
Classification	.060	.041	.101	.147
Year in school	.006	.019	.016	.763
No. of lecture courses taken in science	.012	.009	.101	.172
No. of lab courses taken in science	.010	.014	.056	.463
No. of total credits taken in science	-.003	.002	-.088	.163
School enrollment from 2010 CR	4.499E-6	.000	.091	.347
Setting (rural, suburban, urban)	-.094	.057	-.134	.099
Nursing specific classes available	-.095	.079	-.077	.228
No. of science courses required to apply	.044	.045	.068	.319
No. of science courses required total	-.034	.065	-.044	.601
Public versus Private	.129	.144	.074	.371
Formally accepted into a nursing program	-.036	.089	-.025	.683
Highest degree wanted - PhD	.108	.061	.074	.076
Highest degree wanted - BS or BSN	-.116	.064	-.078	.070
Preferred not to answer degree wanted	.081	.201	.016	.685

Table 13 (continued).

Variable	Unstandardized Coefficients		Standardized Coefficients	<i>p</i>
	B	SE	Beta	
East North Central Region	.126	.129	.079	.327
West South Central Region	.183	.167	.075	.274
West North Central Region	-.105	.146	-.061	.473
North East Region	-.182	.273	-.034	.505
West Region	.108	.130	.038	.408
Doctoral/Research University	.021	.126	.012	.869
Masters Smaller Programs	.209	.203	.068	.304
Special Focus - Health professions	.385	.192	.149	.045
Special Focus - Med schools	.052	.211	.016	.803
Research Universities High Research	.237	.125	.138	.059
Research Universities Very High Research	.076	.151	.044	.613

The fifth multiple regression compared the attitude scale *how science works* against the previously listed 33 variables. This model explained 8.6% of the variability in the sample according to the R^2 value. According to the ANOVA, the model tested was not statistically significant due to the Bonferroni correction.

Summary of Quantitative Results

The model determined by the EFA showed adequate conformation in the CFA. The factor analysis confirmed five factors or attitude scales. These five attitude scales became the dependent variable for five multiple regressions. Four of the five multiple regressions yielded statistically significant results, which the demographic variables entered into the model statistically predicted the variability of the attitude scales. The ANOVA determined that, on the five attitude scales, there was no statistical difference between the institutions that had nursing specific classes and those that did not.

Qualitative Results

I interviewed four key informants who were current or former students from a nursing program: Earl, Kara, Crystal, and Kyle. All of the students were attempting to earn a BSN degree from a large, southern, four year research university. This institution requires five science courses before students can begin the nursing program. Three of these courses must be completed before students can apply to the program. Students must earn a C or above in all science courses, and if needed they are allowed to retake one course one time. The five science courses include an introductory biology course, a two-course series in anatomy and physiology, a course in microbiology, and a chemistry course. Students have the option to take either the general curriculum course or specialized nursing course for three of the five courses (the introductory biology, microbiology, and chemistry).

Earl

Earl was a Caucasian, 20-year-old male who began the nursing program in the spring semester of 2013. He started college out of high school and immediately began to take the nursing prerequisite courses. Earl made the decision to take one science course a semester in order to have the time to focus on his classes, meaning he took five semesters to complete the nursing prerequisites. He explained that although this caused him to be a semester behind, he wanted to make sure he knew the information since he would need it later. This meant that he could not start the nursing program until the spring semester of his junior year. Earl decided to register for the specialty classes designed for pre-nursing majors in both biology and chemistry. He was not sure if he would continue his education after getting a BSN but knew he wanted to join the Peace Corps after graduation to provide nursing to countries in need.

When I asked Earl to respond to the statement “I enjoy science,” he stated, “strongly agree.” He went on to explain:

The way my brain works—it sounds terrible—but it is very mathematical, cliquy, like very logical thinking. And science goes very well with that, nothing is abstract; it’s all pretty much set in stone in the book. I know it changes in real life, but in that book, what I need to know for this class is set in stone.

He also loved the “feeling of learning something every day,” saying you cannot beat that feeling.

For the most part Earl expressed a positive viewpoint toward the courses he completed. The only exception was his chemistry lab. He explained that he did not have a problem with the content but expressed displeasure at the fact that the lab and lecture were not taught in the same sequence. The lack of a specific lab book added to his displeasure of the class. He loved the chemistry lecture, but when he spoke of the lab he expressed confusion about why the two courses were not taught in the same order. To clarify, I asked if he meant he wanted the chemistry lecture and lab to cover the same topics each week and he said no. Earl mentioned

the lab is meant to be used for practice, like applying the skills you learned in lecture and putting them into practice. And since we haven’t gotten to it in lecture yet I don’t know what I am doing, I am just doing what the lab manual tells me to do.

According to Earl, making connections between lab and lecture were needed in order to keep the material straight. This disjointed nature caused Earl to list chemistry lab as his least favorite class.

When I asked for his favorite class he stated, “I really loved microbiology, dealing with the diseases and the aspects of the bacteria.” Earl liked that he could understand why he was learning all the content for the class. He enjoyed that after the first test, which was on microbiology history, the tests were essentially case studies. This allowed him to feel like he was practicing for his future career. One learning technique he used to remember the bacteria and the signs and symptoms of diseases was to treat them as a friend he was meeting. He used the signs and symptoms as characteristics of the “person.” In microbiology there was also a homework requirement, which required students to read and review research articles in microbiology. Earl really liked this because it forced him to start looking at research he will need to keep up with during his career. Later in the interview he added that microbiology was a favorite class.

