

Academic and Nonacademic Predictors of Future Success on the NCLEX-RN®

Licensure

Examination for Nurses

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Abstract

The purpose of this retrospective, descriptive study was to explore possible differences between academic and nonacademic predictors and subsequent success rates on NCLEX-RN® examination in a sample of nursing students. This is a high-stakes examination because graduate nurses must successfully complete this requirement to practice as registered nurses. Data were examined from academic records of 338 nursing graduates who completed associate degree requirements at a college in the Midwest between April 2006 and August 2007. Descriptive and inferential statistics were explored to discern possible differences between the dependent variable, NCLEX-RN® passage rates and various independent variables. Statistical analysis revealed the academic predictors to be good indicators of future success on NCLEX-RN®. For college GPA the *t*-test for equality of means revealed $t = 9.080$, $df = 204.100$, $p = .000$ and mean difference = .35534. Conversely, high school GPA demonstrated $t = 1.286$, $df = 157.528$, $p = .200$ and mean difference = .08081. An explanation of this significant finding with college GPA and lack of significance in high school GPA may be the rigor of nursing education compared to high school course work. Composite ACT as well as math and science ACT were highly predictive of future success on NCLEX-RN®. The mean ACT score for those who passed NCLEX-RN® was 21.6387 and the mean ACT score for those who failed the licensure examination was 19.5968. Nonacademic predictors were not as strong indicators of future success on the licensure examination as academic predictors, however. Only student age at the time of sitting for the NCLEX examination proved to be predictive of future success. Both the HESI Exit Exam (E2) and ATI Comprehensive RN Predictor were predictive of future success on NCLEX-RN®.

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Chapter One

Introduction

Background Information

There are three major levels of educational preparation that lead to entry-level practice of registered nursing; associate degree, diploma and baccalaureate. The terminal requirement of each of these programs of study is successful completion of the licensure examination (NCLEX-RN®) of the National Council of State Boards of Nursing (NCSBN). This is a high-stakes examination because graduates of nursing programs must successfully complete this requirement to practice in the field of nursing. Failure on NCLEX-RN® is associated with a variety of negative issues for the graduated nursing student. Some of these factors include low self-esteem, delay in joining the workforce, added expense of retaking NCLEX-RN® plus loss of RN earnings (Nibert & Young, 2001). In addition, nursing programs have negative issues associated with failure of graduates on NCLEX-RN® because accreditation agencies and state boards of nursing measure the quality of nursing programs based on licensure passage rates. Because of the value placed on success on the licensure examination, it is vital for both students and faculty to develop a process of determining predictors of success prior to graduation and candidacy for NCLEX-RN® (Lauchner, Newman, & Britt, 1999).

According to current Registered Nurse (RN) workforce statistics, a nursing shortage crisis exists. Renaud and Miller (2003) reported the nursing shortage originally expected in 2007 actually began in 2000 with an estimated 6% deficit of nurses (national supply of nurses, 1.89 million with demand at 2 million. The United States (U.S.) Health Resources Service Administration (HRSA) released projections of a possible 12% deficit

in nursing workforce by 2010 and even a possible additional reduction to 29% by 2020 (HRSA, 2008).

The U.S. Department of Labor (2008) reported “registered nurses are projected to generate 587,000 new jobs, among the largest number of new jobs for any occupation. Additionally, hundreds of thousands of job openings will result from the need to replace experienced nurses who leave the occupation” (p. 1). Current workforce statistics indicated a 23% increase in the projected employment need for registered nurses from 2,505,000 in 2006 to 3, 092,000 in 2016. This was a change of 587,000 nursing positions (U.S. Department of Labor, 2008). Bentley (2006) stated that by the year 2010 a projected need for a million new nurses and ones to take existing positions will occur. This statement by Bentley (2006) indicated a need to both increase numbers of entrants into nursing programs and for student completion of those programs with subsequent success on NCLEX-RN®.

In the 1950s there was a proliferation of two-year associate degree (AD) nursing programs developed to meet the urgent need for bedside nurses. Due to the need for nurses to join the workforce in a timely manner, no differentiation was made in the licensure requirements for AD, Diploma (typically three-year programs) and Baccalaureate nursing programs. All graduate nurses wrote the same NCLEX-RN® licensure examination and continue to do so. This fact of one licensure examination for all program types has led to an entry-into-practice debate that continues to the present time. Diploma programs, however, have declined greatly in number while AD and Baccalaureate programs remain widespread throughout the country.

Accelerated Bachelor of Science in Nursing (BSN) programs have gained in numbers and popularity in response to the demand for licensed nurses in 2008. Many nursing programs offer students with a prior bachelor's degree or substantive hours toward a degree an opportunity to finish a program of study toward an accelerated BSN in one to three years. This allows a graduate to enter the workforce much more quickly than with other nursing programs and takes advantage of the educational and life experiences gained in previous college matriculation. Students in accelerated BSN programs are usually more mature, experienced adult learners who tend to adapt well to nursing education (Bentley, 2006).

Successful completion of the nursing licensure examination is the mandated standard to pursue the practice of nursing. The nursing licensure examination (NCLEX-RN®) is updated on a triennial basis by a panel of judges of the National Council of State Boards of Nursing (NCSBN). The NCLEX-RN® blueprint is based on a job analysis conducted with a random sample of entry-level licensed nurses from across the United States and its territories. To conduct the job analysis, a survey is disseminated to a random sample of graduates of nursing programs (AD, diploma and baccalaureate). Specific questions are related to practice issues encountered by those graduates during the first six months of nursing practice. The questions in the survey are related to patient care situations and reflect the acuity of patients in health care settings. Due to increased acuity, the passing standard has been increased in each of the past two updates of the licensure examination (2004 and 2007). The passing standard is based on the minimum level of competence required for nursing practice because safe practice continues to be a

major concern and is reflected in the increased rigor of the licensure examination (NCSBN, Passing Standard, 2007).

Purpose of the Study

The purpose of the study was to investigate academic and nonacademic predictors of success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN®), an examination that nursing graduates must successfully complete at the end of their program of study in order to practice nursing. Potential academic predictors included high school grade point average (GPA), college GPA, ACT/SAT scores, nursing course grades, science and math grades, previous college credits and scores on standardized testing during the program of study and at the end of the program of study. There were also many possible nonacademic predictors such as age, gender, marital status, number of dependents, commuter status and hours worked per week during the program of study.

Method of the Study

A five-semester Associate of Science in Nursing (ASN) program (including accelerated Bachelor of Science in Nursing (BSN) students) was used for this descriptive research study. Data were examined retrospectively from records of students who completed the program of study in 2006 and 2007. Students who completed the program in spring 2006 (N = 96), summer 2006 (N = 78), spring 2007 (N = 92), and summer 2007 (N = 72), a total of 338 students, were included in the sample. Descriptive statistics were utilized to describe and summarize the characteristics of the sample, to examine relationships between variables and to assess differences in those who successfully

completed NCLEX-RN® and those who did not. Inferential statistics were utilized to further delineate possible statistically significant differences between predictors and licensure examination results. Academic predictors and nonacademic predictors were correlated with NCLEX-RN® success. A comparison of scores on two types of standardized testing utilized at the end of the program as predictors of subsequent NCLEX-RN® success (Health Education Systems, Inc., HESI Exit exam, and Assessment Technologies, Inc., ATI Comprehensive RN Predictor) was completed.

Research Questions

1. Is there a significant difference between selected academic predictors and subsequent success on NCLEX-RN®?
2. Is there a significant difference between selected nonacademic predictors and subsequent success on NCLEX-RN®?
3. Is there a significant relationship between student scores on two types of exit standardized tests, Health Education Systems, Inc. (HESI) (2006 students) and Assessment Technologies, Inc. (ATI) (2007 students) and subsequent success on NCLEX-RN®?
4. Is there a significant difference between 2006 students' and 2007 students' success rate on NCLEX-RN®?
5. Is there a significant difference between ASN students and accelerated BSN students' success rate on NCLEX-RN®?

Definition of Terms

Associate Degree (AD)

Associate degree education (basic), typically a two-year program of study.

Associate of Science in Nursing Degree (ASN)

Associate degree education with an emphasis in science, generally a two-year program of study.

Bachelor of Science in Nursing Degree (BSN)

Baccalaureate degree education with an emphasis in science, and is typically a four-year program of study.

Accelerated BSN

Students who have a baccalaureate degree or have completed 30 to 35 credit hours of liberal arts and science (LAS) course work prior to beginning the Associate of Science in Nursing (ASN) program may elect to join the Accelerated BSN program and complete the requirements in a three-year time period. These students are held to the same GPA and graduation requirements as ASN students.

Two plus two nursing programs

Students complete the traditional associate degree nursing program in approximately two years and are eligible for the licensure examination. Students then continue the program of study for approximately two additional years to complete the requirements for a bachelor's degree in nursing.

Entry-level nursing practice

At the completion of the nursing degree (ASN, BSN or accelerated BSN) the graduated student sits for the licensure examination (NCLEX-RN®). Upon receipt

of successful NCLEX-RN® results, the registered nurse begins practice in a beginning nursing position.

At-risk students

Students who are at risk of failure on NCLEX-RN® based on college GPA, SAT/ACT score, and nursing course work during the associate degree portion of the nursing program.

Assessment Technologies, Inc. (ATI)

A testing corporation that partners with nursing institutions to improve content mastery and assist students in preparation for the nursing licensure examination at the end of the program. The Comprehensive Assessment and Retention Package (CARP) is the product disseminated by ATI.

Health Education Systems, Inc. (HESI)

A testing corporation that provides custom tests, at pre-determined points in a nursing curriculum, and an exit test (HESI Exit Exam, E2) at the end point of the curriculum.

NCSBN

National Council of State Boards of Nursing is a professional organization that develops and administers the nursing licensure examination.

NCLEX-RN®

Licensure examination, with successful completion, allows one to practice nursing within the state of issue (NCSBN, nd). Validity and reliability of this examination have been determined (see Appendix B). Job analysis of 6000 nurses

in entry-level nursing practice is completed on a triennial basis to ensure that the examination is consistent with the current level of practice.

Nurse educators/faculty

Nurses who plan, design, facilitate, implement and evaluate programs of study for nursing students.

Progression policy

This policy identifies the requirement for students' successful completion of predetermined criteria as well as the program of study to receive a degree and transcript. The policy may include attainment of a benchmark score on an exit standardized test, participation in a review course, or completion of other criteria to complete program requirements

Delimitations

Potential delimitations exist with this study. Only one college of nursing was examined although a sizable sample of students completed the program of study during the two-year period of the investigation. In addition, the NCLEX-RN® format and the passing standard changed for all candidates in 2007. This allowed for a somewhat different test and passing standard than the 2006 candidates encountered. A further delimitation was a change in the progression policy utilized at the institution under study for the 2007 students compared to the 2006 students. Ethical concerns that prompted this change in progression policy will be further delineated in the review of literature. While ASN and accelerated BSN students completed the same basic program of study, the accelerated BSN students had the opportunity to elect completion of BSN courses at the same time as the basic nursing courses. This may have added to the workload, increased

stress, and increased expectations of the accelerated BSN student compared to the ASN student.

Limitations

There were some limitations in this study centering on methods of analysis of data. The chi-square (χ^2) test is a nonparametric statistic which is inherently less powerful a measurement than a parametric statistic (Polit & Beck, 2006). Analysis of data included nominal data (pass/fail statistics) on NCLEX-RN[®] that allowed for only one or the other category as no numerical scores were provided for the NCLEX-RN[®] licensure examination. Nominal data is at the lowest level of measurement and, therefore, required nonparametric statistical analysis. For this reason, interval and ratio data from other variables were examined using parametric tests.

Significance of the Study

Prediction of student success on NCLEX-RN[®] has been an important issue for faculty in nursing programs for the last 20 years (Haas, Nugent, & Rule, 2004). The shortage of nurses, both locally and nationally, has increased the need for graduate nurses to successfully complete NCLEX-RN[®] and join the workforce. In addition, the NCSBN increased the passing standard in 2004 and 2007 to align the examination with job analysis data suggesting a need for a higher level of practice based on increased patient acuity (Morrison, Free, & Newman, 2004; Davenport, 2007). This increased difficulty level of the examination multiplies the need to discover a defining method to predict success on NCLEX-RN[®] for students in nursing programs. A precise method would

allow for remediation systems to be developed early in programs of study to increase the probability of success on the licensure examination and would in turn have an effect on psychological and financial implications for students and workforce issues for the profession of nursing.

Chapter Two

Review of the Literature

For organizational purposes this review of the literature is divided into the following sections, predictors of readiness for NCLEX-RN®, types of nursing programs, theoretical framework, NCLEX-RN® test plan, at-risk students and progression policies. The theoretical framework included information on adult learning theory as well as classical test theory and critical thinking theory.

Predictors of Readiness for NCLEX-RN®

According to Barkley, Rhodes, and Dufour (1998), success on NCLEX-RN® was reported in the literature to have many predictive factors, both academic and nonacademic. Two variables from nursing programs seen consistently as predictive of NCLEX-RN® success were, final course grade in the senior-level medical-surgical course and cumulative GPA in the program (Daley, Kirkpatrick, Fraizer, Chung & Moser, 2003). In a meta-analysis by Campbell and Dickson (1996) of 172 studies completed from 1981 to 1990, it was noted that cumulative GPA in nursing course work was the best predictor of NCLEX-RN® success. However, as the final cumulative GPA is determined post completion of the program, this does not allow for remediation that could increase the likelihood of NCLEX-RN® success.

Crow, Handley, Morrison, and Shelton (2004) also investigated factors that were predictive of NCLEX-RN® success. These authors utilized survey methodology to conduct a descriptive study on a national sample to extrapolate the best predictors of success in BSN programs as well as future success on NCLEX-RN®. A response rate of 31.2 percent from 513 BSN programs was obtained on a second mailing. Findings

identified several positive predictors of success such as the use of exit examinations as a graduation requirement, admission requirements of ACT/SAT and standardized pre-admission testing and clinical proficiency testing, and commercial review courses at the end of the program. This survey also cited the demographic variable of white, non-Hispanic as being predictive of future NCLEX-RN® success.

Alexander and Brophy (1997) reported Scholastic Aptitude Test (SAT) verbal scores, nursing GPA, and National League for Nursing (NLN) comprehensive achievement test scores were the best predictors of NCLEX success in the associate and baccalaureate sample group (N = 94). In addition, science and math grades were seen as predictive of success both in nursing programs and on the NCLEX-RN® licensing examination (Waterhouse & Beeman, 2003). Potolsky, Cohen and Saylor (2003) reported that prerequisite science course outcomes were reliable predictors of program and subsequent NCLEX-RN® success. In a similar study, Roncoli, Lisanti and Falcone (2000) found that higher grades in science and nursing courses increased the likelihood of success on the licensure examination. Conversely, in a descriptive study by Arathuzik and Aber (1998) utilizing a convenience sample of 79 nursing students, factors predictive of future success on NCLEX-RN® were determined to be higher cumulative GPA, well-honed study skills, and fewer external pressures such as family and work responsibilities. Bentley (2006) reported a high correlation between strong clinical behaviors and course grades for clinical and subsequent success on NCLEX-RN®.

In a study using a quick, hand-scored assessment tool developed by the authors, the Risk Appraisal Instrument (RAI), Barkley et al. (1998) found the tool “correctly classified 95.59 percent of those students who passed the NCLEX-RN® and 76.92 percent

of those who failed the exam” (p. 136). The procedure consisted of analysis of student records with a weight determined for course grades; “using a trial-and-error technique, weights for each item were determined following repeated analysis of the data” (Barkley et al., 1998, p. 136). An RAI score was then determined for each student.

In an adaptation of the RAI developed by Barkley et al. (1998), Waterhouse and Beeman (2003) identified that 61% of NCLEX-RN® failures were correctly classified utilizing the tool, Delaware Risk Appraisal Instrument (DRAI). DRAI scores of 176 or below were found to correlate with high risk of failure of NCLEX-RN® while scores of 253 and above determined low risk of licensure failure. The RAI (or DRAI) are more simplistic tools and did not approach the statistical accuracy of more complex methods but provided a useful, quick method of ascertaining those students at risk early in nursing programs (Barkley et al, 1998; Waterhouse & Beeman, 2003).

Admission criteria have served to be good predictors of success in nursing programs and subsequent pass scores on the NCLEX-RN® (Gallagher, Bomba & Crane, 2001). Yin and Burger (2003) reported use of admission criteria as predictors of future success in nursing programs and on NCLEX-RN® better serves society because those students who are most likely to complete programs of study and enter the work force are identified. In addition, those who are more likely to struggle in programs of study are recognized so remediation services can be provided at an early point in the curriculum.

