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Exploring Factors Influencing Critical Thinking Skills in Undergraduate Nursing Students: A Mixed Methods Study

Christina Mortellaro
christina.poli@student.shu.edu

Exploring Factors Influencing Critical Thinking Skills in Undergraduate Nursing Students: A Mixed Methods Study

By

Christina Mortellaro

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Chair:
Genevieve Pinto Zipp, Ed.D. Genevieve Zipp Date 8/19/2015

Committee Member:
Deborah DeLuca, M.S., J.D. Deborah DeLuca Date 8/19/2015

Committee Member:
Lee Cabell, Ed.D. Lee Cabell Date 8/19/2015

The mentor and any other member who wish to review revisions will sign and date this document only when revisions have been completed. Please return this form to the office of Graduate Studies, where is will be placed in the candidates file and submit a copy with your final dissertation.

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"life is the greatest journey you will ever be on."

--*unknown author*

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■ your protégé

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Abstract

Health science education has been moving towards a model of Interprofessional Education in order to meet the increasing demands of Interprofessional Practice in Healthcare, which focuses on delivering high quality patient centered care. This model of Healthcare will lead to improved patient outcomes and overall efficiency of healthcare. Another integral component between effective health care practice and the education of health professional students is the development of critical thinking skills. In order for healthcare professionals to communicate effectively with their patients and their families and also with one another, as in interprofessional practice, critical thinking skills are required. Therefore, critical thinking would be necessary for interprofessional education and subsequently interprofessional practice. Critical thinking in the different health professions needs to be addressed in order for interprofessional education and practice to be effective.

Critical thinking is a multi- faceted concept and is influenced by a variety of factors. However, throughout the literature on critical thinking, the influence of these factors is not consistent. The primary purpose of this study is to identify the factor(s) that influence critical thinking skills in health science professional students. A concurrent triangulation mixed methods design was used in order to collect both quantitative and qualitative data concurrently and with equal weight. The quantitative design is descriptive and cross sectional,

exploratory, and experimental to gather survey data on critical thinking scores and the potential factors influencing critical thinking. The qualitative design is a one phase convergent design to obtain different but complementary data on the same topic and to validate the quantitative with the qualitative to better understand the problem. One hundred and forty students from three private Universities' accredited BSN programs participated in this study.

Study results revealed that the overall critical thinking score of undergraduate nursing students was a *moderate* level as measure by the Health Science Reasoning Test (HSRT). There is a significant but weak relationship between critical thinking and job shadowing experiences (p= 0.10), between critical thinking and club involvement (p=.003), and between critical thinking and athletics (p=0.035). Students involved in clubs had significantly higher overall critical thinking scores than students not involved in clubs (p= 0.002). Students involved in athletics had significantly higher critical thinking scores than students not involved in athletics (p= 0.050). Surprisingly, the stepwise regression analysis revealed only 10% of the variance in the critical thinking scores due to the involvement of clubs and healthcare experience through job shadowing. Therefore, the difference in critical thinking scores must be due to other factors not explored here, and factors not predominantly mentioned in the literature as well. The qualitative component of the study revealed that the students were involved in more

teacher centered learning activities and did not have a strong understanding of what critical thinking is and its importance.

This study lends support to the position that student centered learning will foster the development of critical thinking skills. The more interactive learning strategies, and opportunities for the students to form social and academic networks, the greater the development of critical thinking skills. Therefore by engaging in the active learning opportunities, the students will have the opportunity to further develop critical thinking skills by practicing and applying these skills, ultimately making them more productive, collaborative members of interprofessional education and practice.

Chapter I

INTRODUCTION

Background of the Problem

Over the last few decades, interprofessional practice has been highlighted as a key aspect in delivering high- quality, patient- centered care (Interprofessional Education Collaborative, 2011 and WHO, 2010). The WHO (2010) defines Interprofessional Practice (IPP), as when "multiple health workers from different professional backgrounds work together with patients, families, and communities to deliver the highest quality of care." The collaboration that occurs between the healthcare professionals will strengthen healthcare and lead to improved patient outcomes. Therefore, professionals need to learn to work as members of a collaborative team. Interprofessional Education (IPE) is when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes (WHO, 2010). Health professions education is therefore transforming in order to enable opportunities for health professions students to engage in interactive learning strategies with those outside of their profession. The four core competencies of Interprofessional education, indicated the ways in which students will be prepared for interprofessional practice are: to know and understand each other's roles, to be able to work effectively as a member of a collaborative team with members of other

professions, to communicate effectively with other healthcare professionals and also patients, families, and communities, and to perform effectively in different team roles, ultimately to provide effective patient- centered care (Interprofessional Education Collaborative, 2011).

Another integral component between effective health care practice and the education of health professional students is the development of critical thinking skills. Brookfield (2012) identifies critical thinking as a skill that will provide health care professionals, the framework to defend their actions. Critical thinking encourages a logical progression through a problem in order to arrive at a solution grounded in evidence by identifying and questioning assumptions. Fero, Witsberger, Wesmiller, Zullo, and Hoffman (2008) describe the safety of patients as being directly related to critical thinking of the health professionals. In order for health care professionals to recognize patient conditions, respond accordingly, making informed decisions quickly and communicating effectively, they need critical thinking skills. Therefore, in order for healthcare professionals to communicate effectively with their patients and their families and also with one another, as in interprofessional practice, critical thinking skills are required. Failure to use critical thinking not only can lead to failure to learn, but also, poor decision making, confounded and confusing collaboration and communication, and ultimately to patient deaths (Facione & Facione, 2013). In addition, Clark (2009) identifies that

Interprofessional education requires learning and learning requires reflection. Reflection also involves higher order mental processing, or critical thinking, of issues or problems for which there is no easy or obvious solution (Clark, 2009). Therefore, critical thinking would be necessary for interprofessional education and subsequently interprofessional practice. Without critical thinking skills, health professional students will not be able to engage effectively in collaborative teams, and as health care providers, without using interprofessional practices can lead to poor patient outcomes and lower quality of care.

With the multiple dimensions encompassed in the definition of critical thinking, it becomes apparent that there are several different factors influencing the development of critical thinking. The literature reveals several studies, which attempted to determine the factors that affect critical thinking ability. Throughout the literature, however, there is a large amount of disparity in regard to the factors that could improve students' ability to think critically. This would lead one to assume that there is not just one specific factor especially within health science education.

A conceptual framework that accentuates the active process of critical thinking is the constructivist learning theory. The major theme of this theory is that learning should be an active process in which new ideas are formed based on previous knowledge. But because critical thinking is defined as not

only an active process, but also being influenced throughout that process by different factors. Therefore, another learning theory which may further help to understand critical thinking in the way it is defined by Brookfield and compliments the constructivist approaches to learning in higher education, and the development of interprofessional education is the Community of Inquiry framework (CoI) (Garrison and Arbaugh, 2007). This theory supports that in order for effective learning to result, it requires the development of a community that supports meaningful inquiry and deep learning (Swan, et.al., 2008).

Need for the Study

Critical thinking in the different health professions needs to be addressed in order for interprofessional education and practice to be effective. For example, if the critical thinking of one of the health professional groups is not at a similar level as the other health professional groups, they will not be considered valuable members of the collaborative team. Critical thinking is an essential part of healthcare practice and education. Critical thinking is a multi-faceted concept and is influenced by a variety of factors. However, throughout the literature on critical thinking, the influence of these factors is not consistent. By identifying the factor(s), educators will be able to expose students to the factors that are found to positively influence critical thinking.

When critical thinking ability of the students is improved, they will be better prepared to enter the healthcare workforce and will be more effective team members for interprofessional practice, which ultimately will provide better patient outcomes and improve healthcare.

Purpose

The primary purpose of this study is to identify the factor(s) that influence critical thinking skills in health science professional students.

Research Question

The primary research question of this study is:

What are the factors that influence the critical thinking skill of health science professional students?

Research Hypotheses

The research question provided a basis for developing the four hypotheses of this study.

H1: There is a significant *association* between the overall critical thinking scores, as measured by the HSRT, of undergraduate nursing students and each of the *"factors."*

H2: There is a significant *difference* in the overall critical thinking scores, as measured by the HSRT, of undergraduate nursing students between the levels of the *"factors."*

H3: There is a significant *difference* in the *five subscales* of critical thinking scores of undergraduate nursing between the levels of the *"factors."* Therefore, the five sub-hypotheses of H3:

- H_{3a}: There is a significant *difference* in the *induction* scores of undergraduate nursing students between the levels of the *"factors."*
- H_{3b}: There is a significant *difference* in the *deduction* scores of undergraduate nursing students between the levels of the *"factors."*
- H_{3c}: There is a significant *difference* in the *analysis* scores of undergraduate nursing students between the levels of the *"factors."*
- H_{3d}: There is a significant *difference* in the *inference* scores of undergraduate nursing students between the levels of the *"factors."*
- H_{3e}: There is a significant *difference* in the *evaluation* scores of undergraduate nursing students between the levels of the *"factors."*

H4: All *factors (16)* will have a significant *predictive effect* on <u>overall</u> Critical Thinking scores of undergraduate nursing students.

Chapter II

REVIEW OF RELATED LITERATURE

Introduction

The responsibility of an educator is to facilitate the learning process and promote students' academic growth (Brookfield, 2006). One outcome educators recently have given more attention to especially in higher education is the development of critical thinking skills in their students (Garrison, Anderson, and Archer, 2010). In the literature, critical thinking has been defined differently yet, consistent in each definition is the underlying tenet that it is an active process, which utilizes a specific skill set and is founded in judgment. Consistently, critical thinking has been identified as fundamental to the development of effective decision- making practices. Without effective critical thinking skills, the knowledge obtained cannot be properly and effectively utilized in practical experiences (Banning, 2006). But if one has critical thinking skills then the knowledge learned lays the foundation to which students will reflect critically about the information in order to be able to apply their knowledge in a critically effective manner. This process of analyzing information is consistent with the constructivist learning theory, which describes learning as an active process where new ideas are based on current or past knowledge (Bodner, 1986 and Ausubel, 1978). Therefore, it can be postulated that if learning enhances one's ability to think, as one

begins to think more critically then their ability to think will increase accordingly.

In today's higher education, especially in health science coursework, there has been a paradigm shift from rote passive learning and the memorization of basic content knowledge to the higher level integration of information using active learning which incorporates analysis and synthesis in order to enhance critical thinking skills (Chaplin, 2007). The students' success within a course is measured by successful completion of course requirements which are typically routed in knowledge acquisition and infers to an increase in critical thinking. To support this outcome, health science faculty design course work to foster the acquisition of knowledge and develop critical thinking abilities of their students. However, it is not uncommon to observe adult learners in the health sciences who possess a similar knowledge base (prerequisite coursework), who are participating in these courses designed to develop critical thinking skills not achieve the same level of success on examinations, projects, and in clinical experiences. Given the disparity between students' success in a course outcomes, one might infer then that students may be developing critical thinking skills at different rates, thus leading one to ask what influences one's ability to develop critical thinking skills. One possible explanation may be that students are entering the academy with different levels of or abilities to think critically to start regardless of the base knowledge

they posses and therefore the student that enters with a higher level of critical thinking ability succeeds in the coursework while the student starting out with a lower level of critical thinking is less successful regardless of the amount of critical thinking development educators infuse into the course. Thus one must further develop an in depth understanding of critical thinking and what we know about how it develops and what factors influence that development.

Established Definitions of Critical Thinking

Critical thinking in higher education has been studied extensively, and many different definitions of critical thinking have been proposed (Banning, 2006, Brunt 2005, Scheffer and Rubenfeld, 2000, Simpson and Courtney, 2002). Given the vast array of definitions noted in the literature, there is no one clear definition. The multiple definitions seem to follow a trend of either being founded on judgment, a specific skill set, or characterized as a process. Cited in several studies, one definition of critical thinking developed by Watson and Glaser (1964) defines critical thinking as a skill set of " attitudes, knowledge, and skills that include: attitudes of inquiry that involve the ability to recognize the existence of problems and an acceptance of the general needs for evidence in support of what is asserted to be true; knowledge of the nature of valid inferences, abstractions, and generalization in which the weight or accuracy of different kinds of evidence are logically determined; and

skills in employing and applying the attitudes and knowledge," (Adams 1999, Turner 2003, Gordon 2000). Even the most frequently cited definition, from the Delphi report of Facione (1990), includes both a subset of skills in coordination with judgment. Using experts in the field of critical thinking to reach a consensus on the definition, in order to provide clarity to the term, critical thinking was defined as "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based," (Facione, 1990). Also referring to critical thinking as "purposeful judgment" is Ennis, Millman, and Tomko (1985) definition of critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do," (Adams 1999, Turner 2003, Gordon 2000, Simpson and Courtney 2002, Scheffer and Rubenfeld 2000). As a process however, Paul (1993) defined critical thinking as "the intellectually disciplined process of actively and skillfully conceptualizing, applying, synthesizing, or evaluating information gathered from, or generated by, observation, experience, reflection or communication, as a guide to belief or action," (Banning, 2006, Scheffer and Rubenfeld 2000, Brunt 2005, Turner 2003). With the multiple definitions that exist, one theme consistent throughout all is that critical thinking involves inquiry.

Given the diverse terms used to define critical thinking, healthcare professionals have questioned if these definitions are broad and descriptive enough to address the critical thinking skills required of healthcare professionals (Scheffer and Rubenfeld, 2000, Gordon, 2000). Gordon (2000) developed a questionnaire based on the Facione Delphi study for nurse educators in order to identify their perceptions of the definition, skills and characteristics of critical thinking. He found nurse educators indicated no difference in how critical thinking is defined in respect to different disciplines, but the results also indicated that the nursing educators used in this study did not view critical thinking in the same way as the experts in the Facione study. Interestingly, nurse educators agreed with the non nursing critical thinking experts on the characteristics associated with critical thinking however, the nurse educators further identified critical thinking skills as encompassing the nursing process, decision making and clinical reasoning which the non nurse critical thinking experts did not. Based upon these additional characteristics Gordon (2008) suggested that the perceptions of critical thinking of nurse educators did differ from non- nurse educators. Thus, the different perceptions of critical thinking influenced by the definitions may even be a factor influencing critical thinking development.

Based upon this lack of a clear definition of critical thinking, Scheffer and Rubenfeld (2000) attempted to identify a discipline specific definition to critical

thinking. Using a panel of nursing professionals in a Delphi process, it was identified that nurses suggested critical thinkers exhibit habits of the mind, which was further defined as "confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity, intuition, open-mindedness, perseverance, and reflection." Nurses further defined critical thinking in nursing practice as the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and transforming knowledge, which further defines critical thinking in practical application. In addition to nursing, other health related professions have developed discipline specific definitions to clarify the term critical thinking. In occupational therapy, critical thinking is defined as clinical reasoning, which is further defined as interpretive judgment, using previous knowledge and experience to offer justification to the decision making process (Mattingly, 1991). While one clear definition does not represent the literature, it is clear that all professionals believe the development of critical thinking is essential in the health sciences.

Based on the notion that critical thinking can be developed and that critical thinking applies to all fields of study (Paul 2005 and Facione and Facione 2008), for the purposes of this paper, critical thinking will be referred to as a process for reasoning (Brookfield, 2012). Brookfield identifies critical thinking as a process that includes takes place across all disciplines, and is a skill that

will provide health care professionals, such as nurses and occupational therapists, the framework to defend their actions (Brookfield, 2012). Critical thinking encourages a logical progression through a problem in order to arrive at a solution grounded in evidence by identifying and questioning assumptions. Brookfield's definition emphasizes that critical thinking involves thinking about the process (means) and not putting all of the focus on the outcome (end). Brookfield explains that emotions are also important to the process of critical thinking because as one thinks critically and helps others to think critically, it is natural to become conscious of their emotions or perceptions to it. Critical thinking is further described as a productive, active process that is not motionless, it involves the continuous questioning of right and wrong, and does not necessarily bring one to an ultimate answer or conclusion which is often characteristic of healthcare practice (Brookfield, 2012). Given the disparity in defining critical thinking, one begins to question if a tool can assess all tenets associated with how it has been defined. Presently no tool has used Brookfield's definition as a frame of reference to further understand and assess the development of critical thinking.