I asked Earl what he liked about taking the nursing specific classes. He discussed how he liked that these classes focused on information he felt he would use in nursing school and beyond. He continued with how “all the nursing courses were focused on human interaction” and “cut out a lot of the information he did not need to know.” Earl felt that this allowed him to have an easier time accessing the information he learned in the classes once he left the course. He also enjoyed how the science labs were interactive and hands-on, allowing him to remember the information. Earl mentioned that the labs in the nursing specific courses seemed to be more focused on the techniques and information he would need in nursing school. Because the courses were focused on teaching the information he would need as a nurse, the classes were able to go further in depth on the topics he needed to be comfortable with. He stated toward the end, “I don’t want to memorize this (referring to the science content); this is stuff I am going to be using for the rest of my life; I want to fully, truly learn it.” One of the last questions I

asked was what he thought should be added to the curriculum. The main course Earl thought would benefit nursing students in general was a medical terminology course.

Kara

Kara was a white 31-year-old female who had just begun taking her nursing prerequisite science courses. Kara was a non-traditional student just starting her second bachelor's degree after serving in the army, where she received her certificate as an EMT-B. She would like to incorporate her first degree, psychology, into her nursing degree. When asked if she would like to continue her education after the BSN, she mentioned that she would at least like to earn a master's degree and maybe come back to school for a PhD. She wanted to combine her nursing and psychology degrees to work as a psych nurse. Kara was hoping to complete her nursing prerequisites in the fall of 2013, allowing her to apply in order to start the nursing program in spring of 2014.

During the current semester Kara was starting on her nursing prerequisites but taking the nursing specific introductory biology course and anatomy and physiology I. When I asked her to respond to the statement "I enjoy studying science," she responded, "hmm enjoy...I do agree; I think it is very necessary. It's just a bit of a headache." Kara discussed how science compounds on itself and she knows she needs to understand the science to be a good nurse. When I asked why she took the nursing specific intro biology instead of the major's intro biology, she said she was forewarned about the difficulty of the major's class.

Although Kara had just begun classes, I asked which class was her favorite. She responded that she enjoyed the introductory biology because "the teacher is just...she's very dynamic and she explains things. I feel like I am in high school again; she makes it that easy" and uses verbiage to make sure students understand the biological concepts.

When I asked Kara how she was studying for classes, she stated she read the chapters to get the vocabulary in her brain and the online notes before class. At that time she made notes on the slides before class, and during class she continued to make notes on further details.

Kara was enthusiastic about learning the scientific concepts; however, she was not sure if that was because of the excitement of being back in school and learning in general or the anticipation of learning science specifically. She was a little apprehensive of future science courses, however. Kara was hoping to enroll in the nursing specific classes in the future as well. She was looking forward to learning how the body works. She felt it was important to know “how the organ systems work, and how they interact with one another” before starting the nursing program. Kara mentioned that she understood having to know chemistry and that chemistry is used in biology, but she did say that she preferred learning biology at that time.

Crystal

Crystal was a 23-year-old African American female. At the time of the interview she was a fifth year senior nursing student going through clinicals. She started the nursing program in the fall of her junior year. I asked Crystal how long she had wanted to be a nurse, and she stated almost always. Actually, she started off wanting to be a pediatrician but changed her mind for three main reasons. The first reason she gave was earning the medical degree would take too long. She stated the second reason was the possibility nurses have to specialize and change their specialty later. The third reason included the family members she witnessed receiving care early in her life. “I saw the impact nursing and a nurse can really have on the patient and the family...and this confirm[ed] that this is what I want to do.” Crystal expressed interest in maybe returning

to school for a master's degree in psychiatric nursing. At one point she thought about double majoring in nursing and psychology.

When I asked Crystal to respond to the statement "I enjoy studying science," she stated, "yeah, definitely, number 10 on a scale of 1 to 10." She went on to state it was one of her favorite subjects, mainly because it really never changes (referring to the normal physiology and anatomy of the body). In addition, she stated when something did change, something was wrong but then you knew something was wrong. Crystal took a majority of non-nursing specific courses but expressed a need for nursing specific courses during the interview. The school created the nursing specific courses for general biology and chemistry after Crystal had completed these prerequisites. Based on the information she remembers of her microbiology class, I believe she completed the nursing specific course for that prerequisite.

When I asked Crystal to remember her favorite science course, she said Anatomy and Physiology II. When asked why, she stated, "it was more information we could use in the future," and it was more challenging than Anatomy and Physiology I. I requested she explain how she studied for that course. Crystal had a number of study techniques, which included reading the chapter, reading her notes, meeting with the professor, and talking about the lecture material with a friend. When I asked which techniques provided the biggest benefit, she stated talking about the material with a friend also in the class was the most helpful, mainly because she could not talk to the professor every day. She stated this technique of teaching the information to someone else as her favorite way to learn science. When I asked Crystal about her favorite method of teaching, she replied that she enjoyed the lecture format of the class because she did not like doing group work or getting up to move around during classes.

When I asked about the lab that goes along with the Anatomy and Physiology II class, she mentioned she didn't really like the lab. She said

I think it was memorization. It was a lot of information that I don't think no one would ever remember. Because it was like different types of the kidneys and every little part that I don't remember.

She went on to say she did not see the point of knowing every part of the kidney. This, however, was not her least favorite class; microbiology lab held that honor. She stated she liked the instructor but felt the microbiology lab had too much paperwork and busy work that did not teach her the information she needed to know.

Although she did not list it as her least favorite class, Crystal only remembered using the information she learned in chemistry for dilutions. She went on to say she did not feel the chemistry class was useful to her, and she was not sure it should be a requirement. As a whole, Crystal felt "honestly, prerequisites for nursing do not prepare you for nursing school." She discussed that there needed to be nursing specific courses that helped the pre-nursing student learn how to study, and how to take tests for the nursing program. But she did say that she needed to know the information that she learned in many of the lecture courses. Her motivation to learn the material included seeing the bigger picture, for example, how understanding diffusion was necessary later in the nursing program.