Computer anxiety is a form of test anxiety that may have an unfavorable effect on student performance, especially for non-traditional students. “The computerized licensure exam, CAT NCLEX-RN®, adopted in 1998, has added yet another dimension to predictive studies, such as whether students have adequate experience in computerized

test taking” (Waterhouse & Beeman, 2003, p. 35). A study by the NCSBN (nd) compared computer literate and non-computer literate candidates and found no significant difference in passage rates between the two groups. However, nursing programs continue to strive for multiple experiences with computer testing prior to program completion and candidacy for NCLEX-RN®. According to Reising (2003) experience with computer testing prior to sitting for the licensure examination serves to increase student confidence levels for this method of testing.

According to Sydow and Sandel (1998), in a study of reasons students did not complete their course of study, work and family were found to be the two most reported causes for attrition. Working in excess of 20 hours per week was found to be a predictor of failure in course work. Daley et al. (2003) reported that family responsibilities and need for employment were determined to be common factors in students at risk in nursing courses. In a study by Sayles, Shelton and Powell (2003) high stress levels and negative money/time issues were associated with decreased probability of passing NCLEX-RN®.

Low self-esteem has been cited as predictive of difficulty with nursing course work and subsequent failure on NCLEX-RN®. In addition, test anxiety, poor study skills and lack of motivation have been identified as predictors of NCLEX-RN® failure.

According to DiBartolo and Seldomridge (2005) gender, age, ethnicity and number of years between first degree and enrollment in nursing were factors indicative of potential success on NCLEX-RN®. Beeson and Kissling (2001) reported non-traditional age students had a higher rate of passing the licensure examination than traditional age students in a sample size of 505. The investigators defined traditional students as those

less than 23 years of age and non-traditional as older than 23 years of age at the time of NCLEX-RN® examination.

In a study by Endres (1997), comparison of success on NCLEX-RN® among African-American, foreign born and white graduates from four baccalaureate nursing programs between 1987 and 1992 was undertaken. This author noted no significant difference in pass or fail status of these ethnic groups when compared to each other. Endres (1997) reported, however, that African American students had lower college GPA's and lower GPA's in math, science, and nursing course work. In addition, foreign-born students had lower math and science GPAs than American-born students. The factor that most determined failure in NCLEX-RN® for all students was the number of C's, D's and F's received in course work during the nursing program (Barkley et al., 1998).

Types of Nursing Programs

As in the 1950's when AD nursing programs proliferated, in 2008 accelerated BSN programs have become prevalent. Cangelosi and Whitt (2005) reported the first accelerated program was a second-degree, one-year program offered by Saint Louis University in 1971. There were over 31 such programs in the U.S. in 1990 with the number of programs increasing to over 133 by 2001. According to a 2007 report by the American Association of Colleges of Nursing (AACN), the growth of BSN accelerated programs increased to 197 in 1997 with 37 more in the planning stages.

The thrust in the development of the accelerated program has been the nursing shortage crisis. Miklancie and Davis (2005) reported "the challenge is to educate registered nurses who are safe and competent practitioners of nursing at a faster pace without compromising the value of educational programs" (p. 291). Accelerated BSN

programs offer students with previous degrees in other disciplines, or those with substantial course work earned but no degree, an opportunity to finish a nursing program in from one to three years. Consideration is given to type of degree and number of credit hours previously obtained by the student. In addition to having previous college credit, these “accelerated” adult learners have a variety of life experiences that not only assist them during the curriculum, but provide enhanced learning for more traditional students as adult learners share their learning experiences.

An innovative delivery method of a BSN curriculum is known as the two plus two program. In this concept students complete the traditional associate in nursing program and are eligible for the licensure examination, then complete course work toward the BSN degree while working as a registered nurse. The major advantage of this type of program is that it addresses the nursing shortage by supplying nurses for the workforce in approximately two years while providing the opportunity for students to continue toward a BSN degree while earning RN wages.

Theoretical Framework

Adult Learning Theory

Adult learning theory provided an appropriate theoretical foundation for this study. Adults differ from children in ways in which they learn. This creates special needs and requirements within the learning environment. Malcolm Knowles pioneered the field of adult learning and introduced the term andragogy to mean learning in adulthood (Merriam & Caffarella, 1999). The following are characteristics of the adult learner (Lieb, 1999):

1. Adults are autonomous and self-directed.
2. Adults have accumulated a foundation of life experiences and knowledge that may include work-related activities, family responsibilities and previous education.
3. Adults are goal oriented.
4. Adults are relevancy oriented.
5. Adults are practical.
6. Adults need to be shown respect, as do all learners (p. 1-2).

Knowles (1970) determined that a learning climate of mutual trust and one that clarified mutual expectations is necessary for the adult learner to excel. Russell (2006) stated “the reasons most adults enter any learning experiences is to create change” (p. 349). Adult learners differ from school-age learners in motivation, amount of previous experience, how engaged the learner is in the learning process, and how the learning is applied (Russell, 2006). In addition, life experiences often promote the motivation to learn for adult learners.

According to Lieb (1999) “there are four critical elements of learning that must be in place to assure that learning occurs: 1) motivation, 2) reinforcement, 3) retention, and 4) transference” (p. 3). To enhance motivation individuals working with adult learners need to establish an open learning environment and challenge learners while eliminating any unnecessary stress. Feedback for learners is also very important. Lieb, 1999, has described the following use of positive and negative reinforcement:

Positive reinforcement is normally used by instructors who are teaching participants new skills. As the name implies, positive reinforcement is “good” and

reinforces “good” (or positive) behavior. Negative reinforcement is normally used by instructors teaching a new skill or new information. It is useful in trying to change modes of behavior. The result of negative reinforcement is extinction - that is, the instructor uses negative reinforcement until the “bad” behavior disappears or becomes extinct (p. 4).

Instructors/teachers must stress retention of information by learners for learning to be successful. For retention of material learners need to interpret and apply information in the learning environment. The importance of the material being disseminated needs to be further evaluated. Allowing learners practice time, “repetition, repetition, repetition”, assists in retention of material. Lastly, transference, how information is utilized in settings away from a classroom, is important. How participants are able to associate new information with something already known will aid in transference (Lieb, 1999).

Learning styles need to be ascertained to determine best methods for disseminating information. Learning style theory was proposed by cognitive psychologists and is defined as “characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with and respond to the learning environment” (Hartman, 1995, p. 18). The concepts of learning styles and learning preferences are used interchangeably. The classic learning preferences are identified as visual, auditory, and tactile or kinesthetic. Individuals have a dominant learning preference. Adult education must offer techniques that appeal to all types of learning preferences to keep students actively involved in learning. Whether or not a learner’s learning preference is matched by the delivery of the material can have a positive or negative influence on the learner’s performance (Hartman, 1995).

There is a potential for more barriers to learning for adults than for children such as work, family and other expectations that may be more prevalent than those encountered by child learners. Some of these barriers to learning are time to attend the session, outlay of money for the program of study, conflicting schedules, and having confidence to further one's education. Both intrinsic and extrinsic factors have an effect on motivation to attend a particular program. Lieb (1999) reported "the best way to motivate adult learners is to enhance their reasons for enrolling and decrease the barriers" (p. 2).

Classical Test Theory

Classical test theory is the study of measurement problems and methods of resolving those problems that has become a specialized discipline in education and psychology (Crocker & Algina, 1986). This body of related psychometric theory predicts outcomes of psychological testing such as the difficulty of items or the ability of test takers.

Application of test theory is prevalent in standardized tests utilized in nursing programs. "The conceptual framework used to develop HESI examinations is grounded in classical test theory and critical thinking theory" (Morrison, Adamson, Nibert, & Hsia, 2004, p. 221). Psychological measurement processes were utilized to create, administer, and interpret HESI examinations. Test-taking behaviors can be determined by identifying relationships between psychological themes and practical outcomes. The first step used by HESI in the process of test development was to acquire nursing syllabi from nursing programs across the United States along with NCLEX-RN® test blueprints provided by

the NCSBN to define test items that reflect behaviors required for entry-level nursing practice (Morrison et al., 2004).

To develop critical thinking test items by HESI, critical thinking theory and the taxonomy developed by Bloom, Engelhart, Furst, Hill and Krathwohl (1956) were utilized. To ensure positive correlation with the current practice of nursing in the U. S., test item evaluation by both nurse educators and nurse clinicians occurred. High priority and high-frequency practice issues undertaken by entry-level nurses received careful scrutiny (Morrison et al., 2004). Test items were categorized and stored in a test bank for future usage

Standardized tests developed by the National League for Nursing (NLN) have long been available for nursing programs to measure student learning. In addition the Mosby Assess Test was found to have a fair degree of accuracy in predicting NCLEX success, but is a paper and pencil test where results are received at a later date and rationales for the questions are not available at the time the test is taken (Haas et al., 2004). The HESI Exit Exam (E2) and the ATI Comprehensive RN Predictor are computer-based and provide a score at the end of the test period. The E2 is a 160-item examination that addresses the NCLEX-RN® test plan and may be given proctored or un-proctored (Morrison et al., 2002). The ATI examination is a 180-item examination that also covers the aspects of the NCLEX-RN® test plan and requires an examination proctor (Davenport, 2007). In addition, Educational Resources, Inc. (ERI) offers the RN-CAT and RN-CAT Plus, types of computer-adapted tests patterned after the format of NCLEX-RN®.

Critical Thinking Theory

Critical thinking skill has been described as essential to the development of practicing nurses (Turner, 2005; Giddens & Gloeckner, 2005). Critical thinking is an element of nursing education guidelines in the United States. The National League for Nursing Accrediting Commission criteria No. 13A identified critical thinking as an essential skill for nursing curricula (National League for Nursing Accrediting Commission, 2004).

Critical thinking, a priority of higher education, is an integral part of professional accountability and quality care within nursing. Nursing critical thinkers practice the cognitive skills of analysis, application of standards, discrimination, seeking knowledge, logical reasoning, intuition, and transformation of knowledge (Scheffer & Rubenfeld, 2000).

Giddens and Gloeckner (2005) reported a study undertaken to explore the relationship between student critical thinking skill and performance on NCLEX-RN®. A sample of university-based baccalaureate nursing students completed two critical thinking tests, the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) both at the beginning and at the end of the nursing curriculum. The results demonstrated that students who passed NCLEX-RN® had statistically significant higher scores on CCTST, both on entry and exit testing. On the exit CCTDI, students who passed NCLEX-RN® had higher scores on five of the eight scales. No statistical difference was noted on the entry level CCTDI and subsequent results on NCLEX-RN®.

NCLEX-RN® Test Plan

“The National Council of State Boards of Nursing (NCSBN) is responsible to its constituents in the creation of psychometrically sound and legally defensible licensure examinations” (NCSBN, Executive Summary, 2007, p.1). The NCLEX-RN® test plan is reviewed and subsequently approved by the NCSBN Examination Committee to ascertain consistency with state nurse practice acts. This review process conduction occurs every three years and involves a job analysis survey of newly licensed nurses. One hundred and fifty activity statements concerning current nursing practice were included in the job analysis survey, “a stratified random sample of 6,000 RN’s was selected from lists of candidates successful on the NCLEX-RN® examinations from January 1, 2005 through May 31, 2005” (NCSBN, Executive Summary, 2007, p. 1). A return rate of 29% (N = 1,666) occurred which was an increase in the number of respondents from the previous study. The results of the survey were utilized in the development of the licensure examination utilized throughout the United States.

The licensure examination includes items that use Bloom’s taxonomy for the cognitive domain (Anderson & Krathwohl, 2001). Because the practice of nursing requires application of knowledge and skills, most of the questions on the examination are written at the application or higher levels of cognitive ability (2007 NCLEX-RN® Detailed Test Plan, NCSBN, 2007).

The structure of the NCLEX-RN® test plan is based on client needs which define nursing actions and competencies. The four categories of client needs of the 2007 NCLEX-RN® Test Plan with percentages of test questions in each category are (2007 NCLEX-RN® Detailed Test Plan):

Safe and Effective Care Environment	Percentage of Items/ Each Category
<ul style="list-style-type: none"> • Management of Care 	13-19%
<ul style="list-style-type: none"> • Safety and Infection Control 	8-14%
Health Promotion and Maintenance	6-12%
Psychosocial Integrity	6-12%
Physiological Integrity	
<ul style="list-style-type: none"> • Basic Care and Comfort 	6-12%
<ul style="list-style-type: none"> • Pharmacological and Parenteral Therapies 	13-19%
<ul style="list-style-type: none"> • Reduction of Risk Potential 	13-19%
<ul style="list-style-type: none"> • Physiological Adaptation 	11-17%

The NCLEX-RN® examination format for eligible candidates through a method of computerized adaptive testing (CAT):

CAT is a method of delivering examinations that uses computer technology and measurement theory. Items go through an extensive review process before they can be used as items on the examination. Items on a candidate's examination are primarily four-option, multiple choice-items. Other types of item formats may include multiple-choice items that require a candidate to select one or more responses, fill-in-the-blank items, or items asking a candidate to identify an area on a picture or graphic. Any of the item formats, including standard multiple-choice items, may include charts, tables or graphic images. With CAT each candidate's examination is unique because it is assembled interactively as the examination proceeds. Computer technology selects items to administer that match the candidate's ability level. The items, which are stored in a large item

pool, have been classified by test plan category and level of difficulty. After the candidate answers an item, the computer calculates an ability estimate based on all of the previous answers the candidate selected. The next item presented to the candidate is selected from the set of items that measure the candidate's ability most precisely in the appropriate test plan category. This process is repeated for each item, creating an examination tailored to the candidate's knowledge and skills while fulfilling all NCLEX-RN® Test Plan requirements. The examination continues with items selected and administered in this way until a pass or fail decision is made. All registered nurse candidates must answer a minimum of 75 items. The maximum number of items that the candidate may answer is 265 during the allotted six-hour period (2007 NCLEX-RN® Test Plan, p. 7).

The passing standard analysis occurs every three years, at the time the test plan is reviewed, to ensure that the passing standard for the NCLEX-RN® examination is consistent with the degree of nursing ability currently required to practice competently in entry-level nursing positions. The following information is crucial to decision-making in the determination of passing standard (NCSBN, Passing Standard, 2007):

- The results of a standard setting exercise undertaken by the Panel of Judges. Currently, this exercise consists of a modified Angoff procedure, with additional statistical result compromise procedures. Also, a list of members on the Panel of Judges and their qualifications are included.
- A historical record of the passing standard and annual summaries of candidate performance on the NCLEX® examination since the implementation of the CAT methodology in 1994.

- The results from the annual Standard Setting Survey, which solicits the opinions of employers and educators regarding the competence of the current cohort of entry-level nurses.
- Information detailing the educational readiness of high school graduates who expressed an interest in nursing. Currently American College Testing service (ACT®) provides this information (p. 1).

A decision by the NCSBN Board of Directors to raise the NCLEX-RN® passing standard occurred at the December 2006 meeting. “The NCLEX-RN® passing standard was changed from -0.28 to -0.21 logits. It was implemented April 1, 2007, in conjunction with the new 2007 NCLEX-RN® Test Plan” (NCSBN, Passing Standard, 2007, p. 1). Wendt and Kenny (2007) reported “a simplified explanation of a logit, or ‘a log odds ratio unit’, is an equal interval unit of measurement like centimeters” (p. 104).

At-Risk Students

Prediction of students at risk for failure both in the nursing program and with NCLEX-RN® is an important responsibility of nurse educators. The present nursing shortage, as well as financial and self-esteem issues that occur with lack of success, make it mandatory to recognize and assist those students who will struggle with nursing education. Safety issues with high acuity patients who are seen in acute and chronic care settings mandate that only students who meet expected competencies be allowed to continue in nursing programs.

According to Daley et al. (2003), through research the use of scores from standardized testing can be utilized to identify students who are at risk for both nursing program and NCLEX-RN® failure. Stuenkel (2006) used a correlationally-designed study

to focus on those students who were identified as at risk for failure on NCLEX-RN®. The sample in this study (N = 241) included 140 students who passed the licensure examination and 71 students who did not. This author utilized discriminant analysis to determine the best standardized testing provided during the program to be the NLN Community Health examination as it correctly identified 24% (17) of the students who failed NCLEX-RN®. Early identification allows for remediation during the nursing program of study.

Morton (2006) reported an important issue in remediation for nursing students related to preparation for the licensure examination was determining the point in the program of study to insert the remediation and the best method of remediation for the most students. Morton (2006) found that waiting until the end of a nursing program of study was often too late to benefit graduates for success on NCLEX-RN®.