Tools to Measure Critical Thinking

While many studies have posed many different definitions, two tools have been utilized extensively in the literature to measure critical thinking. The first

tool, the Watson and Glaser Critical Thinking Appraisal (WGCTA), is a measure of critical thinking judgments and logical reasoning derived from testing argument skills, drawing inferences, interpreting, and deductive reasoning, recognizing assumptions, evaluating conclusions, and assessing reasoning strengths. The internal reliability coefficient ranged from 0.69-0.85. A second tool, the California Critical Thinking Skills Test (CCTST), was developed by Facione from the Delphi report. It was developed to measure critical thinking in adult learners, and addresses similar concepts as the WGCTA. The internal reliability coefficient ranged from 0.68- 0.69. The greatest difference between the two tools is that the CCTST was developed to assess general critical thinking in adult learners to decide what do believe or do while the WGCTA measures the logical and creative components of critical thinking written in more of a business context. The largest criticism of these two tools is that they are not discipline specific, but general measures of critical thinking (Riddell 2007, Simpson and Courtney 2002, Adams 1999) and do not accurately reflects the critical thinking skills of the unique health science population.

The CCTST and the WGCTA have been utilized extensively to measure critical thinking but a review of the literature reveals inconsistencies in the results related to critical thinking when utilizing these tools. For example, Vogel, Geelhoed, Grice, and Murphy (2009) assessed the critical thinking

skills of occupational therapy students and physical therapy students using the WGCTA to determine if students were developing critical thinking skills throughout their coursework before entering the clinical experience of the program. The students were tested at the beginning of their academic program and again twenty months later at the end of their coursework, immediately prior to the clinical phase of the program. Interestingly, only in the occupational therapy students did the critical thinking skills improve during their academic period. Vogel, Geelhoed, Grice, and Murphy (2009) rationalized the improvement in one group and not the other as a result of differences in the timing of when critical thinking skills were taught in each of the programs. This indicates that the earlier critical thinking skills are introduced, the more those skills will improve throughout their academic period. However, Adams (1999) analyzed twenty studies, most of which used the WGCTA to assess critical thinking skills of nursing students. No clear relationship was identified between critical thinking abilities and the number of years in nursing education programs. Similarly, Daly (2001) sought to explore and develop a domain specific method for identifying critical thinking in student nurses' reasoning processes using a curriculum intervention and the WGCTA. However, no change in critical thinking ability was found.

Similar inconsistencies can be seen with the use of the CCTST. Reporting the use of the CCTST, McCarthy, Schuster, Zehr, and McDougal (1999)

compared the critical thinking scores of sophomore and senior nursing students. The study concluded that the seniors scored significantly higher than the sophomores in critical thinking ability. Conversely, McGrath (2003) who utilized the same tests did not find support for McCarthy, Schuster, Zehr, and McDougal's results given that critical thinking scores did not increase with the number of years in the nursing program. Similar studies utilizing the CCTST in physical therapy students also did not find an improvement of critical thinking scores throughout an educational program (Bartlett and Cox 2002, Venderly 2005). Still using the CCTST, German (2008) tested athletic training students, and also found no improvement of scores throughout the education. Beckie, Lowry, and Barnett (2001) also utilized the CCTST to evaluate critical thinking skills before and after a curriculum revision to implement critical thinking skills into a clinical judgment course in three cohorts. The first group of students tested was assessed before the new curriculum was implemented in order to serve as a baseline or control group. A second group of students was assessed the following year using the new curriculum and a third group of students receiving the same educational curriculum the next year. While group 2 achieved higher critical thinking scores group 3 did not, indicating that changes may have been due to differences within each of the groups and not necessarily the modified curriculum.

Interestingly, studies that utilized tests other than the WGCTA and the CCTST did however find critical thinking scores to increase with the level of experience (Martin 2002 and Fero, Witsberger, Wesmiller, Zullo, and Hoffman 2008). Martin (2002) and Fero, Witsberger, Wesmiller, Zullo, and Hoffman (2008) utilized the Elements of Thought Instrument and the Problem Based Development System Assessment respectively. The Elements of Thought Instrument uses a Likertt scale to characterize adjectives that describe critical thinking. The Problem Based Development System Assessment measures critical thinking skills by having students assess videotaped vignettes that depict common problems that nurses would encounter. The instruments were used in conjunction with vignettes of clinical scenarios. The scenarios however, were simulated and the actual clinical decision-making may differ from the actions the subjects stated. Upon reflecting on these discrepancies in the literature surrounding changes in critical thinking, one may speculate that the inconsistent results may be due to the fact that the CCTST and WGCTA is not disciple specific and therefore were not able to capture the changes noted in health science students specific to health science knowledge base. Even though Brookfield defines critical thinking as being general across all discipline, he also emphasizes that in order for students to learn how to think critically, or question their assumptions, they do so under a specific context rather than generally (Brookfield, 2012). Therefore, if

students learn to think critically within a specific context, it would make sense to assess this ability within a similar context.

Based on these discrepancies over the need for a discipline specific tool to accompany a discipline specific definition, Facione and Facione (2006) developed the Health Sciences Reasoning Test (HSRT). The HSRT assesses the critical thinking skills of health science students and healthcare professionals. Insight Assessment (Millbrae, CA: www.insightassessment.com) developed the HSRT so that the items do not require any knowledge of the health sciences but are put into a health science related context. D'Antoni (2009) used the HSRT to determine if a relationship exists between critical thinking skills and mind mapping by comparing pre and post HSRT scores of medical students using only traditional note taking and students using the mind mapping method. No significant difference was found between the pre and post HSRT scores, which the authors suggest could have been explained by the unfamiliarity with and brief exposure to mind mapping. A more recent study established the construct validity of the HSRT by determining if there was a difference in the HSRT scores between the novice and expert physical therapists' critical thinking skills (Huhn, Black, Jensen and Deutsch, 2011). Despite the existence of several tools, two of which are considered the "gold standard," the HSRT was designed specifically to assess critical thinking skills of health science students and

may offer future investigators the opportunity to more effectively asses' critical thinking in health sciences personal.

Factors Affecting Critical Thinking Ability

With the multiple dimensions encompassed in the definition of critical thinking, specifically in a health science context, it becomes apparent that there are several different factors influencing the development of critical thinking. A review of the literature reveals several studies, which attempted to determine the factors that affect critical thinking ability. The majority of the studies identify similar, common factors, as potential sources for influencing the development of critical thinking skills in health science students. Bartlett and Cox (2002) tested undergraduate physical therapy students to determine factors influencing the development in critical thinking ability. In terms of age, they found a negative association with changes in critical thinking skill as measured by both the California Thinking Skills Test (CCTST) and the California Critical Thinking Dispositions Inventory (CCTDI). Similar results were found by several other studies using different samples and tools. McDade (1999) tested undergraduate nursing students, dental students, and veterinary medicine students to determine if a relationship exists between critical thinking using the CCTDI and age, Chau, Chang, In, Lee, and Wootton (2001) tested undergraduate nursing students with the CCTST, and Drennan

(2009) tested graduate nursing students with the WGCTA. Each of these, in addition to Jenkins (1998) and Whitmire (1998), found age to be negatively associated with critical thinking ability. Conversely, other studies have found positive associations between critical thinking and age. Martin (2002), when testing both undergraduate and graduate nursing students to determine if a relationship exists between critical thinking and age using the Elements of Thought Instrument, found a statistically significant relationship. Ulosoy and Ozturk (2009) found a statistically significant difference in undergraduate and graduate students' critical thinking ability according to their age. The results revealed a correlation, indicating that as age increased, the critical thinking ability, as measured by the CCTDI, also increased. Similarly, Clocklin (1995) also found critical thinking of first year nursing students to increase with age as measured by the WGCTA. Based on the literature, inconsistent support is noted for age as a factor that impacts critical thinking.

Another factor explored in the literature as it relates to critical thinking ability is the amount of real-life health care experiences, such as clinical hands on experiences, clinical observations, and volunteering. Similar to the inconsistencies in the literature exploring the relationship between age and critical thinking, inconsistencies are noted in the literature exploring experience. An integrated review done by Banning (2006) highlights these inconsistencies by establishing that there is a lack of evidence to determine if

critical thinking skills are developed through experience or education. Martin (2002), Ulosoy and Ozturk (2009), and Fero, Witsberger, Wesmiller, Zullo, and Hoffman (2009) all found higher critical thinking skills in nursing students and nurses who have had more nursing experiences. Conversely, Reid (2000) identified a negative correlation between the critical thinking ability of associate degree nursing students. However, McDade's (1999) study assessing the critical thinking ability of nursing students, dental students, and veterinary students and experience did not demonstrate a significant relationship between experiences and critical thinking ability.

Gender is another factor that has been studied to determine if there is a relationship to critical thinking. Several studies indicate no relationship exists between critical thinking and gender as it has been tested in physical therapy students, undergraduate and graduate nursing students, dental students, veterinary students (Bartlett and Cox, 2002, Ulosoy and Ozturk 2009, McDade 1999, and Chau, Chang, In, Lee, and Wootton, 2001). Similarly, studies have also found no significant difference between males' and females' levels of critical thinking ability in athletic training students (German, 2008) and in undergraduate science and math students (Quitadamo et.al. 2009).

Brunt (2005) reviewed the findings of several studies and identified a strong link between academic achievement and critical thinking ability. Reid (2000) and Martin (2002) both identified a significant, positive correlation

between critical thinking skill and GPA in nursing students. Ulosoy and Ozturk (2009) studied the factors that affect the level of critical thinking in nursing students and found a positive linear correlation between critical thinking and GPA. In contrast, McDade (1999) failed to find any such relationship in dental and veterinary students.

Another commonly studied factor is the level of education due to the fact that a common goal in higher education is to improve one's ability to think critically, therefore leading one to assume that the higher the level of education achieved, the greater the ability to think critically. Investigating undergraduate education, McCarthy, Schuster, Zehr, and McDougal (1999) assessed the critical thinking outcomes of sophomores and seniors in an undergraduate nursing program and found that the senior students scored significantly higher than sophomore students. Similarly, Drennan (2009) assessed the critical thinking skills of current students and graduates of a graduate nursing program and found graduates to have significantly higher scores. A study by Shin, Jung, Shin, and Kim (2006) revealed statistically significant differences in critical thinking ability between senior students in associate nursing, baccalaureate nursing, and RN to BSN programs. Conversely, however, an integrated review of the literature identified no clear relationship between critical thinking abilities and the number of years in nursing education programs (Adams, 1999). A few of the studies supporting

this finding are Martin (2002) finding no difference between graduate nursing students and students in an RN program and McGrath (2003) finding no increase in critical thinking ability of undergraduate nursing students. Studies involving other areas of health sciences have found similar results. Cisneros (2009) sought to determine if critical thinking skills changed over the course of a year in pharmacy students and found no significant changes. In physical therapy, Bartlett and Cox (2002) found no significant relationship between critical thinking and the year in an undergraduate program and Venderly (2005) found no significant difference in the level of critical thinking skills from the beginning to end of a graduate program. Similar findings were also found in a study in which the critical thinking ability of the students in the second, third, and fourth year of an undergraduate athletic training program were each measured (German, 2008).

Critical thinking dispositions have also been a widely studied influence of critical thinking. The most commonly used definition of critical thinking dispositions is the definition by Facione, which describes critical thinking dispositions as knowable tendencies, readily accessible to description, evaluation, and comparison by oneself and others (Facione, 2000). The relationship between critical thinking skill and critical thinking dispositions have been studied extensively especially in undergraduate nursing students consistently finding positive, significant relationships (Facione 2000,

McCarthy, Schuster, Zehr, and McDougal 1999, McGrath 2003, Shin, Jung, Shin, and Kim 2006, Heath 2000). Wessel and Williams (2004) however, assessed students in a graduate level physical therapy program in which they did not find a significant correlation between critical thinking skills and critical thinking dispositions.

One factor, which has only been researched in a limited manner amongst the adult learners in higher education, is level of student involvement. Involvement includes interactions with students, faculty, on and off campus, clubs and organizations, employment, residency, athletics, to name a few. The majority of studies, which have utilized different research designs, are consistent in the result that involvement positively influences critical thinking development with some exceptions in the type of involvement. Gellin (2003) compared 8 studies to determine the effect of undergraduate involvement on critical thinking. Based on the meta-analysis, results indicate that students involved in clubs and organizations, peer interactions, living on campus, employment, and interaction with faculty experienced an increase in critical thinking skill associated with involvement. Student involvement is also defined as forms of academic, intellectual, or cognitive development. Terenzini, Pascarella, and Blimling (1999) reviewed literature to examine the influences of students' involvement on learning. They reported faculty interactions with students out of class as having a positive association in one

or more area of cognitive development and Greek society membership having a negative interaction on cognitive development while other areas provided mixed results of impact on critical thinking such as campus living, athletics, and employment.

While Terenzini, Pascarella, and Blimling (1999) review of the literature presented mixed results, a more recent study by Pascarella (2001) has provided insight into these earlier results. In the earlier study, Terenzini, Pascarella, and Blimling (1999) studied the influences of students' out of class experiences and found inconsistent results in areas such as athletics and employment. The later study, Pascarella (2001) using a cross sectional study summarized the findings of the National Study of Student Learning (NSSL) from 1992-1995. Here, athletics were divided by type and employment was divided into part time or full time leading to clearer results. The results showed cognitive gains (reading comprehension, mathematics, and critical thinking) to be influenced only by intercollegiate athletics in male basketball and football players; other areas of athletics did not have cognitive gains. The results also indicated part time work to facilitate learning but more than fifteen hours of work has a negative impact on learning. This finding was similar to the findings of Inman and Pascarella (1998) found a negative relationship between the numbers of hours working on critical thinking development quantitatively.

Inman and Pascarella (1998) emphasized that extracurricular involvement not only has a positive influence on cognitive development but also that different amounts of involvement make significantly different changes in critical thinking during the first year of college. Studying first year college students, Terenzini, Springer, Pascarella, and Nora (1993) wanted to estimate the relative importance of course activities, formal instruction and class experiences, and their out of class experiences on critical thinking ability. Both in and out of class experiences were found to make statistically significant contributions to the variance attributed to students' precollege characteristics or other college experiences and students' out of class experiences contributed as much to the gains in critical thinking as did students' class related experiences. In summary, for the majority of student interactions with other students, faculty, clubs and organizations, employment, athletics, and campus living, tend to positively influence critical thinking development.

Purvis (2009) and Gellin (2003) using a qualitative study design found similar results. Purvis (2009) identified factors that influenced the development of critical thinking skills qualitatively through interviews with nursing students in an associate degree program. The students interviewed reported curriculum design and interactive learning strategies as influencing their development of critical thinking skills and identified testing as a factor

improving critical thinking skills. These findings were similar to Gellin (2003) where faculty support was identified as an influence as well. Also different from the previous studies discussed, these studies did not mention out of class experiences and extracurricular involvement.