I asked Crystal one final question: did she see herself as a scientist. She answered quickly, "not a scientist, like research and stuff. I commend you; I couldn't do it." She went on to state that there is more than just science content involved in nursing. When I asked if she saw herself as more of a caregiver, she agreed quickly that, yes, it is more of a caregiving opportunity. She went on to quote a statement the nursing department gives

on the first day: “Nursing is a science and an art.” Crystal believed this quote sums up the role of a nurse; you need the science, but it is more than that.

Kyle

Kyle was a 23-year-old Caucasian male who recently graduated from the nursing program. Kyle graduated in the middle of my study, and I took the opportunity to interview him after he was employed for two months at a local hospital. He started college in 2008 as a speech pathology major, but explained he always had an interest in health care. He switched to pre-nursing at the start of his sophomore year. Kyle was not sure if he wanted to return to school to earn a graduate degree, but said if he did it would be a doctor of nursing practice or some kind of PhD.

Kyle was unique in this study as he was the only participant who did not complete at least one nursing specific course. Kyle was also the only one of my key informants who took one of his prerequisite courses outside the home institution. He completed his microbiology requirement at a community college over one summer. Since Kyle originally started working on a different degree program and he did not have chemistry in high school, he took a total of seven science courses, the required five plus two more. Even with these additional courses, Kyle finished his nursing degree in four and half years. He did this by taking more than one science course in multiple semesters and finishing one requirement over a summer.

When I asked Kyle to respond to the statement “I enjoy studying science,” he said, yes, he enjoyed studying science. When asked why, he said, “I don’t know; I just think it’s interesting the way things work and why they work the way they do, especially when it comes to, like, the human body.” But he also stated, “I don’t like chemistry.” This dislike showed up in his least favorite class, general chemistry lecture. He liked the

teacher—in fact he had the same lecture teacher for both the chemistry classes he took—but said, “my brain does not work that way, mathematical way.” One thing he did take from the class to use later was balancing equations; he said this helped in nursing school to determine dosage calculations.

Kyle said his favorite course was general biology lecture. He stated, “I looked forward to going to that class every week; I just enjoyed all the things we talked about.” His professor took the time during class to draw out the material on an overhead. He would draw the cells and organelles and even the chemical compounds. Kyle mentioned that as a visual person this helped keep him engaged, and it made the material easier for him to understand. When I asked Kyle to recall how he studied for this class he said he would read the notes, rewrite his notes, and tried to duplicate what the teacher drew. The rewriting and redrawing helped the most to remember the information. Kyle stated his favorite way to learn science included a combination of lecture and hands-on practice.

I asked Kyle for an example of how he used the information he learned in biology in his nursing courses. He thought for a moment and said

like when we talk about cancer, if I wouldn't have had a background in biology, ... knowing the structure of cells and normal function of cells, it would be harder to understand cancer and how cancer grows and how it affects normal cells.

He mentioned he wished for a greater knowledge base on blood and blood components because he felt he had not learned enough about them before entering the program. One other thing Kyle wished they taught more, not in just the science courses, was time management. He discussed how, in the field, you had to keep your six patients on

schedule with medications and tests, but still be able to deal with crises that could crop up at any time.

This fed into Kyle's motivation to learn the science for his classes:

It was hard for me to stay motivated in English courses and courses like that but with these [science courses] I knew I needed to know this because I was going to be taking care of patients, [and would be] counted on to know what I was doing.

Kyle explained that knowing the science information could make a difference in a patient's care. He explained he felt he had a responsibility to learn the science knowledge.

Trends Across Profiles

Across all four profiles, I found that most of my key informants stated they liked science, but really they liked the anatomical sciences, mostly dealing with the human body. Even when they stated they enjoyed learning science, a few moments later the fear or dislike of chemistry appeared, with the exception of Earl. The key informants appeared to like the sciences they saw themselves directly using in their futures. Another trend was that, although all the key informants I interviewed expressed the idea that nursing was based in science, they did not see themselves as scientists. They expressed the idea that nursing involves more than science, that nurses are also caregivers and have to care about the patient.

CHAPTER V

CONCLUSION

Discussion

My study's sample data showed a bias toward a few demographics, mainly females, southeastern region, and acceptance to a nursing program. The first of these biases was expected. According to Ellis et al. (2006), the percentage of males in the nursing profession sits close to 6%. Since my sample had approximately 10%, I feel comfortable on how males are represented in the study. Most of the schools in the study were located in the southeastern region of the country. Because I attended a school located in the southeastern region, contacts at these institutions could have felt more inclined to send out my questionnaire. As for the acceptance into the nursing program, the vast majority of students selected they had been accepted into the program. At the time of initial email, I was not aware of how many schools would participate in the study who accepted students into the nursing program out of high school. This caused an unexpected skewness in my results. This early acceptance became apparent when the numbers on classification and years complete on this degree were studied. Many students selected just starting, one year completed, or freshman; however, less than 10% selected they were not formally accepted into a nursing program.

The questionnaire I used (the SAI II) had been previously used on college students; however, this questionnaire had never been used on nursing students exclusively. For this reason I decided to treat the questionnaire as a new instrument and ran both an exploratory and confirmatory factor analysis on the questionnaire. Unlike the original questionnaire that contained 40 questions across six factors, when I ran an EFA I found 36 questions that loaded on five factors. Although structurally this EFA looked

solid when I ran the Cronbach's alphas to determine how reliable the factors held together, the reliability was low. Of the five factors, one factor had what is considered by most an acceptable measure of over .700 (Field, 2009). The other four factors had Cronbach's alphas that came in above .600 but below .700.