According to Nibert, Young, and Adamson (2002) the annual passage rates for NCLEX-RN® have decreased in succession from 1995-2000, from 90.2% in 1995 to 83.8% in 2000. This information makes it imperative for nurse educators to identify at-risk students prior to the end of the program so that remediation plans can be initiated to prevent NCLEX-RN® failure. As a result many nursing programs have begun to utilize the HESI Exit Exam (E2) as a benchmark for progression and remediation. Morrison et al. (2002) reported such test usage to be very effective in identifying students at risk for failure on NCLEX-RN®. In addition, Davenport (2007) cited a similar advantage in the use of ATI's Comprehensive RN Predictor examination to ascertain probability of passing NCLEX-RN® as a first-time tester.

Progression Policies

Morrison et al. (2004) defined a progression policy as withholding permission to take NCLEX-RN® until attainment of a certain score on the HESI-Exit exam (E2). Remediation was recommended and was defined as “any type of additional study used by students in preparation for retesting” (Morrison et. al., 2002, p.95). Progression policies can be tailored for any program requirement, but will be defined in this study as a requirement for students to complete program stipulations thus being allowed to complete application to take NCLEX-RN®.

Individual nursing programs that utilize progression policies choose the benchmark for their program based on the literature and factors associated with their own programs. Nibert, Young and Britt (2003) studied 45 nursing programs with regard to their benchmark selection and found that 36 of the 45 programs (80%) selected 850 on E2 as their progression benchmark.

Spurlock (2006) reported an increasing number of nursing programs are utilizing progression policies that delay a student from taking NCLEX-RN® if the score on HESI Exit Exam (E2) is lower than the benchmark set by that program. A variety of remediation practices are utilized to further prepare the student prior to taking NCLEX-RN®. Michel (2006) raises the issue of relying on one test as a predictor of success on the licensure exam. Providing the opportunity to retake the E2 is an important factor in preparation for NCLEX-RN®.

Davenport (2007) reported that while setting benchmarks for student performance on standardized tests as a graduation requirement is a trend that has increased, the setting of specific benchmarks that might identify students at risk for NCLEX-RN® failure has

been less widely described. Nibert et al. (2003) cited a study that found nursing programs are requiring completion of remediation plans for at-risk students prior to granting approval for graduation and NCLEX-RN® candidacy.

Ethical issues related to progression policies must be entertained. According to Norton, Relf, Cox, Farley and Tucker (2006) research by the National Council of State Boards of Nursing (NCSBN) has demonstrated that pass rates tend to decrease as length of time from program completion and NCLEX-RN® test date increases. In requiring remediation plans that necessitate a length of time prior to eligibility to take NCLEX-RN®, nursing programs may inadvertently decrease a candidate's likelihood of passing the licensure examination.

In addition, challenge of progression policies by the legal system as potentially disadvantageous to graduated students due to delay in candidacy for NCLEX-RN® have occurred. The potential for increased likelihood for success on the licensure examination due to increased study time, versus the potential for decreased success due to the time interval between completion of the program of study and taking the examination, need to be further investigated.

Chapter Three

Methodology

Study Design

Developing predictive criteria for success on NCLEX-RN® is an important consideration for nursing programs because it involves high stakes for both students and nursing programs (Spurlock & Hanks, 2004). Accountability of nursing programs is based in large measure by passage rates of graduated nursing students on NCLEX-RN®. In addition, the nursing shortage in 2008 increases the need for success on NCLEX-RN® to supply the ranks of practicing nurses both in the locale of this nursing program and nationally.

Academic and nonacademic predictors of NCLEX-RN® success as identified in this study were tracked over a five-semester nursing program at a Midwestern college for four cohorts of students, spring 2006, summer 2006, spring 2007 and summer 2007. NCLEX-RN® results for these cohorts of students (as first-time test takers) were obtained for analysis. Anonymity of records was maintained during the study as student information was numerically coded to eliminate identifying factors. While permission was received from the parent institution and the site where the study was conducted, as well as from the college where the degree for this author will be conferred, the participants were not specifically asked to participate in the study as the data collection occurred one to two years after completion of the program and utilized archived data. Confidentiality was maintained as all data specific to individual students was kept in a secure site and viewed by the author of the study only. Data was entered into the

Statistical Package for the Social Sciences (SPSS) 16.0 by the author to ensure that no connection would be identified between students and coded data.

This retrospective, descriptive study was designed to answer the questions:

1. Is there a significant difference between academic predictors and subsequent success on NCLEX-RN®?
2. Is there a significant difference between nonacademic predictors and subsequent success on NCLEX-RN®?
3. Is there a significant relationship between student scores on two types of exit standardized tests, Health Education Systems, Inc. (HESI) and Assessment Technologies, Inc. (ATI) and subsequent success on NCLEX-RN®?
4. Is there a significant difference between 2006 and 2007 students success on NCLEX-RN®?
5. Is there a significant difference in ASN and accelerated BSN student's success on NCLEX-RN®?

Permission to conduct this study was received from the Institutional Review Committee (IRC) of the institution where the study was conducted and from the Institutional Review Board (IRB) of the college this author attended at the time of this research project. In addition, consent of administrators at the institution under study was received prior to initiation of the project (see Appendix A).

Population and sample. The population for this study consisted of students who completed a five-semester nursing program from May 2006 to August 2007 at a private college in a Midwestern city. The total number of students in this population was 338. All

of the students were included in the study; however, there were occasional instances of missing data in student records that were addressed in presentation of the results.

Variables. The *independent variables* for this study were various academic and nonacademic predictors of NCLEX-RN® success, the HESI Exit Exam (E2) scores, and the Comprehensive RN Predictor (ATI) scores; the *dependent variable* was NCLEX-RN® results. Some possible extraneous variables were demographics of students, test anxiety, and term in which students were finishing the program of study. Because the nursing program allowed students to complete the entry-level portion at the ASN level or to continue for a BSN degree (accelerated students), not all students had identical programs of study. In addition to the same basic nursing course work completed by all students, accelerated BSN students took BSN courses. This increased workload may have contributed to stress and reduced the time and commitment to the basic nursing course work. All students were candidates to take the NCLEX-RN® at the end of the ASN portion of the program. This study investigated predictors of subsequent NCLEX-RN® success for both ASN and accelerated BSN students.

Instrumentation. Data were utilized from the NCLEX-RN®, which is a psychometrically sound licensing examination that has established legal parameters:

The National Council of State Boards of Nursing (NCSBN) is responsible to its members, the boards of nursing in the United States and five territories, for the preparation of psychometrically sound and legally defensible licensure examinations. The periodic performance of practice analysis (i.e., job analysis) studies assists the NCSBN in evaluating the validity of the test plan that guides content distribution of the licensure examination. Because changes can occur in

registered nurse (RN) practice, practice analysis studies are conducted on a three-year cycle. A number of steps were necessary for the completion of this practice analysis: a panel of subject matter experts was assembled, a questionnaire was developed, a sample of newly licensed nurses was selected and data were collected and analyzed (NCSBN, Executive Summary, 2007, p. 1).

Nurse graduates are required successful completion of the NCLEX-RN® licensure examination as a method of ensuring safe nursing practice. Every three years the National Council of State Boards of Nursing (NCSBN), which develops and administers NCLEX-RN®, circulates a job analysis survey to a sample of 6000 entry-level nurses to ascertain current practice trends. According to current job analysis studies, beginning nurses are expected to perform at an increasingly high level based on complexities in health care settings (Nibert & Young, 2001; Morrison et al., 2002; Bonis, Taft & Wendler, 2007). Therefore, the NCSBN has increased the passing standard for the NCLEX-RN® in 2004 and 2007 (NCSBN, Passing Standard, 2007).

The HESI Predictability Model (a proprietary mathematical model) was utilized to calculate scores on HESI examinations. “Test items are individually weighted based on their difficulty level, which is determined by dividing the number of correct responses to the item by the total number of responses to that item, thereby deriving a percentage of correct responses to the item” (Morrison et al., 2004, p. 222). Attribution of a conversion score to each item occurred. This represents “a percentage that reflects the average weight of all the test items on an exam and the average weight of the test items answered correctly” (Morrison et al., 2004, p. 222). As such, this conversion score may be utilized as part of students’ final course grades.

HESI database records showed an increase in the number of schools of nursing who utilized HESI examinations “from 85 in December 1999 to 565 in December 2003, an increase of 565% in 4 years” (Morrison, et al., 2004, p. 220). The HESI Corporation provides many different examinations including admission assessment and specialty exams in addition to the HESI Exit Exam (E2). Extensive evaluation of reliability and validity were conducted by HESI to insure faculty who utilize these tests make evidence-based decisions regarding HESI scores (Morrison et al., 2004).

HESI, Inc. Scoring Information (2004) suggested a score of 900 as the recommended level and a score of 850 as the acceptable level on the E2. Validity studies of the E2 covering four years revealed 96.49% to 98.46% accuracy in prediction of NCLEX-RN® success (Lauchner et al, 1999; Nibert & Young, 2001; Nibert et al., 2002).

Reliability of the NCLEX examination was ascertained by using a decision consistency statistic:

This statistic is used instead of a traditional reliability statistic such as Cronbach’s alpha because it captures the reliability of dichotomous pass/fail decisions rather than the reliability of continuous scores of ability estimates. The decision consistency statistic incorporates a candidate’s ability estimate and standard error with normal theory to obtain two probabilities: the probability that the candidate’s ‘true’ ability (as opposed to the estimate of their ability) is above passing and the probability that their ‘true’ ability is below passing (NCSBN, 2007, p. 1).

Reliability is high on standardized exit examinations as well as on the licensure examination. The HESI Exit Exam (E2) demonstrated reliability as the HESI Corporation conducts item analysis on each exam that is administered and returned; “discrimination

data are obtained for each test item by calculating a point- biserial correlation coefficient” (Morrison et al., 2004, p. 223). In addition, Morrison et al., 2004 reported “the estimated reliability coefficients for these HESI exams ranged from 0.86 to 0.99, and the number of times the items were used on these exams ranged from 180 to 47, 320” (p. 223).

The Comprehensive RN Predictor exit examination formulated by ATI has been psychometrically evaluated:

Evidence of score validity must be, of necessity, linked to the purpose and use of the test scores. As with any assessment, a primary source of validity evidence is demonstration of content validity. The detailed information provided for content domains and for the test development process is intended to provide this content validity evidence and give confidence to the user that an iterative review, evaluation and revision process was used in the development of the items to maximize the alignment of the items to the knowledge and skills purported to be measured. Additional validity evidence addresses the internal structure of the test. Specifically, subscales on a test designed to measure the same construct should correlate with one another. The two item-type subscales were found to have a correlation of 0.429. Because the correlation between two scales is bounded by the reliability of the scales themselves, a correction for attenuation was employed to estimate the correlation between the two subscales if each were perfectly reliable: the corrected correlation between the subscales was 0.870 (Technical Manual for the ATI RN Comprehensive Predictor, Version 3.0, 2007. p. 9-10).

Assessment Technologies, Inc. (ATI) has produced and made available for purchase a Comprehensive Assessment and Remediation Package (CARP) (ATI, 2007).

This package allows students to test with each course in the nursing program and to assess their knowledge base of the NCLEX-RN® blueprint by the end of the program. The use of ATI over HESI or other available products is based on the comprehensive nature of the materials provided (Davenport, 2007). While HESI provides custom testing for individual programs and an exit exam at the end of the program, ATI offers testing with each course, an exit examination plus books, DVDs and computer-based materials to aid students throughout the nursing program. In addition, ATI offers students opportunities to track their individual progress on testing and remediation materials as they progress through the nursing program. ATI provides recommended benchmarks with each content mastery assessment including the end-of-program examination, Comprehensive RN Predictor. This College utilized 62% in 2007 as the benchmark for the Comprehensive RN Predictor that statistically correlated with a 92% likelihood of a pass on the NCLEX-RN® as a first-time tester (ATI, 2007).

The HESI Exit Exam (E2) scores were obtained for each of the spring (2006) and summer (2006) students who completed the ASN program. The E2 was proctored by nurse educators and secured during administration. A computer expert employed by the nursing program downloaded and exported the data to the HESI corporation. Individual student probability scores of passing the licensure examination were calculated by the HESI database and printed for students upon completion of the E2. In addition, a summary of the scores for all students within the program who took the E2 was provided to the nursing program by HESI, Inc. NCLEX-RN® results were obtained quarterly (an approximate three month period) from the individual State Board of Nursing (BON).

ATI scores were obtained for each of the spring (2007) and summer (2007) students who completed the ASN program. The ATI Comprehensive RN Predictor exam was proctored by nurse educators and secured during administration. Because this is a web-based examination, students received immediate feedback at exam conclusion. In addition, a summary of student results was available at the website for faculty perusal.

The statistical analysis used for this study was the *t*-test for analysis of HESI Exit Exam (E2) scores and NCLEX-RN[®] results for the spring 2006 and for the summer 2006 graduates. Also, the *t*-test was used for analysis of Comprehensive RN Predictor (ATI) scores and NCLEX-RN[®] results for the spring 2007 and for the summer 2007 graduates. The level of significance was preset at $p < .05$. In addition, frequency distributions were used to demonstrate descriptive statistics. Comparison of NCLEX-RN[®] results for the cohort groups and for the ASN and accelerated BSN groups were also displayed by frequency tables. The mean scores were determined on the E2 and ATI. The *t*-test for means was calculated to determine if a difference between the means of the two samples for each examination was significant (Fraenkel & Wallen, 2006). Both parametric (*t*-test for means) and non-parametric (chi-square) testing were utilized to represent the level of measurement of the academic and nonacademic variables. Chi-square and *t*-test statistics were used to analyze hypotheses.

It is important to note that a progression policy was utilized for the 2006 cohort of students who took the E2. This policy stipulated that students who did not score 850 or above on the E2 would be required to take an NCLEX review course prior to release of transcripts. There were two attempts allowed on the E2, two weeks apart with remediation between the two tests. As a requirement for students to be allowed to take the

NCLEX-RN® is transcript review by the Board of Nursing (BON), students were mandated to take a review course for release of their transcript to the BON.

In contrast, the 2007 students were encouraged to take an NCLEX review course if their ATI score was below 62% after two attempts of the ATI Comprehensive RN Predictor, but not required to do so. These students received the same remediation assistance, but were allowed release of their transcript after the remediation only. The reasons for the change in progression policy were both legal and ethical. The legalities of withholding student transcripts was at issue. In addition, many authors have reported an ethical concern in withholding permission to take NCLEX-RN® as statistics demonstrate the longer the time interval between end of the nursing program and taking NCLEX-RN®, the less likelihood of being successful (Beeman & Waterhouse 2003; Jacobs & Koehn, 2006; Norton et al., 2006). Conversely, there has been reported a trend for students to take the licensure examination the first time for practice. This can be a dangerous practice as research has demonstrated a decreased likelihood of a pass on NCLEX-RN® for repeaters.

Possible threats to internal validity in this study were subject characteristics, testing, and attitude. The researcher controlled for subject characteristics in grouping subjects with like characteristics when possible during data analysis. The testing threat was a consideration as the HESI Exit examination and the ATI Comprehensive RN Predictor are based on the NCLEX-RN® blueprint. Some students may have an advantage based on a greater ability to transfer knowledge between the exit examinations and NCLEX-RN®. Attitude of subjects was difficult to control. Students may not see the E2 or ATI exams as predictive of NCLEX-RN® success, and, therefore, not take the

exams seriously so scores may not reflect true student ability. Test anxiety, being tired on the day of the exit examination, peer pressure and other attitudinal factors may affect the results on the standardized examinations.

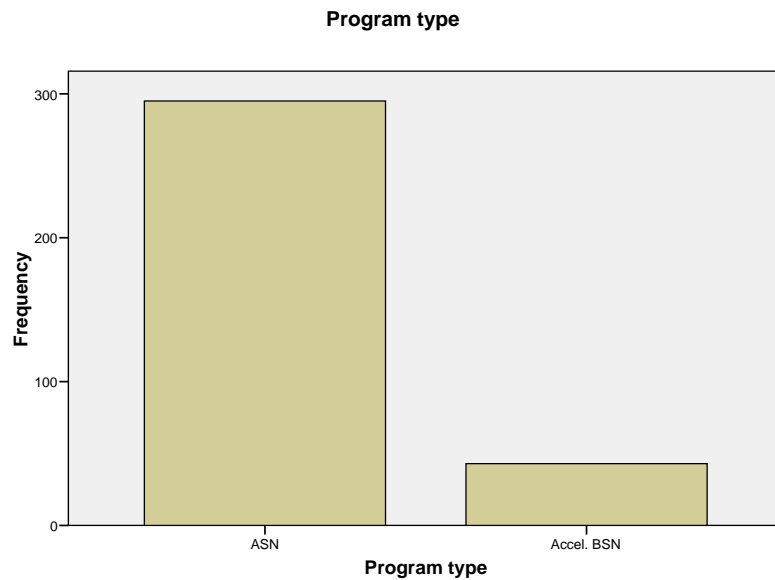
Chapter Four

Results

Introduction

The purpose of this study was to explore possible differences between academic and nonacademic predictors and subsequent success on NCLEX-RN® examination, the licensure examination to practice in the field of nursing as a registered nurse. This study was conducted at one fully accredited college of nursing in the Midwest. The sample included all of the students (N = 338) who completed the ASN program of study in 2006 and 2007. This sample included 295 ASN students and 43 accelerated BSN students (Figure 1). Ten missing NCLEX-RN® results occurred in each of the statistical analyses because these students may not have taken the licensure examination at the time of conduction of this study. There was a trend at this College for accelerated BSN students to wait until they completed the BSN degree to take NCLEX-RN®.

