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Use of Standardized Mastery Content Assessments Given During the First Year of a Baccalaureate Nursing Program For Predicting NCLEX-RN Outcomes

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USE OF STANDARDIZED MASTERY CONTENT ASSESSMENTS GIVEN DURING THE
FIRST YEAR OF A BACCALAUREATE NURSING PROGRAM FOR PREDICTING
NCLEX-RN OUTCOMES

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FIRST YEAR OF A BACCALAUREATE NURSING PROGRAM FOR PREDICTING
NCLEX-RN OUTCOMES

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in Curriculum and Instruction

By

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ABSTRACT

The purpose of this study was to evaluate the relationship between standardized content specific mastery assessments and NCLEX-RN outcomes. Three content-specific standardized assessments testing Fundamentals, Pharmacology and Mental Health concepts were used to explain the dichotomous NCLEX-RN outcome of pass or fail. The three assessments were developed by Assessment Technologies Institute, LLC (ATI). The assessments were administered to baccalaureate nursing students (N = 119) during the first year of a nursing program in one public university over a period of five consecutive semesters. Group comparisons between those passing and those failing NCLEX-RN on the first attempt and correlations were calculated using SAS, Version 9.2. Multivariate analysis of the quantitative data was completed using the logistic regression procedure. The Stepwise iterative method to determine the most accurate model revealed the Pharmacology assessment score predicted the NCLEX-RN outcome of the sample with 73.7% accuracy. Use of the Pharmacology content assessment can assist nurse educators in early identification of at risk students for implementation of a comprehensive remediation plan to decrease NCLEX-RN failures.

This dissertation is approved for
Recommendation to the
Graduate Council

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DISSERTATION DUPLICATION RELEASE

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Chapter One: Introduction

Significance of the Problem

The scope of nursing practice has expanded significantly over the decades since Nightingale's *Notes on Nursing* were authored in 1859. No longer is the scope of nursing limited to the physical and psychological needs evident to Florence Nightingale during the Crimean War and throughout her career. "The challenges that face the nursing profession today have become increasing complex" (Billings & Halstead, 2005, p. xiii). Nursing has grown to include advanced practice skills in specialized units where evidence-based nursing interventions are supported with strong scientific research. Nurses are leaders in health care, influencing policies. They perform as scientists to support and create evidence-based nursing interventions. Nurses are employed in academia, corporate and political arenas (Holstein, Zangrilli & Taboas, 2006) as well as in the community and at the bedside.

To meet the variety of roles in the profession, schools of nursing and nurse educators continually strive to improve the success and educational experience of students. Recognizing the needs of students to achieve success is critical to the profession and teaching practice. A hallmark measure of success for schools of nursing, nurse educators and nursing graduates is passing the National Council Licensure Exam for Registered Nurses (NCLEX-RN). For schools of nursing, the first-attempt pass rate of its graduates is a defining characteristic of a quality program. The licensure examination validates the nursing student's acquisition of the knowledge base needed to provide safe nursing practice (Holstein et al., 2006).

Likewise, NCLEX-RN failures can have many negative ramifications. Low pass rates on NCLEX-RN can have serious implications impacting the academic institution, the nursing program faculty, graduates and employers as well as society at large (De Lima, London &

Manieri, 2011). While the impact of failures is widespread, the outcome is particularly important for three major stakeholders (a) graduate nurses, (b) healthcare organizations and (c) programs of study (Roa, Shipman, Hooten & Carter, 2011). The immediate impact for the new graduate becomes evident in personal and financial consequences. When students become aware of their failure on NCLEX-RN, they can be overwhelmed with feelings of inadequacy, guilt and loss. In addition, the financial impact becomes apparent with loss of potential income as a registered nurse and costs of reapplication for additional attempts (Roa et al., 2011). Many students have incurred loans to fund their educational goals. The new graduate expects to receive a return on investment following completion of the program (Roa et al., 2011). Without the expected income, loan repayment can be difficult if not impossible. As the reality of a second attempt approaches, anxiety levels can increase (Roa et al., 2011) and for good reason. In 2011, United States educated nursing students failing NCLEX-RN on the first-attempt, failed again at 55.8% (National Council State Boards of Nursing, 2011).

Employers of nurse graduates are also impacted by failures. Hiring and training costs of new graduates are significant and on the rise. A failure creates a vacancy which increases costs to the health care facility and also impacts the community through outpatient facilities, community health nursing, school nursing and nursing homes (Roa et al., 2011).

Nursing programs too, feel the impact. Those consistently falling below the national average for first attempt pass rates could experience lower enrollment because the student may choose another program with a higher success rate to improve chances of NCLEX-RN success (Roa et al., 2011). If poor pass rates become common, nursing programs are in jeopardy of losing approval from their respective State Boards of Nursing (Carrick, 2011) and accrediting bodies

such as the National League for Nursing Accrediting Commission (NLNAC) or Commission on Collegiate Nursing Education (CCNE).

Many variables can impact success or failure on NCLEX-RN for students. One variable is the student's attitude toward preparation for licensure. Procrastination in preparing for NCLEX-RN until near completion of the nursing program results in little time for needed remediation efforts. Jacobs and Koehn (2006) studied student attitudes toward licensure preparation. Many students in the study reported being unconcerned with NCLEX-RN and chose to wait until after graduation to prepare. In addition, recent changes in wait time for a second attempt at NCLEX-RN from 90 days to 45 has some students wanting to "see what the test is like" before serious attempts at preparation are completed. Implementation of a standardized assessment program can assist in addressing these student attitudes of procrastination and wait-and-see by providing a means of simulation the licensure exam well before the first-attempt on NCLEX-RN.

In 1994, the NCLEX-RN was converted in method of delivery by the National Council of State Boards of Nursing (NCSBN) to computerized adaptive testing (CAT) for determining safe entry-level practice (NCSBN, 2010). CAT created new challenges for nursing graduates as well as nurse educators. This technological advancement brought additional teaching and learning options for students and programs of nursing. In addition, this change in method of administration offered testing companies with NCLEX preparation programs new opportunities. To assist schools of nursing in recognizing at-risk students early in the educational process, commercially developed standardized assessment programs were made available to evaluate student mastery of content. In an effort to minimize licensure failures, nursing schools have voluntarily incorporated these evaluation strategies and tools into curricula (Holstein et al.,

2006). Research on these strategies since that time has strengthened the move of schools of nursing to utilize commercial companies for assistance through computerized testing programs that simulate CAT for RN licensure.

The available commercially prepared NCLEX preparation programs include a computerized testing option allowing students to simulate the NCLEX-RN testing environment and process. Computerized testing can be used to assess learning needs, administer pre and post tests to determine mastery or provide students with an opportunity to practice test taking. In addition, computerized testing is used for preparing student for licensure or certification exams (Zwirn, 2005; Billings, 1998). With computerized testing a rapid turnaround time is possible that provides feedback to students and faculty for early identification of areas of weakness. Results are almost immediately available to the students and faculty for score comparisons and evaluations related to the content areas (Assessment Technologies Institute, LLC, 2011). The assessment program is implemented throughout the nursing curriculum allowing identification of poor knowledge acquisition very early in the educational process. This early identification allows for remediation to begin immediately to assist students to acquire requisite knowledge and not just at the end (Holstein et al., 2006).

Testing companies specializing in NCLEX-RN preparation provide a series of assessments in specific content areas to detail student mastery of concepts for the purpose of identifying those at-risk for failure earlier in the educational process. The series of standardized content mastery assessments can be aligned within the curriculum at the recommendation of company of origination. Companies such as Educational Resources Incorporated (ERI), Assessment Technologies Institute, LLC (ATI), Health Education Systems, Inc. (HESI) and the National League for Nursing (NLN), as well as others, develop a variety of assessments to assist

nursing programs in the evaluation of student mastery of learning. The company used by the school of nursing included in this study was Assessment Technologies Institute, LLC (ATI). ATI provides a series of mastery assessments in specific content areas as well as a comprehensive predictor to be administered at the end of the program of study. The content mastery series is composed of review modules and assessments based upon the NCLEX-RN blueprint (ATI, 2011). The modules include Fundamentals, Mental Health, Maternal/Newborn, Nursing Care of Children, Community Health, Nutrition and Leadership and Management. At the request of a school of nursing purchasing the review and assessment package, ATI will evaluate educational programs and align the modules and assessments strategically within the nursing curriculum to coincide with the appropriate course content (Assessment Technologies Institute, LLC, 2011; Holstein et al., 2006).

To address the issue of licensure preparation, nurse scholars have conducted empirical studies to identify variables that predict success on the NCLEX-RN. The outcomes of these studies have served to identify variables that will support student achievement of success on NCLEX-RN (De Lima et al., 2011). The plethora of publications studying predictors of NCLEX-RN pass rates lacks sufficient evidence to suggest that the methods and strategies utilized by many nursing programs are adequately supported. Decades of publications on the problem of pass rates have yielded little evidence of substantially effective strategies to correct the problem. Data analysis has failed to identify consistently predictors for success. Thus, failure rates have not changed substantially over the past several years regardless of the efforts by schools of nursing to eliminate NCLEX-RN failures completely.

Multiple studies evaluate the relationship of the end-of-program comprehensive standardized assessment exams to predict success on NCLEX-RN from a variety of companies.

The literature largely supports the ability of the end-of-program comprehensive assessments to indicate accurately which students are more likely to be successful on NCLEX-RN. However, fewer studies were found utilizing standardized content-specific assessments as independent variables. Of those few studies, content specific standardized assessments that recognized significant correlations with NCLEX-RN success were varied in findings. In the studies reviewed, most researchers utilized a variety of commercial vendors and types of content-specific standardized assessments as variables. The use of multiple commercial vendors and varied assessments has resulted in fragmented findings and little consistency for reliability in predicting NCLEX-RN outcomes, especially in the population of NCLEX-RN failures. The lack of consistency and variability of instruments in the research has limited generalizability to many nursing programs. In a study by Crow, Handley, Morrison and Shelton (2004) high scores on content specific standardized assessments for mental health and community indicated a strong correlation with NCLEX-RN success. Ukpabi (2008) utilized eighteen assessments from ATI and the National League for Nursing (NLN) as variables to predict NCLEX-RN success. Content specific assessments found to be significant in predicting NCLEX-RN success were developed by both the NLN and ATI.

Lacking in the body of literature were consistent findings of standardized assessments accurately predicting failures. Only one recent study investigated content-specific assessments as predictors of failure on NCLEX-RN. Findings by the scientists supported the use of standardized assessments developed and provided by the NLN. The assessments were supported as predictors of students most likely to fail NCLEX-RN (De Lima et al., 2011). The findings of this study are summarized in Chapter Two.

Using educational strategies to facilitate learning measurement, such as standardized content-specific assessment scores of first-year nursing students, may lead to early identification of those at-risk for failure on NCLEX-RN and ultimately more successes in meeting the ever growing health care needed for qualified registered nurses.

Significance of the Study

The stakes are high in nursing education. Nursing programs are under continuous pressure to produce more graduates, more quickly, with fewer faculty members and less financial and clinical resources (Siler, DeBasio & Roberts, 2008). Failures indirectly contribute to the already critical nursing shortage and affect a school's reputation which has consequences for faculty and admissions (McGahee et al., 2010). The current projected shortage of nurses has heightened educators' interest in identifying students at-risk for failure. Despite efforts by nurse educators to predict success on NCLEX-RN, addressing the needs of students at-risk for failure is an ongoing problem (DiBartolo & Seldomridge, 2004).

Nursing programs utilize a variety of teacher generated methods to evaluate student mastery of content but teacher generated methods of evaluation to measure student mastery of content and understanding have limitations. Teacher developed tests can be very time consuming and establishing reliability and validity for such tests is an arduous process. "To establish test validation, correlational methods and factor analysis are common statistical techniques" (Crocker & Algina, 1986, p. 9). An additional limitation of teacher generated evaluation methods is the ability to compare student performance to other programs of nursing. Commercially prepared standardized assessment programs can address many of these limitations. The assessment offerings available through the commercial developers provide support for implementation of a standardized program to facilitate successful completion of NCLEX-RN.

Nurse educators should insure students are adequately prepared to be successful on NCLEX-RN and for the complexities of the workplace. Nursing programs must address the ethical responsibility of graduating students who meet the academic rigor of the curriculum but cannot pass boards (Roa et al., 2011). They should also produce practitioners with requisite knowledge, critical thinking abilities and work behaviors to meet the ever changing health care needs of the population by delivering competent, compassionate care with the ability to adapt to change (Johnson & Halstead, 2005; Roa et al., 2011). To assist in achieving this goal, it is important for faculty critically to examine the student body of their respective programs and implement early interventions that will support students who are recognized as at-risk for failure on NCLEX-RN (De Lima et al., 2011). Scientists have support for characteristics identifying at-risk students. These characteristics include low grade point average, low standardized test scores and decreased critical thinking skills. With the knowledge of characteristics surrounding at-risk students, faculty members must make ethical decisions to identify these students and intervene when necessary (Johnson & Halstead, 2005; Pennington & Spurlock, 2010).

The purpose of this study was to explore the relationship between content-specific content assessment scores administered during the first year of a baccalaureate nursing program and outcomes on NCLEX-RN. A finding of this study further informs nurse educators of the predictive ability associated with the three content-specific assessments used in this study. Also, early identification of at-risk students has the potential to decrease NCLEX-RN failures for programs of nursing by allowing intervention with remedial activities before the final academic year of a nursing program. With more successful graduates, the nation as a whole will benefit (Roa et al., 2011).

Educational Foundations

To determine achievement of measurable outcomes from teaching and learning, evaluation becomes necessary. And, is the final step in the educational process (Vandever & Norton, 2005). Evaluation can be presented in a variety of forms. Formative evaluation tools and strategies can be considered diagnostic and serve to assist faculty in identifying areas of deficiency or difficulty for students. These diagnostic tools allow for corrective intervention designed to further facilitate learning (Vandever & Norton, 2005). Summative evaluation methods refer to data collected at the end of the activity or course with focus on the whole event with all work completed (Bourke & Ihrke, 2005). For the purposes of this study, standardized content mastery assessments provided by ATI were used as a formative method of evaluation to determine mastery of content-specific concepts as related to NCLEX-RN Client Need categories.

Acquisition of nursing knowledge is believed to be constructed beginning with a foundation specific to the discipline and progressing to mastery of content. There are times when students must memorize information. Memorization is a traditional learning strategy used effectively for centuries. Every discipline has its own terms, names, facts and rules on which to construct the foundational principles. The challenge to educators is whether a student can use these foundational constructs effectively to solve new problems and develop new schemas (Woolfolk, 2010).

According to Damon (2005), the contrast between the “discovery learning” of constructivism and the “practice-and-drill” of traditional learning is a false dichotomy. Students benefit from both, they require both, and the two complement rather than fight each other in the actual dynamics of mastering knowledge. The usefulness of memorized

facts and definitions are stored and used at a later time, when they are better understood in lived experiences (p. 27).