Behar-Horenstein and Niu (2011) in their work emphasized the importance of developing critical thinking skills in higher education and the role of instructional approaches in that development. Instructional approaches have been studied extensively especially, in terms of which methods help in developing critical thinking skills most effectively. Another metanalysis by Abrami and colleagues (2008) found that when critical thinking is taught as an independent track within a specific content course the largest effects where noted yet when critical thinking is regarded as a byproduct of instruction then the smallest effect was noted. Similarly, Bensley, Crowe, Bernhardt, Buckner, and Allman (2010) also found in a pre- test post- test study that the critical thinking ability of students improved significantly when critical thinking was infused into the class. Bensley, Crowe, Bernhardt, Buckner, and Allman (2010) also explored the contribution and effect of science curriculum on the development of critical thinking ability finding no significant correlation between the number of science courses taken and critical thinking ability. Conversely, Cotter and Tally (2009) found that students majoring in sciences, who are required to take a greater number of science courses, scored

significantly higher in critical thinking ability. Behar-Horenstein and Niu (2011) explain that in order for students to learn how to think critically, the instruction needs to shift from teaching students what to think to helping students develop metacognitive skills. A substantial area of research in nursing education involves assessing a variety of instructional methods incorporated into the curriculum that are believed to help improve the metacognitive skills of nursing students and therefore the ability to think critically. However, the results of the studies in nursing education, such as a study of BSN students where they were tested before and after a curriculum revision, using a control group design revealed inconsistent results as measured by the CCTST (Beckie, Lowry, Barnett 2001). In a study by Heath (2000), BSN nursing students' critical thinking ability was assessed at the entry and exit of the program using both the CCTST and the WGCTA and surprisingly, a growth in critical thinking was not supported. Consistent with Heath (2000), for Daly (2001) a change in critical thinking ability of BSN nursing students as measured by the WGCTA was not found. McMullen and McMullen (2009) however, found an improvement in critical thinking scores as measured by the CCTST but the sample consisted of graduate nursing student. This has also been evidenced in other health science programs such as physical therapy and occupational therapy. Vogel, Geelhoed, Grice, and Murphy (2009) assessed both PT and OT students at the graduate level at the beginning of

their didactic programs, and again before starting clinical work and found no difference in critical thinking between the pre and post test scores of physical therapy students but did see an increase in scores in occupational therapy students, with no significant differences found between the groups of students.

Research has also explored the role of critical thinking in undergraduate nursing programs in order to determine if the classroom or clinical setting strengthens or weakens critical thinking skills (Walsh and Seldomridge,2006). Results found that thinking ability is strengthened in a clinical setting. It was hypothesized that the ability to "think on one's feet" in a clinical setting requires students to use critical thinking skills to develop nursing care plans. This idea is consistent with the encouragement of active learning as a means of developing critical thinking skills, what Behar-Horenstein and Niu (2011) described as a paradigm shift in instructional approaches (Simpson and Courtney, 2008 and Burbach, Matkin, and Fritz, 2004). One instructional strategy used to promote active development of critical thinking skills is the use of simulations. However the use of simulations has led to mixed results. Rush, Dyches, Waldrop, and Davis (2008) qualitatively explored the critical thinking ability of RN to BSN students using simulation experience where students described the experience and clinical backgrounds both facilitated and inhibited critical thinking skills during the simulation. Another study with

traditional BSN students in a pretest posttest design, comparing students had simulation experiences to a control group that did not have a simulation experience, revealed no statistical difference in terms of critical thinking ability between the groups (Ravert, 2008). However, this study discussed being limited in the results due to a limited power to detect the effect of group differences. Another teaching strategy widely studied for developing critical thinking skills in health science students is problem- based learning; however, results are also mixed. Oja (2011) reviewed 6 studies to evaluate whether problem based learning is an effective instructional method to improve critical thinking in nursing students compared to traditional didactic methods. Oja reported five out of six studies to find a significant effect for problem- based learning. On the other hand, Lyons (2008) compared ASN students receiving didactic lecture experience to students receiving a problem based learning experience and did not find a statistically significant difference between the critical thinking scores of the two groups as a result of either instructional strategy.

Different from problem based learning, another active learning method frequently used is case based learning. Zimmerman, Lester Short, Hendrix, and Timson (2011) evaluated the critical thinking ability of graduate level allied health care students when using case based learning as compared to students that did not have case based learning. Results showed however,

there was no change in critical thinking scores from pre to post in either group as a result of case based learning. Conversely, Kaddoura (2011) examined undergraduate nursing students' critical thinking ability when exposed to case based learning, and found a significantly better CCTST score in the students who received case based learning as compared to the group who did not. Another approach encompassing case based learning is the use of videotaped vignettes. Chau, Chang, In, Lee, and Wootton (2001) using a pre test post test design, measured the critical thinking abilities of students using videotaped vignettes but like Zimmerman, Lester Short, Hendrix, and Timson (2011), this study did not find statistically significant differences in scores.

Even didactic methods of instruction, such as traditional testing, revealed mixed results in determining their effect on critical thinking skills. Tsui (1999) explored the impact of didactic experiences' on critical thinking. Using a regression analysis it was found that taking multiple choice exams had a negative effect on students' self reported growth in critical thinking. Conversely, in another study which interviewed associate degree nursing students, all participants mentioned testing as a factor that improved their critical thinking skills (Purvis, 2009).

Further complicating the literature associated with critical thinking are the inconsistencies noted in the learning styles literature with regard to its influence on academic success as defined by developing critical thinking

ability (Curry, 1990). Learning styles have been explored in several areas of education, especially in health sciences. An and Yoo (2008) found a weak and positive correlation to learning styles and critical thinking and also found that the level of critical thinking differed significantly among students with different learning styles. Similarly, Clocklin (1995) found a significant relationship between critical thinking skills and preferred learning styles in nursing students. In a study of nursing students, dental students, and veterinary students, the only group found to have a significant positive correlation between critical thinking and learning styles was the nursing students (McDade, 1999). Conversely, Patterson (1994) found no direct link between scores on the WGCTA and a particular learning style. In areas other than nursing, Wessel and Williams (2004), using a before- after design, assessed the critical thinking and learning styles of masters level physical therapy students and also did not find a statistically significant correlation of learning styles with critical thinking skill. Even in non- health science courses, no significant differences were found in the critical thinking skills of students based on their learning style (Myers and Dyer, 2006).

Based upon the literature, there are many different factors that may influence the development of critical thinking ability and inconsistent results in regard to how these factors influence critical thinking. With critical thinking being defined as an active continuous process, then one would assume that

given that these factors are continuously influencing its development, the constructivist learning theory and the community of inquiry framework can be used to further understand the development of critical thinking skills.

Theoretical Discussion

Throughout this review of the literature, it becomes obvious that there is a large amount of disparity in the critical thinking research in regard to the factors that could improve students' ability to think critically. This would lead one to assume that there is not just one specific factor especially within health science education. In viewing critical thinking as an active process as defined by Brookfield, a conceptual framework we can explore is the constructivist learning theory. The major theme of this theory is that learning should be an active process in which learners construct new ideas or concepts based on their current or past knowledge (Brandon and All, 2010). Therefore, learning is founded on previous knowledge. Assimilation is the central idea around the entire learning theory developed by Ausubel (1978). Assimilation allows new information to be absorbed into cognitive structures. Cognitive structures are an individual's organization, stability and clarity of knowledge in a particular subject, which influences learning and retention. "Meaningful learning" can be viewed as an important component to critical thinking. Therefore one can simplify meaningful learning of adult learners as critical thinking ability and

cognitive structure (D'Antoni, 2009). Brookfield's definition however, involves more than just the process of knowledge apprehension; it includes identifying assumptions, challenging those assumptions, and responding to them accordingly based on knowledge.

Therefore, another learning theory which may further help to understand critical thinking in the way it is defined by Brookfield and compliments the constructivist approaches to learning in higher education is the Community of Inquiry framework (CoI) (Garrison and Arbaugh, 2007). This theory supports that in order for effective learning to result, it requires the development of a community that supports meaningful inquiry and deep learning (Swan, et.al., 2008). As critical thinking is defined as an active process, the CoI framework is a process model, which attempts to outline the core elements and dynamics of the learning experience (Garrison, Anderson, and Archer, 2010). Arbaugh et.al.(2008) describes the purpose of the development of the CoI framework to investigate how features of online learning activities could promote critical/higher- order thinking and that higher- order learning experiences are best conducted as a community of inquiry requiring the engagement of real persons and the demonstration of critical thinking to be successful. The CoI model views the learning experience as a function of the relationship between the three core elements: social presence, teaching

presence, and cognitive presence and is described as having an overlapping presence or lenses (Shea and Bidjerano, 2009).

The core elements of the Community of Inquiry framework have been defined and investigated individually and also the interactions between the elements. Cognitive presence is operationalized through the Practical Inquiry model based on John Dewey's notion of reflective thought, which he believed is the basis for a "worthwhile educational experience." The Practical Inquiry model is defined by two axes, one reflecting integration of thought and action, and the other reflecting analysis and synthesis. According to Swan et.al. (2008), this emphasizes the collaborative nature of cognitive presence. Cognitive presence is associated with critical thinking, the ultimate goal of higher education in the sense that cognitive presence is the extent to which learners are able to construct and confirm meaning through constant reflection and discourse (Garrison, 2010). Cognitive presence is developed as the result of a four phase process; 1) identifying an issue or problem; 2) explore the issue through reflection and discourse; 3) construct meaning from ideas developed during exploration; and 4) apply new knowledge to other context or settings (Arbaugh, 2008). Brookfield (2012) discusses the importance of cognitive presence in critical thinking as identifying assumptions, questioning those assumptions and responding appropriately, involving the same phases for the development of the cognitive presence.

The cognitive presence is also complemented by the teaching presence and vice versa (Arbaugh, 2008). Teaching presence is defined as the design, facilitation, and direction of cognitive social processes for the purpose of realizing personally meaningful and educationally worthwhile outcomes (Arbaugh, 2008). Brookfield (2012) emphasizes the importance of the teacher modeling critical thinking in order for students to learn how to practice critical thinking. The teacher can lead and model how to question and analyze assumptions through communication, which also overlaps with the third element in the model, social presence. Social presence is described as the ability of learners to project themselves socially and emotionally. Brookfield has also found that students identify participating in small group activities as the most engaging moments to learn to think critically because when assumptions and perspectives are discovered by a peer, not only by a teacher, it is most meaningful.

The community of inquiry framework however, has only been tested in online learning environments and blended environments and only discusses the effects and outcomes of learning in an online environment. Garrison, Anderson, and Acher (2010) does not emphasize the development of the model for the online environment but rather describes it as being a generic model; it was acquired for the research in online learning environments and therefore, since the majority of research has only been in online learning

environments, the model has only gained validity in that type of environment. Therefore, regardless of the type of learning environment, the three core elements are present and influence learning. Brookfield's definition, the constructivist approach and Dewey's beliefs of inquiry, remind us that inquiry and learning is a social activity and is based upon the essence of the social experience (Garrison, Anderson, and Archer, 2010). Here, as in the constructivist model, a meaningful learning experience is determined by the development of critical thinking abilities. According to the constructivist theory, meaningful learning as defined as critical thinking is constructed through communication and since teaching presence supports engagement, it can be concluded that teaching presence may support critical thinking (Prasad, 2009). Also, as emphasized by Brookfield, peer interaction and discussion supports engagement, and it can also be concluded that social presence may support critical thinking. Both the teaching presence and the social presence involve engagement, and in order for students to become engaged, they need to have a cognitive presence, or as Brookfield puts it, need to identify assumptions and be able to question them. One could then assume that the higher each of the presences, the higher the level of critical thinking will result and each presence would be greatest in a face to face environment. Supporting this assumption, Shea and Bidjerano (2009) suggest that a crucial factor in the development of higher- order thinking, and

therefore critical thinking depends on the students' comfort levels and in order for an instructor to foster the development of the skills, the instructor should help the students gain that comfort and confidence in the activities used to develop the skills which is further supported by Richardson and Ice (2010) which state that the more comfortable the students are with the instructional strategies, there would be an increase in the level of critical thinking achievement. Given that Garrison, Anderson, and Archer (2010) proposed the CoI framework as being "generic" because it is grounded in theories of teaching and learning, it would be plausible to test the community of inquiry framework in a face to face environment.

The three elements (cognitive presence, social presence, teaching presence) of the framework not only overlap, but also demonstrate many of Brookfield's tenets that he uses to define the process of critical thinking. The results of Shea and Bidjerano (2009) indicate that the CoI survey items also cohere into interpretable factors that represent the intended constructs. In addition, the elements each appear to be larger categories of the factors explored previously as influences affecting critical thinking. For example, Garrison and Arbaugh (2007) define instructional strategies and involvement as components of the teaching presence. Based on the literature to this point and what is understood about these factors and the three presence groups of the CoI, involvement is also part of the social presence as are student

experiences. Shea and Bidjerano (2009) also found a direct effect of student gender, age, and academic level on perceptions of teaching presence and perceptions of teaching presence predict student perceptions of cognitive presence.

Due to the growing interest in the Community of Inquiry framework for online learning environments during the last decade, a survey tool to operationalize the concepts in the CoI model was developed and tested for validity. The tool is a 34- item survey instrument using an ordinal Likertt scale. Arbaugh et.al., (2008) reports on developing and testing an instrument, the CoI survey, to measure constructs of the CoI framework using a multi-institutional sample. The study provides support for the construct validity of the three presences as measured by the CoI as a framework for constructing effective online learning environments finding the three core factors accounting for 61.3% of the total variance in scores. The Principle Components Analysis of the data in Arbaugh et.al.(2008) study supported the construct validity of the teaching presence, social presence, and cognitive presence as measured by the CoI which supports the use of the CoI survey as a valid measure of teaching, social, and cognitive presence. The purpose of the research by Swan et.al.,(2008) was to explain the three presences and to test the construct validity and reliability of a measurement tool for the CoI framework. Factor analysis demonstrated the grouping of elements within

each presence, which according to Swan et.al. (2008), verifies the theoretical structure proposed by Garrison and Archer (2000). In this study, for reliability Cronbach Alpha yielded numbers indicative of high inter-correlations leading to internal consistencies: 0.94 for teaching presence, 0.91 for social presence and 0.95 for cognitive presence, therefore providing a reliable measure for the CoI. Shea and Bidjerano (2009) also validated the CoI Survey based upon the CoI framework. The same 34- item CoI survey tool was utilized as in the previous studies. Here cognitive presence explained 50.63 % of the variance and had a Cronbach alpha of 0.95 same as Swan (2008). The teaching presence counted for an additional 9.63 additional variance and a Cronbach alpaha of 0.96 and the social presence counted for an additional 3.9% of the variance and a Cronbach alpha of 0.92. Shea and Bidjerano (2009) also looked at factor correlations, finding -.69 between the cognitive presence and the teaching presence, .70 between cognitive presence and social presence, and -.49 between teaching presence and social presence. A study by Bangert (2009) however, surveyed students in online and blended learning environments to measure the validity of the CoI survey. Bangert (2009) found the three core factors accounted for approximately 65% of the total item variance. Here, cognitive presence accounted for 52.2% of the total variance, teaching presence accounted for an additional 8.47% of the variance, and social presence accounted for an additional 4.63% of the variance. Cronbach

alpha for internal consistency reliabilities yielded 0.95 for cognitive presence, which is consistent with previous studies, and 0.96 for teaching presence, and 0.91 for social presence. The study rejected the hypothesis that the items were not correlated and obviously added to support the CoI survey is appropriate for measuring the elements of the CoI framework.

Summary

From the literature on critical thinking we know that it is a multidimensional construct that is influenced by a variety of different factors, even though the literature on the impact of these predominant factors reveals inconsistent results. Multiple definitions exist but the definition of critical thinking provided by Brookfield includes all of the major themes from the other definitions observed including a process that involves inquiry, judgment, and actions. However, currently no tool exists to measure critical thinking based on this definition and thus the current tools do not address the multidimensional features associated with critical thinking. We also know that for online learning environments, a theoretical framework has emerged to investigate how features of online learning activities could promote critical/higher- order thinking. Research in the validity of the framework and the definition of critical thinking provided by Brookfield support that higher- order learning experiences are best conducted as a community of inquiry requiring the

engagement of real persons and the demonstration of critical thinking to be successful. The Community of Inquiry framework also demonstrates that learning or developing critical thinking skills is influenced by several factors that can be grouped into one of three presences that all interact with one another. Since the Community of Inquiry framework has been validated in online environments as an outline to develop online courses, and the core elements are similar categories to the factors identified as influencing critical thinking, it would be interesting to see if the framework and tool are also useful for face to face learning environments.