These low Cronbach's alpha readings show that in order to continue using this questionnaire with nursing students, more work needs to be done on the wording of the modified SAI II questions. For instance, three questions were reverse scored in the original questionnaire; however, when nursing students responded to the questions, the results did not support reverse scoring them in the modified questionnaire. All three questions ask about the nature of science. The reason they were originally reverse scored was they ask if technology is science. Since technology is not science, individuals were supposed to answer the questions in a negative fashion. However, for nursing students these questions elicited a positive response. This conflict became one of the main reasons to reword the modified questionnaire.

The modification of question wording might improve the model measurements in the confirmatory factor analysis as well. The current model is not an ideal model, it measures below adequate on two of the three measurement scales. I retained the model for my regression analysis since the RMSEA did measure as close to a good fit, and when the 90% confidence interval was taken into account, it did measure as a good fit model. This being the case, ideally, when the questionnaire is reworded, the other indices (CFI and TLI) will also measure the model as adequate or better. I knew at the beginning of the study I might have problems with the SAI II. In the original paper that published the modifications, the authors stated the CFA did not yield acceptable results (Moore & Foy, 1997). Unfortunately, I cannot compare my CFA numbers to theirs, as they stated they

chose to ignore the CFA and did not publish the results. However, they did continue to publish the questionnaire with the factors they deemed correct. This was the main reason, in addition to having a specific population; that I decided to run both an EFA and a CFA.

The factors that showed a statistically significant ability to predict the attitudes scales changed with each scale. Age showed up as a statistically significant variable in two different attitude scales; however, the difference was minimal. Even though the movement of at each level of the age variable showed a low amount, I would like to point out the variable age had a range of over 40 years. Each time age increased, the students' attitudes toward science became more positive. That increase might come from older students understanding the amount of science needed in the nursing field before committing to the nursing program.

Race was a statistical predictor in all the scales except *working in science*. Students who selected their race as African American showed a more negative attitude compared to Caucasians on three of the attitude scales: *science answers all questions*, *scientific ideas*, and *science is hard*. My research looked to find the attitude students had toward science but not the way they developed these attitudes. The reasons behind the lower scores in attitude for this race was unknown, but now that we know there were lower scores, the why can be studied. Students who selected Asian showed a significant predictive ability in one attitude scale, *science is hard*, with lower scores in their attitude toward science. Students who selected Hispanic/Latino also showed lower scores on *science is hard* and *science answers all questions*, compared to Caucasian students. In some ways these results are unsettling. They show that the minority students in the nursing programs have lower attitudes toward science compared to Caucasian students.

These results showed a similar outcome to a study that explored the predictive factors for measuring a student's success on a specific licensure test (Lamm & McDaniel, 2000). They found that African American students had a statistically significant higher failure rate than other students, so there is a chance this difference might have a correlation with their attitude.

The highest degree a student hopes to earn was a variable I originally thought would help predict nursing students' attitudes toward science. I had assumed that the higher the degree students wanted to achieve, the more positive their attitude would be. This pattern did show up in one scale; students who did not want to go past the bachelor's degree had more negative attitude scores than students who wanted to earn a master's in the future. The pattern continued for students who wanted to earn a PhD, who have more positive attitude scores. The attitude scale of working in science showed both the negativity of the students stopping at a bachelor's degree and the positive attitude of students wanting a PhD.

Surprisingly, the region of the country showed up as a predictor of students' attitudes toward scientific ideas. Students who attended institutions in the west and west north central region had more negative attitude scores than those in the southeast. This scale looked at how science can change. This same pattern was also seen in *science answers all questions*; students from the northeast region showed lower scores than the southeast.

The last variable showing a predictive ability for scientific ideas makes sense. As the number of science classes increase before a student can apply, the attitude of the students becomes more positive. The one surprising thing was the number of total science classes did not have a predictive effect; however, that might be because students

had not completed all their science courses before taking my questionnaire but all should have all started working on their prerequisites.

When the students of mixed race were removed from the regression models, the opportunity for students to attend nursing specific classes showed up as significant. This occurred in the attitude scale *scientific ideas*. Students had lower scores on this scale if they had the opportunity to take nursing specific courses. Although these students did attend institutions with nursing specific classes, there was no information on whether these students took nursing specific classes.

Another surprising result showed that students attending a special focus–med school had more negative attitude scores toward *working in science*. The only reason I can come up with for these negative attitude scores was the possible pressure students might feel to succeed in these schools. The only other type of special focus schools in the study focused on health professions. These students had more positive attitude scores on the scale *science is hard*; these showed that these students believe everyone can learn science. Students attending a very high research university had more negative attitude scores toward *scientific ideas* compared to students at a Masters L institution. This could be since the three questions that did not come up as reverse scored were in this scale. All three questions were on the nature of science, so there was a chance, if students answered these questions negatively as in the original questionnaire, that it could have altered their total score on the scale.

Classification only showed up as a predictor for the scale *science answers all questions*. As students get further into their nursing programs, they have positive increases in their attitudes toward that scale. This increase could be because students have more contact and experience with science later in their nursing careers. As nursing

students get further into their program, they will be exposed more to the ideas that science does not answer all questions, especially when they cover diseases.

One variable that did not show up as a significant predictor was sex. Although males only accounted for approximately 10% of my sample, that is actually a higher percentage than seen in the profession, so I do not believe this lack of statistical significance was due to sample size. At least one article in the literature stated males have a different viewpoint of nursing school than their female counterparts (Ellis et al., 2006).