Constructivism provides a solid framework for the educational processes in nursing education with each course building upon previous knowledge in subsequent courses. Use of content-specific assessments to evaluate knowledge level serves as building blocks to construct the concepts of nursing. Without the foundations of nursing, additional concepts within the discipline are more difficult to acquire. The combination of knowledge acquisition and constructivist views supports the educational practice of using standardized assessments to assist in preparation for NCLEX-RN. This framework is discussed further in Chapter Two.

Research Design

This non-experimental quantitative retrospective case study sought to determine the relationship between student scores on three content-specific assessments and NCLEX-RN outcomes. The three content-specific assessments administered in the first academic year of the nursing program required by the Eleanor Mann School of Nursing were (a) Fundamentals (b) Pharmacology and (c) Mental Health, developed by ATI. The independent variables were the individual student scores on each of the assessments administered during the first year (two semesters) of the nursing program. The dependent variable was the dichotomous outcome of pass or fail on the first attempt of NCLEX-RN. Five consecutive semesters of admitted students between fall 2008 and spring 2010 provided data for the analysis. The descriptive and inferential between group statistics of those passing NCLEX-RN on the first attempt and those failing on the first attempt were used for comparison.

Research Question

The research question guiding the inquiry was:

1. What are the odds or the probability that student scores on the following ATI assessments: Fundamentals, Pharmacology, and Mental Health will predict their outcome of pass or fail on the NCLEX-RN exam?

Definition of Terms

1. Standardized content-specific assessment: Refers to the “measurement of a student’s abilities and changes in knowledge, skills and attitudes after participation in courses”(Bourke & Ihrke, 2005, p. 444) aligned with the content in each of the specific assessments. The three content-specific assessments provided by ATI are used in this study as independent variables. The assessments are (a) Fundamentals (b) Pharmacology and (c) Mental Health.
2. First year of academic program: Refers to courses offered during the first two consecutive semesters of the baccalaureate program at the University of Arkansas, Eleanor Mann School of Nursing.
3. NCLEX-RN: A Computerized Adaptive Test (CAT) developed by the National Council of State Boards of Nursing (NCSBN), designed to test knowledge, skills, and abilities essential to the safe and effective practice of nursing at the entry level (Department of Consumer Affairs, 2011).
4. NCLEX-RN Failure: Unsuccessful first-attempt on NCLEX-RN for licensure.
5. NCLEX-RN Success or Passing: Achievement of the passing benchmark as designated by the NCSBN resulting in licensure as a registered nurse.
6. Content Specific Assessment Benchmark: The national average score for each assessment provided by ATI. This benchmark is determined by the Eleanor Mann School of Nursing.

7. At-risk students: Those students who are at a level of achievement on standardized assessments below the recommended benchmark set by the University of Arkansas Eleanor Mann, School of Nursing.
8. Fundamentals assessment: A 65-item test offering an assessment of the student's basic comprehension and mastery of the fundamental principles for nursing practice. Concepts assessed include: 1) foundations of practice (health care delivery, thinking strategies for nursing practice, communication, professional standards, nursing through the lifespan, health assessment); 2) basic nursing care (admission, transfer and discharge processes, medication administration and error prevention, safety, infection control, comfort and basic needs and care of wounds); 3) support of psychosocial needs (psychosocial, family, cultural and spiritual health, end-of-life); 4) support of physiologic needs (oxygenation, circulatory, fluid, electrolyte and acid-base balance, gastrointestinal, elimination, neurosensory); and 5) health assessment (e.g., assessment of vital signs and general and system specific assessments).
9. Pharmacology assessment: A 65-item test offering an assessment of the student's basic comprehension and mastery of pharmacologic principles and knowledge of prototype drugs. Concepts assessed include: basic pharmacologic principles (pharmacodynamics, pharmacokinetics, safe medication administration, medication error prevention, age specific considerations) and knowledge related to the safe administration and monitoring of prototype drugs that are used to treat infections, pain and inflammation; as well as those that affect the immune, nervous, cardiovascular, respiratory, renal, digestive, endocrine, reproduction systems and the blood.

10. Mental Health assessment: A 65-item test offering an assessment of the student's basic comprehension and mastery of mental health nursing principles. Assessed concepts include: 1) basic concepts in mental health nursing (assessment, legal/ethical principles, therapeutic communication, therapeutic nurse-client relationship, anxiety and defense mechanisms, mental health nursing in diverse populations); 2) non-pharmacologic therapy of mental health disorders; 3) pharmacologic therapy of mental health disorders; and 4) nursing care of clients with various mental health disorders.

Assumptions

The following assumptions were identified in this research study:

1. Data received from the University of Arkansas were accurate and appropriately reflected the scores and pass or fail status for graduates between fall 2008 and spring 2010.
2. The reliability and validity of the commercially prepared standardized assessments from ATI has been established by the developer.
3. Students desire to perform at their optimal level to reflect accurately acquired knowledge of content specified in the assessments.
4. Students are capable of reading and comprehending the English language at the proficiency level required of NCLEX-RN.
5. All students in the study sample received the same educational instruction from semester to semester.
6. The testing environment for all students was consistent.

Limitations

There were several limitations in this study. The first was sample size. Because most nursing programs have fewer failures than passing students, the sample size was self-limiting due

to the dichotomous outcome of NCLEX-RN as either pass or fail. Additionally, the sample lacks randomization and was purposive in that participant selection was consistent with the purpose of the study. The generalizability of the findings was limited to nursing programs with similar curricular structures that include administration of the three selected ATI assessments during the first academic year. Also, use of the findings by schools of nursing utilizing other commercial preparers of assessments could prove problematic. Assessments included as instruments for this study were limited to the 2007 versions provided by ATI. The available data for the recently updated 2010 versions of content-specific assessments were available to students currently enrolled and progressing through the nursing program beginning fall 2010. No NCLEX-RN data were available for these students and thus, were not included in the sample for this study.

Summary

Nursing student preparation continues to be a valid concern for nurse educators. The projected shortage coupled with 10% failure rates nationwide brings attention to methods to decrease NCLEX-RN failures. Empirical evidence on the use of standardized content-specific assessments in predicting NCLEX-RN success or failure was limited and lacks consistency and generalizability. In addition, the lack of available research identifying use of standardized assessments ability to contribute to early identification of NCLEX-RN failures is evident. Those studies including assessments developed by ATI were even fewer in number. The purpose of this study was to explore the relationship between content-specific content assessment scores administered during the first year of a baccalaureate nursing program and outcomes on NCLEX-RN. To guide the inquiry, one primary research questions was identified. Definitions of terms, assumptions and potential limitations were described. The educational framework of integrating knowledge acquisition and constructivism was introduced in relation to use of standardized

assessments as a means of formative evaluation. A thorough review of the most recent available literature is provided in Chapter Two.

Chapter Two: Review of Literature

Overview

This chapter contains a review of the current literature regarding the use of standardized assessments, specific to the domain of nursing, to predict success and/or failure on NCLEX-RN. A brief historical overview of standardized assessment development and use in nursing education are described. This literature review presents research studies utilizing a wide variety of commercially prepared standardized assessments from multiple companies. The educational framework describes the use of standardized content-specific assessments during the first academic year of a nursing program as a foundation for constructing nursing knowledge to impact performance on NCLEX-RN. Finally, the gaps in the existing literature are revealed as support for the completion of this research study.

History of Standardized Testing and NCLEX-RN

One of the most important developments of educational measurement came from psychologists Alfred Binet and Theodore Simon in the form of the intelligence test (IQ). The IQ test was originally developed for the purpose of identifying students in need of special education. The original 1905 version was brought to the United States in 1908 by Henry Goddard for use in a school for retarded children. Through repeated implementation and modification of the original testing methods, the IQ test became a tool for predicting success. As methods of assessment improved, scientists realized the possibility that training could impact outcomes (Button & Provenzo, 1989).

In 1904, Thorndike published the first textbook on test theory. Since that time, many scholars have contributed to the body of knowledge surrounding testing theory that has now evolved into *Classical Test Theory*. “This theory provides the theoretical foundation for the

development of most aptitude, achievement, personality and interest measures used in this century.” (Cocker & Algina, 1986, p. v).

Measurement is quantitative in nature and describes an event using numbers. The quantitative statistical approach, using numbers, from Belgium native, A. Quitelet, was borrowed by Florence Nightingale to show the terrible shortcomings of Crimean War hospitals (Button & Provenzo, 1989). Measurement allows for comparison of performance with a specific standard or the performance of others on the same task (Woolfolk, 2010). The term *assessment* is used to describe the process of gathering data about student learning. Assessment is broader than testing and measurement because a variety of methods are used to sample a student’s skill, knowledge and abilities. “Standard methods of developing items, administering the test, scoring it and reporting the scores are all implied by the term *standardized* test.” (Woolfolk, 2010, p. 606). The roots of today’s use of standardized assessments in nursing stems from the need to measure “inputs” and “outputs” of education.

Measurement and evaluation of student achievement has continued to advance rapidly. Student outcomes such as test scores, grade point averages, attrition rates, standardized assessment test scores and NCLEX-RN performance serve as feedback loops to assist in determining the effectiveness of nursing programs (Carrick, 2011). The National Council of State Boards of Nursing (NCSBN) was developed in 1978 with the goal of insuring safe competent nursing care to protect the public. NCSBN recognized the best way to insure safe nursing care for the public was development of the legally defensible nurse licensure exam. The NCSBN insures the NCLEX examination is appropriate for the profession of nursing by establishing content, face, construct, predictive and scoring validity (National Council State Boards of Nursing, 2011b). In 1982, the NCLEX-RN replaced the State Board Test Pool

Examination as the accepted method of mandating that a nurse has met the minimum requirement for safe nursing practice (Holstein et al., 2006). In 1994, the previously hand-written exam moved to administration by use of computerized adaptive testing (CAT). Following the implementation of CAT for NCLEX-RN licensure a significant decline in the first-attempt passing rate of new graduates was realized. Since 1994, over 2.4 million candidates educated in the United States have taken NCLEX utilizing the computer adaptive test (National Council State Boards of Nursing, 2011b).

In 2004 NCSBN changed from multiple choice only items for NCLEX-RN. Higher level questions were incorporated into the NCLEX-RN test blueprint (Carrick, 2011). These changes were reflected in the emphasis placed on construct and content representativeness for each of the Client Need categories. Of particular interest was the increase in content associated with Pharmacology and Physiological Integrity. The NCSBN, which controls NCLEX-RN, increases the passing standard every three years to reflect the complexities of the patient population encountered by nurses. The latest update occurred in April 2010 (National Council State Boards of Nursing, 2011a). Consistent with expectations, the national pass percentage for nursing programs declined over the next few years. Current trends in national pass rates between 2007 and 2011 to date are reported at 85.5%, 86.7%, 88.4%, 87.4% and 87.9%, respectively.

Recent projections indicate a shortage of approximately one million nurses nationally by the year 2020 (Bargaliotti, 2009; as cited in Roa et al., 2011). The end of year report from NCSBN for 2011 shows the first-attempt US educated baccalaureate nursing student number was 58,264 with a national pass rate of 89.1%, continuing the trend of approximately 10% of nursing students failing NCLEX-RN. Existing NCLEX-RN failure rates coupled with the aging RN workforce has created a heightened awareness of the impending shortage of qualified nurses for

healthcare organizations (Roa et al., 2011). The resulting first-attempt failures of 10.9% reflect over 6300 US educated baccalaureate graduates unable to contribute to the nursing shortage. Hiring and training costs for each new graduate has risen to \$27,600. When a new graduate fails NCLEX-RN, the result increases cost to \$87,197 (Greenspan, Springer & Ray, 2009). Decreasing NCLEX-RN first attempt failures can assist to decrease the impact of the expected shortage as well as decrease the cost of orientation for newly graduated nurses.

Because nursing programs should produce graduates with requisite knowledge, critical thinking abilities and work behaviors to meet the health care needs of the population, the depth and breadth of learning required to master the body of knowledge in nursing and then apply that knowledge in appropriate context using clinical judgment are overwhelming to new nursing students. As students attempt to navigate through the learning process, many find it difficult to differentiate information that is important to learn and that which is less important. Many students lack experience in nursing that could assist them in sense-making of the information and the appropriate context for application (Carrick, 2011).

To assist students and supplement teaching and evaluation methods to address NCLEX-RN outcomes, commercially prepared standardized assessment programs were increasingly adopted by schools of nursing. Standardized assessment programs developed for nursing education serve to evaluate knowledge in specific content areas and comprehensively at the end of the nursing program. Testing companies specializing in NCLEX-RN preparation provide a series of content-specific assessments for use throughout the nursing curriculum to detail student progress in knowledge acquisition.

After 1994, CAT was adopted as the method of delivery for NCLEX-RN. This move required companies specializing in NCLEX preparation to develop programs to reflect the

current licensure standards for administration. With standardized computerized assessments, a rapid turn-around time with immediate feedback on students' level of performance was readily available. This educational tool identified low student scores and provided feedback on areas of weakness earlier in the educational process than ever before and not just at the end of the program (Holstein et al., 2006). Companies such as Educational Resources Incorporated (ERI), Assessment Technology Institute, LLC (ATI), Health Education Systems, Inc. (HESI), the National League for Nursing (NLN) and Mosby developed a variety of computerized assessments to assist nursing programs in the evaluation of student acquisition of knowledge.

ERI offered the first testing program in 1997. Since that time, the available assessment packages have expanded to contain content-specific and predictive comprehensive end-of-program exams. In addition to the assessment packages, ATI offers remediation materials and tools to assist students and faculty in the educational process. The inclusion of predictive testing has increased use of comprehensive assessment programs exponentially. Recently, reports of a near 7-fold increase in the use of HESI testing in the past 5 years have been identified (Sayles, Shelton & Powell, 2003). Crow et al. (2004) studies 160 nursing programs use of standardized assessments and found 90% utilized a standardized comprehensive end-of-program exam to evaluate student performance. Currently, ATI reports a collaborative testing relationship with more than 2100 schools of nursing (Assessment Technologies Institute, LLC, 2011a). The addition of content-specific assessments in specialty areas of nursing has allowed for evaluation of student knowledge acquisition and early identification of at-risk students for remediation throughout the nursing program well before the critical NCLEX-RN examination.

Predicting NCLEX-RN Performance

As evident in the literature, nurse scientists have been interested in the predictive relationship of standardized assessment exams in identifying students likely to be successful and unsuccessful on NCLEX-RN for some time. While many studies evaluate variables related to success, fewer are evident in the literature attempting to identify variables with a relationship to students at-risk for failure (Alexander & Brophy, 1997; De Lima et al., 2011; Jacobs & Koehn, 2006; Spurlock & Hunt, 2008; Uyehara, Magnussen, Itano, & Zhang, 2007). The initial search in the available literature focused on content-specific assessments in a variety of nursing preparation programs, using NCLEX-RN failure as the dependent variable. The literature search revealed relatively few studies regardless of academic preparation. This finding was supported by De Lima et al. (2011). Even fewer studies were found using content-specific assessments as independent variables within a sample population of baccalaureate nursing students. In contrast, the literature comparing end-of-program assessments and NCLEX-RN success or failure with samples from a variety of nursing preparation programs revealed a multitude of studies. The focus of this study required the review of literature to expand and include research on a variety of standardized and content-specific assessments and their relationship to NCLEX-RN outcomes and various techniques surrounding their use in schools of nursing. The following section includes the current evidence in the literature consistent with the purpose of the study.