Chapter III

METHODS

Design

This mixed methods study will address the factors that influence the development of critical thinking skills. A concurrent triangulation mixed methods design will be used, also known as a convergent parallel design, and it is a “type of design in which qualitative and quantitative data are collected in parallel, analyzed separately, and then merged” (Creswell and Clark, 2007). It is therefore, also a one- phase design where the quantitative and qualitative methods are “implemented during the same time frame and with equal weight” (Creswell and Clark 2007). A variation of the convergent design, data- validation is used, and includes the “use of both open and closed ended questions and uses the results from the open ended questions to better understand the result of the closed ended questions” (Creswell and Clark, 2007). The reason for collecting both quantitative and qualitative data is to converge the two forms of data, to obtain different but complementary data on the same topic, and to validate the quantitative with the qualitative, in order to bring greater insight into the problem than would be obtained by either type of data separately.

The quantitative design is descriptive and cross sectional, exploratory, and experimental. Cross-sectional studies are used when data will be collected at

one point in time to prevent testing or history effects; in this case data will be collected from a group of health science professional students (nursing students) at one point in time. Exploratory research designs are used to examine a phenomenon of interest (critical thinking) and explore its dimensions, including how it relates to other factors (Portney and Watkins, 2009, p.22). Therefore, the design will also include a correlational design to explore if a relationship exists between levels of each of the independent variables and the dependent variable and if the dependent variable correlates linearly/predictably with the independent variables. Demographic characteristics of the sample will be organized and summarized through a descriptive design. The decision to use a descriptive and correlational design is supported by Portney and Watkins (2009) who suggests that a descriptive design is appropriate for use in documenting phenomena of individuals or groups of individuals under study, while a correlational design is appropriate for use in describing the nature of existing relationships among variables. A pilot study was conducted first for two purposes. Primarily, to ensure the protocol for the proposed study was methodologically sound and secondly to identify factors measured by the demographic profile fact sheet, Gregorc Style Delineator (GSD), that correlate with higher critical thinking scores on the Health Sciences Reasoning Test (HSRT).

Variables

The independent variables in this study are the potential influencing factors identified from the literature, age, gender, grade point average based on a 4.0 scale, educational level, healthcare experience, community involvement, instructional method, and learning style. Educational level includes highest degree earned and credits earned in current program. Healthcare experience includes employment, volunteer services, and shadowing experiences in healthcare environments. Community Involvement includes campus residence status, engagement in clubs, organizations, honors societies, mentorship programs, and athletic teams. The independent variables are on nominal and ordinal scales.

The dependent variable in this study is the score achieved on the HSRT as a measure of critical thinking. The HSRT provides six scores. The overall score of critical thinking skills measured on an interval scale, and five subscales, induction, deduction, analysis, inference, and evaluation on an ordinal scale. According to the HSRT Test Manual (2013) for the Overall score, a score of 0-14 indicates critical thinking skills are *not manifested*, 15-20 indicates *moderate* critical thinking skills, 21-25 indicates *strong* critical thinking skills, and 26 or higher indicates *superior* critical thinking skills. For the induction and deduction subscales, 0-4 indicates critical thinking skills are *not manifested*, 5-7 indicated *moderate* critical thinking skills, and 8 or more

indicates *strong* critical thinking scores. For the subscales of analysis, inference, and evaluation, a score of 0-2 indicates critical thinking skills are *not manifested*, 3-4 indicated *moderate* critical thinking skills, and 5 or more indicates *strong* critical thinking scores.

Instrumentation

The Health Sciences Reasoning Test (HSRT), evolved from the CCTST, is a standardized, valid and reliable tool for assessing critical thinking skills specifically in health science students and professionals. It is a 33- item multiple choice test developed by Facione and Facione (2006). The items use everyday scenarios and any specialized information required to respond to the question is included in the question itself. Scores are reported for overall reasoning skills as well as analysis, inference, evaluation, induction, and deduction. Reliability ratings of 0.65 to 0.75 have been suggested (Facione & Facione, 2006). Construct validity established for each of the five sub scales ranging from .52-.77. (Huhn, Black, Jensen, and Deutsch, 2011)

The Gregorc Style Delineator is a valid and reliable tool to assess learning style preference, classifying learners as Concrete- Sequential (CS), Abstract-Sequential (AS), Concrete- Random (CR), and Abstract Random (AR) (Gregorc, 1982). The GSD consists of 10 columns and each column contains four words that the subject is asked to rank by self reflection. The reliability

range of the GSD (alpha coefficients) is from 0.89 to 0.93 with test retest correlation coefficients from 0.85 to 0.88 (Gregorc, 1984). Construct validity correlations range from 0.55 to 0.78 (Gregorc, 1984). Although there are several valid and reliable tools for evaluating learning style, the GSD will be used in this study because this model includes a larger dimension of cognitive style and better validity and reliability that other Learning Style Inventories (Raynor and Riding, 1997, and Vanvoorhees et.al, 1988).

The Demographic Profile Fact Sheet is a PI developed tool to identify demographic information in the form of closed ended questions for age, gender, grade point average, educational level, healthcare experience, community involvement, and instructional method as well as open ended questions.

Survey packages were assembled by the PI, and labeled with a numerical code on the outside of the envelope and on each document within the envelope. Each package contained one (1) each of the following documents: a letter of solicitation/ implied consent form, demographic fact sheet, Health Sciences Reasoning Test (HSRT), Gregorc Style Delineator (GSD), and an envelope.

Setting

The participants of the study were solicited and recruited in a class of an accredited nursing program at 3 private liberal arts Universities in New Jersey. Participation and completion of the surveys, took place in the classes of the respective undergraduate nursing programs.

Sample

The sample size was not calculated based upon the pilot study due to the fact that only 5 of the 45 nursing students solicited completed and returned the survey packet to the PI. Based upon the low sample size, an a priori power analysis was conducted. Medium effect size was used based on criteria established by Cohen (1988), when no previous analysis is available to calculate true effect size. The final sample size of N= 200 with a calculated power of .8 using G power analysis or 80% which Portney and Watkins (2009), suggest is reasonable to protect against type II error, was used.

The study used a convenience sample of nursing students who voluntarily participate in the study. Inclusion criteria includes undergraduate nursing student, currently enrolled in an accredited BSN program, at least 18 years of age and willing to participate in the study. Exclusion criteria include non-undergraduate nursing students, not enrolled in an accredited BSN program, under the age of 18, and not willing to participate in the study.

Protocol

Upon receiving IRB approval, prior to recruitment, the Nursing Departments were made aware of the study and prepared for the recruitment as part of the organization's procedure when permission is granted for research conducted on site. The Principal Investigator (PI) spoke with the Directors of the Nursing Programs prior to the start of recruitment to determine the best days and hours for recruitment. Once the days and times had been established and communicated to the PI, the PI introduced the Research Assistant (RA), an NIH certified colleague in the Graduate Program for Health Sciences at Seton Hall University, to the Director of Nursing prior to the beginning of the day of the recruitment process.

On the day(s) of recruitment, the Director of Nursing then introduced the potential participants to the RA, and then left the classroom, to avoid the appearance of coercion. The RA explained the research process to the students, including the purpose of the study, explaining that their participation in the study would involve completing surveys to learn about their critical thinking skills and the factors that may potentially influence these skills. The RA distributed the research packages to the students, which will contain the letter of solicitation/ informed consent attached to the front of the package. The solicitation letter stated and the RA emphasized that their consent is implied by their participation and completion of the survey

documents. They were also informed that the entire survey process should take about 60 minutes to complete. Students interested in voluntarily participating in completing the anonymous surveys were instructed to begin and complete the survey, and return the three completed surveys, in the enclosed envelope, sealed to the designated, designated drop box in the front of the classroom. Students that did not wish to participate in the study were instructed to return the research package to the Research Assistant. The Research Assistant then returned the completed surveys in the drop box to the PI for scoring and analysis. The completed HSRTs were mailed to insight assessment for scoring.

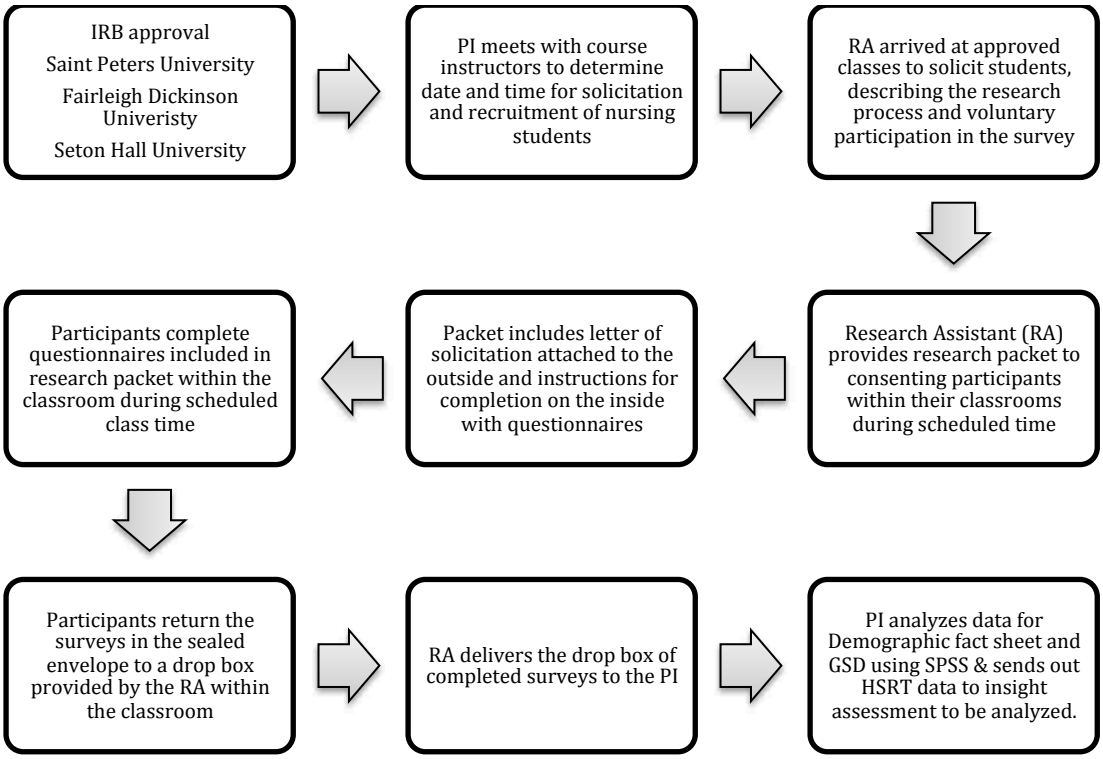

Figure 1. Research Protocol

Analysis

Based on the triangulation design model, both types of data were analyzed independently and concurrently.

The quantitative data was analyzed using both descriptive and inferential statistics, using SPSS version 21.0. Parametric statistics were used where appropriate, otherwise, nonparametric statistics were used when the level of data was nominal or ordinal, if the sample size was small, or when the data were not normally distributed (Portney and Watkins, 2009). To determine if the data were normally distributed, Kolmogorov- Smirnov and Shaprio- Wilk tests for normality were performed for the dependent variable, as well as examining the Histogram, normal Q-Q plot, and box plot. The descriptive summary statistics (mean, standard deviation, and frequency) were used for the demographic data collected. The inferential statistics were correlations, stepwise multiple regressions, and comparisons of means.

In order to identify if a factor is associated with or related to the dependent variable, critical thinking, as it is measured by the HSRT, correlations were used. According to Portney and Watkins (2009), correlations are appropriate for exploratory analyses, where the purpose of the research question is to evaluate the relationship between two variables. Correlations describe the strength and direction of the relationship between two variables. If either of the two variables were not normally distributed, the Spearman rho rank

calculation was used. However if the independent and dependent variables were normally distributed, Pearson's r calculation was used.

Portney and Watkins (2009) describe the purpose of multiple regression analysis is to predict the dependent variable, HSRT (critical thinking) score, using several independent variable and to better understand a phenomenon by identifying the factors associated with it. Stepwise multiple regressions were used to enter the variables into the regression equation, which allowed variables to be entered one at a time so that the percentage of variability due to the predictor variables could be observed (Fields, 2007).

In order to analyze the difference between the means of two independent groups (i.e. male, female), a parametric independent t test or nonparametric Mann Whitney U calculation was used. In order to determine which calculation to use, was dependent on the sample size, the type of data, and if the data was normally distributed. If the sample was large enough *and* the data was interval or ratio and normally distributed, a parametric, independent t test was used to analyze the differences between the means of two independent groups. If the sample was small *or* the data was not normally distributed and ordinal or nominal, then nonparametric Mann Whitney U test was used.

In order to analyze the difference between the mean of more than two groups (i.e. sophomores, juniors, seniors), a parametric ANOVA or

nonparametric Kruskal Wallis calculation was used. To determine which calculation would be used depended on the sample size and if the data were normally distributed, as well as the type of data. If the sample was large enough *and* the data was normally distributed, and interval or ratio, a parametric, ANOVA was used to analyze the differences between the means of the groups. If the sample was small *or* the data was not normally distributed and was nominal or ordinal, then nonparametric Kruskal Wallis was used. These comparisons were made until all demographic data influences on the variables were analyzed.

For all the statistics analyses, significant differences were fixed at 0.05 α level and 0.2 β level with a corresponding power of 80% which Portney and Watkins (2009), suggest is reasonable to protect against type II error.

The qualitative data analysis started with coding the data, dividing the text from open- ended question responses into small units or phrases, and assigning a label to each unit. In vivo codes, labels from exact words or phrases of the participants, and pre- established codes from the literature were utilized. The participants' responses were transcribed and coded by two separate researchers individually in order to determine inter-coder agreement or reliability by calculating kappas. Rates were developed for the percentage of codes that were similar and the results from both types of analyses were used for interpretation.

Chapter IV

Results

Characteristics of the Sample

The target population was the total number of Undergraduate Nursing Students currently enrolled in one of three accredited Bachelors of Science in nursing programs at private Universities in New Jersey (N= 1,174). The surveys were permitted to be distributed to 232 nursing students as per the nursing program faculty. There were 140 completed surveys for a 60.3% response rate. The sample demographics were very characteristics of undergraduate nursing programs.

22 respondents (15.7%) were male. 118 respondents (84.3%) were female. 76 of the respondents (54.3%) were between the ages of 18-21. 44 respondents (31.4%) were between the ages of 22-25. 11 respondents (7.9%) were between the ages of 26-29. 9 respondents (6.4%) were 30 years of age or older.

111 respondents (79.3) had high school diplomas. 5 respondents (3.6%) had associates degrees. 24 respondents (17.1%) had bachelor degrees.

40 respondents (28.6%) were in the first year of the nursing program. 32 respondents (22.8%) were in the second year of the nursing program. 28 respondents (20.0%) were in the third year of the nursing program. 40 respondents (28.6%) were in the fourth year of the nursing program (Table 1).

Table 1.