All the key informants showed either an interest in taking nursing specific classes or having the opportunity to take nursing specific courses. They expressed that these classes would allow for the opportunity to learn only the relevant information that students need later in the nursing program.

All the students I interviewed stated that nursing had its foundation in science and that learning the science was important. They specifically mentioned knowing how the body works and other parts of anatomical and physiological sciences. This went hand in hand with Courtenay's (1991) findings. Students placed anatomy knowledge as the highest importance of the information they learned. My study gives further evidence to what Courtenay (1991) found, that even when students do not fully enjoy science they still understand the importance of anatomy, physiology, and microbiology.

I mentioned in Chapter 1 that little research existed on chemistry and nursing students. While my study does not have a large piece to add to the literature, the qualitative participants did mention chemistry as a least favorite science or a science they fully disliked. This shows that as educators we should reinforce the need for chemistry in the nursing program. On a final note, one scientific attitude came out in the key

informant interviews. Although my research project was looking at attitudes toward science, it was interesting to find out that nursing students do not see themselves as scientists.

Implications

I started this dissertation to identify potential obstacles facing nursing student education, specifically focusing on attitude and motivation toward learning science. I wanted to know the current status of the attitudes of nursing students in the U.S. Now that I know nursing students do not have a negative attitude, but actually have a slightly positive attitude toward science, this allows me and other researchers to have a baseline comparison on whether certain programs encourage an improvement in students' attitudes toward science.

This information allows me to develop future research projects to further define the attitude of nursing students. More information is needed to determine what overlap occurs between the predictor variables. Now that we have a baseline of overall attitudes, the difference between demographic groups can be explored. In addition, the amount of variability explained in my regression models by my demographic variables was less than 20%, meaning there are other factors that need to be included.

Future Directions

The SAI II was not the strongest questionnaire for looking at nursing students' attitudes toward science. One future project I hope to undertake is altering the SAI II language in order to create a stronger questionnaire to survey nursing students. This first questionnaire would still look at the student's personal attitude toward science. A second project would look into creating a questionnaire that focuses on nursing students' professional attitudes toward science. As discussed in my theoretical framework and

further emphasized by my study participant Kara, a student does not have to enjoy or like science in order to understand the importance it carries in their future careers.

Although I found no statistical difference in the attitudes expressed by nursing students between the schools that had nursing specific classes and those that did not, I did not collect information on whether any of these students completed the nursing specific classes. Now that I know the baseline attitude of nursing students, I need to further explore if taking nursing specific science courses improves a student's attitude.

Final Conclusions

My research project explored the current attitudes of nursing students toward science. The results showed that, currently, nursing students have a slightly positive attitude. On all five attitude scales the mean of the nation calculated as above three and below four on a five point scale ranging from one to five. Although I did not find an average negative attitude among nursing students, negative scores did show up in the sample. However, now that I have uncovered these attitudes, I can conduct further research to determine what factors and interventions work to improve the attitudes of nursing students toward science. My study has provided a baseline against which to compare future nursing student attitudes in order to see what programs we should put our time and resources into developing.

APPENDIX A

INTERVIEW PROTOCOL

The goal of this interview is to obtain a better idea of nursing and pre-nursing majors attitudes toward science.

After I give an introduction of the project and assured the participant of the confidentiality of the interview, including their right to withdraw from the interview at any point, I will build rapport and ask the participant about their experience in their science courses.

Opening questions include the demographic questions:

- 1) Have you applied to the nursing program? Have you been accepted to the nursing program?
- 2) What is your age?
- 3) What is your race?
- 4) Do you think you will come back to school for a graduate degree?
- 5) What is your rank?
- 6) How many years have you been working on this degree?
- 7) Please tell me what science courses you have completed so far?
 - a. Were they all for this degree?
 - b. Were they all at this institution?
 - c. Why did you take these particular courses?

The last demographic question will lead into the possible interview prompts.

1. Do you agree with the following statement: I enjoy studying science?
 - a. Please explain why.
2. Which of your science courses was your favorite?
 - a. What reason is this your favorite class?
 - i. If needed give prompts e.g., did you like the
 1. instructor,
 2. other students,
 3. class topic
 - b. How did you study for this class?
 - c. How was the class taught?
 - d. What were some of the assignments you had for the class?
3. Which class was your least favorite class?
 - a. Same prompts from question 2.
4. What is your favorite way to learn science?
5. What science topics do you think are needed to go into the nursing field?
6. How do you feel your prerequisite science courses have prepared you for your classes in the nursing program (only asked to current nursing students)?

APPENDIX B

INSTITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION



THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD

118 College Drive #5147 | Hattiesburg, MS 39406-0001

Phone: 601.266.6820 | Fax: 601.266.4377 | www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months.
- Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **12051001**

PROJECT TITLE: **Nursing Students' Attitudes Toward Science**

PROJECT TYPE: **Dissertation**

RESEARCHER/S: **Jill Maroo**

COLLEGE/DIVISION: **College of Science & Technology**

DEPARTMENT: **Center for Science & Mathematics Education**

FUNDING AGENCY: **N/A**

IRB COMMITTEE ACTION: **Exempt Approval**

PERIOD OF PROJECT APPROVAL: **08/02/2012 to 08/01/2013**

Lawrence A. Hosman, Ph.D.

Institutional Review Board Chair

APPENDIX C

QUANTITATIVE CONSENT FORM

Dear Participant,

This research study is being conducted to provide a better understanding of nursing students' attitudes towards science. Eventually we would like to publish the findings. NO results will be reported in a manner that would allow a reader to associate any responses to you. You will not be purposely deceived, and this project does not pose physical danger. Participating in the study will subject you to no risks greater than those you normally encounter in everyday life.