Literature on NCLEX-RN failures.

De Lima, et al. (2011) completed a retrospective study using demographic data and academic records to identify common characteristics of the students who were unsuccessful on NCLEX-RN. Some of the independent variables included were a standardized preadmissions assessment, NLN content-specific assessment scores and a HESI comprehensive end-of-program

assessment score. The dependent variable was identified as success on first attempt at NCLEX-RN. The sample ($N = 38$) consisted of 19 students failing NCLEX-RN on the first attempt and 19 students randomly selected from those passing NCLEX-RN on the first attempt from one associate degree program of nursing. An independent two sample t -test was used to compare the independent variables mean scores between the groups. Statistically significant values were indicated ($p < .05$) for the standardized pre-admission PAX-RN the score on the HESI comprehensive exit assessment and the NLN content-specific assessment scores on the Fundamental, Parent-Child and Mental Health assessments. The authors reported findings that support standardized content-specific assessment results as the most significant variables identified as profiling the student most likely to fail NCLEX-RN.

Vandenhouten (2008) also recognized the lack of consistency in findings related to NCLEX-RN failures. In her retrospective study for dissertation, *Predictors of Success and Failure on NCLEX-RN for Baccalaureate Graduates*, a convenience sample of graduates ($N = 296$) was tested using a dichotomous outcome of success or failure on the licensure exam. Regression analysis indicated scores on standardized content-specific assessments from ATI were able to predict NCLEX-RN success ($p < .05$). However, the regression models were less effective in predicting NCLEX-RN failures. The most significant finding in detecting failures resulted from the regression model utilizing a combination of content-specific assessment scores including Nursing Care of Children, Leadership, Mental Health, Community Health and Pharmacology. The combinations of interactions in assessments were able to predict NCLEX-RN failures 30.8% of the time. Individual ATI content assessment scores for Fundamentals, Medical Surgical, and Maternal Newborn assessments were predictive of failure to a lesser degree in a range of 7.7% - 8.7%. The researcher recommends further studies including

graduates from multiple nursing programs with more diverse student bodies were needed to improve generalizability of findings.

Steunkel (2008) focused her study on exploring the predictive value of various standardized assessments and achievement measures with NCLEX-RN performance especially on those students who were likely to fail. The author used an archival correlational design to examine nursing student records from six graduating classes ($N = 312$). The overall pass rate on the first attempt for the convenience sample was 77% ($n = 241$). Of this number 71 students failed NCLEX-RN on the first attempt. A variety of content-specific standardized assessments were utilized from the NLN. Of the five standardized content specific assessments used, the most predictive of NCLEX-RN failures was the NLN Community Health assessment which detected 24% ($n = 17$) of the failures. In the combination effects, the NLN Community Health and NLN Adult Health examination detected 29% ($n = 20$) failures. The findings indicate that standardized assessments are upheld in predicting NCLEX-RN failures but fall well below the ability to predict successful performance. Steunkel suggests the identification of students who will fail remains elusive.

Bondmass, Moonie, and Kowalski (2008) evaluated standardized admission and content-specific assessments for their relationship to NCLEX-RN pass rates. The authors compared 16 ERI standardized assessment scores in a sample of baccalaureate graduates ($N = 147$) who passed or failed NCLEX-RN. One aim of the study was to determine if a standardized nurse entrance assessment (NET) and ERI content-specific assessment scores differ between baccalaureate graduates passing NCLEX-RN on the first attempt and those who do not. Of those who graduated, 87.8% ($n = 129$) passed on the first attempt and 12.2% ($n = 18$) did not. Graduates who passed the NCLEX-RN had statistically higher NET scores for admission and

scores significantly higher on 13 out of 16 ERI exams ($p < .05$) than those who failed NCLEX-RN. Significant findings were reported for scores on gerontology, adult care, therapeutic communication, critical care and end-of-program RN assessments. Composite ERI scores for pharmacology, mental health and maternal child were found to be higher although not to a level of significance. Findings support the belief that students with lower standardized exam scores may require intervention to increase their knowledge level to achieve higher scores on standardized tests.

Spurlock and Hunt (2008) conducted a retrospective descriptive correlational design studying poor outcomes following the implementation of a progression policy that included the use of a comprehensive standardized end-of-program assessment exam provided by HESI. Logistic regression analysis was used to predict NCLEX-RN failures from the HESI end-of-program examination. Data was collected from one large college of nursing ($N = 179$). The student name, number of attempts on the HESI end-of-program examination with accompanying scores and pass/fail status were gathered from student records. The established benchmark for progression to graduation was determined by the college of nursing at 850. When the scientist used the first-attempt score only on the HESI end-of-program examination and correlations were calculated, results revealed a statistically significant relationship between first examination score and NCLEX-RN outcomes ($p < .05$). Using the highest HESI end-of-program assessment score for each student regardless of number of attempts showed that of those predicted to pass NCLEX-RN ($n = 167$), 22 failed. Based on final HESI scores of the 12 expected to fail, 10 passed NCLEX-RN. The results showed that two of those expected to fail actually failed. Further analysis classified HESI end-of-program assessments first-attempt scores as *fair* predictors of NCLEX-RN outcomes. Only students' first-attempt scores on the HESI end-of-program

examination were found to be statistically significant in predicting NCLEX-RN outcomes.

Students who repeat the examination until the benchmark was successfully reached dilute the relationship between the variables. Students requiring repeat testing to achieve the benchmark are more likely to fail after three, four or five attempts than those who reach the benchmark on the first attempt. Allowing repeated testing to reach a benchmark on the HESI end-of-program examination for prediction of NCLEX-RN success or failure was not supported empirically. The authors also recommend decreasing the cutoff score below the recommended level of 850 can increase the predictive accuracy of the HESI examination. Predicting NCLEX-RN failures were not supported using HESI end-of-program assessments alone.

Seldomridge and DiBartolo (2004) conducted a retrospective study of baccalaureate students ($N = 186$) to determine variables that best predict success and failure on NCLEX-RN. The researchers were interested in three points during the curriculum for the sample of baccalaureate students (a) preadmission, (b) after the first year of nursing courses and (c) immediately prior to graduation. The NLN comprehensive end-of-program assessment was analyzed and a positive correlation was found with NCLEX-RN success. The regression model identified the ability of the NLN comprehensive end-of-program assessment as 94.7% accurate in predicting success and 25% accurate in predicting failures. The findings of the study suggest that the NLN comprehensive assessment and course scores in selected classes were very accurate in predicting NCLEX-RN successes; they were much less accurate in predicting NCLEX-RN failures. Findings of the interaction models between the NLN comprehensive end-of-program assessment and the pathophysiology course grade showed the highest ability to predict failures at 50% of the time. Overall, the variables under study were not consistent in predicting NCLEX-RN failures.

Literature on NCLEX-RN success.

The strongest evidence found in the literature for predicting NCLEX-RN success in baccalaureate nursing students was reported in a meta-analysis conducted by Grossbach and Kuncel (2011). Meta-analysis is the dominant approach to research synthesis in the sciences. Meta-analysis evaluates quantitative data and provides summaries relevant to the content in question (Aguinis, 2011). The authors reviewed 31 studies of baccalaureate nursing students ($N = 7,159$) on first attempt at NCLEX-RN. Inclusion of studies for the meta-analysis was based on correlational methods used to analyze data or findings that could easily be translated into correlations. Program type was a limiting factor and only studies with samples of baccalaureate nursing students were considered. The extensive review identified 13 separate academic variables including standardized assessment examinations as possible predictors of NCLEX-RN success. ACT ($r = .42$) and SAT ($r = .46$) scores and to a lesser extent prenursing GPA ($r = .39$) proved predictive. Interactions between the standardized assessment scores and prerequisite grades also demonstrated a strong relationship to performance on NCLEX-RN. Nursing grades in general and second year grades in particular ($r = .49$) were highly predictive of NCLEX-RN success which rivaled predictive validity for some standardized NLN and Mosby end-of-program assessments as claimed by the authors. Standardized admissions assessment scores and grades earned in nursing programs were identified as the two best predictors of performance on NCLEX-RN with prenursing GPA and standardized end-of-program assessments predictive to a lesser extent.

Harding (2010) completed a systematic literature search associated with standardized comprehensive end-of-program assessments' ability to predict success on NCLEX-RN. Sixteen studies were reviewed utilizing a variety of commercially available standardized comprehensive

end-of-program assessments. The inclusion criteria for the systematic review were (a) reported a relationship between computerized assessment measures and NCLEX-RN pass rates (b) administered a commercially available standardized end-of-program examination comparable to the NCLEX-RN, using the same test blueprint and similar computerized features (c) and presented new information not already reported in an earlier source. Harding's claim of end-of-program comprehensive testing was found to be a consistently strong predictor of NCLEX-RN success among students scoring high on the comprehensive end-of-program assessments. However, the review of the literature found the end-of-program assessments were not significant in predicting failures.

Pennington and Spurlock (2010) conducted a systematic review to assess the quality of studies focused on remediation only in the context of improving NCLEX-RN results. All studies included in the review were prior to the CAT administration method for NCLEX which was implemented in 1994. A total of eight studies met the criteria for inclusion. All studies were single descriptive studies. No experimental or quasi-experimental designs could be located to evaluate the effectiveness of remediation interventions on improving NCLEX outcomes. Several themes were apparent in the recommendations of the included studies. For the purposes of this study, the noteworthy finding was that the use of standardized assessments was recognized as possibly beneficial in assisting students to identify areas of weakness when combined with other factors. However, the review provided no substantial evidence of effectively supported remediation plans, even those including standardized assessments.

Matos' (2007) correlational study examined the relationship between selected nonacademic variables and students' standardized assessment scores on the comprehensive ERI produced examination given at the end of the program and successful passage of NCLEX-RN.

Participants were selected from a convenience sample ($N = 291$) from one school of nursing from 2002 to 2005. Qualified participants successfully completed a baccalaureate program and were eligible to take the NCLEX-RN. *T*-test comparison showed a significant difference in scores on standardized end-of-program assessments from ERI between those who passed ($n = 273$, $M = 59.03$, $p < .05$) and those who failed ($n = 18$, $M = 54.89$, $p < .05$) NCLEX-RN. The Pharmacology course grade was found to be significant ($p < .05$) in predicting NCLEX-RN outcomes. The author indicated that the use of the results can assist faculty in identifying at-risk students early in the nursing program and prior to sitting for NCLEX-RN.

Treas (2006) studied the degree to which use of a nursing achievement test, as well as other variables, account for the success or failure on NCLEX-RN for baccalaureate and associate degree programs using logistic regression analysis procedures. The sample ($N = 968$) was from 34 programs of nursing in the United States. The comprehensive predictor end-of-program assessment developed by ATI was used in conjunction with other strategies to predict NCLEX-RN outcomes. The test of significance showed the differences in the scores between those passing and those failing NCLEX-RN were found significantly different ($p < .05$). Using the Stepwise procedure, the reduced model, combining the comprehensive end-of-program predictor assessment with five additional variables predicted outcome status on NCLE-RN with 81.5% accuracy. The model revealed correct classification of passing at 97.7%. However, the author espouses that the assessment is less likely to be an accurate predictor of failures.

Crow, Handley, Morrison and Sheldon (2004) conducted a descriptive correlational study of schools of nursing ($N = 160$) to identify predictors of success and interventions that increase pass rates on NCLEX-RN across baccalaureate programs. The purposes of the study were (a) to identify specific program requirements and educational interventions that might positively

impact NCLEX-RN success and (b) to determine the best predictors of NCLEX-RN success used by baccalaureate programs. The study included admission parameters, content-specific assessments for progression and comprehensive end-of-program assessments used as graduation requirements. Of the schools surveyed, only a few utilized standardized assessment test scores, such as NLN, as a means for progression. Fifty-nine of the 160 programs represented required a standardized end-of-program examination before graduation. Ninety percent of programs surveyed utilized comprehensive standardized end-of-program assessments to predict NCLEX-RN success or failure for students. For programs using NLN content-specific assessments to determine student readiness to progress, the at-risk benchmark scores identified by the programs found only two examinations significantly correlated with passing NCLEX. These were Mental Health nursing ($r = .55, p = .02$) and Community nursing ($r = .76, p = .02$). Two graduation requirements were found to be significantly correlated with NCLEX-RN success: clinical proficiency ($p = .03$) and use of a standardized comprehensive end-of-program assessment ($p = .05$). The findings of the study indicate a strong positive relationship between NLN Mental Health and Community content examinations as well as clinical proficiency and end-of-program examinations with passing NCLEX. The authors suggest that baccalaureate programs should continue using at-risk scores on content specific assessments for progression in the nursing program or at least to identify at-risk students.

In the study by Ukpabi (2008), nursing students from one university ($n = 39$) were sampled to determine significant variables to indicate success on the NCLEX-RN. Mean scores for those who passed compared to those who failed NCLEX-RN were significantly discriminating. The eleven significant assessments were: ATI Critical Thinking, ATI TEAS Comprehensive, ATI Reading, ATI Math, ATI English, NLN Adult I, NLN Adult II, Nursing

Care of Newborn, Pediatric, Mental Health ATI, Pharmacology ATI and Fundamental ATI. The findings suggest that NCLEX-RN success for students in the convenience sample of graduates in the 2006 nursing program can be predicted by a combination of eleven identified Assessment Technology Institute, LLC (ATI) assessments and National League for Nursing (NLN) assessments more than others. Eleven of the assessment test variables were determined to be statistically significant ($p < .05$). Implications of the study suggest that scores on the various ATI and NLN assessments may be useful in advising students and for developing academic support services to increase student success in nursing programs and as a predictor of success on NCLEX-RN.

Esper (2009) utilized the Test of Academic Skills (TEAS) and Fundamentals content-specific assessments from ATI to determine a relationship with student outcomes for the first semester in an associate degree nursing program. In her exploratory action study for her doctoral dissertation, freshman nursing students ($N = 120$) were examined to assess the relationship of variables to predict first semester success. The study sought to determine the strength of relationships between the predictor variables (TEAS scores overall and content-specific; math, science, and English course grades; age and gender) and the dependent variables (pharmacology and math exam grade, Nursing Fundamentals course grade, Nurse Health Assessment course grade, and standardized ATI Nursing Fundamental content-specific scores). The standardized TEAS assessment provided by Assessment Technologies Institute, LLC (ATI) was utilized along with other additional admissions variables. An additional focus of the study was to determine the best indicator of first semester academic outcomes. Simple correlations and regression analysis procedures were used to determine the contributions of each of the predictor variables in determining student success in the first semester of the nursing program. Only the TEAS total

score showed significant positive correlation with a broad range of successful course grades and the standardized ATI Fundamentals content-specific assessment ($p = .05$).