Demographics

Variable	N= 140	%
Gender		
Male	22	15.7
Female	118	84.3
Age		
18- 21	76	54.3
22- 25	44	31.4
26- 29	11	7.9
30 +	9	6.4
Highest Degree Earned		
Diploma	111	79.3
Associate	5	3.6
Bachelor	24	17.1
Year in Program		
First Year	40	28.6
Second Year	32	22.8
Third Year	28	20.0
Fourth Year	40	28.6

Critical Thinking Skills of Undergraduate Nursing Students

The descriptive statistics for the critical thinking skills of undergraduate nursing students (N= 140) currently enrolled in a private University accredited nursing program in New Jersey is as follows: the mean Overall Critical Thinking Score was 16.46 (SD= 5.24), the mean subscale score for Induction was 5.78 (SD= 2.08), the mean subscale score for Deduction was 4.50 (SD= 2.28), the mean subscale score for Analysis was 2.91 (SD= 1.44), the mean subscale score for Inference was 3.25 (SD= 1.44), the mean subscale score for Evaluation was 3.62 (SD= 1.55). Based on the results, using the HSRT manual, it can be determined that the students had a *moderate* level (15- 20) of overall critical thinking ability. For the subscale of Induction, the lowest level of critical thinking, students had a *moderate* (5-7) skill. For the subscale of Deduction, students were in between *not manifested* (0-4) and *moderate* (5-7) skill. Increasing in complexity of development of critical thinking, for the subscale of Analysis, students were again in between *not manifested* (0-2) and *moderate* (3-4) skill. For the deepest levels of critical thinking, the subscales of Inference and Evaluation, students had *moderate* skills. Therefore, the critical thinking ability of the undergraduate nursing students was identified as low, or just beginning to develop (Table 2).

Table 2.

Critical Thinking Scores of Undergraduate Nursing Students

	Mean	Median	Mode	SD
Overall	16.46	16.0	16.0	5.24
Induction	5.78	6.0	6.0	2.08
Deduction	4.50	4.0	5.0	2.28
Analysis	2.91	3.0	2.0	1.44
Inference	3.25	3.0	3.0	1.44
Evaluation	3.62	4.0	3.0	1.55

Quantitative Results

For the *first hypothesis* (H1), to evaluate if there is a significant relationship between the overall critical thinking scores and each of the factors identified in the literature, was measured using Pearson's correlation. The analysis using Pearson's correlation coefficient indicated that there was a significant but weak relationship between overall critical thinking skill and job shadowing, $r= -0.218$, $p < 0.05$. There was also a significant but weak relationship between overall critical thinking skill and clubs, $r= -0.248$, $p < 0.05$. A significant but weak relationship also existed between overall critical thinking skill and athletics, $r= 0.178$, $p < 0.05$. A coefficient of determination was also calculated to indicate the percent of data that is closest to the line of best fit or how well the regression line would represent the data. Values equal to or close to 1 would indicate that the regression line represents all or most of the data where values of 0 would indicate the regression line would not represent any of the data (Table 3).

Table 3.

Relationship between overall Critical Thinking Score and each factor

	r	r^2	*p*
Age	- .147	.0216	.083
Gender	.020	.0004	.818
GPA	.011	.0001	.895
Highest Degree	- .159	.0252	.060
Year in Program	- .013	.0002	.875
Employed	.050	.0025	.556
Experience			
Years Employed in Healthcare	- .018	.0003	.835
Time Job Shadowing Nurses	- .218	.0475	.010*
Time Volunteering in Healthcare	.048	.0023	.576
Involvement			
Mentor	- .016	.0003	.848
Residence	- .063	.0039	.463
Greek Organization	.022	.0005	.793
Clubs	- .248	.0615	.003*
Honors	.048	.0023	.574
Athletics	.178	.0317	.035*
Learning Style	.041	.0016	.628

Note: highlighted values indicate statistical significance of p< 0.05

The results for analysis of the *second* and *third* hypotheses were grouped together by "*factor."* All of the statistical analyses performed to test H3, used non- parametric statistics for the reason that each of the subscales were ordinal data.

For the factor of *age*, there were four age groups, 18-21 years, 22-25 years, 26-29 years, and 30 years and older. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the factor of age (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= .23, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between the four different age groups, F(3,136)= 1.39, p= 0.2475. Since the required N was not obtained, post hoc power analysis revealed power= 0.63.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of age (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between the age groups, x^2 (3)= 3.31, p= 0.347. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between the age groups, x^2 (3)= 2.39, p= 0.494. The Kruskall Wallis

test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between the age groups, x^2 (3)= 0.607, p= 0.895. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between the age groups, x^2 (3)= 3.35, p= 0.340. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between the age groups, x^2 (3)= 4.55, p= 0.207 (Table4). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of age, were rejected.

Table 4.

Factor 1: Critical Thinking Scores of Undergraduate Nursing Students by Age Group

	18-21 (n= 76)		*22- 25 (n= 44)*		*26- 29 (n= 11)*		*30+ (n= 9)*		*One way Anova*	
	M	SD	M	SD	M	SD	M	SD	F	p
Overall	17.1	4.93	15.8	5.87	16.7	5.23	13.7	3.83	1.39	.247
									Kruskall Wallis	
									X^2	p
Induction	5.91	1.98	5.68	2.40	6.09	1.75	4.77	1.48	3.31	.347
Deduction	4.72	2.13	4.25	2.46	4.45	3.01	4.00	1.58	2.39	.494
Analysis	2.92	1.25	2.84	1.72	3.09	1.86	3.00	1.00	.607	.895
Inference	3.44	1.45	3.09	1.34	3.18	1.47	2.55	1.74	3.35	.340
Evaluation	3.72	1.48	3.54	1.74	4.00	1.34	2.66	1.11	4.55	.207

To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the factor of gender (H2), an independent t- test was used. Levene's test for equality of variances yielded a non- significant p= 0.476, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between male and female undergraduate nursing students, t(138)= -0.23, p= 0.818.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of gender (H3), non- parametric Mann Whitney U was used. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between male and female nursing students, *U*= 1162.5, p= 0.432. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between male and female nursing students, *U*= 1239.0, p= 0.733. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between male and female nursing students, *U*= 1199.0, p= 0.562. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between male and female nursing students, *U*=

1245.5, p= 0.759. The Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between male and female nursing students, *U*= 1202.5, p= 0.578 (Table 5). Based on the results, H2 and H3, including all sub-hypotheses, for the factor of gender, were rejected.

Table 5.

Factor 2: Critical Thinking Scores of Male & Female Undergraduate Nursing Students

	Male (N= 22)		*Female (N= 118)*		*Independent t test*	
	M	SD	M	SD	t	p
Overall	16.22	5.94	16.50	5.12	-.230	.818
					Mann Whitney U	
					U	p
Induction	5.40	2.26	5.85	2.05	1162.5	.432
Deduction	4.81	2.73	4.44	2.19	1239.0	.733
Analysis	2.81	1.62	2.93	1.41	1199.0	.562
Inference	3.18	1.46	3.27	1.44	1245.5	.759
Evaluation	3.36	1.91	3.66	1.47	1202.5	.578

For the factor of highest degree earned (education), there were three groups, high school diploma, Associate's degree, and Bachelor's degree. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the different degrees earned (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.221, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between the different degrees earned, $F(2,137)= 2.26$, p= 0.108. Since the required N was not obtained, post hoc power analysis revealed power= 0.75.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of highest degree earned (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between the different degrees earned, $x^2(2)= 4.11$, p= 0.128. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between the different degrees earned, $x^2(2)= 2.51$, p= 0.285. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between the different degrees

earned, x^2 (2)= 0.805, p= 0.669. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between the different degrees earned, x^2 (2)= 4.71, p= 0.095. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between the different degrees earned, x^2 (2)= 4.80, p= 0.090 (Table6). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of highest degree earned, were rejected.

Table 6.

Factor 3: Critical Thinking Scores of Undergraduate Nursing Students by Highest Degree Earned

	Diploma (n= 111)		*Associate (n= 5)*		*Bachelor (n= 24)*		*One way Anova*	
	M	SD	M	SD	M	SD	F	p
Overall	16.92	5.24	13.60	7.36	14.91	4.47	2.26	.108
							Kruskall Wallis	
							x^2	p
Induction	5.93	2.09	3.80	2.58	5.50	1.79	4.11	.128
Deduction	4.64	2.23	4.00	2.64	3.95	2.44	2.51	.285
Analysis	2.93	1.42	3.20	1.09	2.75	1.62	.805	.669
Inference	3.39	1.40	3.00	2.34	2.66	1.30	4.71	.095
Evaluation	3.75	1.53	2.40	2.07	3.25	1.42	4.80	.090

For the factor of current level in program (education), there were four groups, first year, second year, third year, and fourth year. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the different levels in the program (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.501, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between the different levels in the nursing program, F(3,136)= 0.139, p= 0.936. Since the required N was not obtained, post hoc power analysis revealed power= 0.68.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of different levels in the program (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between the different levels in the program, x^2 (3)= 3.50, p= 0.320. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between the different levels in the program, x^2 (3)= 2.69, p= 0.442. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between the different levels in the

program, x^2 (3)= 4.02, p= 0.259. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between the different levels in the program, x^2 (3)= 1.24, p= 0.743. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between the different levels in the program, x^2 (3)= 2.18, p= 0.536 (Table 7). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of current level in the nursing program, were rejected.

Table 7.

Factor 4: Critical Thinking Scores of Undergraduate Nursing Students by Year in Program

	Yr 1 (n= 40)		*Yr 2 (n= 32)*		*Yr 3 (n= 28)*		*Yr 4 (n= 40)*		*One way Anova*	
	M	SD	M	SD	M	SD	M	SD	F	p
Overall	16.4	5.04	16.9	4.71	16.1	6.05	16.4	5.39	.139	.936
									Kruskall Wallis	
									X^2	p
Induction	5.77	1.95	5.71	2.20	5.25	2.11	6.22	2.08	3.50	.320
Deduction	4.55	2.18	4.96	1.89	4.28	2.74	4.25	2.33	2.69	.442
Analysis	2.82	1.37	2.68	1.25	3.42	1.57	3.20	1.39	4.02	.259
Inference	3.35	1.29	3.40	1.60	3.03	1.57	3.20	1.39	1.24	.743
Evaluation	3.60	1.53	3.53	1.54	3.35	1.63	3.90	1.53	2.18	.536

For the factor of GPA (education), there were three groups, 2.5-2.9 based on a 4.0 scale, 3.0- 3.5 based on a 4.0 scale, and 3.6- 4.0 based on a 4.0 scale. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the different GPA's (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.686, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between the different GPA's, F(2,137)= 0.161, p= 0.852. Since the required N was not obtained, post hoc power analysis revealed power= 0.75.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of different GPA's (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between the different GPA's, x^2 (2)= 0.070, p= 0.965. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between the different GPA's, x^2 (2)= 0.637, p= 0.727. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between the different GPA's, x^2 (2)= 0.200, p= 0.905. The

Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between the different GPA's, x^2 (2)= 0.555, p= 0.758. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between the different GPA's, x^2 (2)= 2.47, p= 0.293 (Table 8). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of GPA, were rejected.

Table 8.

Factor 5: Critical Thinking Scores of Undergraduate Nursing Students by GPA

	2.5- 2.9 (n= 5)		*3.0- 3.5 (n= 71)*		*3.6- 4.0 (n= 64)*		*One way Anova*	
	M	SD	M	SD	M	SD	F	p
Overall	15.20	5.97	16.57	5.03	16.43	5.48	.161	.852
							Kruskall Wallis	
							x^2	p
Induction	5.60	1.67	5.78	2.16	5.79	2.05	.070	.965
Deduction	3.60	2.51	4.54	2.16	4.53	2.41	.637	.727
Analysis	3.20	2.38	2.93	1.38	2.87	1.44	.200	.905
Inference	3.40	.54	3.33	1.42	3.15	1.52	.555	.758
Evaluation	2.60	1.14	3.66	1.57	3.65	1.54	2.47	.293

For the factor of healthcare employment (Healthcare Experience), there were four groups, no employment in healthcare, 1-5 years employed in healthcare, 6-10 years employed in healthcare, and 10 years or more employed in healthcare. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between different amounts of healthcare employment (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.354, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between different amounts of healthcare employment, F(3,136)= 0.512, p= 0.675. Since the required N was not obtained, post hoc power analysis revealed power= 0.68.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of healthcare employment (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between different amounts of healthcare employment, x^2 (3)= 0.2.75, p= 0.431. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between different amounts of healthcare employment, x^2 (3)= 0.918, p=

0.821. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between different amounts of healthcare employment, x^2 (3)= 0.336, p= 0.953. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between different amounts of healthcare employment, x^2 (3)= 3.99, p= 0.262. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between different amounts of healthcare employment, x^2 (3)= 2.01, p= 0.570 (Table 9). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of healthcare employment, were rejected.

Table 9.

Factor 6a: Critical Thinking Scores of Undergraduate Nursing Students by Years Employed in Healthcare

	None (n= 71)		*1-5 yrs (n= 53)*		*6-10 yrs (n= 14)*		*10 + yrs (n= 2)*		*One way Anova*	
	M	SD	M	SD	M	SD	M	SD	F	p
Overall	16.6	5.59	16.0	4.66	17.5	5.89	13.5	2.12	.512	.675
									Kruskall Wallis X^2	p
Induction	5.76	2.23	5.64	1.89	6.57	2.06	5.00	1.41	2.75	.431
Deduction	4.69	2.27	4.34	2.30	4.35	2.46	3.50	.70	.918	.821
Analysis	2.91	1.39	2.96	1.46	2.78	1.76	2.50	.70	.336	.953
Inference	3.38	1.47	3.07	1.32	3.50	1.74	2.00	0.0	3.99	.262
Evaluation	3.63	1.64	3.49	1.44	4.14	1.51	3.00	1.41	2.01	.570

For the factor of job shadowing in healthcare (Healthcare Experience), there were five groups, no shadowing experience in healthcare, 1-10 hours shadowing in healthcare, 11- 20 hours shadowing in healthcare, 21- 30 hours shadowing in healthcare and over 30 hours of shadowing experience in healthcare. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between different amounts of job shadowing in healthcare (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.713, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between different amounts of job shadowing in healthcare, $F(4,135)= 2.01$, p= 0.096. Since the required N was not obtained, post hoc power analysis revealed power= 0.63.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of job shadowing in healthcare (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between different amounts of job shadowing in healthcare, $x^2(4)= 2.53$, p= 0.639. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was a statistically significant difference in the *deduction* scores

between different amounts of job shadowing in healthcare, x^2 (4)= 11.33, p= 0.023. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between different amounts of job shadowing in healthcare, x^2 (4)= 4.57, p= 0.334. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between different amounts of job shadowing in healthcare, x^2 (4)= 9.00, p= 0.061. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between different amounts of job shadowing in healthcare, x^2 (4)= 1.12, p= 0.890 (Table 10). Post hoc analysis for comparison of deduction scores was performed using Tukey procedure. Tukey post hoc analysis revealed there was a significant difference between the *deduction* scores of no job shadowing experience and 1- 10 hours of job shadowing experience, p= 0.012 and, there was a significant difference between the *deduction* scores of no job shadowing experience and more than 30 hours of job shadowing experience, p= 0.036 (Table 11). Based on the results, H_{3b}*:* There is a significant *difference* in the deduction scores of undergraduate nursing students between the levels of the *factor* of job shadowing experience, was accepted. H2 and H3, including all other sub- hypotheses, for the factor of job shadowing experience in healthcare, were rejected.

Table 10.