Figure 1. ASN and accelerated BSN Program type



Organization of this chapter included demographic information about the sample and descriptive statistics to describe and summarize the characteristics of the sample, to examine relationships between variables and to assess differences in those who successfully completed NCLEX-RN® and those who did not. Table 1 demonstrates values and means of variables. In addition, inferential statistics further delineated possible relationships between predictors and licensure examination results. Each of the research questions were addressed utilizing descriptive or inferential statistics, as well as a Type 1 error rate (alpha) of .05, with the Statistical Package for the Social Sciences (SPSS) 16.0.

Table 1

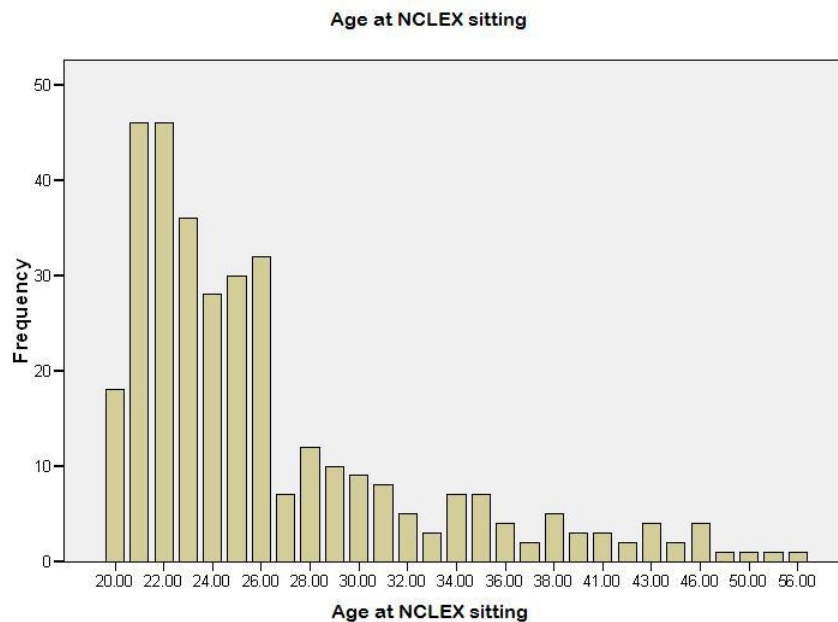
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age at NCLEX time	338	20.00	56.00	26.3412	6.42766
Gender	338	1.00	2.00	1.0710	25722
Ethnicity	338	1.00	7.00	1.1746	86936
College GPA	338	2.08	3.96	3.0309	40274
High school GPA	321	1.66	4.05	3.1526	53119
ACT	261	13.00	30.00	21.1724	3.18001
Math ACT	260	6.00	31.00	19.8846	3.92917
Science ACT	257	8.00	30.00	21.3813	3.19340
Previous college credits	337	1.00	4.00	2.9199	.89449
HESI Exit Test	172	465.00	1119.00	770.1802	132.31244
ATI Comp. Predictor	161	47.80	77.80	63.9410	5.36095
Program type	338	1.00	2.00	1.1272	33371
NCLEX-RN®	328	1.00	2.00	1.2470	43190
Marital status	338	1.00	3.00	1.3343	61923
Completion date	338	1.00	4.00	2.4142	1.11373
Nursing course	338	1.00	8.00	4.4290	1.87186
Science course	338	1.00	8.00	3.0799	1.97375
Repeated course	338	1.00	2.00	1.1627	36966

Descriptive Statistics

Age at sitting for NCLEX-RN® examination. Students in the sample ranged in age from 20 to 56 years with a mean age of 26.34 (Figure 2). This is consistent with the literature as many nursing students have had other educational pursuits and life experiences prior to entering nursing programs (Jacobs & Koehn, 2004; Higgins, 2005).

Figure 2. Age at NCLEX sitting



Gender. The sample was predominantly female, 314 to only 24 male students which is also consistent with the literature (Vere-Jones, 2008). The number of men in nursing has been increasing over the past 20 years, but female nurses continue to significantly outnumber their male counterparts (Table 2).

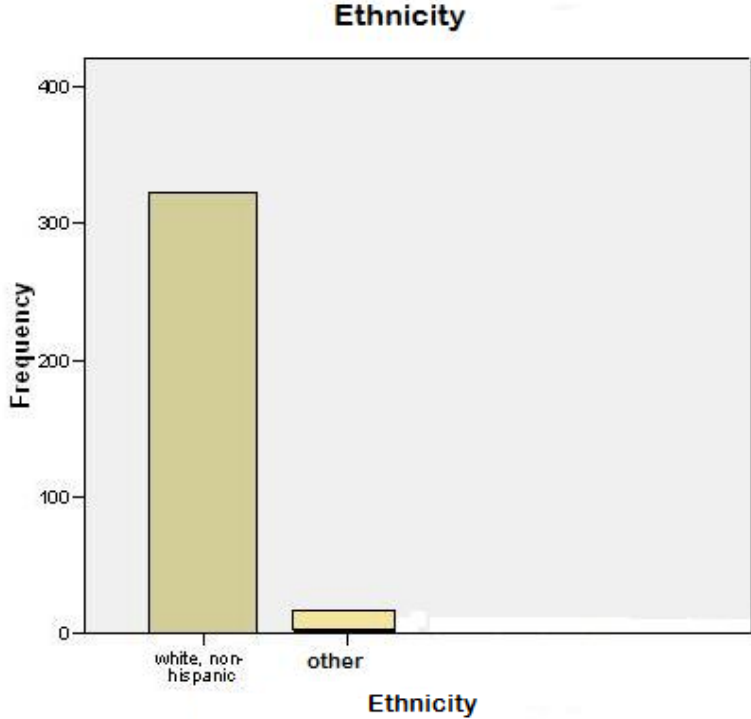
Table 2

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	314	92.6	92.9	92.9
	male	24	7.1	7.1	100.0
	Total	338	99.7	100.0	---
Missing	System	1	.3	---	---
Total		339	100.0	---	---

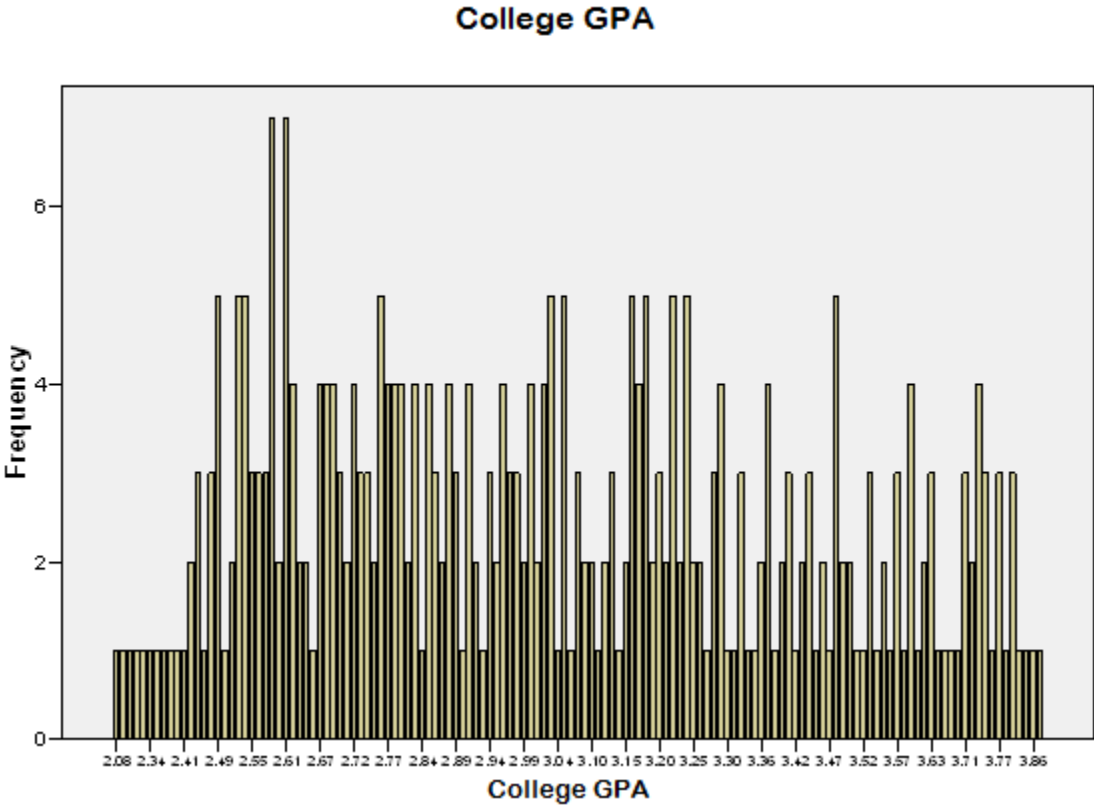
Ethnicity. White, non-Hispanic students made up 95% of the sample. An initiative exists at this college to increase diversity. One suggestion prevalent in the literature to decrease the nursing shortage that exists in the United States is to educate more foreign-born individuals in nursing (Endres, 1997). Figure 3 illustrated the disparity between white, non-Hispanic and minority students at this college.

Figure 3. Ethnicity



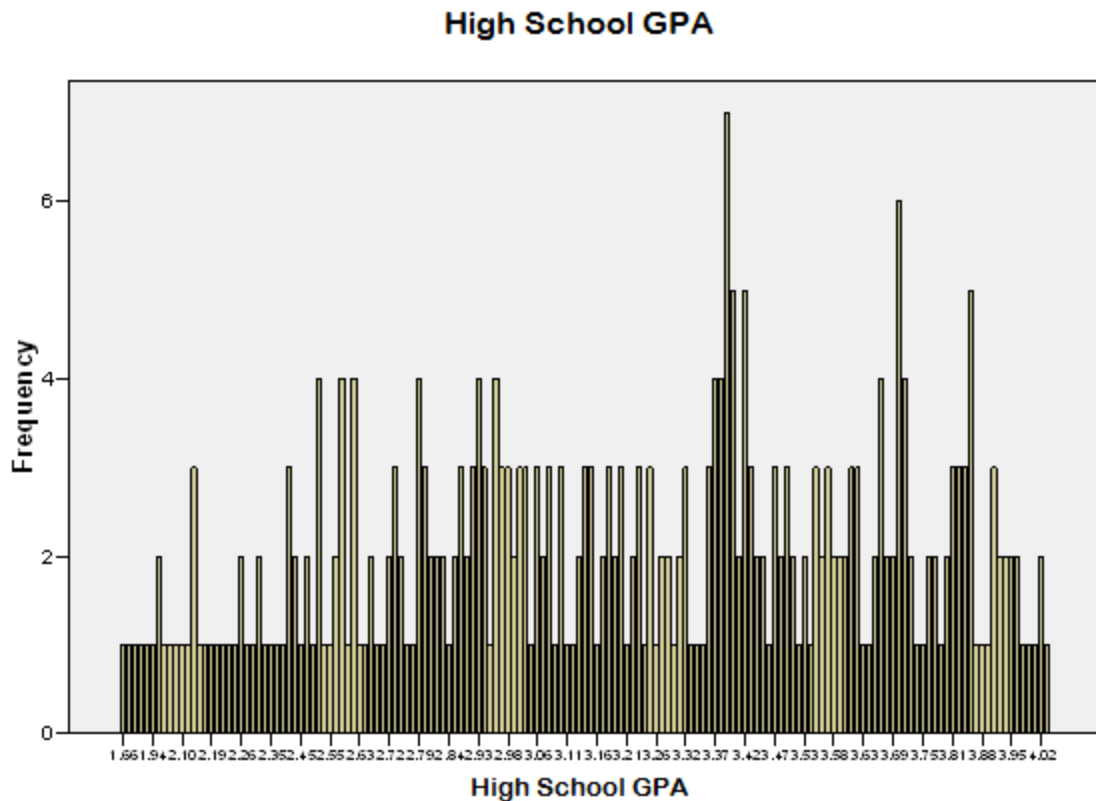
College GPA. College GPA ranged from 2.08 to 3.96 (4.00 the equivalent of A grading scale). There was no significant relationship between college GPA when compared to high school GPA for this sample. This finding may relate to high school grade inflation or may be more related to the increased complexity of nursing education compared to high school education. Another possible factor may be the high prevalence of non-traditional students in this sample as noted by average age of 26.34 years. Non-traditional students tend to combine family, work and other responsibilities along with college attendance that may have a negative effect on college GPA (Figure 4).

Figure 4. College GPA



High school GPA. High school GPA ranged from 1.66 to 4.05 (4.00 the equivalent of A grading scale). There were 18 missing cumulative high school GPA's in this category. Explanations for this finding are students whose secondary education utilized a different system of grading such as foreign-educated students, students from regions other than the Midwest and students who received a GED. Those 18 high school GPA calculations were eliminated from the study (Figure 5).

Figure 5. High school GPA

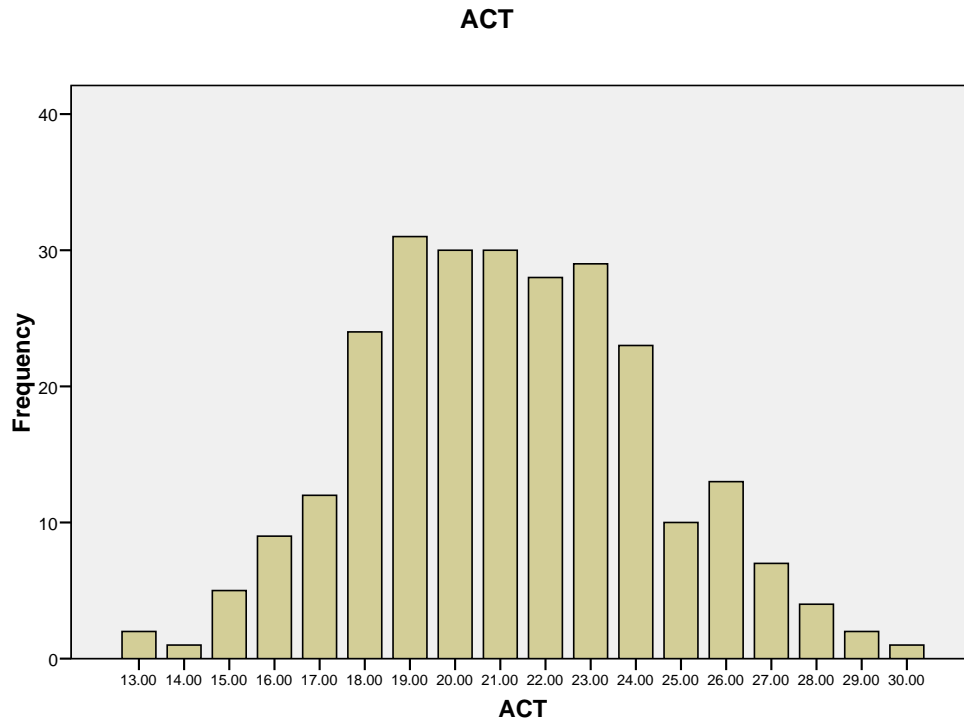


ACT. American College Testing (ACT®) is the most common college entrance examination utilized in the locale of this study. The ACT website (2008) reported “the ACT test assesses high school students’ general educational development and their ability to complete college-level work” (p. 1). Composite scores ranged from 13 – 30 in this

study with a mean score of 21.17 (Figure 6). Most of the students in this sample took the ACT test prior to entrance into the nursing program (N = 261). Seventy-seven students did not take the ACT or did not have results included in their student records. The ACT test is only one of the entrance requirements for this College. According to the College Catalog (2006-2007, p. 12). Students must meet one of the following criteria for admission to the College:

1. High school graduates
 - a. Have a high school cumulative grade point average of 2.25 or above
 - b. Have an ACT composite score of 18 or above
2. College transfer students – students earning 9 credit hours or more of post-secondary course work are considered to be transfer students
 - a. Must have a cumulative grade point average of at least 2.25 on a 4.0 scale for all college work (a minimum of 9 credit hours)
3. High school completion students
 - a. Earn a General Educational Development (GED) certificate
 - b. Achieve a standard score of 500 or above.