In dissertation work, Carl (2008) completed a retrospective quantitative correlation study ($N = 65$) that included nursing students in an associate degree program between 2003 and 2006. The scientist study included eight ATI assessments. The study described the development of a nursing program performance improvement model to measure pass/fail rates. Sixty-one (93.8%) students passed NCLEX-RN on the first attempt with four (6.2%) students failing. The eight ATI standardized content specific and comprehensive end-of-program assessments were critical thinking, leadership, math, science, English, reading, total TEAS scores and the comprehensive predictor end-of-program assessment. Pearson's product-moment correlation was used to identify relationships between variables. Statistical analysis results revealed higher ATI test scores were associated with passing the NCLEX-RN on the first attempt and lower scores were associated with nursing program failures. Positive significant correlations were found in GPA, reading, science, English, TEAS total score, critical thinking and the end-of-program RN Comprehensive 2.0 predictor. The strongest relationship based on inferential statistics was with English ($r = .447, p < .01$). The combination of English and critical thinking correlation found the higher the scores in those areas, the more likely the student was to pass the NCLEX-RN on the first attempt. Reading and science scores also demonstrated a significant positive correlation to NCLEX-RN pass rates. The relationship between NCLEX-RN success and failure was not found to be significant with age, math and leadership.

Work by McGahee, Grambling, and Reid (2010) examined predictors from a baccalaureate nursing program ($N = 153$) over a three year period. The purpose of the study was to examine student academic variables from a baccalaureate nursing program to determine

factors that may be predictive of student success on NCLEX-RN. Academic variables examined were scores on the Scholastic Aptitude Tests (SAT), American College Test (ACT), performance in pre-nursing, science GPA, selected nursing courses and scores on standardized nursing assessments. The standardized assessment included a critical thinking assessment, and an end-of-program RN comprehensive assessment designed to be predictive of NCLEX-RN success. End-of-semester teacher generated comprehensive exams specific to the nursing program were also identified as independent variables. In this retrospective correlational design, logistic regression for analysis of the data was used with NCLEX-RN passing success as the dependent variable. The logistic regression analysis indicated the variables with a significant main effect on NCLEX-RN success were RN Assessment Test scores, passing grades of C or better in Theoretical Foundations and passing grades in Pathophysiology. The combined variables having a significant main effect on NCLEX-RN success were the RN Assessment Test and pathophysiology. The variables that were significant in the interaction models included science GPA, RN Assessment Test, the Fundamentals course scores, and scores in Health Assessment and Pathophysiology. Science GPA was found to be significant in four different interaction models. The strongest predictors of NCLEX-RN success were found among the interactions.

Sayles, Shelton and Powell (2003) conducted a correlation study investigating the relationship between scores on commercially prepared standardized assessment exams created by ERI and success on NCLEX-RN. The purpose of the study was to determine the relationship between performance on the standardized nurse entrance assessment (NET) and the end-of-program PreRN comprehensive assessment scores and success on the NCLEX-RN. The sample population ($N=78$) consisted of one graduating class of an associate degree in nursing program. Sixty-eight students (87.2%) successfully passed NCLEX-RN on the first attempt. Pearson's

product-moment was used to determine strength of relationship between variables. For between group comparisons, the two tailed independent *t*-test statistic was calculated ($p < .05$). Variables found to have significance from the standardized NET scores included math, reading and the overall composite scores. The end-of-program PreRN comprehensive examination composite score correlated higher values positively with success on NCLEX-RN.

Jacobs and Koehn (2006), in a case study approach, described the implementation process for a commercially available standardized testing program in a large Midwestern university. The standardized testing program offered by ATI was adopted in an effort to meet recommendations to address the need for increasing NCLEX-RN pass rates. First-attempt pass rates were compared before and after implementation of the program. The descriptive statistic showed an increase from 86% to 92%. Senior level student feedback from 36 students reported 29 students reacting positively to the ATI program. Those in descent reported a lack of time to prepare. The obstacles to implementing the ATI program were discussed and the impact of the ATI program on curriculum decisions was identified. The article goes on to explain the implementation process in detail to assist schools of nursing in similar endeavors.

In the qualitative study by Rogers (2010), students recognized standardized assessments as instrumental in their success on NCLEX-RN. Three faculty and five former students passing NCLEX-RN on the first attempt were interviewed. Three major thematic categories emerged (a) student related, (b) collaborative and (c) curriculum related. Within the curriculum related theme, use of standardized assessments that mimic NCLEX-RN were recognized as a reoccurring activity identified by participants as contributing to preparation and success.

Uyehara, Magnussen, Itano, and Zhang (2007) used NLN content specific assessment scores as predictors of NCLEX-RN and program success and as indicators for attrition. The

study was conducted at one school of nursing over a five year period after implementation of a new curriculum. Data were collected retrospectively at three phases (a) admissions, (b) within the program and (c) at exit with a convenience sample ($N = 280$) of generic baccalaureate nursing students. Within the program, NLN content-specific assessment scores for Mental Health, Maternal Newborn, Pediatric nursing and Adult Health nursing were evaluated. Of those passing NCLEX-RN on the first attempt significant correlations were detected between the Adult Health ($p < .05$), the Maternal Newborn ($p < .05$) and, the Pediatric Nursing ($p < .05$) assessments. When variables were analyzed by statistical regression models, the best predictor of success was the score on the Adult Health test ($p < .05$). Of the eleven students who were unsuccessful, no significant correlations among the variables were detected. The outcome of the study indicated that early recognition of the student as being at-risk based on NLN content-specific assessment scores, course grades and GPA are warranted so that students are able to prepare sufficiently prior to taking NCLEX-RN.

Alexander and Brophy (1997) conducted a study identifying predictors of NCLEX-RN success and failures in baccalaureate students. Data was collected from a five year period beginning in July 1988 and ending February 1994, just prior to implementation of the CAT for licensure. The study contained a convenience sample ($N = 94$) of students failing NCLEX-RN on the first attempt and compared this group with a sample ($N = 94$) of students passing the exam. The independent variables tested included all admission criteria, nursing program course and exam scores and a standardized comprehensive end-of-program exam from NLN. A logistic regression model selected four significant variables related to NCLEX-RN success (a) NLN comprehensive end-of-program assessment, (b) Childbearing course, (c) Nursing Adult 1 course and (d) Mental Health course grades. The authors claim using these variables for progression

would allow for identification and intervention of students at-risk in nursing programs. The study recognized the importance of early evaluation for student counseling and intervention.

Summary of the Literature Reviewed

The literature reflects student preparation for safe, entry-level practice and successful completion of the NCLEX-RN for licensure is a priority for nurse educators. Many studies seek to identify predictive factors and interventions that enhance success of graduates on the NCLEX-RN. Multiple studies indicated that nursing standardized comprehensive end-of-program assessments are significantly correlated with NCLEX-RN success regardless of company affiliation (Alexander & Brophy, 1997; Bondmass et al., 2008; Carl, 2008; Crow et al., 2004; DeLima et al., 2011; Grossbach & Kuncel, 2011; Harding, 2010; Matos, 2007; McGahee et al., 2010; Noel, 2009; Sayles et al., 2003; Seldomridge & DiBartolo, 2004; Spurlock & Hunt, 2008; Treas, 2006; Ukpabi, 2008). In the one meta-analysis (Grossbach & Kuncel, 2011) found in the literature reviewing a variety of standardized assessments as variables related to NCLEX-RN, results show the strongest statistically correlated evidence was detected between ACT and SAT and end-of-program comprehensive examinations.

Nursing content-specific standardized assessments used to determine correlations with NCLEX-RN outcomes were varied in content and company affiliation from study to study. Mental Health (Alexander & Brophy, 1997; Bondmass et al., 2008; Crow et al., 2004; De Lima et al., 2011; Steunkel, 2008; Ukpabi, 2008), Community (Crow et al., 2004), Parent Child (Bondmass et al., 2008; De Lima et al., 2011), Pharmacology (Bondmass et al., 2008; Ukpabi, 2008) and Fundamentals (De Lima et al., 2011; Esper, 2009; Ukpabi, 2008) as well as other content-specific assessments were significantly correlated with NCLEX-RN success. Studies show the relationships between standardized comprehensive end-of-program exams and

NCLEX-RN failure not significant and inconclusive. However, end-of-program assessments were found predictive of NCLEX-RN success consistently. A variety of content-specific assessments were studied to determine their relationship to NCLEX-RN outcome that were also inconsistent in findings.

This completes the review of the most recent and significant literature relevant to the study. The theoretical support for the educational foundations for utilizing standardized assessments will be described in the following section.

Educational Framework Applied to Nursing Education

Behaviorism and constructivism.

Knowledge about the world does not simply exist out there, waiting to be discovered, but is rather constructed by human beings in their interaction with the world (Gordon, 2009). As students gain knowledge and apply that knowledge in the social context of professional nursing practice, understanding of concepts become more evident. Ultimately students must be able to demonstrate their level of understanding on standardized assessments showing mastery of specific content within the discipline needed for safe nursing practice.

Behaviorism forms the basis of traditional learning environments in which the teacher is the authority in the classroom and students do as the teacher instructs. Historically, nursing has utilized a behaviorist approach to learning. Behavioral theories focus on direct instruction where the teacher transmits the knowledge to students in a well-organized manner (Li, 2007). Criticism of the limitations of behaviorism, as a system for explaining learning led to development of other theoretical formulations in cognitive and developmental psychology that focused on how people learn. Some students did not respond well to the behaviorist approach and need the opportunity to explore and discover their own ideas..... (Norton, 1998; Vandever & Norton, 2005).

Behaviorist teaching is able to account for measurable goals and outcomes in education but cannot be uncritically applied to education. Kohn (as cited in Gordon, 2009) criticized some of behaviorism's main concepts when appropriated into classroom management.

Prominent nursing educators of the 1970s and 80s made extensive use of the principles of behaviorism. The move from the pure behaviorist approach toward a constructivist philosophy supports the educational framework in nursing programs. Nursing is defined by NCSBN as “both an art and a science, founded on a professional body of knowledge that integrates concepts from the liberal arts, and the biological, physical, psychological and social sciences.” (National Council State Boards of Nursing, 2010a). To Accomplish the less visible processes involved in complex mental functions such as concept formation, problem solving, and critical thinking, a move from the behavioristic paradigm was required.

Foundations of cognitive learning theory originated from the Gestalt psychologists who believed that people respond to complex situations or patterns rather than just parts of a situation which provides insight into a phenomenon (Vandever & Norton, 2005). Cognitive theorists focus on and emphasize the mental processes and knowledge structure that can be inferred from behavioral actions. The specific focus is on mental processes of perception, thinking, knowledge representation and memory with emphasis on understanding and knowledge acquisition not just on a new behavior or learning how to perform a task (Vandever & Norton, 2005). In cognitive models of learning students have active rather than passive roles in instruction and a new responsibility for learning.

Constructivism in general terms, as explained in Gredler (2005), emphasizes the importance of social processes along with cognitive learning in the production of knowledge. The constructivist sociocultural theory accounts for the important roles that social relations,

community, and culture play in cognition and learning. The goal of learning within social constructivism is to shift the focus from correctly replicating the teacher's words and actions to the successful organization by the student based on experiences. Educational constructivist theory suggests that learners actively develop their own knowledge and social interactions (Woolfolk, 2010).

According to Windschitl (as cited in Gredler, 2009) constructivism is based on the assertion that learners actively create, interpret, and organize knowledge in individual ways. These fluid intellectual transformations, he maintains, occur when students reconcile formal instructional experiences with their existing knowledge, with the cultural and social contexts in which ideas occur, and with a host of other influences that serve to mediate understanding (p. 39).

Cognitive constructivism acknowledges that new knowledge is developed and builds on previous knowledge. To accomplish the building of knowledge, a learner-centered approach is required, where the teacher aims to elicit and understand what previous knowledge each individual has and helps to construct new knowledge to develop new schemas (Woolfolk, 2010) within the discipline of nursing (Li, 2007). The previous knowledge should include those learned terms, conditions and principles that apply to nursing. Learners build upon previous knowledge and life experiences in the acquisition of knowing and understanding. One method to acquire this needed foundation is through development of declarative knowledge. Declarative knowledge is knowledge that can be declared through words and symbol systems. Procedural knowledge is recognizing the process of doing something. It is knowing in action (Woolfolk, 2010). Understanding involves declarative knowledge about characteristics and images as well as procedural knowledge for application in context. People learn best when they have a good base

of knowledge in the area they are studying. With well-defined schemas to guide cognition new material makes more sense.

In the context of nursing, declarative knowledge is important to development of schemas toward understanding. Schemas originated from Piaget. Woolfolk (2010) describes schemas as the “basic building blocks of organized thinking” (p. 46). They are systems of thought that link objects with events in the environment. A person’s thinking processes become more organized and new schemas develop; behavior becomes more sophisticated and better suited to the environment. Examples of such content in schema development are medical terminology, pharmacology classifications and mathematical principles to calculate medication dosages for administration to patients. “Understanding binds together knowledge learned from schemas to make sense of the world. Without understanding only unclear, isolated or unhelpful facts are seen.” (Wiggins & McTighe, 2005, p. 7).

“Nursing is a dynamic, continually evolving discipline that employs critical thinking to integrate increasingly complex knowledge, skills, technologies and client care activities into evidence-based nursing practice.” (NCSBN, 2010a). Consistent with the theory of learning described the foundations of nursing practice for recall of information becomes necessary to create the basis for continued complexity of learning required throughout subsequent nursing courses. Students must be active participants in the learning process. Self-regulation becomes necessary to manage learning needs. Self-regulatory knowledge is knowing how to manage your learning. It is knowing when and how to use declarative and procedural knowledge. In this framework, the locus of control no longer rests with the teacher. Students need to learn how to learn (Li, 2007).

The ATI standardized content-specific assessments evaluate the students' basic foundational concepts and principles required at the beginning level (Assessment Technologies Incorporated, LLC, 2011b). Students' prior knowledge and experiences are organized into schema, patterns and connections for understanding and remembering (Woolfolk, 2010) nursing content. Learning is augmented by active events in the classroom and clinical settings requiring participation in authentic learning opportunities for transfer of knowledge. Transfer of knowledge to the authentic environment is evidence of understanding concepts learned. The evidence can then be measured by multiple means including use of standardized content-specific assessments. Mastery of this foundation is then built upon through subsequent course work and clinical experiences toward understanding of the domain of nursing culminating in success on NCLEX-RN.

As mentioned previously, foundations of nursing practice are evaluated in the content-specific assessments offered by ATI. The Fundamentals assessment evaluates students' basic comprehension and mastery of the fundamental principles of nursing practice. The list of concepts includes communication techniques, health assessment, medication administration, safety and support of psychosocial needs. The Pharmacology assessment includes basic pharmacologic principles and knowledge related to safe administration and monitoring of drugs. The Mental Health assessment covers basic assessment, therapeutic nurse-client relationships, anxiety and defense mechanisms as well as pharmacologic and non-pharmacologic interventions for clients with a variety of mental health disorders (Assessment Technologies Institute, LLC, 2011b). Chapter one has a complete description of concepts contained in each assessment used in this study.