Factor 6b: Critical Thinking Scores of Undergraduate Nursing Students by Hours Job Shadowing

	None (n= 86)		*1-10 hours (n= 17)*		*11-20 hours (n= 12)*		*21-30 hours (n= 2)*		*30+ hours (n= 23)*		*one way Anova*	
	M	SD	M	SD	M	SD	M	SD	M	SD	F	p
Overall	17.2	4.93	15.4	6.11	16.8	5.42	14.5	4.94	14.0	5.17	2.01	.096
											Kruskall Wallis	
											X^2	p
Ind.	5.94	2.03	5.94	1.78	5.66	2.60	6.50	2.12	5.08	2.21	2.53	.639
Ded.	4.91	2.11	3.47	2.52	4.50	2.43	2.50	.70	3.91	2.41	11.3	.023
Anal.	3.02	1.40	2.35	1.61	3.33	1.15	2.50	.70	2.73	1.57	4.57	.334
Inf.	3.51	1.46	3.17	1.42	2.83	1.19	2.50	.70	2.65	1.40	9.00	.061
Eval.	3.67	1.48	3.52	1.69	3.75	2.05	4.00	1.41	3.39	1.52	1.12	.890

Note: Highlighted values indicated statistical significance p< 0.05

Table 11.

Post Hoc Analysis of Deduction Scores for Different Amounts of Time in Job Shadowing Experience

	None (0)	1- 10 hrs (1)	11- 20 hrs (2)	21- 30 hrs (3)	30+ hrs (4)
None (0)		U= 452.00 p= .012**	U= 439.50 p= .401	U= 23.50 p= .077	U= 710.00 p= .036**
1- 10 hrs (1)			U= 75.50 p= .236	U= 14.00 p= .686	U= 172.00 p= .516
11- 20 hrs (2)				U= 5.00 p= .195	U= 117.00 p= .461
21- 30 hrs (3)					U= 15.00 p= .417

Note: Highlighted values indicated statistical significance p< 0.05

For the factor of volunteering in healthcare (Healthcare Experience), there were five groups, no volunteer experience in healthcare, 1-10 hours volunteering in healthcare, 11- 20 hours volunteering in healthcare, 21- 30 hours volunteering in healthcare and over 30 hours of volunteer experience in healthcare. To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between different amounts of volunteer experience in healthcare (H2), a one- way ANOVA was used. Levene's test for homogeneity of variances yielded a non- significant p= 0.187, indicating equal variances could be assumed. There was no statistically significant difference in the mean overall critical thinking scores between different amounts of volunteer experience in healthcare, F(4,135)= 0.561, p= 0.691. Since the required N was not obtained, post hoc power analysis revealed power= 0.63.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores of undergraduate nursing students between the factor of volunteer experience in healthcare (H3), non- parametric Kruskall Wallis was used. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between different amounts of volunteer experience in healthcare, x^2 (4)= 2.65, p= 0.618. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the

deduction scores between different amounts of volunteer experience in healthcare, x^2 (4)= 2.63, p= 0.621. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between different amounts of volunteer experience in healthcare, x^2 (4)= 6.49, p= 0.165. The Kruskall Wallis test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between different amounts of volunteer experience in healthcare, x^2 (4)= 3.30, p= 0.508. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between different amounts of volunteer experience in healthcare, x^2 (4)= 2.89, p= 0.576 (Table 12). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of volunteer experience in healthcare, were rejected.

Table 12.

Factor 6c: Critical Thinking Scores of Undergraduate Nursing Students by Hours Volunteering in Healthcare

	None (n= 67)		*1-10h (n= 11)*		*11-20h (n= 9)*		*21-30h (n= 9)*		*30+h (n= 44)*		*one way Anova*	
	M	SD	M	SD	M	SD	M	SD	M	SD	F	p
Overall	16.4	5.46	14.2	4.14	16.5	7.40	17.0	4.71	16.8	4.81	.561	.691
											Kruskall Wallis	
											x^2	p
Ind.	5.71	2.28	5.45	1.80	5.00	2.29	5.77	1.92	6.13	1.83	2.65	.618
Ded.	4.50	2.27	3.45	2.29	5.22	2.94	4.55	2.00	4.61	2.22	2.63	.621
Anal.	2.77	1.47	2.18	1.07	3.00	1.73	3.55	1.01	3.15	1.42	6.49	.165
Inf.	3.32	1.58	3.27	1.19	3.33	1.22	2.44	1.33	3.29	1.35	3.30	.508
Eval.	3.70	1.61	3.09	1.37	3.00	2.00	3.66	1.22	3.75	1.46	2.89	.576

For the factor of *Involvement*, which includes employment, having a mentor, living on campus, involved in Greek Organizations, clubs, honors program, or athletics, were for the majority tested using non- parametric statistics where the *n* of the two groups was unevenly distributed.

To evaluate if there was a significant difference in the overall critical thinking scores between employed undergraduate nursing students and unemployed undergraduate nursing students (H2), an independent t- test was used. Levene's test for equality of variances yielded a non- significant p= 0.211, indicating equal variances could be assumed. There was no

statistically significant difference in the mean overall critical thinking scores between employed undergraduate nursing students and unemployed undergraduate nursing students, t(138)= -0.591, p= 0.556.

To evaluate if there was a significant difference in each of the subscales of critical thinking scores between employed undergraduate nursing students and unemployed undergraduate nursing students (H3), non- parametric Mann Whitney U was used. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between employed undergraduate nursing students and unemployed undergraduate nursing students, *U*= 2337.5, p= 0.950. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between between employed undergraduate nursing students and unemployed undergraduate nursing students, *U*= 2186.0, p= 0.476. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between employed undergraduate nursing students and unemployed undergraduate nursing students, *U*= 2239.5, p= 0.624. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between employed undergraduate nursing students and unemployed undergraduate nursing students, *U*= 2334.5, p= 0.939. The

Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between employed undergraduate nursing students and unemployed undergraduate nursing students, *U*= 2240.5, p= 0.629 (Table 13). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of employment, were rejected.

Table 13.

Factor 7a: Critical Thinking Scores of Employed & Unemployed Nursing Students

	Employed (n= 84)		*Unemployed (n= 56)*		*Independent t test*	
	M	SD	M	SD	t	p
Overall	16.25	5.03	16.78	5.57	-.591	.566
					Mann Whitney- U	
					U	p
Induction	5.77	2.13	5.80	2.03	2337.5	.950
Deduction	4.42	2.29	4.62	2.28	2186.0	.476
Analysis	2.86	1.44	2.98	1.44	2239.5	.624
Inference	3.26	1.33	3.25	1.60	2334.5	.939
Evaluation	3.56	1.57	3.71	1.52	2240.5	.629

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) of undergraduate nursing students that have a mentor and undergraduate nursing students that do not have a mentor, a Mann Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was no statistically significant difference in the *overall* critical thinking scores between mentored undergraduate nursing students and non- mentored undergraduate nursing students, U= 1042.0, p= 0.982. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between mentored undergraduate nursing students and non- mentored undergraduate nursing students, *U*= 996.5, p= 0.751. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between mentored undergraduate nursing students and non- mentored undergraduate nursing students, *U*= 1041.0, p= 0.979. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between mentored undergraduate nursing students and non- mentored undergraduate nursing students, *U*= 916.0, p= 0.398. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between

mentored undergraduate nursing students and non- mentored undergraduate nursing students, *U*= 1034.0, p= 0.940. The Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between mentored undergraduate nursing students and non- mentored undergraduate nursing students, *U*= 968.0, p= 0.615 (Table 14). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of mentorship, were rejected.

Table 14.

Factor 7b: Critical Thinking Scores of Mentored Nursing Students & Non-Mentored Nursing Students

	Mentor (n= 17)		*No Mentor (n= 123)*		*Mann- Whitney*	
	M	SD	M	SD	U	p
Overall	16.23	5.37	16.49	5.24	1042	.982
Induction	5.88	2.14	5.77	2.08	996.5	.751
Deduction	4.35	1.86	4.52	2.34	1041	.979
Analysis	2.58	1.27	2.95	1.46	916	.398
Inference	3.23	1.56	3.26	1.43	1034	.940
Evaluation	3.76	1.64	3.60	1.54	968	.615

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, a Mann Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was no statistically significant difference in the *overall* critical thinking scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, U= 1780.0, p= 0.458. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, *U*= 1819.0, p= 0.572. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, *U*= 1896.0, p= 0.843. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, *U*= 1827.0, p= 0.595. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference

in the *inference* scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, *U*= 1927.0, p= 0.960. The Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between undergraduate nursing students that reside on campus and commuting undergraduate nursing students, *U*= 1755.0, p= 0.383 (Table 15). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of campus residence, were rejected.

Table 15.

Factor 7c: Critical Thinking Scores of Resident Nursing Students & Non-Resident Nursing Students

	Commuter (n= 102)		*Resident (n= 38)*		*Mann- Whitney*	
	M	SD	M	SD	U	p
Overall	16.26	5.13	17.00	5.55	1780	.458
Induction	5.74	2.11	5.89	2.02	1819	.572
Deduction	4.52	2.31	4.44	2.21	1896	.843
Analysis	2.97	1.43	2.76	1.47	1827	.595
Inference	3.26	1.50	3.26	1.50	1927	.960
Evaluation	3.81	1.44	3.81	1.44	1755	.383

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, a Mann Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was no statistically significant difference in the *overall* critical thinking scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, U= 745.0, p= 0.864. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, *U*= 700.5, p= 0.611. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, *U*= 767.0, p= 0.994. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing

students not involved in Greek Organizations, *U*= 759.5, p= 0.948. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, *U*= 599.5, p= 0.20. The Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between undergraduate nursing students involved in Greek Organizations and undergraduate nursing students not involved in Greek Organizations, *U*= 681.0, p= 0.510 (Table 16). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of Greek Organization involvement, were rejected.

Table 16.

Factor 7d: Critical Thinking Scores of Nursing Students in Greek Organizations & Nursing Students not in Greek Organizations

	Greek Life (n= 12)		*No Greek Life (n= 128)*		*Mann Whitney*	
	Mean	SD	Mean	SD	U	p
Overall	16.08	5.07	16.50	5.27	745.0	.864
Induction	5.58	1.88	5.80	2.11	700.5	.611
Deduction	4.33	1.92	4.52	2.32	767.0	.994
Analysis	2.83	1.52	2.92	1.43	759.5	.948
Inference	2.66	1.55	3.31	1.42	599.5	.200
Evaluation	3.42	1.24	3.64	1.58	681.0	.510

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, a Mann Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was a statistically significant difference in the *overall* critical thinking scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, U= 1697.5, p= 0.002. The Mann Whitney test for comparison of *induction* scores indicated that

there was a statistically significant difference in the *induction* scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, *U*= 1929.0, p= 0.033. The Mann Whitney test for comparison of *deduction* scores indicated that there was a statistically significant difference in the *deduction* scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, *U*= 1839.0, p= 0.012. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, *U*= 2059.0, p= 0.110. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, *U*= 2002.5, p= 0.067. The Mann Whitney test for comparison of *evaluation* scores indicated that there was a statistically significant difference in the *evaluation* scores between undergraduate nursing students involved in clubs and undergraduate nursing students not involved in clubs, *U*= 1819.5, p= 0.009 (Table 17). Based on the results, H2 and H3, for the factor of club involvement, were accepted. Sub Hypotheses H3c and H3d, for the factor of club involvement, were rejected.

Table 17.

Factor 7e: Critical Thinking Scores of Nursing Students involved in Clubs and Nursing Students not involved in Clubs

	Clubs (n= 64)		*No Clubs (n= 76)*		*Mann- Whitney*	
	M	SD	M	SD	U	p
Overall	17.87	5.19	15.27	5.01	1697.5	.002
Induction	6.17	2.07	5.46	2.05	1929.0	.033
Deduction	5.01	2.27	4.07	2.21	1839.0	.012
Analysis	3.10	1.43	2.75	1.43	2059.0	.110
Inference	3.50	1.32	3.05	1.52	2002.5	.067
Evaluation	3.98	1.45	3.31	1.57	1819.5	.009

Note: Highlighted values indicate statistical significance p<0.05

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved in honors programs, a Mann Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was no statistically significant difference in the *overall* critical thinking scores between undergraduate nursing students involved in honors programs and undergraduate nursing

students not involved in honors programs, U= 2190.0, p= 0.571. The Mann Whitney test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved in honors programs, *U*= 2288.5, p= 0.884. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved in honors programs, *U*= 2115.5, p= 0.372. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved in honors programs, *U*= 2218.0, p= 0.649. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved in honors programs, *U*= 2141.0, p= 0.429. The Mann Whitney test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between undergraduate nursing students involved in honors programs and undergraduate nursing students not involved

in honors programs, *U*= 2194.5, p= 0.578 (Table 18). Based on the results, H2 and H3 and all sub hypotheses, for the factor of club involvement, were rejected.

Table 18.

Factor 7f: Critical Thinking Scores of Nursing Students involved in Honors Programs and Nursing Students not involved in Honors Programs

	Honors (n= 54)		*Non- Honors (n= 86)*		*Mann- Whitney*	
	M	SD	M	SD	U	p
Overall	16.14	5.56	16.66	5.05	2190.0	.571
Induction	5.74	2.20	5.81	2.02	2288.5	.884
Deduction	4.27	2.39	4.65	2.21	2115.5	.372
Analysis	2.83	1.38	2.96	1.48	2218.0	.649
Inference	3.14	1.41	3.32	1.46	2141.0	.429
Evaluation	3.66	1.57	3.59	1.54	2194.5	.578

To evaluate if there was a significant difference in the overall critical thinking scores (H2) and each of the subscales of critical thinking (H3) between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, a Mann

Whitney U test was used. The Mann Whitney test for comparison of *overall* critical thinking scores indicated that there was a statistically significant difference in the *overall* critical thinking scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, U= 783.5, p= 0.05. The Mann Whitney test for comparison of *induction* scores indicated that there was a statistically significant difference in the *induction* scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, *U*= 688.5, p= 0.01. The Mann Whitney test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, *U*= 848.5, p= 0.117. The Mann Whitney test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, *U*= 912.0, p= 0.236. The Mann Whitney test for comparison of *inference* scores indicated that there was no statistically significant difference in the *inference* scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students

not involved in athletics programs, *U*= 886.5, p= 0.179. The Mann Whitney test for comparison of *evaluation* scores indicated that there was a statistically significant difference in the *evaluation* scores between undergraduate nursing students involved in athletics programs and undergraduate nursing students not involved in athletics programs, *U*= 690.0, p= 0.01 (Table 19). Based on the results, for the factor of athletic involvement, H2 was accepted, also H3a and H3e, for the factor of athletic involvement, were accepted, H3b, H3c, H3d, for the factor of athletic involvement, were rejected.

Table 19.

Factor 7g: Critical Thinking Scores of Nursing Students involved in Sports and Nursing Students not Involved in Sports

	Athletes (n= 18)		*Non- Athletes (n= 122)*		*Mann- Whitney*	
	Mean	SD	Mean	SD	U	p
Overall	18.89	4.62	16.10	5.25	783.5	.050
Induction	6.83	1.91	5.63	2.07	688.5	.010
Deduction	5.44	2.59	4.36	2.21	848.5	.117
Analysis	3.33	1.53	2.85	1.42	912.0	.236
Inference	3.66	.84	3.19	1.50	886.5	.179
Evaluation	4.50	1.54	3.49	1.51	690.0	.010

Note: Highlighted values indicate statistical significance p<0.05

For the factor of Learning Style, there were four groups of learning styles, concrete sequential (CS), abstract sequential (AS), abstract random (AR), and concrete random (CR). To evaluate if there was a significant difference in the overall critical thinking scores of undergraduate nursing students between the different learning styles (H2), a non- parametric Kruskall Wallis test was used. For the factor of *Learning Styles,* the non- parametric Kruskall Wallis test was used to test both H2 and H3 for the differences in critical thinking scores among the different learning styles because normality was questionable, and the *n* within the four groups was small and unequal. The Kruskall Wallis test for comparison of the *overall* critical thinking scores indicated that there was no statistically significant difference in the *overall* critical thinking scores between the different learning styles, x^2 (3)= 3.86, p= 0.277. The Kruskall Wallis test for comparison of *induction* scores indicated that there was no statistically significant difference in the *induction* scores between the different learning styles, x^2 (3)= 2.51, p= 0.473. The Kruskall Wallis test for comparison of *deduction* scores indicated that there was no statistically significant difference in the *deduction* scores between the different learning styles, x^2 (3)= 3.47, p= 0.323. The Kruskall Wallis test for comparison of *analysis* scores indicated that there was no statistically significant difference in the *analysis* scores between the different learning styles, x^2 (3)= 4.67, p= 0.197. The Kruskall Wallis test for comparison of

inference scores indicated that there was no statistically significant difference in the *inference* scores between the different learning styles, x^2 (3)= 1.92, p= 0.589. The Kruskall Wallis test for comparison of *evaluation* scores indicated that there was no statistically significant difference in the *evaluation* scores between the different learning styles, x^2 (3)= 2.54, p= 0.468 (Table 20). Based on the results, H2 and H3, including all sub- hypotheses, for the factor of learning styles, were rejected.