Figure 6. ACT Scores

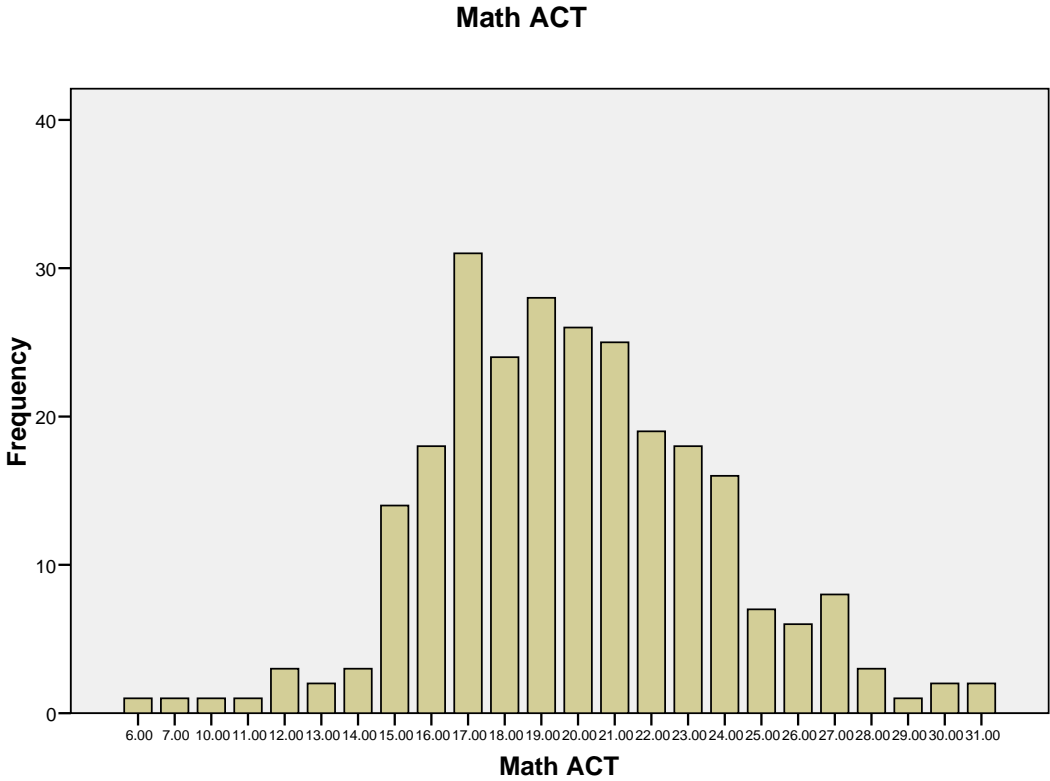


Math ACT and Science ACT. Student ability in math and science has been found to be predictive of overall success in nursing programs, with subsequent success on NCLEX-RN®, by several authors (Roncoli et al., 2000; Gallagher et al., 2001; Crow et al., 2004). Data from this study indicated 260 of the sample (N = 338) had math ACT scores ranging from 6 to 31 with a mean score of 19.88 (Figure 7). The College Catalog from the program under study suggested the importance of math ability of nursing students by utilizing an admission policy specific to math (College Catalog, 2006-2007, p. 106):

ASN and BSN Accelerated students must schedule the COMPASS test or meet one of the following criteria to demonstrate competency in mathematical ability:

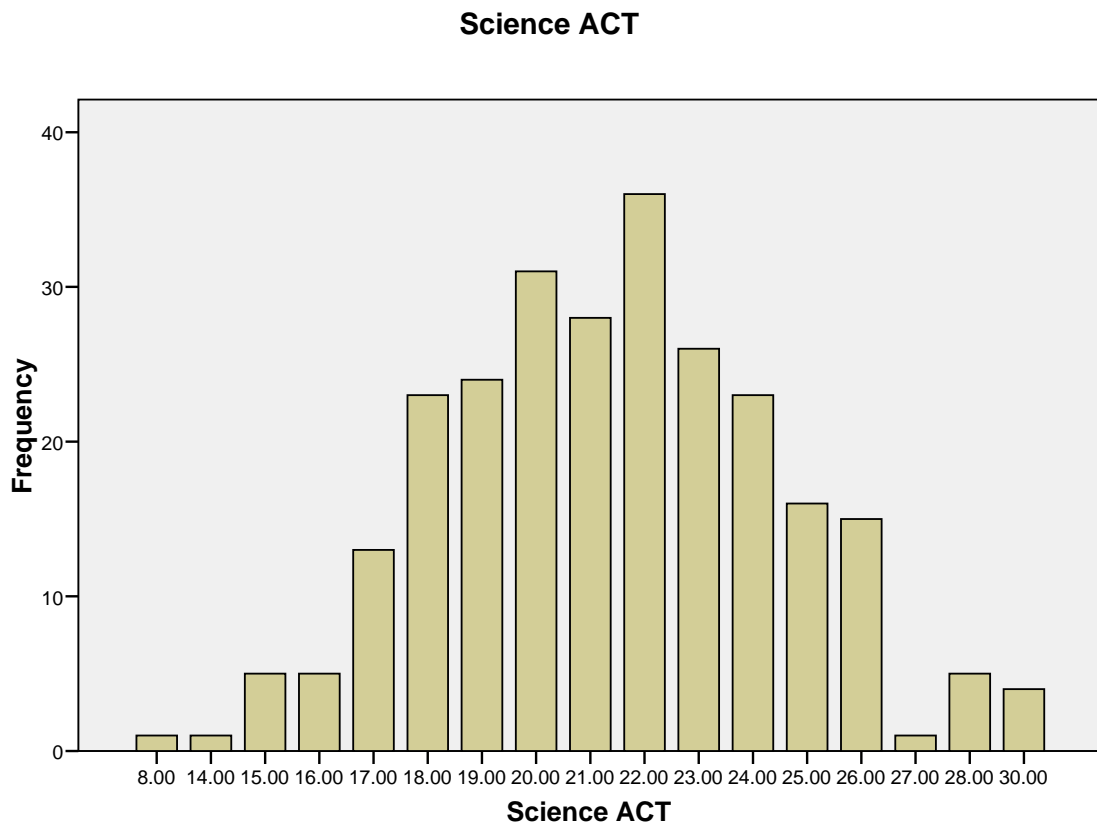
- a. Achieve a mathematics score of 20 or higher on the ACT test or a mathematics score of at least 480 on the SAT within the last two years
- b. Achieve a grade of “C” (not C-) or higher in a college-level mathematics course within the last two years.
- c. Achieve a scaled mathematics score of 48 or greater on the pre-algebra section of the COMPASS test within the last two years. If a student does not achieve a score of 48 on the COMPASS exam, the student must take either MAT 095 Pre Algebra or MAT 105 College Algebra prior to or during the first semester of the nursing program. College credit is not awarded for MAT 095.

Figure 7. Math ACT



Science ACT scores ranged from 8 – 30 with a mean score of 21.38 (Figure 8). This College is in the process of adopting the Test of Essential Academic Skills (TEAS), a product of ATI, to assess math, science, reading and English competencies of beginning nursing students (fall 2007). This will provide additional information on skill level of students in math and science (also reading and English) as they begin the nursing program of study.

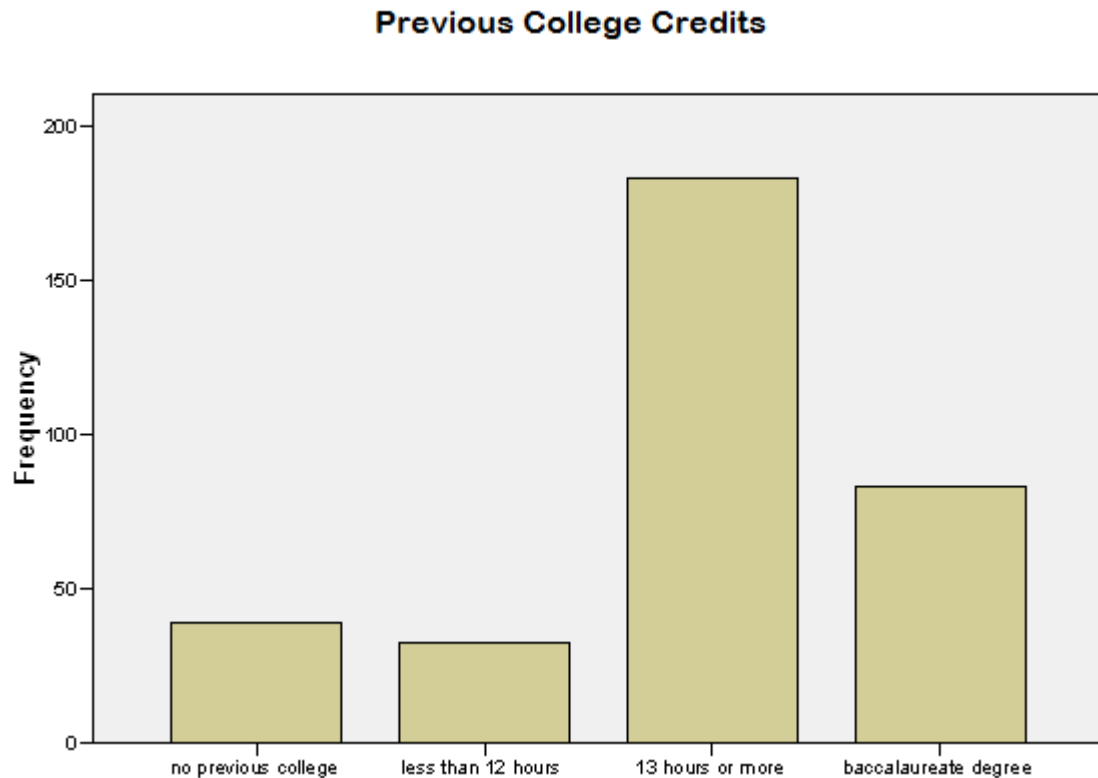
Figure 8. Science ACT



Previous college credits. Over half of the sample had previous college course work of 13 credit hours or more (54%). Of this group 24.5% had baccalaureate degrees in fields other than nursing. Only 11.5% of the sample had no previous college credit when beginning the nursing program (Figure 9). This is consistent with the majority of the

student population being non-traditional students. These students have sought educational credits prior to beginning the nursing program for a variety of reasons. The traditional nursing student, unlike past decades, has become the minority of the nursing program at this institution.

Figure 9. Previous college credits



Standardized testing. A variety of standardized examinations are available for nursing programs to assess content mastery at the end of programs of study. The Mosby Assess Test, NLN tests, HESI Exit examination (E2), and ATI Comprehensive RN Predictor test are a few of the most popular tests available. The College in this study has utilized all of these tests in the past. The E2 was administered for the 2006 students in this study and the ATI Comprehensive Predictor test was administered for the 2007 students. Both HESI and ATI are geared for the student at the end of programs of study.

In this sample there were 172 students who took the E2 (two eligible students chose to take an NCLEX review course instead of taking the E2) and 161 students who took the ATI Comprehensive Predictor test (three students chose to take an NCLEX review course instead of taking the ATI Comprehensive Predictor test). Scores on the E2 ranged from 465 to 1119 with the mean score of the 2006 students being 770.18 that was lower than the 850 acceptable range suggested by the HESI Corporation and correlates with an approximately 90% predictability of successfully completing NCLEX-RN® on the first attempt (Figure 10). Scores on the ATI Comprehensive Predictor test ranged from 47.80 to 77.80 with the mean score of the 2007 students being 63.94, which correlates with ATI statistics of a 94-95% likelihood of successfully completing NCLEX-RN® on the first attempt (Figure 11).

Figure 10. HESI Exit Test

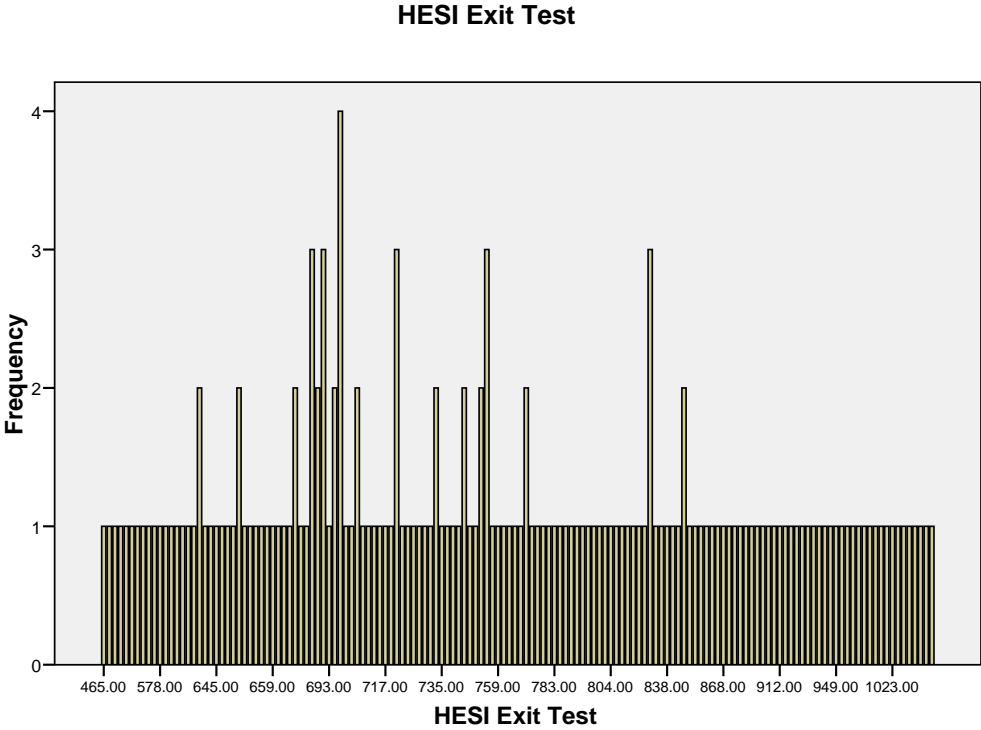
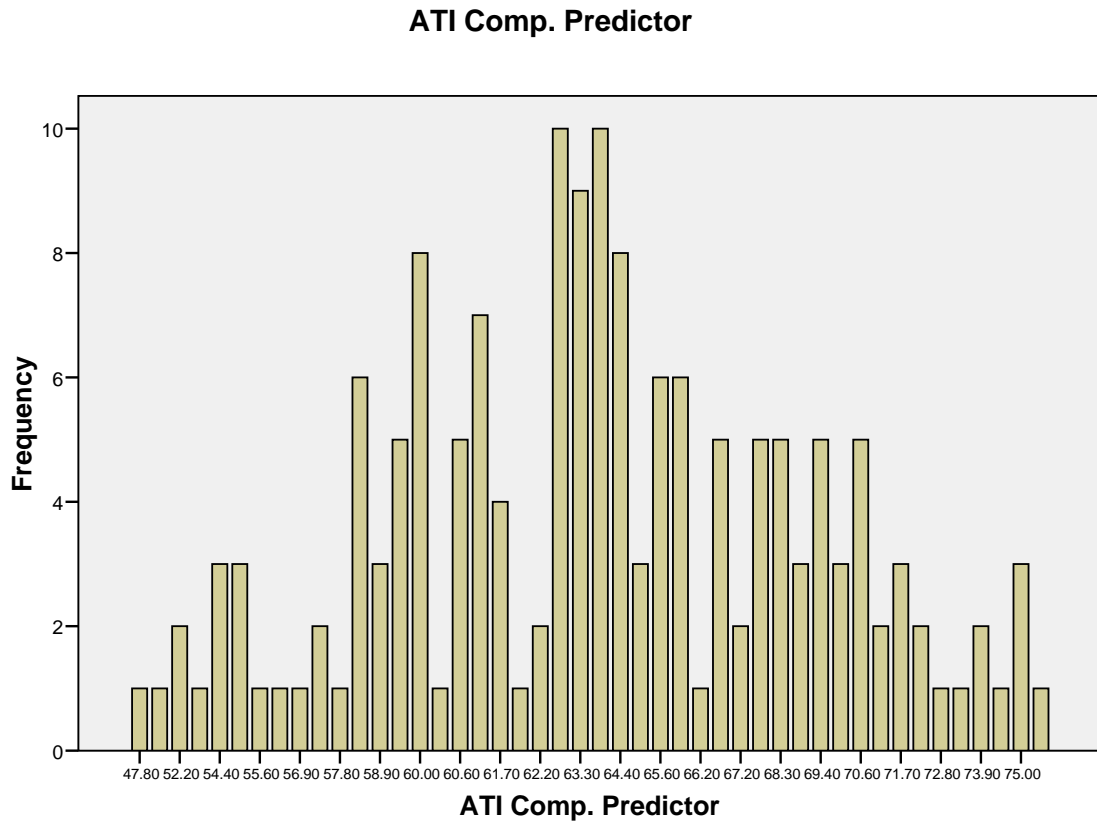