Foundational concepts of nursing.

The combination of declarative and constructivist influences described previously form the educational framework for this study. The foundations of learning in nursing use memory and recall of concepts developed in the didactic setting and build upon those concepts through authentic clinical experiences. It is hypothesized that a student's success or failure on NCLEX-RN is directly related to the acquisition of the cognitive knowledge of foundational principles in the domain of nursing and are influenced by the educational framework of constructivism. The knowledge constructed during the first academic year influences performance on standardized content-specific assessments which will ultimately impact the knowledge acquisition and formation of principles and concepts expressed in future performance on NCLEX-RN.

The concepts and processes assessed by ATI are consistent with the foundations basic to nursing practice. The content of NCLEX-RN is organized into Client Need categories and subcategories. The categories described by the NCLEX-RN blueprint are Safe and Effective Care Environment, Health Promotion and Maintenance, Psychosocial Integrity and Physiological Integrity (National Council State Boards of Nursing, 2010a). Table 1 shows the comparison of concepts consistent between the three ATI assessments under study and NCLEX-RN Client Need categories.

Table 1

Concept Comparison

| ATI | NCLEX-RN |
|-----|----------|
|-----|----------|

| | |
|--|--|
| Fundamentals <ul style="list-style-type: none">• Health care delivery• Thinking strategies• Communication• Professional standards• Nursing through the lifespan• Health Assessment• Admission, transfer, discharge• Medication administration• Error prevention• Safety• Infection control• Comfort• Basic needs• Wound Care• Psychosocial family, cultural and spiritual health• End of life care• Oxygenation• Circulatory• Fluid and electrolyte, Acid/Base• Elimination• Neurosensory | Safe Effective Care Environment <ul style="list-style-type: none">• Legal rights and responsibilities• Ethical practice• Confidentiality• Advocacy• Error prevention• Safety• Variance reporting• Safe use of equipment• Use of restraints/safety devices• Handling infectious materials |
| Pharmacology <ul style="list-style-type: none">• Pharmacodynamics• Pharmacokinetics• Safe medication administration and monitoring• Medication error prevention• Age specific considerations | Health Promotion and Maintenance <ul style="list-style-type: none">• Aging processes• Health promotion• Disease prevention |
| Mental Health <ul style="list-style-type: none">• Legal/ethical principles• Therapeutic communication• Therapeutic nurse-client relationship• Anxiety• Defense mechanisms | Physiological Integrity <ul style="list-style-type: none">• Assistive devices• Elimination• Mobility/immobility• Non-pharmacologic comfort interventions• Medication adverse effects• Blood and blood products• Dosage calculation• Vital signs• Fluid and electrolyte imbalances |
| | Psychosocial Integrity <ul style="list-style-type: none">• Behavioral interventions• Chemical and other dependencies• Coping mechanisms• Crisis interventions• Cultural diversity |

- MH nursing in diverse populations
 - Non-pharmacologic therapies
 - Pharmacologic therapies for various mental health disorders
 - End of life care
 - Family dynamics
-

Conclusion

This chapter provides a brief history of the development and use of standardized assessments and student outcomes on the NCLEX-RN licensure examination. Multiple studies were reviewed that examined the relationship of standardized assessments to student performance on the licensure exam. Studies utilizing content-specific assessments as predictor variables for NCLEX-RN outcomes were limited in the literature. The variety of content-specific assessments used as independent variables within those studies was inconsistent in content and company of origination. No studies were found to predict NCLEX-RN outcomes using first-year content-specific assessments only as the independent variables. Many studies utilized associate degree nursing programs as the population of interest whereas the population of interest for this study was baccalaureate prepared nursing students.

Based upon the lack of studies to identify any relationship between ATI content-specific assessment scores of baccalaureate students during the first academic year with NCLEX-RN outcomes, the findings of this study will further inform schools of nursing and add to the body of knowledge surrounding the subject. Reliable predictors of passing and failing are needed in the first year of a nursing program. Early identification can allow for intervention to increase the probability of passing NCLEX-RN on the first attempt which will ultimately increase the number of nurses graduating to fill the projected shortages needed to care for the growing aged population.

Some educators criticize the use of standardized assessments (Spurlock & Hunt, 2004; Wiggins, 1991). One limitation identified is the exams have a history of molding instructional content to teach to the test (Gordon, 2009). Other nurse educators support the implementation of a standardized assessment program. Jacobs and Koehn (2006), describe the need for standardized assessments as part of a program for early identification of at-risk students. Their recommendations included using individual student percentile scores from content-specific assessments offered by ATI.

Even though Bondmass et al., (2008) identified critical assessments necessary for student progression to include Fundamentals of nursing, Pharmacology and Mental Health nursing. No studies were found evaluating the relationships among these three ATI content-specific assessments to NCLEX-RN outcomes for baccalaureate prepared nursing students during the first year of a nursing program. The rationale for including Fundamentals, Pharmacology and Mental Health content-specific assessments was influenced by the curricular framework of the Eleanor Mann School of Nursing generic baccalaureate program. In addition, the NCLEX-RN Client Need categories identified by NCSBN include psychosocial integrity, basic care and comfort and pharmacological therapies. Chapter 3 contains tables explaining each Client Need category as related to the three ATI assessments.

Studies reviewed utilized a variety of companies and types of content-specific standardized assessments as variables. The sample populations were drawn from a variety of nursing program. In most studies samples were small, especially when using NCLEX-RN failures as the outcome of interest. Those studies utilizing ATI standardized assessments were also limited. Of the four studies found utilizing ATI assessments, two reported sample populations from a university setting. In summary, the gaps in the literature where the results of

this study could be useful were identified as predicting NCLEX-RN outcomes based on scores from content-specific assessments administered during the first year of a baccalaureate program.

Chapter Three: Method

Introduction

This chapter is presented using the organizing framework developed by Collins, Onwuegbuzie and Sutton (2006). The authors' conceptualize the research process as comprised of 13 steps. The steps were developed primarily for mixed-methods research although the framework is appropriate for monomethod quantitative and qualitative studies as well. Collins and colleagues describe the process beginning at;

the Research Formulation stage followed by the Planning and Implementation stages.

Within each stage multiple steps describe the research process through completion. The proposed study will be described in the following steps; (1) determining the goal of the study, (2) formulation of the research objectives(s), (3) determining the research rationale, (4) determining the research purpose, (5) determining the research questions, (6) selecting the sampling design, (7) selecting the research design, (8) collecting the data, (9) analyzing the data, (10) validating the data and data interpretations, (11) interpreting the data, (12) writing the final report, and (13) reformulating the research questions (p. 69-70).

Formulation Stage

In this stage, five steps represent a linear process to begin the formulation of the research design. The overall approach of the design was quantitative. The type of quantitative inquiry was correlational with predictive analysis in an attempt to determine if a relationship exists between the independent and dependent variables. The approach utilized descriptive and inferential statistical procedures to analyze the data. No variables were manipulated and inferences were made based on retrospectively collected assessment scores, results on NCLEX-RN and

demographics. The potential impact of the study on the field of nursing education is discussed at length in Chapter Five.

Goal of the Study

Findings of this study further informs nurse educators regarding the use of standardized content-specific assessments provided by ATI in predicting NCLEX-RN failures within the first year of a nursing program and adds to the body of knowledge surrounding use of commercially prepared standardized testing programs. Early identification of at-risk students has the potential to decrease NCLEX-RN failures for programs of nursing by allowing time for implementation of a remedial plan before and during the final academic year of a nursing program and first-attempt on the licensure exam. Examining students' past performance can serve to inform the stakeholders in nursing education for future impact on NCLEX-RN failure rates.

Research Objective

The objective for this study is to identify any relationships between the independent variables (ATI assessments) and the dichotomous dependent variable (NCLEX-RN outcome).

Research Rationale

The vision for this study was guided by the gaps in the literature utilizing commercially prepared content-specific assessments developed by ATI to predict NCLEX-RN outcomes in first-year baccalaureate nursing students. Use of ATI assessments was limited in the research literature. No studies utilizing the combination of content-specific assessments analyzed as independent variables to predict NCLEX-RN failures for first-year baccalaureate nursing students were found in the literature.

An electronic search for the most current research was conducted during the period of June 2011 and October 2011. The computer-based search engines used were primarily EBSCO

and OVID. The descriptors used to locate the available literature included: standardized assessment, exam, assessment, nursing, education, Assessment Technologies Institute, predicting NCLEX-RN, predictor NCLEX-RN, licensure and NCLEX-RN success and failure. Searches for the latest educational literature surrounding the topic were also completed from electronic educational newsletters, such as *Chronicles of Higher Education*, and from personal holdings.

The Eleanor Mann School of Nursing program Standardized Tests policy for implementation of the ATI CARP program for the first academic year guided the selection of the content-specific assessments identified for use as independent variables in the study. Analysis of relationships between the variables of content-specific assessments scores during the first year of the nursing program could prove to assist in early identification of at-risk students which can ultimately influence NCLEX-RN pass and fail rates.

Purpose of the Research

As explained in Chapter One, the purpose of this study was to determine the relationship and predictive ability between ATI developed content-specific assessment scores and student outcomes on NCLEX-RN. Scores were collected from archived data available through the Eleanor Mann School of Nursing and ATI.

Research Question

The question guiding the selection of the research design was:

What are the odds or the probability that student scores on the following ATI assessments: Fundamentals, Pharmacology, and Mental Health will predict their outcome of pass or fail on the NCLEX-RN exam?

Planning Stage and Implementation Stage

Sampling and Research Design

The University of Arkansas is a public university and considered to be the state's flagship higher educational institution having provided advanced learning opportunities for nearly 150 years. The total student population has exceeded 23,000 students for the fall 2011 enrollment period. Students from approximately 100 nations attend the University seeking continued educational experiences. The University boasts nearly 200 academic programs with an emphasis on teaching, research and service (University of Arkansas, 2011a).

The Arkansas Board of Nursing reported a total of 272 graduates between 2008 and 2010. The report also indicates 228 students successfully passing NCLEX-RN on the first attempt for the same time frame (Arkansas Board of Nursing, 2011). These numbers indicated a potential of 44 NCLEX-RN failures for the 2008 through 2010 time frame. The number of those reported graduating from the generic baccalaureate program was not specified. The sample containing student records on the first-attempt of NCLEX-RN was collected. The number was expected to be significantly larger for NCLEX-RN pass category than for those failing NCLEX-RN on the first attempt. The anticipated total sample was expected to be within the range of 200-250. The final number of participants included in the sample was quite lower at 119. The dependent variable was dichotomous with two groups (a) those who failed NCLEX-RN on the first attempt and (b) those who passed NCLEX-RN on the first attempt.

The participants for this study were from one university, which is consistent with a case-study research strategy. Quantitative studies characteristically use large, representative samples with the purpose of generalizability (Green, 2007, p. 149). However, a case can be made for this studies' sampling design to meet the characteristics of purposive sampling as described by Teddlie and Tashakkori (2009) where researchers want to generate a wealth of information from a few cases. The sampling design was purposive in that the sample addresses the specific

purpose of the study and was selected to achieve representativeness that is typical of the larger population and for comparability across studies (Teddlie & Tashakkori, (2009). Because the study includes a dichotomous outcome of passing or failing NCLEX-RN, the size of the sample varied significantly between the two groups. The total sample size was 119. One-hundred twelve participants passed and seven failed NCLEX-RN on the first attempt. Glass and Hopkins (1996) declare convenience samples as “accidental” (p.226). The selection of the sample for this study was not accidental and the sampling characteristics align more closely to purposive. Based upon the evidence in the literature, the sample design for this study was identified as purposive.

The sample selected for this study was from a generic baccalaureate of nursing program offered by one University. Johnson (1988) studied differences in nursing performance between baccalaureate prepared nurses and the more technical programs of associate degree and diploma. Baccalaureate prepared nurses showed significant differences in communication, knowledge, problem-solving and the professional role. Associate degree and diploma programs have traditionally prepared nurses for the direct patient care roles. In addition to patient care skills, baccalaureate nurse are provided didactic courses on research, leadership and management and community focused health care. The addition of the described courses limits the number of credits devoted to direct patient care for baccalaureate education as compared to associate degree and diploma programs. This difference in philosophy of nursing programs could result in score differences on standardized assessments. NCLEX-RN is developed and presented to all levels of education for entry into practice as a registered nurse with the focus on patient care to promote a safe effective care environment (NCSBN, 2011c). Thus, it might be expected that average scores on the content-specific assessments differ across program types with baccalaureate prepared students performing at a lower level.

Inclusion criteria for the sample were (a) completion of the generic baccalaureate nursing program (b) completion of the 2007 versions of the content specific mastery assessments provided by ATI and (c) record of the pass or fail status on the first-attempt of NCLEX-RN. Archived student data for the graduates completing the 2007 version of the ATI content-specific assessments between 2008 and 2010 from one university were used in the sample. Subsequent graduates received the updated 2010 versions of the ATI content-specific assessments and were not included in this study. Data were incomplete for those students taking the 2010 versions of the content-specific assessments as NCLEX-RN pass or fail status for this population will not be available until summer of 2012. Exclusion criteria omitted those students with missing scores on any of the three assessments identified as variables in the study or who had no record of first-attempt on NCLEX-RN.

To further guide the investigation, the research design selected used systematic quantitative research techniques to develop and measure the relationship between the variables. All data collected were retrospective in nature and considered non-experimental due to lack of implementation of a treatment.

Description of the nursing program.

The Eleanor Mann School of Nursing resides on the campus of the University in Fayetteville, Arkansas. The school of nursing offers baccalaureate and graduate programs in nursing. The baccalaureate nursing program prepares graduates for a variety of care settings including acute care facilities and community settings where they manage acute and chronic patient care and promote health and wellness. The first nursing program offered at the School of Nursing (SN) was at the associate degree level approximately 30 years ago. The baccalaureate program was first offered in 1992.

The SN offers four options for granting baccalaureate degrees including a generic program, generic with honors program, licensed practical nurse to baccalaureate program (LPN – BSN) and registered nurse to baccalaureate program (RN-BSN). The SN admits two times per year. The two generic and LPN – BSN programs prepare graduates to take the NCLEX-RN for licensure as a registered nurse (University of Arkansas, 2011b). The generic baccalaureate program is four semesters in length for full time students requiring two years for completion. The SN holds accreditation from the Commission on Collegiate Nursing Education (CCNE) and approval from the Arkansas State Board of Nursing. CCNE accreditation was earned in 2002 and continued approval is granted through June 20, 2017. The state board of nursing approval is current and granted through January 2013. The minimum GPA expected of students applying to the SN is a 3.0 with the application process being competitive using a ranking system for admissions.

Use of ATI in the nursing program.