Table 20.

Factor 8: Critical Thinking Scores of Undergraduate Nursing Students by Learning Style

	CS (n= 67)		*AS (n= 16)*		*AR (n= 29)*		*CR (n= 28)*		*Kruskall Wallis*	
	M	SD	M	SD	M	SD	M	SD	x^2	p
Overall	16.6	5.72	14.1	6.00	16.1	3.96	17.5	4.54	3.86	.277
Induction	5.79	2.25	5.06	2.69	5.79	1.47	6.17	1.78	2.51	.473
Deduction	4.67	2.52	4.06	2.29	3.96	1.67	4.92	2.17	3.47	.323
Analysis	3.00	1.46	2.62	1.36	2.51	1.50	3.28	1.30	4.67	.197
Inference	3.22	1.54	2.81	1.55	3.37	1.34	3.46	1.23	1.92	.589
Evaluation	3.67	1.61	3.25	2.01	3.44	1.18	3.89	1.44	2.54	.468

To test the *fourth* hypothesis, a stepwise regression analysis was used to enter the variables one at a time so the percentage of variability due to the predictor variable could be observed (Field, 2009). The stepwise regression functions to determine the best combination of predictor (independent) variables in order to predict the dependent variable. For the regression, the following equation was used:

$$\text{Critical thinking} = b_0 + b_1\text{learning style}_i + b_2\text{gender} + b_3\text{age} + b_4\text{degree} + b_5\text{level} + b_6\text{GPA} + b_7\text{employment} + b_8\text{yearexp} + b_9\text{jobshadow} + b_{10}\text{volunteer} + b_{11}\text{mentor} + b_{12}\text{dorm} + b_{13}\text{greekorg} + b_{14}\text{clubs} + b_{15}\text{honors} + b_{16}\text{athletics}$$

The stepwise regression analysis revealed $F_{(2, 137)} = 8.33$, $p < .001$, $R^2 = .108$, indicating 10% of the variance in the critical thinking scores was due to involvement in clubs and healthcare experience through job shadowing (Table 21):

$$\text{Critical thinking} = 21.208 + (-2.587\text{clubs}) + (-.758\text{jobshadow})$$

Therefore, the variables of club involvement and healthcare experience through job shadowing significantly predicted overall critical thinking scores.

Table 21.

Stepwise regression to predict Critical Thinking Scores from all factors (16)

	B	Std error	t	p
Constant	21.208	1.399	15.165	.000
Clubs	-2.587	.846	-3.058	.003
Job Shadow	-.758	.282	-2.688	.008

Qualitative Results

The final questions of the demographic questionnaire included open- ended questions. The first, asked the participants to "check all that apply" of a list of various instructional methods that they had participated in during their current educational program. The list was randomized, but is organized here by didactic/ teacher centered learning methods and active/ student centered learning methods. Teacher Centered, passive learning techniques, ranged from 78.4% of participants- 98.6% of participants having been exposed to the instructional methods, while Student centered, active learning technique ranged from 13.7% of participants- 83.5% of participants having been exposed to the instructional methods (Table 22). The results reveal that the undergraduate nursing students were involved in more teacher centered learning opportunities than student centered learning activities.

Table 22.

Engaged Instructional Methods

Instructional Method	N	%
Teacher Centered Learning		
Lecture	137	98.6
Video	132	95.0
Clinical	110	79.1
Online	109	78.4
Discussion	122	87.8
Student Centered Learning		
Simulations	80	57.6
Mind map	19	13.7
Concept map	83	59.7
Group	113	81.3
Case Study	116	83.5

The first open- ended question specifically asked the participant, “How would you define Critical Thinking?” 8 of the participants did not provide a response to this item. Using the definitions of critical thinking from the literature, the PI had pre- established themes that were expected to appear in the responses. The participants’ responses were transcribed. The PI and

another researcher both coded the transcribed responses separately (Table23). Once all of the responses were transcribed and labeled with a code for each theme, Cohen's Kappa was calculated to determine the inter-rater reliability. To calculate kappa, a contingency table was organized and the responses from the 132 participants. Themes that were in agreement between the two raters were placed in one of the diagonal cells, themes that were not agreed upon were placed in one of the off-diagonal cells. Row totals, column totals, and overall total were calculated. It is important to note that the overall total equals more than the total number of responses because some responses provided more than one, or one lengthy response, therefore identifying more than one theme. The total number of agreements Σa= 133 of 143 codes. The percent of agreement calculated was 93% agreement. The expected frequency for the number of agreements that would have been expected by chance for each code was calculated with the equation:

$$Ef = \frac{\text{row total} * \text{column total}}{\text{Overall total}}$$

The expected frequencies were totaled to Σef= 27.02. To calculate Cohen's Kappa the following equation was used:

$$K = \frac{\Sigma a - \Sigma ef}{N - \Sigma ef}$$

The calculated kappa totaled k= 0.91 and it could therefore be concluded that the inter- rater reliability was satisfactory (k > 0.7).

Table 23.

Open ended responses of Undergraduate Nursing Students' Definition of Critical Thinking

Themes	N= 132	%
Applying/ using information/ knowledge	48	36.3
Problem solving/ how to solve a problem	38	28.7
Situations and scenarios	25	18.9
Thinking outside of the box	21	15.9
Thought process	19	14.3
Analysis	11	8.3
Decision making process	9	6.8
How to find an answer or conclusion	8	6.0
logic	6	4.5
reasoning	4	3.0

Note: Highlighted themes and values indicate predetermined themes

The second open- ended question specifically asked the participant, "when you hear your instructor say your assignment or class activity is to help develop your critical thinking, what do you immediately think the assignment will include?" 13 of the participants did not provide a response to this item.

Using the definitions of critical thinking from the literature, the PI had pre-established themes that were expected to appear in the responses. The participants' responses were transcribed. The PI and another researcher both coded the transcribed responses separately (Table 24). Once all of the responses were transcribed and labeled with a code for each theme, Cohen's Kappa was calculated to determine the inter-rater reliability. To calculate kappa, a contingency table was organized and the responses from the 127 participants. It is important to again note that the overall total equals more than the total number of responses because some responses provided more than one, or one lengthy response, therefore identifying more than one theme. The total number of agreements $\Sigma a = 121$ of 137 codes. The percent of agreement calculated was 88% agreement. The expected frequency for the number of agreements that would have been expected by chance for each code was $\Sigma ef = 22.23$. The calculated kappa totaled $k = 0.86$ and it could therefore be concluded that the inter- rater reliability was satisfactory ($k > 0.7$).

Table 24.

Open ended responses of Undergraduate Nursing Students' Perceptions of Critical Thinking

Theme	N= 127	%
Difficult/ challenging	37	29.1
A lot of work	16	12.5
Time consuming	16	12.5
Open ended	12	9.4
Helpful, important, useful	11	8.6
Use knowledge/ what we learned in class	10	7.8
Scenarios/ situations	8	6.2
Problem solving	5	3.9

Note: Highlighted themes and values indicate predetermined themes

Chapter V

Discussion

In this study, undergraduate nursing students exhibited moderate levels of overall critical thinking skills. Moderate levels of overall critical thinking scores, according to Facione (2013), indicate the potential for skill related challenges when engaged in problem solving and reflective decision making associated with learning development. This finding is further supported by this study's results observed in the subscale scores of critical thinking as well. In the literature, the development of critical thinking skills begins with decision-making then further develops to deep levels of critical thinking and analytical and reasoning skills. In this study, the strongest scores were obtained in the subscales of induction and deduction, the basic skills required for decision making, indicating that critical thinking is beginning to develop. While this observation was of interest, the main purpose of this study was to identify which factors influence the development of these skills. The quantitative analysis revealed very little significance between the factors and overall critical thinking scores, indicating there was no significant relationship or a significant difference in the overall critical thinking scores due to these factors. While one could question the factors chosen in this study for analysis, they were identified from the health science literature and were those explored most frequently with the most inconsistent results.

Unexpectedly, the stepwise regression analysis revealed only 10% of the variance in the overall critical thinking scores explained by these factors explored. Therefore, the difference in critical thinking scores must be due to other factors not explored here, and factors not predominantly mentioned in the literature as well.

For age as a factor that influences critical thinking, this study found no significant correlation between age and critical thinking. Also, no significant difference in overall critical thinking scores between the four age groups (18-21, 22-25, 26-29, and 30+) was present, as well as all five subscales of critical thinking. Other studies, however, such as Chau, Chang, In, Lee, and Wootton (2001) and Drennan (2009) have found negative associations between critical thinking and age in undergraduate and graduate nursing students, respectively. Where as, Martin (2002) found a significantly positive relationship between critical thinking and age in both undergraduate and graduate nursing students. The sample of this study consisted of 54.3% in the age group 18-21 and only 6.4% of the participants were in the 30+ age group. Therefore, it is possible that the sample did not adequately reflect a broad range of ages to detect a relationship or a significant difference between the critical thinking scores. But as Brookfield describes, critical thinking as a skill, is continuously being developed, and thus it would be

reasonable for the skill to be consistent across the age groups and age not necessarily have an effect on the development of these skills.

The results observed in this study are consistent with the findings of several other studies of undergraduate and graduate nursing students, in which no significant relationship was found between critical thinking and gender (Chau, Chang, In, Lee, and Wootton, 2001, and Ulosoy & Ozturk, 2009). Also, no significant differences in any of the critical thinking scores between males and females were present.

Level of education as a factor influencing critical thinking, was divided into two parts for this study, highest degree earned and level in the current nursing program. However, no significant relationship was noted between either of these factors and no significant differences existed between the critical thinking scores. This was surprising to find, as healthcare education especially nursing education seeks to develop critical thinking skills due to the highlighted importance of these skills in providing efficient healthcare. However, in Adams (1999) integrated review of the literature, no significant relationship was found between level in the nursing program and critical thinking ability. Also, Martin (2002) and McGrath (2003) found no improvement in the critical thinking skills of nursing students throughout their respective nursing programs. In addition to nursing, other areas of health science education have seen similar results, Cisneros (2009) in pharmacy

students, Bartlett and Cox (2002) and Venderly (2005) in physical therapy students, and German (2008) in athletic training students. Many of these results however, are clarified and explain further by the qualitative results of this study.

GPA, often noted in the literature as academic achievement, also did not have a significant relationship between overall critical thinking skills. There was also no significant difference between GPA and overall critical thinking as well as the subscales of critical thinking. Only 3.5% of the sample identified a GPA lower than 3.0. This is in part due to the nature of an undergraduate nursing program, with specific requirements in order to successful continue and complete a nursing educational program in good standing.

Healthcare experience was another factor identified in the literature as important to the development of critical thinking skills. For this study, healthcare experience was divided into three types of experience, employment in healthcare, job shadowing a practicing nurse, and volunteering in a healthcare setting. Surprisingly, the results for employment in healthcare supported a previous study by McDade (1999) where no significant relationship was identified between amount of healthcare experience due to working in the field and critical thinking ability. A significant but negative, weak relationship was found between job shadowing experience and overall critical thinking. No significant difference existed between any of the forms of

healthcare experience and overall critical thinking skill. This could be because of the participants ultimately just beginning to develop critical thinking skills as they were all also undergraduate students. Surprisingly, the only significant differences found were for the subscale of deduction and job shadowing experience. A significant difference was found between students that had no job shadowing experience and students that had 1- 10 hours of job shadowing experience, with the job shadow experience showing a significantly lower deduction score. Another significant difference was found between students that had no job shadowing experience and students that had over thirty hours of experience, with the students having the job shadowing experience score significantly lower in the deduction scores. The job shadowing experience may simply be too passive of an experience to actively develop critical thinking skills in the process. The shadowing experience may not challenge the students to think critically or to utilize the skills learned in a practical setting.

When exploring the influence of involvement in the college experience on critical thinking skills, significant differences in the critical thinking scores were found between student that were and were not involved in clubs and students that were and were not involved in athletics. Involvement in clubs on the college campus had a significant, negative, weak relationship with overall critical thinking. However, students that were involved with clubs had a

significantly higher overall critical thinking score, induction, deduction, and evaluation score. Involvement in athletics on the college campus had a significant, positive, weak relationship with overall critical thinking score and students involved in athletics exhibited a significantly higher overall critical thinking score, induction, and evaluation scores. These results support Gellin (2003) study finding that club involvement leads to an increase in critical thinking skill and Pascarella (2001) finding that certain athletics lead to improved critical thinking. However, in this study, the different types of athletics were not explored as in Pascarella (2001). Students involved in athletic or in clubs and organizations on campus, form small, close social groups. In these groups they interact with one another on both a social and academic level. As Brookfield (2012) defines critical thinking as an active process, learning is also described as being a social process. Therefore, the development of critical thinking skills is a social process and the more positive interaction during the development of these skills, the greater the critical thinking ability of the students will be. This is further supported by the Community of Inquiry (CoI) framework, which emphasizes the importance of the social aspect of learning and critical thinking development.

The last factor explored, as it relates to critical thinking, is preferred learning style, as it is measured by the Gregorc Style Delineator. No significant relationship was found between learning style and overall critical

thinking. These results support the findings of Wessel and Williams of no significant correlation between learning style and critical thinking in physical therapy students. Similarly, a study by Myers and Dyer (2006) also found no significant difference in the critical thinking of non- health science students based on their learning style.

The quantitative analysis revealed very little significance between the factors and overall critical thinking scores, indicating there is a significant relationship between job shadowing (healthcare experience), clubs involvement and athletic involvement with overall critical thinking. The stepwise regression analysis revealed only 10% of the variance in the overall critical thinking scores explained by job shadowing and club involvement. Therefore, the difference in critical thinking scores must be due to other factors not explored here, and therefore not predominantly mentioned in the literature as well. Many of the results were surprising and inconsistent, also conflicting with large amounts of research. However, the qualitative component of the study provided explanation to the quantitative findings.

One of the questions on the survey, asked the students to check all of the instructional methods that they have experienced during their nursing educational program. The instructional methods provided on the survey were predetermined based on adult learning theories. The results indicate a larger percentage of teacher centered learning experiences. As research indicates,

active learning methods significantly improve critical thinking development as compared to didactic methods. A study by Kaddoura (2011) found similar results in a quantitative analysis of nursing students enrolled in nursing programs routed in case based learning and nursing students enrolled in nursing programs grounded in traditional didactic methodologies. The results revealed statistically significant higher critical thinking scores of the students enrolled in the active learning program and also found that students who completed three years of education in these active nursing curricula received higher critical thinking scores. Based on the results of Kaddoura (2011), the qualitative results for instructional method provide some explanation to the moderate critical thinking scores of the undergraduate nursing students. Since the students emphasized limited active learning experiences, the critical thinking development was low as well as the possibility that active learning methodologies were not practiced consistently throughout the nursing program. The lack of student centered learning could also have played a role in the lack of difference in critical thinking score due to different levels within the nursing program, as one would assume that as learning helps to develop critical thinking, students in the fourth year of the program would have had higher levels of critical thinking than students in the first year of the program. But if active learning strategies are not utilized throughout the nursing program, the students will not develop critical thinking skills regardless of the

level of the program they are in. Therefore, as educators, to improve the critical thinking of nursing students, the curriculum of these nursing and health science programs should be infused with student centered learning, such as problem based learning methodologies.