Figure 11. ATI Comprehensive Predictor Test

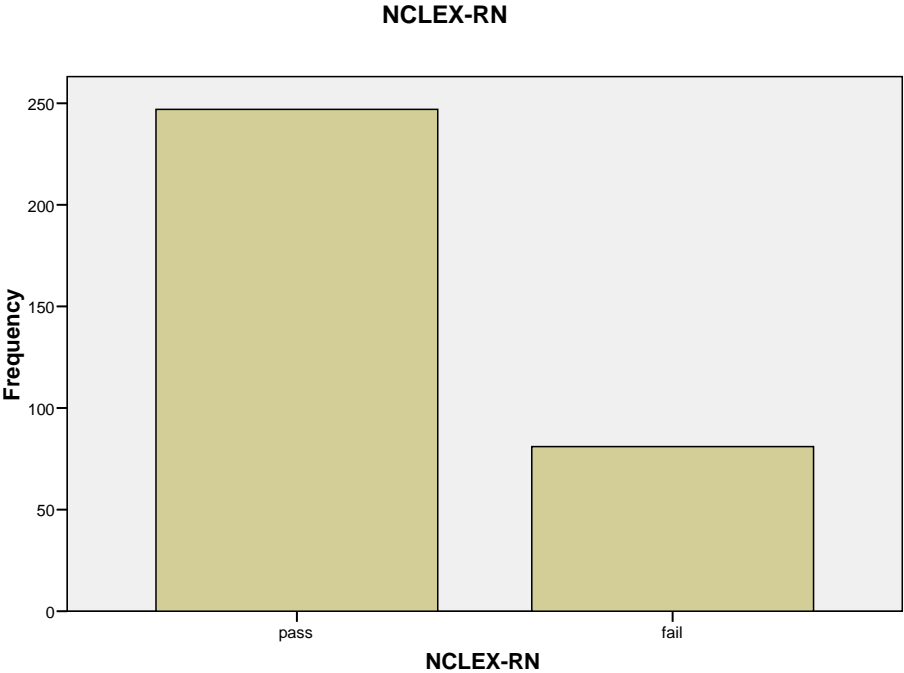


Program type. As previously noted in Figure 1, the sample was 87% (N = 295) ASN students and 13% (N = 43) accelerated BSN students. ASN and accelerated BSN students take the same associate degree courses, but accelerated BSN students have completed the majority if not all of the liberal arts and science requirements so are taking BSN courses simultaneously with the ASN curriculum. Accelerated BSN programs are common practice with the combination of the nursing shortage and need for more BSN-prepared nurses both at the bedside and in management and education positions.

NCLEX-RN®. At the time of this study 328 of the students had taken the NCLEX-RN® examination. The college had not received information on ten of the students. These students may have taken the examination out of state or may not have taken the

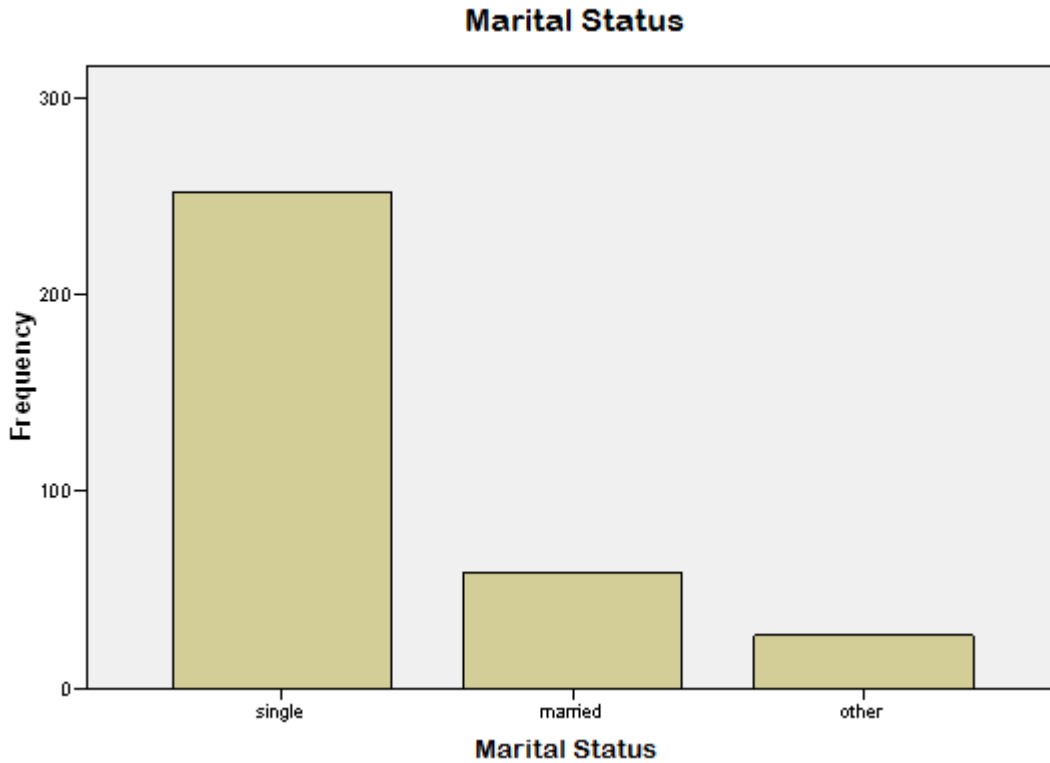
examination. There is a trend at this College for accelerated BSN students to delay the licensure examination until they finish the BSN program even though they are eligible to take the examination after completion of the ASN portion of the program. Of the 328 students who had taken NCLEX-RN®, 248 passed the licensure examination and 81 failed the examination for a 73.4 passage rate (Figure 12). This compared to 85.03 state and 88.11 national passage rates in 2006 and 81.67 state and 85.47 national passage rates in 2007.

Figure 12. NCLEX-RN® Passage Rate



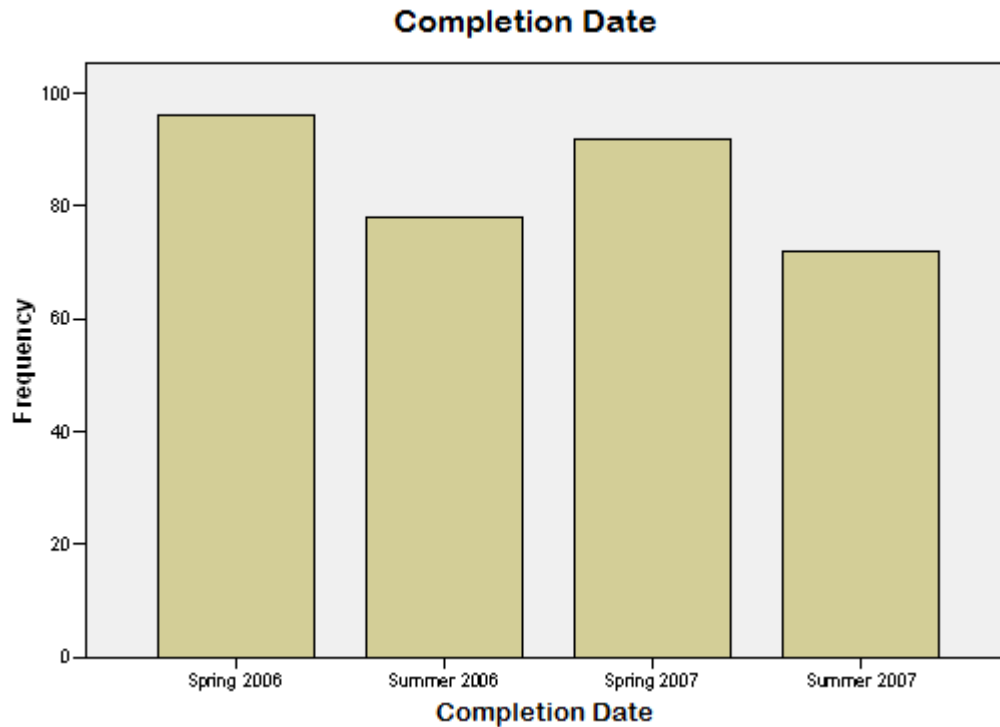
Marital status. Of this sample, 252 of the students were single, 59 were married and 27 stated “other” in the student record (Figure 13).

Figure 13. Marital status



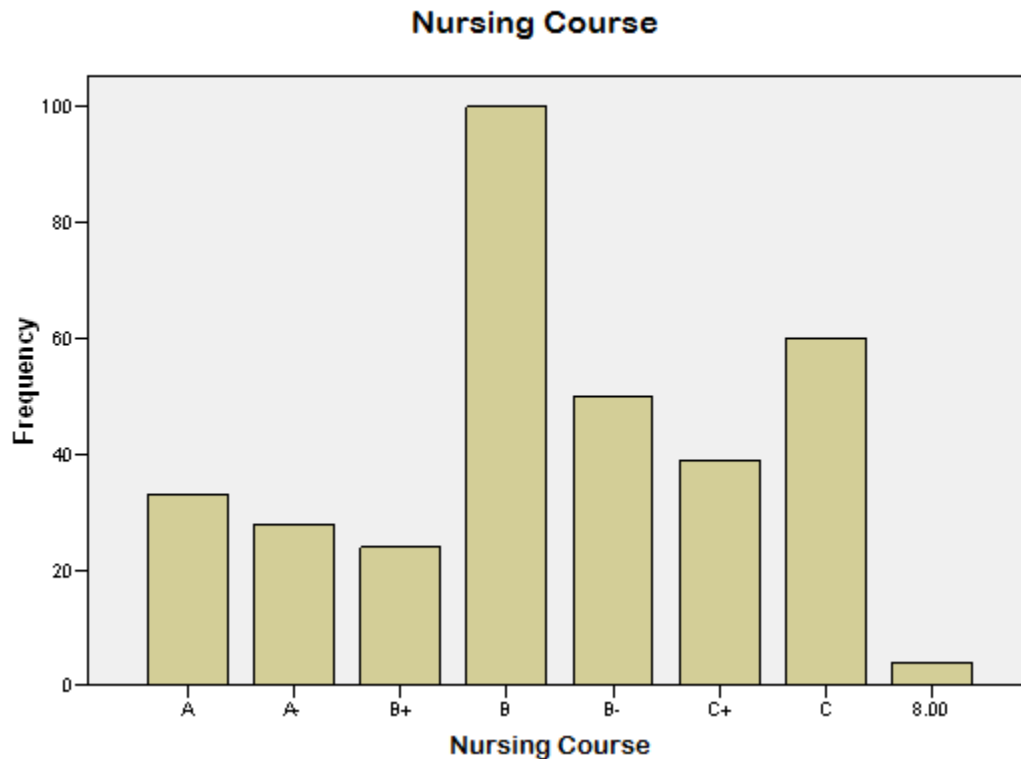
ASN Program completion date. Ninety-six students completed the ASN program of study in spring 2006 and 78 students completed the program in summer 2006. In addition 92 students completed the ASN program of study in spring 2007 and 72 students completed the program in summer 2007 (Figure 14).

Figure 14. ASN Program completion date



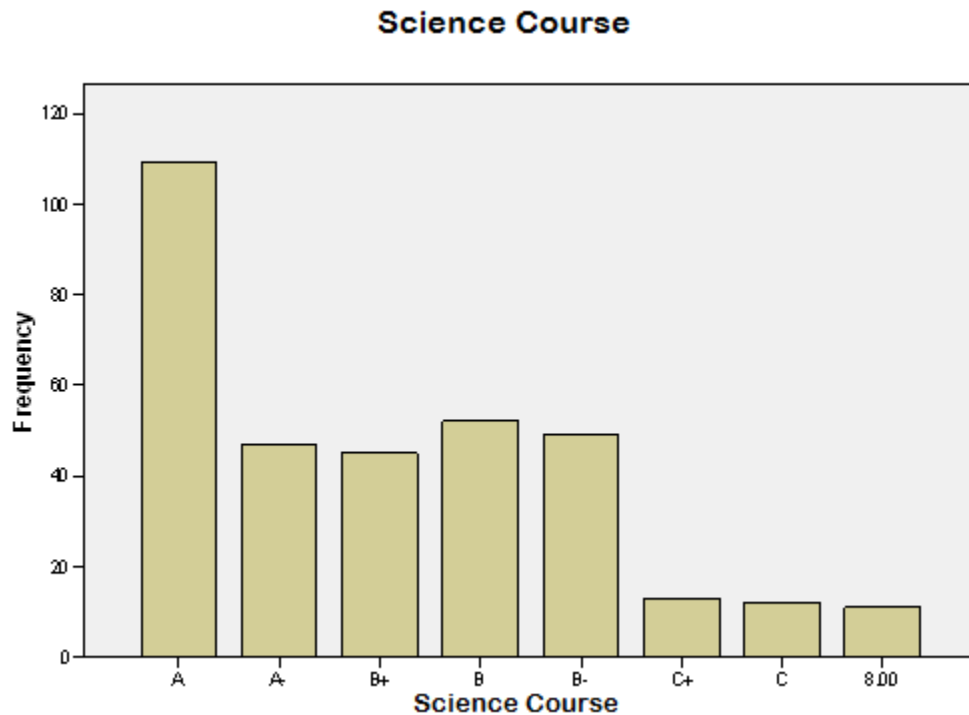
Nursing course. The third medical-surgical course in the nursing program, Adult Health Nursing III, was the course designated as the nursing course in this study. Grades in this course, which occurred in the middle of the ASN program, ranged from A to C (grades of C- and below were considered to be failing grades in this program). The highest percentage of grades were at the B level (29.5%) and the lowest percentage of grades were at the A- level (8.3%) (Figure 15). Evaluation of nursing course work as a function of prediction of future NCLEX-RN® success is prevalent in the literature. According to Alexander and Brophy (1997) and Beeman and Waterhouse (2001) grades in nursing courses were a strong predictor of NCLEX-RN® success. A higher number of C's earned in nursing courses was predictive of failure on NCLEX-RN® (Barkley, et al. 1998; Beeson & Kissling, 2001).

Figure 15. Nursing Course



Science course. Pharmacology and physiology were the science courses most discussed in the literature as being predictive of future NCLEX-RN® success (Campbell & Dickson, 1996; Waterhouse & Beeman, 2003). Pharmacology was the course utilized for this study as most of the nursing students at this college take this course on site rather than transferring in another pharmacology course. Grades for pharmacology ranged from A to C (grades of C- and below are considered to be failing grades in this program). The highest percentage of students were at the A level (32.2%) and the lowest percentage of students were at the C level (3.5%) (Figure 16).

Figure 16. Science Course



Repeated course. The literature suggested a high predictability of future failure on NCLEX-RN® with a higher number of repeated courses in the nursing program (Beeman & Waterhouse, 2001). In this study, 283 students had no repeated courses in the nursing curriculum and 55 students repeated one course (Figure 17). The following failed course policy was listed in the 2006-2007 College Catalog p. 104-105:

1. A maximum of one failed (C- or lower) nursing course may be repeated. Failure of or withdrawal from the repeated professional course, or failure of a second professional course will result in dismissal from the nursing program. A student will be permitted no more than one medical withdrawal during a program.
2. Students failing a nursing course or liberal arts and sciences program required course prior to the official end of the semester may finish the other courses in

which they are enrolled that semester, provided the failed course is not a pre-requisite to one of the courses they are taking.

- 3. A student may repeat a required program LAS course with a grade of C- or lower a maximum of one time per course as long as the student’s cumulative GPA remains 2.0 or above (according to the College probation and dismissal policy).

The student must have at least a “C” in all required LAS courses to progress in the nursing program.

Figure 17. Repeated Course



Inferential Statistics

Hypothesis one. The first research question: Is there a significant difference between selected academic predictors and subsequent success on NCLEX-RN[®]? The null hypothesis that no difference existed between academic predictors and subsequent success on NCLEX-RN[®] was tested using the *t*-test for equality of means with equal variances not assumed and the chi-square (χ^2). The academic predictors utilized in this study were college GPA, high school GPA, composite ACT[®], Math ACT, Science ACT, standardized testing at the end of the program (E2 or ATI), previous college credits, nursing course grade, pharmacology course grade, and whether the student had repeated one or more required courses during the program of study.