The SN began using the ATI Comprehensive Assessment and Remediation Package (CARP) in the fall of 2008. The student handbook for nursing students at the University of Arkansas contains a policy for *Standardized Tests* requiring all baccalaureate students to achieve the national average or higher on the content-specific assessments for completion of the nursing program. Administration of the Fundamentals, Pharmacology and Mental Health assessments occurs during the first two semesters of the nursing program. The Standardized Tests policy followed by the Eleanor Mann School of nursing allows for multiple attempts to reach the benchmark accompanied with supplemental remediation activities. For the purposes of this study, first-attempt scores on content-specific assessments were used. Spurlock and Hunt (2004) found that programs allowing multiple attempts to achieve a minimum score on standardized

assessments were not significant in identifying those students at-risk for failure on NCELX-RN. Further, the authors indicate only the first-attempt scores were significant in relation to NCLEX-RN outcomes and were considered the best indicators of level of knowledge in nursing. The content-specific assessments and associated nursing course placement is displayed in Table 2. The complete *Standardized Testing* policy is included as Appendix A.

Table 2

Content-Specific Assessment Placement within the Curriculum

| Content-Specific Assessment | Nursing Course |
|-----------------------------|--|
| Fundamentals of Nursing | NURS 3422: Foundations of Nursing Practice |
| Pharmacology | NURS 3634: Adult Health and Illness 1 |
| Mental Health Nursing | NURS 3742: Mental Health and Illness |

ATI offers the CARP via computerized means or the more traditional paper and pencil method. ATI provides schools of nursing with standardized procedures for administration of proctored assessments. The Eleanor Mann School of Nursing administers the assessments utilizing the computerized option. The assessment administration environment was a classroom space with computers available to each student. The testing parameters for students were provided to proctors in the *Proctor Manual for ATI On-line Assessments*. This document is available to proctors on-line for reference. The proctor manual is available only to faculty members with a valid identification code and password from institutions purchasing assessment products from ATI. The specific physical environment for computerized testing was claimed to be appropriate and consistent with the standards expected by ATI. Accommodations are made available for students with disabilities to comply with the Americans with Disabilities Act

(ADA) “requiring reasonable testing accommodations for students with disabilities” (Airasian, 2010, p. 341).

Data Collection

Retrospective data was collected from archived files from the University of Arkansas admissions office and the Eleanor Mann School of Nursing. “Retrospective studies use historical data to look backward in time and are particularly useful for studying the relationship between variables whose occurrences are difficult to predict” (Kirk, p. 9). Permission for use of the data was sought from the Institutional Review Board (IRB) at the University of Arkansas and the Eleanor Mann School of Nursing. Following approval, the data collection process was coordinated with the Eleanor Mann School of Nursing. Demographic data of age and gender were provided by the administrative contact from the SN. Additional demographic information was not gathered for purposes of admission to the SN therefore no additional demographics were included in this study.

Ages, gender, ATI content-specific assessment scores and NCLEX-RN pass or fail status from the first academic year of the nursing program were combined into one data set. Data were correlated and then de-identified by replacing student names with dataline numbers that could not be re-linked. Date of birth was transformed into age in number of years at the time of first-attempt on NCLEX-RN. During the research process the data and all associated documents were maintained in a locked system in electronic format. All data were reported in aggregate form. The original file correlating student names with corresponding assessment scores, NCLEX-RN status and demographic data was discarded and deleted from all devices. The de-identified data files were and will continue to be secured by the principle investigator with password protected files in electronic format.

Age was calculated and placed into ranges. Gender was categorized as female (1) or male (2) and dummy coded in the analysis. A summary of the age ranges and gender is provided in table format in Chapter Four.

Instruments and procedure.

ATI claims to assist students in achieving NCLEX-RN success at a rate closer to 100% than any other commercially prepared educational system on the market today and also claims to be the leader in on-line learning (Assessment Technologies Institute, LLC, 2011). The comprehensive assessment and review program (CARP) offered by ATI provides remediation and assessment activities to assist students throughout the nursing program. The CARP also includes academic measuring tools to identify potential problems for early intervention to promote student success.

As part of the CARP package, the content mastery series (CMS) provides assessment information regarding a student's mastery of concepts in specific areas that are correlated to the NCLEX-RN test plan. The CMS is designed to evaluate assessment scores and provide a formative indication of developing NCLEX-RN readiness in specific content areas. Group performance information can be obtained by participating schools of nursing purchasing the ATI CARP. The CMS contains eight content specific assessments. Three of the eight were used in this study: (1) Fundamentals, (2) Pharmacology and (3) Mental Health. For the purposes of this study, these mastery assessments are referred to as "content-specific assessment" for the remainder of this paper. Table 1 provides a complete list of concepts addressed in each assessment utilized as independent variables for this study. The assessments are criterion referenced indicated a specific behavior or outcome associated with the score reflecting performance on a set of standards expected of the registered nurse. A combination of the Angoff

and the Bookmark standard setting methods were used to establish reliability and validity of the assessments and determine cut scores for three levels of proficiency on each of the CMS assessments. In this process, expert nurses (judges) were consulted and test items evaluated and scored according to set criteria. Each level cut score range was calculated at a 95% confidence interval (Kelley, 2007).

From the reports of the scientists and psychometricians at ATI, it is concluded that reliability and validity of the content-specific assessments has been established for the intended use and purposes of the test. Cultural bias is addressed by ATI with ethnic and gender experts. Multiple revisions and modifications are suggested to display the assessments items without bias to gender or ethnicity. It is concluded that bias within the existing 2007 assessments has been satisfactorily addressed by ATI.

Students receive a report (Appendix B) following administration of the assessment providing overall raw percentage correct, a norm-reference of percentile rank comparing each student's respective score to all students taking the assessment from a baccalaureate program of study and comparisons to all students in registered nursing programs nationally. Students are also provided an assigned level of performance based on their respective scores. Table 3 describes students expected behaviors at each level. Table 4 shows the levels of performance and associated cut score for each assessment used in this study.

ATI aligns assessment content with NCLEX-RN Client Need categories. Each category is assigned a specified number of assessment items. Table 5 identifies the categories and number of items to evaluate student performance in each content-specific area. Each assessment includes an additional 5 items for analysis and possible use in future assessments. The added items are not included in the student performance analysis in the results.

Table 3

Levels of Proficiency

| | |
|---------|---|
| Level 1 | <ul style="list-style-type: none"> -is expected to just meet NCLEX-RN standards in this content area. - should demonstrate the minimum level of knowledge in this content area required to support academic readiness for subsequent curricular content. - should meet the absolute minimum expectations for performance in this content area. |
| Level 2 | <ul style="list-style-type: none"> - is expected to readily meet NCLEX-RN standards in this content area. - should demonstrate a level of knowledge in this content area that more than adequately supports academic readiness for subsequent curricular content. - should exceed minimum expectations for performance in this content area. |
| Level 3 | <ul style="list-style-type: none"> - is expected to exceed NCLEX-RN standards in this content area. - should demonstrate a high level of knowledge in this content area that confidently supports academic readiness for subsequent curricular content. - should exceed most expectations for performance in this content area. |

Table 4

Content-Specific Assessment Levels With Cut Scores

| Assessment | Level 1 | Level 2 | Level 3 |
|--------------------------|---------|---------|---------|
| Fundamentals | 58.3% | 66.7% | 80.0% |
| Pharmacology | 50.0% | 63.3% | 76.7% |
| Mental Health Nursing | 61.7% | 70.0% | 85.0% |

Fundamentals assessment.

The 65 item assessment evaluates the student's basic comprehension and mastery of the fundamental principles for nursing practice. Concepts assessed include foundations of practice (health care delivery, thinking strategies for nursing practice, communication, professional standards, nursing through the lifespan, health assessment), basic nursing care (admission, transfer and discharge processes, medication administration and error prevention, safety, infection control, comfort and basic needs and care of wounds), support of psychosocial needs (psychosocial, family, cultural and spiritual health, end-of-life), support of physiologic needs (oxygenation, circulatory, fluid, electrolyte and acid-base balance, gastro enteral, elimination, neurosensory) and health assessment (assessment of vital sign and general and system specific assessments).

Pharmacology assessment.

The 65 item assessment evaluates the student's basic comprehension and mastery of pharmacologic principles and knowledge of prototype drugs. Concepts assessed include, basic pharmacologic principles, safe medication administration, medication error prevention, age specific considerations and knowledge related to the safe administration and monitoring of prototype drugs that are used to treat infections, pain and inflammation as well as those that affect the immune, nervous, cardiovascular, respiratory, renal, digestive, endocrine, reproduction systems and the blood.

Mental health assessment.

The 65 item assessment evaluates the student's basic comprehension and mastery of mental health nursing principles. Assessed concepts include, basics in mental health nursing (assessment, legal/ethical principles, therapeutic communication, therapeutic nurse-client

relationship, anxiety and defense mechanisms, mental health nursing in diverse populations), non-pharmacologic therapy of mental health disorders, pharmacologic therapy of mental health disorders, and nursing care of clients with various mental health disorders.

Table 5

Item Distribution in Client Need Categories

| NCLEX-RN Client Need Categories | Content Specific Assessment | | |
|---|-----------------------------|---------------|--------------|
| | Fundamentals | Mental Health | Pharmacology |
| Management of Care | 4 | - | - |
| Safety and Infection Control | 8 | 2 | - |
| Health Promotion and Maintenance | 16 | - | - |
| Psychosocial Integrity | 11 | 55 | - |
| Basic Care and Comfort | 13 | - | - |
| Pharmacological and Parenteral Therapies | 5 | 2 | 60 |
| Reduction of Risk Potential | 2 | 1 | - |
| Physiological Adaptation | 1 | - | - |

Note. (-) indicates no test items in the Client Need category

Two versions of each content-specific assessment are available. Form B is distributed for the initial attempt. If a retake of the assessment becomes necessary (based on program policies), version A is available upon request. Students are typically allowed one minute per test item.

Individual testing parameters can be adjusted for special needs.

NCLEX-RN licensure exam.

The reliability and validity of NCLEX-RN has been established by the NCSBN. Adjustments are made to the test every three years. Because practice changes over time, the NCSBN performs job practice analysis studies every three years to reflect accurately current nursing performance expectations and provide psychometrically sound and legally defensible licensure examinations. The performance of practice analysis serves to evaluate the validity of the test plan guiding content distribution of the licensure examination. The methodology used for the three year review include: (a) descriptions of subject matter expert panel processes (b) questionnaires (c) sample selection (d) data collection procedures (e) information on assurance of confidentiality (f) response rates and (g) participant representativeness of the population of newly licensed nurses. The process convenes a panel of experts in practice for creating a list of nurse activities and behaviors expected of the newly licensed registered nurse. Data were also collected from a randomized sample of individuals passing the NCLEX-RN examination (Wendt & O'Neill, 2008). For the purposes of this study, the NCLEX-RN serves as the outcome variable of interest. Complete reliability and validity documents are available at www.ncsbn.org.

Description of Data Analysis

Once the data were received, an initial exploratory analysis was conducted to determine missing values, outliers and distributions. Parameters describing the sample population data including range, means, variances and standard deviations were calculated using the Statistical Analysis System (SAS), Version 9.2 program and univariate procedure. Assumptions of normality were analyzed. However the use of logistic regression lacks the need for normality to be established. Tables displaying the data and associated distributions were developed. Once the exploratory data analysis was completed the researcher moved forward with the inferential

statistical analysis of the methods associated with answering the research question. The independent two sample *t*-test procedure was used for between group comparisons.

To analyze further the data to answer the research question guiding the inquiry, binary logistic regression models of inferential statistical analysis were employed to determine strength of relationship of the three ATI content-specific assessments for predicting NCLEX-RN outcomes. Binary logistic regression was determined to be the appropriate statistical model to fit the observed data. The interval scale used for scoring ATI content-specific assessments combined with the dichotomous dependent outcome of pass or fail support use of the binary logistic regression model. “The outcome of pass or failure NCLEX-RN on the first attempt is mutually exclusive.” (Leech et al., 2008, p. 152). The assessment scores aligned with the interval classification because a score of zero cannot accurately determine an absence of knowledge regarding the content on the exam. Because the dependent variable was dichotomous and does not fall on a continuum, the assumptions of bivariate normality cannot be met. Logistical regression does not assume a linear relationship between the independent and dependent variables (Glass & Hopkins, 1996). A condition of binary logistic regression is a large sample size for accuracy. Some researchers indicate a minimum of 20 cases per predictor with a minimum of 60 cases (Leech et al., 2008). Other scientists recommend a minimum of 50 participants per predictor variable (Wright, 1995). For this study, the sample size was self-limiting because of the finite number of graduates and retrospective nature. Increasing the sample size above the available 119 would require participation by schools of nursing outside the University of Arkansas as the administration of the 2007 versions of all the content-specific assessments have been replaced with the updated 2010 versions.

The conventional level of significance for risk of error was established at the .05 level. Data were imported for use in the SAS, Version 9.2 program supported by the graduate college at the University of Arkansas. Remote access was provided to the SAS program through purchase from the Information Technology department at the University of Arkansas.

Correlations between the independent variables were evaluated for multicollinearity. According to Pedhuzar (1982), Multicollinearity suggests a strong linear relationship among the independent variables and could be a potential source of confusing or misleading interpretation of findings. Slight fluctuations in correlations between the multiple independent variables (due to sampling or random errors) and the outcomes coupled with multicollinearity may lead to very large fluctuations in the regression coefficient estimates. The definition of a strong linear relationship among independent variables is not consistent within the research community. In fact, Pedhuzar espouses that the definition of multicollinearity is not consistent (p. 246).

Additionally, each score is determined to be independent of each other and linearly related to the natural log of the odds ratio of the dependent variable. The odds ratio describes the strength of association between the two binary values in each of the categories of pass or fails on NCLEX-RN. “The odds ratio is the ratio determining the odds of an event occurring in one group and compared to another group.” (Leech et al., 2008, p. 152). This measure is appropriate for data with dichotomous variables.

Once the calculated values were determined, comparisons were made to any associated critical values. Effect size estimates (d) were calculated to further describe between group differences to complement the inferential statistics. Odds ratio estimates were calculated by SAS

and analyzed. Confidence intervals (CI) were calculated for a 95% chance of inclusion in the established range. The results of the data analysis are presented in Chapter Four.

Even though the sample population of this study was limited to one university and one nursing program, generalizations can be appropriate. External generalizations of the findings provide faculty and students with predictive value of content-specific assessments to identify students at-risk for NCLEX-RN failure. Early identification of students lacking the necessary knowledge level of these content-specific assessments presented during the first academic year of a nursing program serves to inform faculty and students to direct teaching strategies and methods to address NCLEX-RN outcomes. Since ATI acknowledges a relationship with 2100 colleges and universities nationwide utilizing their products, generalizability to some baccalaureate programs is anticipated and feasible (ATI, 2012). Significant findings for any one of the content-specific assessments would inform many baccalaureate nursing programs implementing the CARP developed by ATI.

Description of Data Validation

The plan for validation of the data was followed to include a visual inspection of values and numerical data for any discrepancies to insure accuracy. The researcher remained aware of the emerging relationships in the data. “The data were validated by considering trustworthiness, credibility, dependability, applicability, consistency, neutrality, reliability, objectivity, transferability and interpretation evident” (Collins et al., 2006, p. 72). Personal bias toward the subject under study was recognized as important in the validation of the results.