Open- ended questions posed at the end of the survey also helped to provide some explanation to the lack of significance in the quantitative results. The first question asked the students to "define critical thinking." Pre-determined themes were formed based on the definitions used in this study, which include, reasoning, logic, how to find an answer or conclusion, and decision making process. However, very small percentages of responses included descriptions that fall into these themes. Using in vivo coding then, the majority of the responses included themes such as, applying information, problem solving, and thinking outside of the box. A second open- ended question asked, "When you hear an instructor say that an assignment or class experience is to help 'develop critical thinking', what do you immediately think the assignment will include?" Again, pre- determined themes were formed based on the literature such as problem- based learning, or scenario/ case based learning. Similarly to the first question, very small percentages of responses included these themes and therefore, in vivo coding was again used and identified themes such as difficult, a lot of work, time consuming, important, use what we learned in class. These types of responses to the two

open- ended questions highlights the fact that the students are not familiar with what critical thinking is and its significance to their profession. The lack of knowledge and understanding of critical thinking also helps to explain the moderate levels of the participants overall critical thinking scores.

Upon reviewing and reflecting on the data presented in this study, the Community of Inquiry framework is supported. The CoI framework and Brookfield's definition of critical thinking remind us that inquiry and learning is a social activity and is based upon the essence of the social experience (Garrison, Anderson, and Archer, 2010). The results of this study, specifically the significant differences in the critical thinking scores of the students involved in athletics and clubs, as well as the identified need for more active learning experiences, support the concept that learning is a social activity. This is also apparent through each of the three core elements of the CoI framework. The framework identifies the three core elements, the cognitive presence, the teaching presence, and the social presence as overlapping lenses. Therefore, each of the presences influences the other. For example, the cognitive presence and the teaching presence complement one another. This can be seen by the results of this study as well. With the lack of student centered learning experiences, the development of critical thinking skills was low. Brookfield (2012) emphasizes the importance of the teacher modeling critical thinking in order for students to learn how to practice critical thinking.

The teacher can lead and model how to question and analyze assumptions through communication which is again supported by the need for more active learning experiences and also overlaps with the third element in the model, social presence. Also as Prasad (2009) and Brookfield (2012) describes, critical thinking is constructed through communication, peer interaction and discussion, all of which support engagement. The teaching presence also supports engagement as well as the social presence and therefore, both support critical thinking. Therefore, the more interactive learning strategies, and opportunities for the students to form social and academic networks, the greater the development of critical thinking skills. By engaging in the active learning opportunities, the students will have the opportunity to further develop critical thinking skills by practicing and applying these skills, ultimately making them more productive, collaborative members of interprofessional education and practice.

CHAPTER VI

Summary & Conclusions

Identifying the factors that influence critical thinking skills in undergraduate nursing students are important for developing interprofessional education programs routed in critical thinking. The results of this study however did find that the factors explored here only account for 10% of the variance in critical thinking scores, indicating 90% was not explained by any of the factors explored in this study. Several of the factors which were not explored in this study because they have not been investigated extensively may warrant further investigation. For example, Shea and Bidjerano (2009) suggest that a crucial factor in the development of critical thinking depends on the students' comfort levels and in order for an instructor to foster the development of the skills, the instructor should help the students gain that comfort and confidence in the activities used to develop the skills. Therefore, the learning environment can influence the development of critical thinking ability and should be explored further. Purvis (2009) interviewed nursing students and they identified that testing or assessment method influences the development of their critical thinking skills. Furthermore, Tsui (1999) that taking multiple-choice exams had a negative effect on students' self reported growth in critical thinking, and therefore assessment should also be explored further as an influence of critical thinking development. It is also important to note,

generational differences in the students currently enrolled in undergraduate nursing programs as that may be a factor impacting their critical thinking skills. Millennial learners in particular have grown up with constant access to technology. Montenery, et.al.(2013) not only found that millennial learners prefer the use of instructional technologies in the classroom but also indicated a preference towards computerized testing as well. Other unique technologies such as gaming, has also been utilized as a teaching strategy in nursing education and has been positively perceived by the nursing students, promotes active learning, and therefore enhances critical thinking (Royse and Newton, 2013). This may be another component of active learning that may influence the development of critical thinking skills. It would also be interesting to see if exposure to different media sources plays a role in the development of critical thinking skills. Also, with the increasingly diversity on college campuses and throughout the nursing programs, diversity experiences may also factor in the development of critical thinking skills as found in a study by Pascarella, Palmer, Moye, and Pierson (2001).

In order for healthcare professionals to practice within an interprofessional practice model for the promotion of patient centered care, health science educational programs need to develop interprofessional education experiences that will support the development of critical thinking skills across all healthcare professionals. The qualitative data of this study revealed

several learning strategies that can be positive in developing the critical thinking skills of nursing students, which can also be used across the health science professions. Specifically, organizing learning environments not based upon teacher centered instructional strategies, but to a more student centered learning environment, and from didactic lectures and textbook study to more active pedagogic techniques. In future studies, it would be interesting to use an intervention grounded in problem- based learning and compare the critical thinking scores before and after the intervention and to follow this over the length of a the course or program. Additionally, it would be helpful to use and further assess a learning model that drives critical thinking, such as SOLO taxonomy (Structure of Observed Learning Outcomes).

To ensure that the workforce is ready for team based care we must first be intentional in the development and professional formation of our students There are more undergraduate nurses in the workforce today and as the work force continues to grow so will the numbers. According to the American Association of Colleges of Nursing, nursing is the country's largest healthcare profession; nurses are the primary providers of care within a hospital setting and make up a significant portion of the hospital staff. Nurses also provide most of the population's long-term care. To meet the more complex demands of today's healthcare environment, the National Advisory Council on Nurse Education and Practice requires that at least two thirds of the nurse workforce

possess a baccalaureate degree or higher in nursing. Therefore, nurses with RNs are returning to the university to obtain the BSN degree and the numbers are steadily increasing. According to the American Association of Colleges of Nursing, in 1980, only 22 percent of nurses held the bachelor's degree but by 2008, the number of nurses with bachelor's degrees as their highest education had climbed to 36.8 percent and currently reaching more than 50%. The U.S. Bureau of Labor and Statistics projects that more than 581,500 new RN jobs will be created by 2018. So the number of BSN students is growing dramatically and these critical components of our healthcare environments need to have higher levels of critical thinking to provide the highest quality of care and to be integral members of interprofessional practice.

In conclusion, identifying the factors affecting CT in nursing students is just the first step- once we know this, then the differences can be explored across the health science professional students. Critical thinking in the different health professions needs to be addressed in order for interprofessional education and practice to be effective and ultimately improve patient care.

Limitations

This study explored the factors influencing critical thinking in a group of nursing students from three private universities in New Jersey, but the results are not generalizable to the entire population of undergraduate nursing students. The sample represented a very small percentage of the 250,000 students enrolled in undergraduate nursing programs. The sample size also was not large enough to achieve power in all statistical analyses, which leads to question if significance could have been expected. Also, using a survey method, critical thinking scores could have been low due to lack of effort by the participant and the demographics collected were based on self- reported data.

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APPENDIX A

Exploring Factors Influencing Critical Thinking in Undergraduate Nursing Students: A Pilot Study

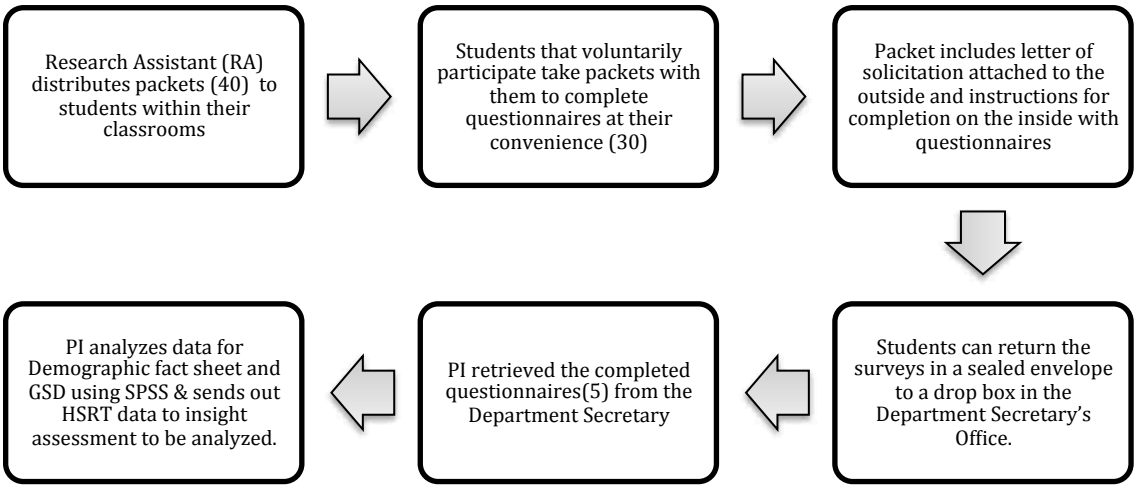
Introduction

Healthcare has been moving towards a model of interprofessional practice, which has been highlighted as a key aspect in delivering high quality, patient centered care. In order to meet the demands of the emerging interprofessional practice model and the paradigm shift in learning, healthcare education has started to move towards interprofessional education, which focuses on patient centered care in order to promote critical thinking skills needed for practice. However, in order to develop interprofessional education programs that are routed in critical thinking, a more in depth understanding of critical thinking, what we know about how it develops, and what factors influence that develop is essential. The purpose of this pilot study was to 1) to determine if the recruitment and data collection process and methodology employed in the pilot study are methodologically sound, and 2) to identify factors that influence the development of critical thinking skills in undergraduate nursing students.

Methods

The research design for the pilot study was descriptive, correlational and cross sectional. The Health Sciences Reasoning Test (HSRT) was used to

determine level of critical thinking skill in undergraduate nursing students, and a demographic fact sheet (PI developed) to collect information regarding the "factors" as well as the Gregorc Style Delineator (GSD). After obtaining IRB approval, a research assistant distributed surveys to a class of 30 nursing students.



Results

Five completed surveys were reviewed, 16.6% response rate. Because only 5 research packets were returned statistical analyses would be insignificant; so the data were analyzed qualitatively to look for any trends. Two of the participant had *moderate* critical thinking overall skill (15-20), two participants had *strong* overall critical thinking skill (21-25), and one had *superior* overall critical thinking skill (26-33).

	Overall CT score	Gender	Level	GPA	Learning Style	Experience	Involvement
1	18	F	2	3.5-4.0	CR	X	X
2	22	F	2	3.5-4.0	CS		
3	23	F	3	3.5-4.0	CR		X
4	28	F	3	3.5-4.0	CS		X
5	17	M	4	3.0-3.4	CS	X	X

Conclusion

The purpose of the pilot study was to determine if the methodology was feasible. Therefore, due to the low response rate, alternate locations for survey distribution were sought and instructors offered use of class time for completion of surveys. Otherwise, the methodology was sound, no surveys were missing responses in any fields, confusion in responses etc. Also to increase N, three private universities' nursing programs in northern New Jersey would be used to keep consistency across demographic characteristics, environment, faculty, etc.

Committee:

Dr. Pinto Zipp, Dr. DeLuca, Dr. Cabell

APPENDIX B

SETON HALL UNIVERSITY
1 8 5 6

April 29, 2013

Christina Poli

Dear Ms. Poli,

The Seton Hall University Institutional Review Board has reviewed the information you have submitted addressing the concerns for your proposal entitled "A Pilot Study: Exploring Factors Influencing Critical Thinking in Health Science Professional Students". Your research protocol is hereby accepted as revised and is categorized as exempt.

Please note that, where applicable, subjects must sign and must be given a copy of the Seton Hall University current stamped Letter of Solicitation or Consent Form before the subjects' participation. All data, as well as the investigator's copies of the signed Consent Forms, must be retained by the principal investigator for a period of at least three years following the termination of the project.

Should you wish to make changes to the IRB approved procedures, the following materials must be submitted for IRB review and be approved by the IRB prior to being instituted:

- Description of proposed revisions;
- *If applicable*, any new or revised materials, such as recruitment fliers, letters to subjects, or consent documents; and
- *If applicable*, updated letters of approval from cooperating institutions and IRBs.

At the present time, there is no need for further action on your part with the IRB.

In harmony with federal regulations, none of the investigators or research staff involved in the study took part in the final decision.

Sincerely,

Mary F. Ruzicka, Ph.D.

Mary F. Ruzicka, Ph.D.
Professor
Director, Institutional Review Board

cc: Dr. Genevieve Pinto Zipp

APPENDIX C

LETTER OF SOLICITATION AND INFORMED CONSENT

Study Title: Exploring Factors Influencing Critical Thinking in Nursing Students.

Affiliation:

My name is Christina Poli and I am a Doctoral Candidate in the School of Health and Medical Sciences program at Seton Hall University South Orange, NJ. I am conducting a research project that will culminate in my dissertation.

Purpose:

You are invited to participate in this study because you are a health science professional student. Studies have shown that critical thinking is an essential and important skill in the health science professions. However, the factors that influence the development of these skills is unclear. Therefore, the purpose of this study is to identify that factors that influence the development of critical thinking skills in health science professional students.

Procedure:

You will be asked to complete 3 anonymous questionnaires found inside this packet.

1. Demographic Questionnaire
2. The Health Sciences Reasoning Test (HSRT)
3. The Gregorc Style Delineator (GSD)

It is important that you complete all three questionnaires and return them in the enclosed envelope, sealed, to the drop box provided by the Research Assistant. The process will take approximately 60 minutes of your time.

Voluntary participation

Your participation in the research study is entirely voluntary. Your may decide not to participate at any time. If you decide not to participate, you will not be penalized or lose any benefits to which you are entitled, and will not affect any grade, to any course, or requirement. Consent to participate in this study is indicated by returning the enclosed questionnaires to the designated drop box when they have been completed.

Anonymity

At no time in answering these questions will you be asked to provide your name or any other identifying information. The questionnaires will remain completely anonymous. You will not be identified by name or description in any reports or publications about this study. A coding system, through the use of numbers found in the top left hand corner of each questionnaire will be used to maintain complete anonymity at all times.

Confidentiality

All information in this study will be kept strictly confidential. All research data will be stored on a USB memory key in a locked cabinet in the principle investigator's office. The principle investigator, Christina Poli is the only individual who will have access to all of the research data for a period of three years. Thereafter, all research data will be destroyed.

Risk

There is no foreseeable risk factor or discomfort of any part of this research project.

Benefit of Participation

There are no proposed direct benefits of the study for you. However, the results of this study will provide health science professional educators and students information about the factors that influence the development of critical thinking skills.

Compensation

There will be no monetary or other kind of compensation for participation in this study.

Alternate procedures

There are no alternative ways to participate in this study.

Contact information

You have the right to ask questions concerning this study at any time. If you have any questions concerning this study or your rights as a study participant, please contact the principle investigator, Christina Poli through the office of Dr. Genevieve Zipp, Dissertation Advisor in the Graduate Programs in the Health Sciences Department at Seton Hall University School of Health and Medical Sciences at 973- 275- 2076. Additionally, Dr. Mary Ruzicka in the office of the IRB at Seton Hall University may be reached at 973- 313- 6314.

Informed Consent

I fully understand the purpose of this study and the lack of potential benefits of my participation.

**My consent to participate in this study is indicated by returning the enclosed questionnaires to the designated drop box.