Statistical analysis demonstrated a mean college GPA of 3.1256 for the students who passed NCLEX-RN[®] (N = 247) and a mean of 2.7702 for the students who failed NCLEX-RN[®] (N = 81). This demonstrated a significantly different college GPA for those who passed the licensure examination versus those who failed, therefore, the null hypothesis was not retained for this academic predictor (Table 3). Table 4 identified $t = 9.080$, $df = 204.100$, $p = .000$ and mean difference = .35534 for college GPA. Conversely, when evaluating high school GPA with NCLEX-RN[®] results, a mean of 3.1812 was achieved by those students who passed (N = 234) NCLEX-RN[®] and a mean of 3.1004 for those who failed (N = 78) (Table 5). Table 6 demonstrated high school GPA and indicated $t = 1.286$, $df = 157.528$, $p = .200$ and mean difference = .08081. This finding showed no significant difference in high school GPA between those who were successful on NCLEX-RN[®] and those who were not successful. In 2008, there is information in the literature about grade inflation in high schools which may explain the

difference between the significance of college GPA and lack of significance of high school GPA's and licensure passage rates. A more likely explanation for this finding is the complexity of nursing education compared to high school education.

Table 3

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
College GPA	pass	247	3.1256	.39954	.02542
	fail	81	2.7702	.26775	.02975

Table 4

Independent Samples Test

T-test for Equality of Means					
		t	df	Sig. (2-tailed)	Mean Difference
College GPA	Equal variances assumed	7.469	326.000	.000	.35534
	Equal variances not assumed	9.080	204.100	.000	.35534

Table 5

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
High school GPA	pass	234	3.1812	.54908	.03589
	fail	78	3.1004	.45528	.05155

Table 6

Independent Samples Test

		T-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
High school GPA	Equal variances assumed	1.172	310.00	.242	.08081
	Equal variances not assumed	1.286	157.528	.200	.08081

Composite ACT, math ACT and science ACT were predictors of success on NCLEX-RN®. For composite ACT, Table 7 demonstrated a mean of 21.6387 for those who passed the licensure examination (N = 191) and a mean of 19.5968 for those who failed the examination (N = 62). In Table 8 the *t*-test for independent means identified $t = 5.043$, $df = 128.206$, $p = .000$, and mean difference = 2.04197 for composite ACT. The math ACT demonstrated a mean of 20.4526 for those who passed NCLEX-RN® (N = 190) and a mean of 18.0323 for those who failed the examination (N = 62) (Table 9). Table 10 identified $t = 4.852$, $df = 129.361$, $p = .000$ and mean difference = 2.42037. For science ACT, Table 11 revealed a mean of 21.8075 for those who passed the licensure examination (N = 187) and a mean of 19.9839 for those who failed the examination (N = 62). The *t*-test for equality of means identified $t = 4.408$, $df = 127.989$, $p = .000$ and mean difference = 1.82362 (Table 12). Therefore, the null hypothesis was not retained for these predictors indicating a significant difference between composite ACT, math ACT, and science ACT for those who were successful on NCLEX-RN® compared to those who were not.

Table 7

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
ACT	pass	191	21.6387	3.24935	.23511
	fail	62	19.5968	2.59545	.32962

Table 8

Independent Samples Test

T-test for Equality of Means					
		t	df	Sig. (2-tailed)	Mean Difference
ACT					
	Equal variances assumed	4.502	251	.000	2.04197
	Equal variances not assumed	5.043	128.206	.000	2.04197

Table 9

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
Math ACT	pass	190	20.4526	4.01655	.29139
	fail	62	18.0323	3.18793	.40487

Table 10

Independent Samples Test

		T-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
Math ACT	Equal variances assumed	4.320	250.000	.000	2.42037
	Equal variances not assumed	4.852	129.361	.000	2.42037

Table 11

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
Science ACT	pass	187	21.8075	3.28492	.24022
	fail	62	19.9839	2.65189	.33679

Table 12

Independent Samples Test

		T-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
Science ACT	Equal variances assumed	3.962	247.000	.000	1.82362
	Equal variances not assumed	4.408	127.989	.000	1.82362

The chi-square statistic was utilized to analyze previous college credits for this study. NCLEX pass/fail numbers corresponding to previous college credits are represented in Table 13. Table 14 demonstrated cross-tabulation value of 4.724 when using the Pearson chi-square with $df = 3$ and $p = .193$. Therefore, the null hypothesis was

retained for this variable as the amount of previous college credit was not a good predictor of success on NCLEX-RN® in this study.

Table 13

Previous college credits

		NCLEX-RN®		
		pass	fail	Total
Previous college credits	no previous college	31	7	38
	less than 12 hours	18	12	30
	13 hours or more	133	43	176
	baccalaureate degree	64	19	83
	Total	246	81	327

Table 14

Chi-Square Tests

Previous college credits

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.724 ^a	3	.193
N of Valid Cases	328	---	---

Note: 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.43.

In Table 15 nursing course grades proved to be a positive indicator of subsequent success on NCLEX-RN® as those students who achieved a B or above for the mid-curricular nursing course demonstrated a passage rate of 85.7% (156 out of 182) and those students who achieved a B- or less demonstrated a passage rate of 62.3% (91 out of 146). Utilizing the Pearson chi-square cross-tabulation value of 43.183, with $df = 7$, and $p = .000$ was identified (Table 16). The null hypothesis was not retained for this variable.

Table 15

Nursing course NCLEX-RN®

		NCLEX-RN®		
		Pass	Fail	Total
Nursing course	A	33	0	33
	A-	25	2	27
	B+	21	2	23
	B	77	22	99
	B-	34	15	49
	C+	16	22	38
	C	39	17	56
	Repeated Course	2	1	3
	Total	247	81	328

Table 16

*Chi-Square Tests, cross-tabulation**Nursing course*

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.183 ^a	7	.000
N of Valid Cases	328	---	---

Note: 2 cells (12.5%) have expected count less than 5. The minimum expected count is .74.

Science course grades were shown to be good predictors of success on the licensure examination as those students who achieved a B or above for the pharmacology course demonstrated a passage rate of 79.8% (197 out of 247) and those students who achieved a B- or less demonstrated a passage rate of 61.7% (50 out of 81) (Table 17).

Using the Pearson chi-square cross-tabulation value of 35.562 with $df = 7$ and $p = .000$ was identified (Table 18).

Table 17

Science course NCLEX-RN®

		NCLEX-RN®		
		Pass	Fail	Total
Science course	A	98	9	107
	A-	36	11	47
	B+	29	13	42
	B	34	17	51
	B-	33	14	47
	C+	8	4	12
	C	6	5	11
	C-	3	8	11
	Total	247	81	328

Table 18

Chi-Square Tests, cross-tabulation

Science course

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35.562 ^a	7	.000
N of Valid Cases	328		

Note: 3 cells (18.8%) have expected count less than 5. The minimum expected count is 2.72.

Repeated required courses in the curriculum revealed cross-tabulation value of 8.821, $df = 1$ and $p = .003$ (Table 19). This finding was consistent with the literature in that repeating one or more courses in a nursing curriculum was a predictor of risk for failure of the licensure examination. For this study 277 students did not repeat a required course in the curriculum and 217 were successful on NCLEX-RN® for a passage rate of 78.3% and 51 students repeated at least one course in the curriculum for a passage rate of

58.8% (30 of the 51 repeat students were successful) (Table 20). It is important to note this College allowed only one repeated nursing course because failure of a second nursing course resulted in dismissal from the College. Students were allowed to repeat liberal arts and science (LAS) courses twice but would be dismissed from the College with any subsequent failure of the required course.

Table 19

Chi-Square Tests, cross-tabulation

Repeated course

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.821 ^a	1	.003		
N of Valid Cases	328				

Note:

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.59.

b. Computed only for a 2x2 table

Table 20

Repeated course NCLEX-RN®

		NCLEX-RN®		
		Pass	Fail	Total
Repeated course	No repeated required course	217	60	277
	At least one repeated required course	30	21	51
Total		247	81	328

Hypothesis two. The second research question: Is there a significant difference between selected nonacademic predictors and subsequent success on NCLEX-RN®? The null hypothesis that no difference existed between nonacademic predictors and

subsequent success on NCLEX-RN® was tested using the *t*-test for equality of means with equal variances not assumed and the chi-square (χ^2). The nonacademic predictors utilized in this study were age at the time of NCLEX, gender, ethnicity, and marital status.

The mean age for students who passed the licensure examination (N = 247) was 26.8502 and the mean age for those who failed (N = 80) was 25.0125 (Table 21). Table 22 demonstrates a *t* value = 2.371, *df* = 151.571, *p* = .019 and mean difference = 1.83770. The null hypothesis for this variable was not retained because there was a difference in the age of students who passed as opposed to failed the licensure examination.

Table 21

Age at NCLEX sitting

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
Age at NCLEX sitting	pass	247	26.8502	6.65083	.42318
	fail	80	25.0125	5.80810	.64937

Table 22

Age at NCLEX sitting

T-test for Equality of Means					
		t	df	Sig. (2-tailed)	Mean Difference
Age at NCLEX sitting	Equal variances assumed	2.213	325.000	.028	1.83770
	Equal variances not assumed	2.371	151.571	.019	1.83770

There were 304 female and 24 male students in the study population. Table 23 demonstrated a 75.3% passage rate for female students (229 out of 304) and a 75%

passage rate for male students (18 out of 24). Male students made up 5.5% of this population. This is consistent with the distribution of male students in nursing curricula (Vere-Jones, 2008). Utilizing the Pearson chi-square cross-tabulation value of .001, $df = 1$ and $p = .971$ was ascertained (Table 24). Therefore, the null hypothesis for this variable was retained as there was no significant difference between NCLEX-RN® passage rates for female and male students in this population.

Table 23

Gender NCLEX-RN®

		NCLEX-RN®		
		Pass	Fail	Total
Gender	Female	229	75	304
	Male	18	6	24
	Total	247	81	328

Table 24

Chi-Square Tests, cross-tabulation

Gender

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.001 ^a	1	.971	---	---
N of Valid Cases	328	---	---	---	---

Note:

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.93.

b. Computed only for a 2x2 table

Data were collapsed for the ethnicity variable because there were too few minority students to guarantee confidentiality in reporting NCLEX-RN[®] passage rates. There were 314 white, non-Hispanic students in this population and 14 minority students. Table 25 demonstrates a 75.4% passage rate for white, non-Hispanic students (237 out of 314) and a 71.4% passage rate for minority students (10 out of 14). Cross-tabulation value (using Pearson chi-square) was 4.996, $df = 5$ and $p = .416$ (Table 26). The null hypothesis was retained for this variable.

Table 25

Ethnicity NCLEX-RN[®]

		NCLEX-RN [®]		
		Pass	Fail	Total
	White, non-Hispanic	237	77	314
Ethnicity	Other	10	4	14
	Total	247	81	328

Table 26

Chi-Square Tests, cross-tabulation

Ethnicity

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.996 ^a	5	.416
N of Valid Cases	328		

Note: a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .25.

Table 27 for the marital status variable identified a 73.5% passage rate for single students (178 out of 242), 83% for married students (49 out of 59) and 74% for students who designated “other” category in their student record (20 out of 27). Cross-tabulation value (using Pearson chi-square) was 2.325, $df = 2$ and $p = .313$ (Table 28). The null hypothesis was retained; however, due to disparate numbers in this population the statistical analysis may be skewed.

Table 27

Marital status NCLEX-RN®

		NCLEX-RN®		
		Pass	Fail	Total
Marital status	Single	178	64	242
	Married	49	10	59
	Other	20	7	27
	Total	247	81	328

Table 28

Chi-Square Tests, cross-tabulation

Marital status

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.325 ^a	2	.313
N of Valid Cases	328	---	---

Note: a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.67.

Hypothesis three. The third research question: Is there a significant relationship between student scores on the two types of exit standardized tests, Health Education

Systems, Inc. (HESI) (2006 students) and Assessment Technologies, Inc. (ATI) (2007 students) and subsequent success on NCLEX-RN®? The null hypothesis that no relationship existed between scores on E2 or ATI and subsequent success on NCLEX-RN® was tested using the *t*-test for equality of means with equal variances not assumed. Table 29 demonstrates $t = 7.875$, $df = 63.194$, $p = .000$, mean difference = 155.71746 for the E2. The mean score on the E2 for students who passed the licensure examination ($N = 135$) was 802.6889 and the mean score for those who failed ($N = 35$) was 646.9714 (Table 30). Table 31 identifies the mean score on the ATI Comprehensive RN Predictor for those who passed the licensure examination ($N = 112$) as 65.3991 and those who failed ($N = 44$) 60.0727. Table 32 demonstrates $t = 6.009$, $df = 75.6624$, $p = .000$ and mean difference = 5.32638. Both HESI, Inc. and ATI publish scores that correlate with expected success on NCLEX-RN® at 95% probability of passing NCLEX-RN® as a first-time test taker. The suggested scores for achieving the 95% probability of success on the licensure examination as a first-time tester was 900 for E2 and 65% for the ATI Comprehensive RN Predictor exam. The mean score for the two cohorts of students (2006) who took E2 was below the recommended scores that HESI published. The mean score for the two cohorts of students (2007) who took the ATI Comprehensive RN Predictor was slightly below the level published by ATI. Both the E2 and the ATI standardized examinations given at the end of the nursing program were found to be good predictors of success on the licensure examination, therefore, the null hypothesis was not retained.

Table 29

Independent Samples Test

		T-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
HESI Exit Test	Equal variances assumed	6.991	168.000	.000	155.71746
	Equal variances not assumed	7.875	63.194	.000	155.71746

Table 30

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
HESI Exit Test	Pass	135	802.6889	121.61276	10.46676
	Fail	35	646.9714	99.24612	16.77566

Table 31

Group Statistics

	NCLEX-RN	N	Mean	Std. Deviation	Std. Error Mean
ATI Comp. Predictor	pass	112	65.3991	4.82065	.45551
	fail	44	60.0727	5.04406	.76042

Table 32

Independent Samples Test

		T-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
ATI Comp. Predictor	Equal variances assumed	6.129	154.000	.000	5.32638
	Equal variances not assumed	6.009	75.624	.000	5.32638

Hypothesis four. The fourth research question: Is there a significant difference between 2006 students and 2007 students' success rate on NCLEX-RN®? The null hypothesis that no difference existed between 2006 and 2007 students on the NCLEX-RN® was tested utilizing chi-square. Pass/fail numbers are represented in Table 33. The spring 2006 cohort demonstrated an 84.2% passage rate (80 out of 95), summer 2006 passage rate was 73.3% (55 out of 75), spring 2007 passage rate was 65.5% (59 out of 90) and summer 2007 passage rate was 77.9% (53 out of 68). Chi-square tests are reported in Table 34 using the Pearson chi-square as cross-tabulation value 9.062, $df = 3$ and $p = .028$. The spring 2006 cohort had the highest passage rate and the spring 2007 cohort had the lowest passage rate. An explanation for the lower passage rate for the spring 2007 cohort may be the change in the NCLEX test plan and the increase in the passing standard the spring 2007 cohort utilized for the licensure examination. The null hypothesis was not retained for these variables.

Table 33

Completion Date

		NCLEX-RN®		
		Pass	Fail	Total
Completion date	Spring 2006	80	15	95
	Summer 2006	55	20	75
	Spring 2007	59	31	90
	Summer 2007	53	15	68
	Total	247	81	328

Table 34

*Chi-Square Tests, cross-tabulation**Completion Date NCLEX- RN®*

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.062 ^a	3	.028
N of Valid Cases	328	---	---

Note: a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.79.

Hypothesis five. The fifth research question: Is there a significant difference between ASN students and accelerated BSN students' success rate on NCLEX-RN®? The null hypothesis, no difference existed between ASN students and accelerated BSN students' success rate on NCLEX-RN® was tested utilizing the chi square. Pass/fail numbers are represented in Table 35. The ASN cohort had a 75.9 % passage rate (217 out of 286) and the accelerated BSN cohort had a 71.4% passage rate (30 out of 42). Chi-

square tests are reported in Table 36 as cross-tabulation value .389, $df = 1$ and $p = .533$.

The null hypothesis was retained for this research question.

Table 35

Program type

		NCLEX-RN®		
		pass	fail	Total
Program type	ASN	217	69	286
	Accel. BSN	30	12	42
	Total	247	81	328

Table 36

Chi-Square Tests, cross-tabulation

Program type

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.389 ^a	1	.533	---	---
N of Valid Cases	328	---	---	---	---

Note:

0 cells (.0%) have expected count less than 5. The minimum expected count is 10.37.