Description of Data Interpretation

The plan for interpretation of the statistical analysis presented by the SAS program included careful evaluation of the output for relationships between the independent and

dependent variables through inductive reasoning. The principle use of statistical inferences in research is to obtain knowledge about a larger population from a relatively small number of persons intuitively from the particular to the general (Glass & Hopkins, 1996, p. 223).

Consideration for the purpose of the study directed the interpretation to answer the research question leading the inquiry. Inferences were identified for generalizability of findings to the population of nursing students in baccalaureate programs.

Chapter Four: Data Analysis

The purpose of this retrospective study was to determine the ability of ATI assessments utilized during the first year of a baccalaureate nursing program to predict failure on NCLEX-RN. The question guiding the inquiry was: What are the odds or the probability that student scores on the following ATI assessments: Fundamentals, Pharmacology, and Mental Health will predict their outcome of pass or fail on the NCLEX-RN exam? Pearson's product-moment correlations, *t*-tests and logistic regression were appropriate model fits for the observed data and were utilized to identify relationships with the dichotomous outcome of passing or failing NCLEX-RN.

Sample Description

All students who graduated from a generic baccalaureate program between fall 2008 and spring 2010 from one university were included in the sample. Participants must have completed the first year ATI assessments of Fundamentals, Pharmacology and Mental Health and taken the NCLEX-RN at least once. First-attempt scores on the content specific assessments were tested to explain the pass or fail status on the first-attempt of NCLEX-RN.

The appropriate permissions and letters of approval were obtained from the Research Review Board at the University of Arkansas and the Eleanor Mann School of Nursing. The Dean of the School of Nursing provided written electronic notification of permission. This document was submitted with the Research Protocol form for review by the Institutional Review Board (IRB). The study was granted exempt status with permission to move forward to the archival data collection phase. Appendices C and D provide these documents for review and confirmation of permissions for the study.

All information related to student identify was carefully protected in a secure environment to ensure confidentiality. The electronic version of the dataset was maintained on a personal computer requiring a password for access. Archival data received included age; gender; student scores on the three content specific assessments of fundamentals, mental health and pharmacology provided by ATI; date of first attempt on NCLEX-RN; and pass or fail status on the first attempt of NCLEX-RN. At the conclusion of the study, all names were removed from the original dataset and discarded. Participants were identified by the corresponding number line in the dataset during the analysis.

Data Validation

Prior to data analysis, the explanatory variables and binary outcomes of the 167 participants were inspected for accuracy, plausibility, missing information, visual distributions and outliers. Age was calculated from the date of birth and date of first-attempt on NCLEX-RN using functions in the Excel software program. In the age category, one participant was calculated as 19 years of age. This was recognized as a possible error and confirmed through the Eleanor Mann School of Nursing. The age of the participant was determined to be correct. The assigned graduating class for each participant was not provided in the Excel file submitted with the sample data. All categories of data were provided in aggregate form. Participants' data with missed results for any of the assessments or NCLEX-RN were eliminated from the study. The majority of omitted information was due to lack of NCLEX-RN first-attempt status. As reported by the School of Nursing, several participants from the spring 2010 class had not taken NCLEX-RN to date. One participant with incomplete content-specific assessment scores with a corresponding failure status on NCLEX-RN was eliminated. No other participants in the failure category were eliminated from the study. Forty-eight participants with missing results from one

or more assessments or NCLEX-RN were eliminated from the study, leaving $N = 119$ participants. No participant data was removed due to extreme values. The SAS, version 9.2 was utilized as the program for analyzing the dataset.

Data Interpretation

Descriptive analysis.

The national average benchmark established by ATI was utilized by the Eleanor Mann School of Nursing to determine those who had met the requirements of the Standardized Testing Policy and those needing remediation and additional instruction. Table 6 provides a comparison of the two groups with the national average on each of the three assessments.

Table 6

Group Score Compared to National Average

| ATI Content Assessment | National Average | Group Scores | |
|------------------------|------------------|--------------|------|
| | | Pass | Fail |
| Fundamentals | 69.1 | 74.1 | 68.6 |
| Mental Health | 71.1 | 80.3 | 76.7 |
| Pharmacology | 62.3 | 71.1 | 63.1 |

To calculate the descriptive statistics the PROC UNIVARIATE procedure was used in SAS. The distributions of the variables were visually inspected for normality. The average age of the population sampled at the time of taking NCLEX-RN was 23.6, $SD = 4.51$ years. Age ranged from the youngest participant reported at 19 years of age and the oldest participant at 58. Seventy-five percent ($n = 89$) of the participants were aged 22 or 23. Ninety-three percent of the participants fell in the age range of 19-29, 5% in the 30-39 range and 2% in the 40-49 and 50+

categories. The age distribution revealed a positive kurtosis of 30.17 with a leptokurtic shape with the median and mode falling at the age point of 22. The Shapiro-Wilk test for normality statistic revealed $p < .001$. This value indicates the distribution of age in the sample violates normality as expected. Table 7 displays the age and gender distributions of participants who passed or failed NCLEX-RN.

Table 7

Participants (N = 119) by Group, Gender and Age

| | Group | | | |
|-----------------|---------------|-----|---------------|---|
| | NCLEX-RN Pass | | NCLEX-RN Fail | |
| Age by Category | 19-29 | 104 | 19-29 | 7 |
| | 30-39 | 6 | 30-39 | 0 |
| | 40-49 | 1 | 40-49 | 0 |
| | 50+ | 1 | 50+ | 0 |
| Gender | Male | 12 | Male | 0 |
| | Female | 100 | Female | 7 |

In analysis of gender designation to describe the sample, the vast majority of participants were female at 90% ($n = 107$). All male participants ($n = 12$) successfully passed NCLEX-RN on the first attempt. The seven failures accounted for 6.5% of the female participants. The number of male participants in the sample was consistent with the percentage documented in the literature indicating that “5-10% of the professional nursing workforce is men” (Brown, 2009, p. 120).

Group comparisons.

Inferential statistical techniques were employed to compare the means of scores between the group that passed NCLEX-RN and the group that failed NCLEX-RN on the first attempt. Independent two sample *t*-tests compared those who failed on the first attempt ($n = 7$) and those who passed ($n = 112$) for the three content assessments. In tests for Equality of Variance, p values were analyzed to determine the appropriate use of the Pooled or Satterthwaite statistic for equal or unequal variances respectively. Results of the analysis revealed a significant difference between the two groups on the Fundamentals assessment $t(117) = -2.25; p = .03$. In the Pharmacology assessment two-group comparison showed evidence of a significant difference in the means between those who passed and those who failed $t(117) = -2.35; p = .02$. For the Mental Health assessment $t(117) = -1.41; p = .16$, the independent *t*-test statistic findings for equal variances is greater than the established alpha of .05 which indicated no significant differences between the two groups of those passing and those failing NCLEX-RN. For age, the Satterthwaite statistic for unequal variances $t(14.86) = -0.09; p = .93$ indicated no difference in the mean age of the two groups. Table 8 displays the means, standard deviations, standard error, confidence intervals and range for group comparison of those passing and those failing NCLEX-RN.

The index of effect size (d) was calculated for each explanatory variable and age to detect the degree of difference in the means of the two groups of those passing and those failing each assessment. The statistic is expressed in terms of standard deviation units (O'Rourke, Hatcher & Stepanski, 2005). According to Cohen (1992) the effect size for Fundamentals ($d = 0.87$) indicated a large difference between the two groups. Similar findings were revealed for the Pharmacology assessment ($d = 0.91$). A moderately significant difference was displayed in the

Mental Health assessment calculation ($d = 0.54$) between groups. For age ($d = 0.01$) no significant difference was detected in those that passed and those failed NCLEX-RN.

Table 8

Content Assessment Scores by Group

| Content Assessment | <i>M</i> | | <i>SD</i> | | <i>SE</i> | | Range | | 95% <i>CI</i> | |
|--------------------|----------|------|-----------|------|-----------|------|---------------|---------------|-----------------|-----------------|
| | Pass | Fail | Pass | Fail | Pass | Fail | Pass | Fail | Pass | Fail |
| Fundamentals | 74.1 | 68.6 | 6.4 | 4.9 | 0.6 | 1.9 | 56.7- 86.7 | 63.3- 78.3 | 72.94- 75.35 | 64- 73.14 |
| Mental Health | 80.3 | 76.7 | 6.4 | 9.2 | 0.6 | 3.5 | 61.7- 93.3 | 61.7- 86.7 | 79.08- 81.46 | 68.19- 85.19 |
| Pharmacology | 71.1 | 63.1 | 8.8 | 8.5 | 0.8 | 3.2 | 46.7- 90 | 50- 76.7 | 69.48- 72.78 | 55.27- 70.93 |

Multicollinearity was addressed by examining the computed Pearson's correlation coefficients using the PROC CORR procedure in SAS. The strength of relationship reported by the Pearson's correlation coefficients between the explanatory variables of Fundamentals, Mental Health and Pharmacology assessment scores ranged from $r = .25$; $p = .007$ to $r = .39$; $p = <.001$. No strong relationships were detected between the explanatory variables satisfying the assumption of logistic regression that multicollinearity does not exist between the variables. This conclusion was supported by the SAS, version 9.2 logistic regression analysis which detected no highly correlated variables. Table 9 displays the relationships among the variables.

Binary logistic regression.

In analyzing the results, a meaningful relationship was sought between the explanatory variables of assessment scores on three content specific ATI developed tests and the outcome of

pass or failure on NCLEX-RN. The use of the binary logistic regression procedure on the available dataset was appropriate for this study due to the interval assessment scores and the dichotomous outcome. In terms of validating the data at the interval level, a score of zero (0) would not accurately describe the level of knowledge in the content areas of Fundamentals, Mental Health and Pharmacology.

Table 9

Between Variable Correlations

| | Fundamentals | Mental Health | Pharmacology |
|---------------|--------------|---------------|--------------|
| Fundamentals | 1.00 | | |
| Mental Health | .30* | 1.00 | |
| Pharmacology | .25* | .39* | 1.00 |

* $p < .01$

In the initial analysis, the traditional logistic regression procedure was performed for predicting the log likelihood for explaining the outcome. “When a binary outcome variable is modeled using logistic regression, it is assumed that the logit transformation of the outcome variable has a linear relationship with the predictor variables.” (Introduction to SAS, 2012). The initial full model with all main effects and possible interactions resulted in no identified significant relationship between the explanatory variables and passing or failing NCLEX-RN. Table 10 displays the main effects and interactions with corresponding p -values in the initial analysis.

Table 10

Full Model Main and Interaction Effects with p-Values

| Effects | <i>p</i> -Value |
|---|-----------------|
| Fundamentals | .7652 |
| Mental Health | .8585 |
| Pharmacology | .8368 |
| Fundamentals + Mental Health | .8332 |
| Fundamentals + Pharmacology | .8014 |
| Mental Health + Pharmacology | .9106 |
| Fundamentals + Mental Health+Pharmacology | .8838 |

Because the findings showed no significance, the model was possibly over-fitted (D. Zhao, personal communication, March 16, 2012). Over-fitting can occur when a model analyzes random error instead of the underlying relationship between the explanatory variables and the outcomes. To simplify, the model is asking too much of the available data. In addition, over-fitting generally occurs when a model is excessively complex resulting in poor predictive ability (Babayak, 2004). To adjust for the over-fit, a model selection command was appropriate for further analysis of the data.

While many models are available, the Stepwise procedure was chosen as the exploratory technique to answer the research question. This procedure analyzes the data to determine a good model-fit in an effort to explain the relationship between the explanatory variables as they relate to the pass or fail outcome.

Stepwise logistic regression combines forward and backward selection model building strategies. Using the maximum likelihood method, the individual predictor coefficients (b) are tested by entering and removing them from the model. Whenever a predictor is entered into the model, other variables in the model are tested for removal. This process continues until all variables are entered and analyzed for significance in explaining the outcomes. The Stepwise logistic regression at any point in the procedure will identify the variable with the highest correlation to the outcome producing the largest likelihood ratio statistics (Wright, 1995).

The Stepwise procedure was coded to remove the explanatory variables from the model deemed insignificant at alpha .05.

The Stepwise logistic regression procedure output was generated by the SAS program. Logistic regression does not remove the variance components from the model but instead uses a measure of the overall fit expressed as the maximum likelihood, $-2 \log$ likelihood ($-2LL$). $-2LL$ is also referred to as the *deviance* in the literature. The $-2LL$ statistic reflects the chance that the data would be observed given the maximum likelihood parameter estimates. When significance is detected through the testing of the multiple coefficients, the resulting statistics were evaluated to reject the null hypothesis of all regression coefficients (b) equals 0 in favor of the alternate hypothesis that at least one regression coefficient (b) is not equal to 0 as tenable.

The model optimization technique used by SAS as the default method was Fisher's scoring. Fisher's scoring is an iterative method of estimating regression parameters that yields estimates of regression coefficients in terms of standard error. To model the probability of those failing (model $pf = 0$) in relation to the explanatory variables, the default order of levels was maintained.

Akaike Information Criterion (AIC), Schwarz Criterion (SC) and maximum log likelihood (-2LL) measurements were calculated by the SAS program to evaluate model fit. Each method compares the models using intercept only and intercept combined with covariates in the multivariate distributions. The more complex fitted model, utilizing intercepts and covariates, resulted in the smallest statistic reported and is correct and most desirable for analysis of the variables under study. Table 11 displays the results of the model fit statistics using the Stepwise logistic regression procedure.

Table 11

Model Fit Statistics

| Criterion | Intercept Only | Intercept and Covariates |
|-----------|----------------|--------------------------|
| AIC | 55.24 | 51.98 |
| SC | 58.02 | 57.54 |
| -2 Log L | 53.25 | 47.98 |

To validate the AIC, SC, and -2LL model fit measurements for a binary outcome, the Hosmer-Lemeshow Goodness-of-fit was appropriate for the observed data. Using the LACKFIT procedure in the SAS, the Hosmer-Lemeshow Goodness-of-fit $\chi^2 = 2.97$; $p = .89$ statistic reflects a positive model-fit to the variables and dichotomous outcome and provides support of previous findings. Without such analysis, the inferences may be misleading and contain serious errors that could have been detected through model fitting procedures (Hosmer, Taber & Lemeshow, 1991).

The model convergence analysis describes whether the maximum-likelihood algorithm has converged or not, using the relative gradient convergence criterion (Introduction to SAS, 2012). For this study, model convergence was satisfied by SAS.

From the three explanatory variables of Pharmacology, Fundamentals and Mental Health assessment scores entered into the model, the Pharmacology assessment score remained as significant $p = .02; <0.05$. The Fundamentals and Mental Health assessment scores did not contribute significantly in the model and were eliminated in the Stepwise logistic regression procedure. No interaction modeling contributed significantly to the Pharmacology assessment in explaining pass or failure on NCLEX-RN in the sample at the .05 level.