You must be 18 years old to participate in this study. If you agree to participate, you may choose not to answer any question. You may withdraw from the study at any time without consequences to you. Participation in this study is anonymous. Your name will not be associated with your questionnaire. All associated files will be securely stored in a password protected file.

Please feel free to ask any question during or after your participation in this study. If you have any questions or concerns about this study, you may contact me via phone (601-266-4048) or email jill.maroo@eagles.usm.edu. This project and consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

Participation in this survey is completely anonymous. Electronic completion of the questionnaire indicates you consent to participate in this study.

Thank you!
Sincerely,

Jill Maroo, Graduate Assistant
The Center for Science and Mathematics Education

APPENDIX D
QUALITATIVE CONSENT FORM

Participant's Name _____

Consent is hereby given to participate in the research project entitled Nursing Students' Attitudes Toward Science. All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained by Jill Maroo. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected.

The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All personal information is strictly confidential, and no names will be disclosed. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project.

Questions concerning the research, at any time during or after the project, should be directed to Jill Maroo at 601-266-4048. This project and this consent form have been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

A copy of this form will be given to the participant.

Signature of participant

Date

Signature of person explaining the study

Date

APPENDIX E

MODIFIED SCIENTIFIC ATTITUDE INVENTORY II

Working in science

- 1. I would enjoy studying science.
- 13. The search for scientific knowledge would be boring.
- 14. Scientific work would be too hard for me.
- 22. I do not want to be a scientist.
- 27. I would like to work with other scientists to solve scientific problems.
- 30. I may not make great discoveries, but working in science would be fun.
- 36. I would like to be a scientist.
- 40. Working in a science laboratory would be fun.

How science works

- 4. Scientists are always interested in better explanations of things.
- 9. Electronics are examples of the really valuable products of science.
- 20. A scientist must have a good imagination to create new ideas.
- 21. Ideas are the important result of science.
- 23. People must understand science because it affects their lives.
- 24. A major purpose of science is to produce new drugs and save lives.
- 29. Every citizen should understand science.
- 31. A major purpose of science is to help people live better.
- 33. The senses are one of the most important tools a scientist has.
- 34. Scientists believe that nothing is known to be true for sure.

Scientific ideas

- 3. It is useless to listen to a new idea unless everybody agrees with it.
- 5. If one scientist says an idea is true, all other scientists will believe it.
- 16. Scientific ideas can be changed.
- 17. Scientific questions are answered by observing things.
- 18. Good scientists are willing to change their ideas.
- 38. Scientific work is useful only to scientists.

Science answers questions

- 2. Anything we need to know can be found out through science.
- 7. We can always get answers to our questions by asking a scientist.
- 10. Scientists cannot always find the answers to their questions.
- 15. Scientists discover laws which tell us exactly what is going on in nature.
- 19. Some questions cannot be answered by science.
- 26. If a scientist cannot answer a question, another scientist can.
- 35. Scientific laws have been proven beyond all possible doubt.

Science is hard

- 6. Only highly trained scientists can understand science.
- 8. Most people are not able to understand science.
- 12. Most people can understand science.
- 37. Scientists do not have enough time for their families or for fun.
- 39. Scientists have to study too much.

Underlined numbers are questions that are reverse scored.

APPENDIX F

QUESTIONNAIRE AS IT APPEARED ON SURVEY MONKEY

	Strongly Disagree	Mildly Disagree	Neutral/Undecided	Mildly Agree	Strongly Agree
I would enjoy studying science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anything we need to know can be found out through science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is useless to listen to a new idea unless everybody agrees with it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists are always interested in better explanations of things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If one scientist says an idea is true, all other scientists will believe it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Only highly trained scientists can understand science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We can always get answers to our questions by asking a scientist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most people are not able to understand science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronics are examples of the really valuable products of science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists cannot always find the answers to their questions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Disagree	Mildly Disagree	Neutral/Undecided	Mildly Agree	Strongly Agree
When scientists have a good explanation, they do not try to make it better.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most people can understand science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The search for scientific knowledge would be boring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific work would be too hard for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists discover laws which tell us exactly what is going on in nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific ideas can be changed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific questions are answered by observing things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good scientists are willing to change their ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Some questions cannot be answered by science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A scientist must have a good imagination to create new ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Strongly Disagree	Mildly Disagree	Neutral/Undecided	Mildly Agree	Strongly Agree
Ideas are the most important result of science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not want to be a scientist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People must understand science because it affects their lives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A major purpose of science is to produce new drugs and save lives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists must report exactly what they observe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a scientist cannot answer a question, another scientist can.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to work with other scientists to solve scientific problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Science tries to explain how things happen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every citizen should understand science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I may not make great discoveries, but working in science would be fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Disagree	Mildly Disagree	Neutral/Undecided	Mildly Agree	Strongly Agree
A major purpose of science is to help people live better.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists should not criticize each other's work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The senses are one of the most important tools a scientist has.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists believe that nothing is known to be true for sure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific laws have been proven beyond all possible doubt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to be a scientist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists do not have enough time for their families or for fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientific work is useful only to scientists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scientists have to study too much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working in a science laboratory would be fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. Sex**7. Age****8. Race** African American Asian Caucasian Hispanic/Latino(a) Inuit/Eskimo Native American Pacific Islander

Other (please specify)

9. What institution do you attend?

Other (please specify)

10. What state is your school in?**11. Have you been accepted into the nursing program at your school?****12. What is your classification?**