Computed only for a 2x2 table

Chapter Five

Discussion

The purpose of this study was to explore possible differences between academic and nonacademic predictors and subsequent success on NCLEX-RN®. In addition, investigation of the differences in success rates of 2006 and 2007 students and ASN and accelerated BSN students on NCLEX-RN® occurred. Efficacy of standardized exit testing was ascertained. Organization of this section included a presentation of results and their significance, discussion of hypotheses, limitations of the study, conclusions and recommendations for further research.

Presentation of Results

Several authors have investigated predictors of NCLEX success but few factors were identified as predictive in all studies (Barkley et al., 1998; Daley et al., 2003; Waterhouse & Beeman, 2003; Crow et al., 2004; DiBartolo & Seldomridge, 2005; Bentley, 2006). The results of this study suggested that there were differences between many of the academic and nonacademic predictors and subsequent success on NCLEX-RN®. In addition, there were other possible predictors not researched in this study due to lack of availability of archived data such as reading ability, language spoken at home, grade level completed by parents, hours commuted to and from school, number of dependents, and hours worked per week. It would be important to include these possible predictors in future studies.

Cumulative college GPA was identified as a good predictor of success on the licensure examination. Conversely, high school GPA did not predict future success on NCLEX-RN®. Students who achieved a B or above on the mid-curricular nursing course

had an 85.7% passage rate and those who achieved a B- or below in the nursing course had a passage rate of 62.3% on NCLEX-RN®. Similarly, students who achieved a B or above in the science course (pharmacology) had a passage rate of 79.7% and those who achieved a B- or below in the science course had a passage rate of 61.7% on NCLEX-RN®. In addition, students who needed to repeat required courses due to lack of success in a course had a lower percentage of success on NCLEX-RN® (78.3% passage rate for non-repeaters and 58.8% passage rate for repeaters). Therefore, nursing course grades, pharmacology grades, and not repeating required courses in the curriculum were significant predictors of future success on NCLEX-RN®.

By comparison, nonacademic predictors utilized in this study were less likely to predict NCLEX-RN® success than academic predictors. While age at the time of sitting for NCLEX-RN® was predictive at $p = .019$, gender, marital status, and ethnicity did not predict future success on the licensure examination. Explanations for these findings may be the majority of more mature non-traditional graduates in the sample and the disparity of numbers in the gender marital status, and ethnicity samples at this College

Means of both E2 and ATI exit scores were considerably higher for those who passed NCLEX-RN® versus those who failed the licensure examination. Composite ACT as well as math and science ACT results were predictive of future success on NCLEX-RN®. In contrast, previous college credits were not predictive of success on NCLEX-RN®. An explanation for this finding is the small percentage of students who did not have any previous college credits (11.5%).

Discussion of Hypotheses

Five hypotheses were generated for this study:

1. Is there a significant difference between selected academic predictors and subsequent success on NCLEX-RN®?
2. Is there a significant difference between selected nonacademic predictors and subsequent success on NCLEX-RN®?
3. Is there a significant relationship between student scores on two types of exit standardized tests, Health Education Systems, Inc. (HESI) (2006 students) and Assessment Technologies, Inc. (ATI) (2007 students) and subsequent success on NCLEX-RN®?
4. Is there a significant difference between 2006 students and 2007 students' success rate on NCLEX-RN®?
5. Is there a significant difference between ASN students and accelerated BSN students' success rate on NCLEX-RN®?

Statistical analysis utilizing SPSS 16.0 was conducted retrospectively from student record data after receiving permission from the administration of the College under study as well as the Institutional Review Boards of the institution under study and the College this author is attending. The author maintained anonymity of all data.

Data from hypothesis one demonstrated a difference between the academic predictors and future success on NCLEX-RN®. The null hypothesis was not retained for academic predictors except for previous college credits and high school GPA.

Conversely for hypothesis two, the nonacademic predictors, only age at the time of sitting for NCLEX was predictive of success on the licensure examination. The null

hypothesis was retained for gender, marital status and ethnicity. These findings may be the result of disparity in numbers within these groups and the homogeneity of the group in general.

For hypothesis three, both the E2 and ATI standardized exit tests were found to be good predictors of future success on NCLEX-RN®. Therefore, the null hypothesis was not retained. Further study is needed to determine which standardized exit examination was the best predictor of licensure examination success. Utilizing each exit examinations published probability statistics, the E2 sample (N = 170) had an approximate 90% probability of passing NCLEX-RN® on the first attempt and the ATI sample (N = 156) had an approximate 94-95% probability of passing NCLEX-RN® on the first attempt. As the rating scales were different on the two exit examinations, it would be difficult to generalize these findings to other nursing programs.

Analysis of hypothesis four revealed significant differences between the 2006 cohorts and the 2007 cohorts success on NCLEX-RN®. The null hypothesis was not retained for this research question. There were significant differences in the spring 2006 and summer 2006 cohorts' passage rates as well as significant differences in the spring 2007 and summer 2007 cohorts' passage rates. Several confounding variables existed to explain the differences as presence of a progression policy for the 2006 cohorts and the change in the NCLEX test plan and increase in passing standard that occurred in April 2007. It is also important to note that students who graduated in the summer had two summer semesters and students who graduated in the spring had one summer semester. Attending classes in the summer can add to stresses due to distractions of vacations, weather, family and other similar concerns.

For hypothesis five success rates of ASN versus accelerated BSN students was explored. The null hypothesis was retained for this factor because there was not a significant difference between success rates on NCLEX-RN® between the ASN and accelerated BSN students. It should be noted, however, the disparity of numbers between the ASN group (N = 286) and accelerated BSN group (N = 42).

Limitations of the Study

This study was limited to one college of nursing and four graduating classes over a two-year period. In addition, there were situational factors present as the change in the NCLEX test plan in April, 2007, presence of a progression policy for 2006 but not 2007 students and spring versus summer graduation for two of the cohort groups. Ability to generalize these findings to other nursing programs is limited, therefore.

In several areas as gender, ethnicity, and accelerated BSN students, a disparity in student numbers may have skewed results. The students in the majority far exceeded the students in the minority in each of those areas. This finding corresponds with the literature in that female nursing students far outnumber their male counterparts (Vere-Jones, 2008). In most U.S. nursing programs, white, non-Hispanic students represent the largest category of students (Endres, 1997). In addition, while accelerated BSN students are increasing in numbers nationally (Renaud & Miller, 2003) they remain in the minority at this College.

Test anxiety was another factor that was not investigated in this study but may have a negative predictive factor on success both in nursing programs and on NCLEX-RN®. In addition, student ability to interpret test questions, specifically multiple-choice questions that make up the majority of the NCLEX examination, can be very different

from student to student. While familiarity with computer testing has not been found to be a limiting factor for students taking NCLEX-RN®, confidence that comes with continued use of computers for testing may increase success rates on the licensure examination (Reising, 2003).

The use of nonparametric testing was necessary due to the nominal data collected for gender, ethnicity, marital status, previous college credit, program type, nursing course, science course, and repeated courses, as well as pass/fail data on the licensure examination. The use of a parametric test instead may have improved the strength of the findings (Polit & Beck, 2006). In addition, a study of more courses in the nursing program instead of one nursing and one science course may have provided additional information.

Differences between HESI and ATI existed in this study. While both of these standardized examinations proved to be predictive of success on NCLEX-RN®, this study did not provide information of better predictability with one over the other. As the two examinations were given to different samples of students, generalizability to even this nursing program would be difficult. It would be valuable to include exit examinations available through other corporations in a study of efficacy of standardized exit examinations.

Conclusions

This study indicated that academic and nonacademic variables can be important predictors of future success on NCLEX-RN®. Results pointed to the need to begin preparing students for success in nursing programs, and future success on the licensure examination, when admitted to programs of study. While this study did not focus on pre-

admission factors to identify those students who may be at risk for failure, both during programs of study and on the licensure examination, this is an area that deserves additional study. Nursing shortage issues make it imperative that colleges and universities facilitate student progress throughout programs of study to build on the ranks of practicing nurses both in this locale and throughout the country. In addition, increased patient acuity and increased complexity in technology associated with patient care mandates that students are prepared to practice at the highest level both during the program and as future registered nurses.

Recommendations for Future Research

While this study revealed the positive nature of many academic and nonacademic predictors of future success on NCLEX-RN®, it is important to continue this research in other colleges and universities throughout the United States. This study revealed information beneficial to this College but can not be generalized to other colleges and universities. The use of multiple regression statistical analysis would assist in determination of those factors that are most predictive of success both in nursing programs and on the licensure examination. Determination of those most predictive factors may reduce attrition of students in nursing programs. Adding to the ranks of practicing registered nurses is a very important issue today in view of the nursing shortage that affects most of the country.

Studies have demonstrated factors that are predictive of success both in nursing programs and on NCLEX-RN® should be identified prior to admission to programs of study. Most colleges and universities focus on high school GPA and ACT/SAT scores, but additional predictors of success, both in nursing programs and on licensure

examination, such as pre-admission testing using programs like Education Resources, Inc., NET (Nurse Entrance Testing) and ATI's TEAS (Test of Essential Academic Skills) may identify at-risk students prior to enrollment in programs of study. In this way, remediation may begin early in a program to prevent failure in course work as well as on NCLEX-RN®. Therefore, continued exploration of factors related to pre-admission data should be conducted including pre-admission testing.

While higher scores on both the HESI Exit Exam (E2) and ATI Comprehensive RN Predictor were predictive of future success on NCLEX-RN®, it would be beneficial to compare these exams as well as other exams on the market to ascertain the most predictive exit testing for the population under study. Continued exploration of the efficacy of progression policies, as well as legal and ethical issues associated with these policies, would be valuable research.

Additional research on determination of better methods of identification of at-risk students and more efficient and timely remediation programs to assist these students both during programs of study and for the licensure examination would be beneficial. Identification of students at risk for failure needs to be a component of the admission process. Early remediation is the key to assisting students with success both in nursing programs and on NCLEX-RN®.

Determination of characteristics of the various nursing programs, ASN, BSN, accelerated BSN and two plus two programs that are most predictive of future success on NCLEX-RN® requires further study. Utilizing the best factors in each of these types of programs to develop course work that prepares students for success both in nursing programs and on the licensure examination is of utmost importance.

In summary, it is possible to use predictive factors to ascertain likelihood of future success on NCLEX-RN®. It is beneficial to do so for students because risk for failure both in nursing programs and subsequently on the licensure examination may be ascertained so remediation is conducted early in programs of study. It is also beneficial for nursing programs as accreditation agencies place major emphasis on licensure passage rates. In addition, it is beneficial to the public because increased passage rates on the licensure examination allows for an increased nursing workforce.

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Appendix A





December 6, 2007

JoAnn Humphreys
36710 Meadowbrook Circle
Cumming, IA 50061

Dear JoAnn,

The Institutional Review Board at College of Saint Mary has granted approval of your request, "NCLEX-RN Predictors," at the December 3, 2007 meeting, which was held electronically. The Committee has assigned approval number CSM 07-48. The approval expires in one calendar year, December 6, 2008.

Attached is the "Rights of Research Participants" document. You are required to give each IRB research participant a copy of the document. Congratulations on your IRB approval and best wishes as you conduct your research!

Sincerely,


Peggy L. Hawkins, PhD, RN, BC, CNE
Professor
Chair, Institutional Review Board

Consent for Research Study

Jo Ann Humphreys, RN, EdDc

I am requesting your consent to conduct a research study for a dissertation to complete requirements for a Doctorate in Education with an emphasis on Health Professions Education at College of Saint Mary (CSM), Omaha, Nebraska.

The purpose of this study is to investigate academic and nonacademic predictors of success on NCLEX-RN®. I seek to examine archived student records of 2006 and 2007 ASN graduates of Mercy College of Health Sciences.

Please find attached an initial draft of a proposal for this study. I have included approval forms from the Institutional Review Committees of College of Saint Mary, Omaha, Nebraska and Mercy Medical Center, Des Moines, Iowa.

If you have questions about this study, please email me at jhumphreys@mercydesmoines.org. My committee chair for this study is Dr. Peggy Hawkins at College of Saint Mary. Dr. Hawkins may be reached at phawkins@csm.edu

Thank you in advance for your time to review this document.

Barbara Decker, JD

Date

John Nies, PhD

Date

Shirley Beaver, RN, PhD

Date

Susan Rhoades, PhD

Date

Appendix B

“There are several different aspects of validity: content validity, face validity, construct validity, predictive validity and scoring (passing standard) validity. National Council procedures insure that the NCLEX-RN® examination is valid with respect to these aspects of validity” (NCSBN, 2007, p.1): The following content validity, sampling validity, face validity, construct validity, scoring validity and pass/fail validity has been interpreted by NCSBN, 2007, p. 1-4:

Content Validity: Does the NCLEX examination content cover the scope of entry-level nursing practice?

In order to cover the entire range of nursing content, a vast number of examination questions are written. These questions are written by panels of volunteers from around the country with backgrounds in covering the entire spectrum of different specialties and practice settings. By having this diversity in the item writers, the examination questions cover the entire domain of entry-level nursing practice. However, it would be impossible for each NCLEX examination to cover the entire domain of entry-level nursing practice. If this were so, then each examination would need to include all of the thousands of questions written by the panels of volunteers. Obviously, this is not feasible. This is where sampling validity comes into play (NCSBN, 2007, p. 1).

Sampling Validity: What sample of questions should an NCLEX examination contain in order to make valid inferences about candidates’ knowledge of the entire scope of entry-level nursing practice?

In order to determine what sample of questions should be included in each examination, an on going evaluation of the scope of entry-level nursing practice is conducted. This evaluation is called a job analysis. Every three years, the results of the on going job analysis are compiled. From these results, the NCLEX Test Plan is derived. The test plan provides a set of content categories that define nursing actions and competencies across all settings for all clients. Every NCLEX question is classified into one of these content categories. When a candidate takes the NCLEX examination, their test questions are chosen such that there are some questions from each content category. Since some content categories are more fundamental to the practice of nursing than others, it is necessary to prescribe the percentage of questions chosen from each content category. Again, the job analysis provides the information that is necessary to derive these percentages. These percentages are provided in the NCLEX Test Plan (NCSBN, 2007, p.1).

Face Validity: Even with the detail of the NCLEX Test Plan, there are still hundreds of questions in each content category. How can the National Council (NC) ensure that each NCLEX examination contains questions on a wide variety of medications, procedures, conditions, diseases, clients, settings etc.?

Although the Test Plan ensures that the content of nursing is sampled adequately, it is far from a perfect sampling of the nursing domain. No matter how one slices the domain of nursing, there is always going to be similar content across content categories. For example, several items may be about Radiation Therapy. These different questions may investigate side effects (D10), emotional support for the client (C6), teach about the procedure (D10), handling of radioactive materials

(A2) on infinitum. In theory, someone could receive an examination which met all specifications outlined in the Test Plan and contain solely Radiation Therapy questions. Well, not exactly. That's because the NC conducts a procedure to ensure that this does not happen. This procedure is called a Face Validity review. During this process, real and simulated examinations are read by experienced test developers to ensure that the balance and juxtaposition of content is on face, representative of the domain of nursing (NCSBN, 2007, p. 1-2).

Construct Validity:

If entry-level nursing competency was concrete and observable, then it would be easy to measure. However, entry-level nursing competency is latent and abstract. Therefore, the National Council has “constructed” the NCLEX examination scale to produce a measure of an examinee’s entry-level nursing competency. The National Council uses measurement theory via Rasch measurement theory (Wright and Stone, 1977) to construct the NCLEX examination scale. There is an abundance of research that certifies this theory’s capability to produce valid measures of a latent construct such as entry-level nursing competency (NCSBN, 2007, p. 2).

Scoring Validity: How does the National Council ensure that NCLEX scores are?

During examination administration, each examinee receives at least 15 “tryout” items are not counted towards an examinee’s score. Rather, examinee performance on these items is tracked for all examinees. This allows the National Council to determine the exact difficulty of each item. Using this information and

Rasch measurement theory, the National Council can accurately calculate a measure of each examinee's ability (NCSBN, 2007, p. 2).

Pass/Fail Decision Validity: How does the National Council ensure that NCLEX passing standard truly reflects the minimum competency needed to practice safe and effective entry-level practice?

The minimum level of competency that an examinee must attain in order to pass the NCLEX examination is investigated thoroughly on a triennial basis. This level of competency is called the passing standard. The passing standard is established by the National Council's Board of Directors after they have reviewed extensive information gathered systematically from several sources including a panel of nursing experts. Through this process, the passing standard maintains currency and validity (NCSBN, 2007, p. 2-3).