Other (please specify)

13. What degree are you currently seeking?

Other (please specify)

14. How long have you been working on this degree?**15. What is the highest degree you hope to earn in nursing?**

Other (please specify)

16. Answer the following questions using courses taken in these science departments (Biology, Chemistry, and Physics):

Number of lecture courses taken in the sciences

Number of lab courses taken in the sciences

Total number of college credit taken in the sciences

REFERENCES

- Aday, R. H., & Campbell, M. J. (1995). Changes in nursing students' attitudes and work preferences after a gerontology curriculum. *Educational Gerontology, 21*(3), 247-260.
- Andrew, S. (1998). Self-efficacy as a predictor of academic performance in science. *Journal of Advanced Nursing, 27*, 596-603.
- Andrew, S., Salamonson, Y., Weaver, R., Smith, A., O'Reilly, R., & Taylor, C. (2008). Hate the course or hate to go: Semester differences in first year nursing attrition. *Nurse Education Today, 28*, 865-872.
- Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine. *Journal of Research in Science Teaching, 47*, 564-582.
- Banu, D. P. (1986). Secondary school students' attitudes towards science. *Research in Science & Technological Education, 4*, 195-202.
- Bishop, P. (1990). Science background of nursing students: Effect on performance in science courses. N. B. Piller & M. G. Venning (Eds.), *SINE 90 Conference Proceedings*, (pp. 58-61) South Australia: S.A. Institute of Technology.
- Brown, J., Nolan, M., Davies, S., Nolan, J., & Keady, J. (2008). Transforming students' views of gerontological nursing: Realising the potential of 'enriched' environments of learning and care: A multi-method longitudinal study. *International Journal of Nursing Studies, 45*, 1214-1232.
- Bruner, J. S. (1963). *On knowing: Essays for the left hand*. Cambridge, MA: Belknap Press of Harvard University Press.

- Cangelosi, P. R. (2006). RN-to-BSN education: Creating a context that uncovers new possibilities. *Journal of Nursing Education, 45*, 177-181.
- Casey, G. (1996). Analysis of Akinsanya's model of bionursing. *Journal of Advanced Nursing, 23*, 1065-1070.
- Cashion, A. (2009). The importance of genetics education for undergraduate and graduate nursing programs. *Journal of Nursing Education, 48*, 535-536.
- Clancy, J., McVicar, A., & Bird, D. (2000). Getting it right? An exploration of issues relating to the biological sciences in nurse education and nursing practice. *Journal of Advanced Nursing, 32*, 1522-1532.
- Clarke, M. (1995). Nursing and the biological sciences. *Journal of Advanced Nursing, 22*, 405-406.
- Clyburn, G. (2010). Institution lookup. Retrieved from http://classifications.carnegiefoundation.org/lookup_listings/institution.php
- Courtenay, M. (1991). A study of the teaching and learning of the biological sciences in nurse education. *Journal of Advanced Nursing, 16*, 1110-1116.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. (3rd ed.) Los Angeles, CA: Sage.
- Csokasy, J. (2002). A congruent curriculum: Philosophical integrity from philosophy to outcomes. *Journal of Nursing Education, 41*, 32-33.
- Dalgety, J., Coll, R. K., & Jones, A. (2003). Development of chemistry attitudes and experiences questionnaire (CAEQ). *Journal of Research in Science Teaching, 40*, 649-668.

- Davies, S., Murphy, F., & Jordan, S. (2000). Bioscience in the pre-registration curriculum: Finding the right teaching strategy. *Nurse Education Today*, 20, 123-135.
- Diekelmann, N. (2002). Developing a science of nursing education: Innovation with research. *Journal of Nursing Education*, 41, 379-380.
- Ellis, M. Meeker, B. J., & Hyde, B. L. (2006). Exploring men's perceived educational experiences in a baccalaureate program. *Journal of Nursing Education*, 45, 523-529.
- Field, A. (2009). *Discovering statistics using SPSS*. (3rd ed) Thousand Oaks, CA: Sage.
- Ganum, V. (2004). Nursing students' perceptions of nursing as a subject and a function. *Journal of Nursing Education*, 43, 297-304.
- Gardner, P.L. (1975). Attitudes to Science: A Review. *Studies in Science Education*, 2, 1-41.
- Garson, G.D. (2012). *Factor analysis*. Retrieved from <http://www.statisticalassociates.com/>.
- Greco, K. E. & Salveson, C. (2009). Identifying genetics and genomics nursing competencies common among published recommendations. *Journal of Nursing Education*, 48, 557-565.
- Hannafin, M. J., & Hooper, S. R. (1993). Learning principles. In M. Fleming & W. H. Levie (Eds.), *Instructional message design: Principles from the behavioral and cognitive sciences* (2nd ed., pp. 191-232). Englewood Cliffs, NJ: Educational Technology Publications, Inc.
- Hannah, V. (2006). The big picture: Learning to think like a nurse. *Journal of Nursing Education*, 45, 239-240.

- Hofler, L. (2008). Nursing education and transition to the work environment: A synthesis of national reports. *Journal of Nursing Education, 47*, 5-12.
- Howe, A. C. & Jones, L. (1998). *Engaging children in science* (2nd ed.). Columbus, OH: Merrill.
- Johnson, A. N. B. & McAllister, M. (2008). Back to the future with hands-on science: Students' perceptions of learning anatomy and physiology. *Journal of Nursing Education, 47*, 417-421.
- Jordan, S., Davies, S., & Green, B. (1999). The biosciences in the pre-registration nursing curriculum: Staff and students' perceptions of difficulties and relevance. *Nurse Education Today, 19*, 215-226.
- Jordan, S., & Hughes, D. (1998). Using bioscience knowledge in nursing: Actions, interactions and reactions. *Journal of Advanced Nursing, 27*, 1060-1068.
- Kaufman, D. M., & Mann, K. V. (1997). Basic science in problem-based learning and conventional curricula: Students' attitudes. *Medical Education, 31*, 177-180.
- Lamm, G., & McDaniel, A. M. (2000). Factors that predict success on the NCLEX-PN. *Journal of Nursing Education, 39*, 315-317.
- Lichtenstein, M. J., Owen, S. V., Blalock, C. L., Liu, Y., Ramirez, K. A., Pruski, L. A., Marshall, C. E., & Toepperwein, M. A. (2008). Psychometric reevaluation of the scientific attitudes inventory-revised (SAI-II). *Journal of Research in Science Teaching, 45*, 600-616.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage.
- Lyckhage, E. D., & Pilhammar, E. (2008). The importance of awareness of nursing students' denotative images of nursing. *Journal of Nursing Education, 47*, 537-543.

- McKee, G. (2002). Why is biological science difficulty for first-year nursing students? *Nurse Education Today*, 22, 251-257.
- McKee, G. (2003). Is biological science difficult for first year students or do we simply need more information? A response to Ian Scott's criticism of 'Why is biological science difficult for first-year nursing students? *Nurse Education Today* 22:3:251-257. *Nurse Education Today*, 23, 157-158.
- McMillian, D. E., Bell, S., Benson, E. E., Mandzuk, L. L., Matias, D. M., McIvor, M. J., Robertson, J. E., and Wilkins, K. L. (2007). From anxiety to enthusiasm: Facilitating graduate nursing students' knowledge development in science and theory. *Journal of Nursing Education*, 46, 88-91.
- Moore, R. W. & Foy, R. L. H. (1997). The scientific attitude inventory: A revision (SAI II). *Journal of Research in Science Education*, 34, 327-336.
- Moore, R. W. & Sutman, F. X. (1970). The development, field test and validation of an inventory of scientific attitudes. *Journal of Research in Science Teaching*, 7, 85-94.
- National Council of State Boards of Nursing (NCSBN). (2009). *NCLEX-RN examination: Test plan for the national council licensure examination for registered nurses*. Retrieved from <https://www.ncsbn.org/>.
- Nicoll, L. (1996). The study of biology as a cause of anxiety in student nurses undertaking the common foundation programme. *Journal of Advanced Nursing*, 24, 615-624.
- Office of the Registrar. (2012). Undergraduate bulletin. Retrieved from <http://www.usm.edu/registrar/undergraduate-bulletins>.

- Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*, 1049-1079.
- Patton, M. Q. (2002). *Qualitative research & evaluation methods*. Thousand Oaks, CA: Sage.
- Petersson, G. (2005). Medical and nursing students' development of conceptions of science during three years of studies in higher education. *Scandinavian Journal of Educational Research, 49*, 281-296.
- Ramsden, J. M. (1998). Mission impossible?: Can anything be done about attitudes to science? *International Journal of Science Education, 20*, 125-137.
- Sandstorm, S. (2006). Use of case studies to teach diabetes and other chronic illnesses to nursing students. *Journal of Nursing Education, 45*, 229-232.
- Schau, C. (1996). Survey of attitudes towards statistics [questionnaire]. Unpublished instrument. Retrieved from <http://www.evaluationandstatistics.com/>.
- Scott, I. (2003). Is biological science difficult for first-year students or do we simply need more information? A response to why is biological science difficult for first-year nursing students? *Nurse Education Today, 23*, 155-156.
- SPSS AMOS (Version 17) [Computer software]. Armonk, NY: IBM SPSS.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon.
- Thornton, T. (1997). Attitudes towards the relevance of biological, behavioural and social sciences in nursing education. *Journal of Advanced Nursing, 26*, 180-186.

- Thorpe, K. & Loo, R. (2003). The values profile of nursing undergraduate students: Implications for education and professional development. *Journal of Nursing Education, 42*, 83-90.
- Trnobranski, P. (1993). Biological sciences and the nursing curriculum: A challenge for educationalists. *Journal of Advanced Nursing, 23*, 1071-1079.
- U.S. Census Bureau Geography Division. 2010 Census Regions and Divisions of the United States [Map]. Retrieved from www.census.gov/geo/www/us_regdiv.pdf.
- U.S. News & World Report LP. (2013). Education colleges. Retrieved from <http://colleges.usnews.rankingsandreviews.com/best-colleges/search>.
- van Aalderen-Smeets, S. I., Walma van der Molen, J. H., and Asma, L. J. F. (2012). Primary teachers' attitudes toward science: A new theoretical framework. *Science Education, 96*, 158-182.
- Vygotsky, L. S. (1978). *Mind in society*. M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.
- Wang, M. M., Wu, K., & Huang, T. I. (2007). A Study on the factors affecting biological concept learning of junior high school students. *International Journal of Science Education, 29*, 453-464.
- Webber, P. B. (2002). A curriculum framework for nursing. *Journal of Nursing Education, 41*, 15-24.
- Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of literature from 1970 to 1991. *Journal of Research in Science Teaching, 32*, 387-398.
- Welch, W. W. (1972). Evaluation of the PSNS course. II: Results. *Journal of Research in Science Teaching, 9*, 147-156.

Wong, J., & Wong, S. (1999). Contribution of basic sciences to academic success in nursing education. *International Journal of Nursing Studies*, 36, 345-354.

Young, T. (1998). Student teachers' attitudes towards science (STATS). *Evaluation & Research in Education*, 12, 96-111.