The Wald Chi-Square $\chi^2 = 4.92; p = 0.03$, Score Chi-Square $\chi^2 = 5.36; p = 0.02$ and Likelihood Ratio Chi-Square $\chi^2 = 5.26; p = 0.02$ to test the global null hypothesis of all logistic regression coefficients (b) are equal to zero were consistent in rejecting the null in favor of the alternate hypothesis at least one of the predictors regression coefficients (b) is not equal to zero as tenable. With alpha established at .05, the procedure tests the data to determine which model is more likely to be correct given the parameter estimates. The residual Chi-Square test statistic also supports the findings of the Global Null Hypothesis test of rejecting the null in favor of the alternate that at least one Chi-Square value is not equal to zero. To summarize the results of the Stepwise logistic regression model selection process, all analyses demonstrate the Pharmacology assessment as significant in relation to the dichotomous outcome of pass or failure on NCLEX-RN.

Logistic regression determines the extent of predictability in the independent variables of assessment scores on the dichotomous outcome of passing or failing NCLEX-RN. The statistics describing the maximum likelihood estimates for the Pharmacology assessment model using the Stepwise iterative process is found in Table 12. For every one point change in the Pharmacology assessment score, the log odds of failure vs. success on NCLEX-RN increased by 0.10 or 10%. Logistic regression also generates an odds ratio to determine the predictive power of each

independent explanatory variable. The odds ratio estimates the increase or decrease in the odds of membership in either of the dichotomous outcomes for every one unit increase or decrease in the predictor score while controlling for the other predictors in the model (Wright, 1995). The odds ratio was reported at 0.90 with 95% CI [0.83, 0.99]. In other words, the odds of passing decreases 10% for any one point decrease in the score on the pharmacology assessment.

Table 12

Results of Stepwise Logistic Regression

| Variable | <i>b</i> | <i>SE</i> | Wald | <i>df</i> | Sign. |
|--------------|----------|-----------|------|-----------|-------|
| Intercept | 3.98 | 2.93 | 1.85 | 1 | 0.17 |
| Pharmacology | -0.10 | 0.05 | 4.92 | 1 | 0.03 |

The Association of Predictive Probabilities and Observed Responses presented in the SAS output from the Stepwise logistic regression analysis displayed the average of the positive and negative predictive values across the pass or fail outcome. Logistic regression models do not always yield good classification for each category of dichotomous or categorical outcomes. For this reason, the mean predictive values across the pass or fail outcome is often of greatest interest to researchers (Wright, 1995). The percent concordant indicated the Pharmacology assessment predicts NCLEX-RN outcomes of pass or fails accurately 73.7% of the time. The percent discordant indicated the Pharmacology assessment failed to accurately predict those who failed NCLEX-RN 22.1% of the time. The remaining 4.2% was recorded as tied in the ability to predict the outcome.

In summary, descriptive analysis of the variables in the study was completed and reported using the appropriate SAS procedures to obtain the needed statistics. Comparisons between the

groups of those passing NCLEX-RN and those failing NCLEX-RN on the first attempt were described. The correlations among predictors met the multicollinearity assumption of the logistic regression model. To determine the most parsimonious model, the Stepwise logistic regression procedure was performed eliminating the explanatory variables unable to significantly predict success or failure on NCLEX-RN at alpha .05. The analysis identified the Pharmacology assessment as a significant predictor of pass or fail status. This model was accurate 73.7% of the time for predicting NCLEX-RN outcomes.

Chapter Five: Discussion

The primary goal of this study was to determine if significant results could be obtained to identify students early in their programs in need of remediation to avoid NCLEX-RN failures. The selection of Pharmacology, Fundamentals and Mental Health assessments to predict NCLEX-RN outcomes was determined by the Eleanor Mann School of Nursing, Standardized Testing Policy (Appendix A). Schools of nursing and students invest enormous resources in commercially prepared standardized assessment packages to assist in preparing for NCLEX-RN. The 2011 end-of-year report from the NCSBN identified the number of first time NCLEX-RN, US educated nursing graduates from all registered nursing programs at 144,583 with a national pass rate at 87.9%. The reported first-attempt failures of 12.1% reflect over 18,000 US educated graduates who are delayed in joining the profession at a time of a severe nursing shortage that is expected to continue with Baby Boomers reaching retirement age resulting in continued increasing need for health care workers (National Council State Boards of Nursing, 2011d).

Review of the literature clearly supports the ability of the end-of-program comprehensive assessments prepared by multiple vendors, like HESI, Mosby, NLN and ATI, to predict NCLEX-RN success with high levels of consistency and accuracy (Harding, 2010). However, the literature was inconsistent and limited with studies containing content-specific assessments' administered early in a nursing program such as Pharmacology, Fundamentals and Mental Health to predict NCLEX-RN outcomes. The end-of-program comprehensive assessments have traditionally been used to identify at-risk students too late in the educational process for the approximately 10% of the nursing student population failing NCLEX-RN. Recognizing at-risk students earlier in the nursing program can assist educators and institutions of higher learning to

intervene well before the first attempt at licensure and ultimately impact the number of NCLEX-RN failures.

The purpose of this retrospective study was to determine the relationship between the explanatory variables of three content-specific standardized assessments developed by ATI and the dichotomous outcome of success or failure on NCLEX-RN. The research question guiding the inquiry was: What are the odds or the probability that student scores on the following ATI assessments: Fundamentals, Pharmacology, and Mental Health will predict their outcome of pass or fail on the NCLEX-RN exam?

The literature on predicting NCLEX-RN outcomes is extensive in the area of standardized testing (Alexander & Brophy, 1997; Bondmass et al, 2008; Carl, 2008; Crow et al, 2004; DeLima et al, 2011; Firth et al, 2005; Grossbach & Kuncel, 2011; Harding, 2010; McGahee et al, 2010; Rogers, 2010; Seldomridge & DiBartolo, 2004; Spurlock & Hunt, 2008; Steunkel 2008; Treas, 2006; Uyehara et al, 2007; Vandenhouten, 2008). Common comprehensive standardized exams used as explanatory variables in the reviewed literature included ACT (Grossbach & Kuncel, 2011; McGahee et al, 2010), SAT (Grossbach & Kuncel, 2011; McGahee et al, 2010), Nurse Entrance Exams (Carl, 2008; Esper, 2008; Grossbach & Kuncel, 2011; Sayles et al, 2003; Ukpabi, 2008; Uyehara, et al, 2007) and end-of-program assessments (Alexander & Brophy, 1997; Bondmass et al, 2008; Carl, 2008; DeLima et al, 2011; Firth et al. 2005; Harding, 2010; Sayles et al, 2003; Rogers, 2010; Seldomridge & DiBartolo, 2004; Spurlock & Hunt 2008; Steunkel 2008; Treas, 2006; Uyehara et al, 2007; Vandenhouten, 2008). As mentioned previously, many schools of nursing have adopted use of commercially prepared standardized assessment programs such as those developed by ATI to assist in preparing students for licensure (Alamedia et al., 2011). ATI professes a relationship to more

than 2100 colleges and universities (Assessment Technologies Institute, 2011). Studies using standardized assessments offered by ATI as predictors of success or failure on NCLEX-RN are evident in the literature but limited, especially studies with samples from baccalaureate programs of nursing. In fact, no studies were found utilizing the three content-specific assessments, collectively, in this research to predict NCLEX-RN outcomes in a baccalaureate program for first year students.

The literature supports the claim that use of the results on standardized assessments can assist faculty in identifying at-risk students early in the nursing program and prior to sitting for NCLEX-RN. Harding (2010), Matos (2007) along with Pennington and Spurlock (2010) and others recognized the use of standardized assessments throughout nursing programs as beneficial in assisting students and educators to identify areas of weakness when combined with other factors. What has not been established, however, is the predictive value of scores on content-specific assessment administered during the first year to determine NCLEX-RN performance. To add to the body of research, use of content-specific standardized assessments administered early in the students' educational programs for prediction of NCLEX-RN outcomes has the potential for identifying students, with supporting evidence, in need of rigorous remediation to prevent failure. Firth, et al (2005) declares waiting until the last semester at the end of a program of study before preparing for NCLEX-RN is unwise. Nurse educators should be committed to rapid identification of at-risk students early in nursing programs so that remedial activities can be implemented well before the date of graduation and ultimately before NCLEX-RN attempts.

Demographics

Demographics collected for analysis included age and gender. While age and gender were not intended as variables for determining significant relationships to the dichotomous

outcome, the data were analyzed. In the sample age was not found to have a significant relationship to success or failure. Thus the review of the literature supports the findings of this study that no relationship exists between age and NCLEX-RN outcomes (Alamedia et. al, 2011; Beeson & Kissling, 2001; Giddens & Gloeckner, 2005).

The sample participants from the one school of nursing were predominantly self-reported as female. In this study, the males ($n=12$) all successfully passed boards on the first attempt. The number of male participants in the sample is consistent with the percentage documented in the literature indicating that “5-10% of the professional nursing workforce is men” (Brown, 2009, p. 120). However, the literature was inconsistent with conclusions surrounding gender and outcomes associated with NCLEX-RN. Haas et al, (2004) and Firth et al, (2005) found that males failed at a significantly higher rate than females while other scientists conclude just the opposite (Alameida et al, 2011; Beeman & Waterhouse, 2001; Giddens & Gloeckner, 2005; Higgins, 2005, Sayles et al., 2003).

Correlation Among Variables

Even though correlations between the explanatory variables and the dependent outcome of pass or fail status was not sufficient to answer the research question guiding the inquiry, the coefficients were calculated and addressed briefly here. The Pearson’s product-moment correlation statistic was calculated among the variables suggesting minimal to moderately weak strength in relationships to the dependent outcome. The strongest correlation among the explanatory variables and pass or fail status was with the Pharmacology assessment $r = 0.21$. The Fundamentals assessment $r = 0.20$ also revealed similar findings. The Mental Health assessment $r = 0.13$ showed a minimal relationship to the outcome. One possible explanation for the low correlation statistics is that pharmacology, fundamentals and mental health content continues to

be presented throughout the nursing program. Given another year of the program has yet to be completed, the correlations between the content-specific assessments and NCLEX-RN outcome might be expected to be relatively weak during the first year of a nursing program.

Group Comparisons

Group scores on the three content-specific standardized assessments were compared, using the independent two sample *t*-test procedure between those passing NCELX-RN and those failing NCLEX-RN on the first attempt. This method of analysis identifies any significant differences in the group means on each of the content-specific assessments. Significance difference was found between the means on the Fundamentals ($p = 0.03$) and Pharmacology ($p = 0.02$) assessments for the pass and fail groups. The two group comparison findings associated with the Mental Health assessment ($p = 0.16$) resulted in no statistically significant difference in the means. However, the literature shows some studies with significance related to the Mental Health content assessments from a variety of testing companies (Alexander & Brophy, 1997; Crow, et al, 2004; Ukpabi, 2008). DeLima, et al (2011) found the scores on Fundamentals and Mental Health assessments provided by NLN as revealing a significant relationship among the scores and NCLEX-RN successes. Findings were not conclusive in significant relationships to NCLEX-RN failures. In addition, Matos (2007) found a relationship between ERI Pharmacology and Mental Health assessment scores and NCLEX-RN success using two group *t*-test comparisons. The finding in this study of significant differences between the means for the Pharmacology and Fundamentals assessment *t*-test statistics lead to the possibility of similar findings in the robust multivariate analysis.

In the simple contrast of means between groups, the index of effect size showed a strong significant difference among the Pharmacology ($d = 0.91$) and Fundamentals ($d = 0.87$)

assessments. The Mental Health ($d = 0.57$) assessment also demonstrated a moderately strong difference between the mean scores of the two groups. The greater the difference in the means, the more likely the sample of scores was drawn from different populations (O'Rourke, et al, 2005). Pedhazur (1997, p. 172) has indicated that "reliabilities of many measures used in behavioral sciences are, at best, moderate". In this study, effect sizes could be overestimated because the full effects of the additional covariates are not considered. This is a significant concern when determining the accurate model for identifying the *real* relationship between the variables.

Because the index of effect size and Pearson's product-moment correlation coefficients were inconsistent in strength of relationship, a better model-fit was needed for a more complete and accurate analysis. To further analyze the data and account for possible measurement error, multivariate analysis using logistic regression was found to be appropriate given the sample data.

Binary Logistic Regression

Multivariate regression analysis techniques were utilized to further evaluate the data. The logistic regression model was appropriate for the interval assessment scores and dichotomous outcome to answer the inquiry question. An additional benefit of using logistic regression was the lack of assumptions, allowing for a dichotomous outcome and violations of normality in the explanatory variables. In the initial analysis, using the full mode, no relationship among the variables was found with all p -values well above the .05 level of significance.

The Stepwise procedure was used to further the model development to eliminate those variables not found to contribute significantly to the dichotomous outcome. The Stepwise logistic regression iterative analysis indicated a significant positive relationship between the explanatory variable of the Pharmacology assessment and the ability to predict the outcome on

NCLEX-RN at the $p = .05$ level. However, according to Hosmer and Lemeshow (as cited in Treas, 2006) some scientists suggest the $p = .05$ level to be too stringent for the Stepwise procedure that could exclude important variables. Had the alpha been reduced, the findings could include additional explanatory variables. Also for consideration, the iterative processes in the Stepwise procedure completed multiple tests of the individual coefficients which could dramatically increase the Type 1 error rate for the overall study, thus supporting the need for cross validation (Wright, 1995).

The ability of the Pharmacology assessment to correctly classify the outcome of pass or fail 73.7% of the time was viewed as impressive. The result is important in that schools of nursing can utilize this assessment score as an indicator of risk for NCLEX-RN failure. Similar findings have shown to have a predictive relationship between Pharmacology content and NCLEX-RN success with various levels of significance (Bondmass, et al, 2008; Ukpabi, 2008; Treas, 2006; Vandenhouten, 2008). However, the standardized assessments used within each study differed in company of origin and placement within the curriculum. Ukpabi (2008) found Pharmacology in combination with other factors as significant in predicting NCLEX-RN outcomes. The ability of the Pharmacology assessment alone to predict pass or fail was not reported. Vandenhouten (2008) in a study involving baccalaureate students ($n = 219$) found ATI Fundamentals used in the first semester of study as worthy of evaluation to identify at-risk students earlier in the curriculum. In the same study, Pharmacology content assessment scores were found to have the most predictive ability in identifying NCLEX-RN outcomes. However, the Pharmacology assessment was administered at the end of the nursing program and not during the first academic year.

The finding of this study should be considered with the existing literature as valuable based on the NCLEX-RN test plan that includes Pharmacology as a major component tested for licensure. The NCSBN reports Pharmacology content comprises 13-19% of the licensure exam. Also reported in the *2010 NCLEX-RN Detailed Test Plan*, Psychosocial and Basic Care and Comfort categories aligning with the mental health and fundamentals concepts, account for 6-12% of the licensure exam, respectively. The literature recognizes fundamentals and mental health content as possibly significant and warrants further study.

The odds ratio indicates for every 1 point variation in the Pharmacology assessment score, the odds of passing or failing NCLEX-RN increased or decreased respectively by 10%. This is an indication that the lower the score on the Pharmacology assessment the more likely of NCLEX-RN failure.

Implications

This study have several implications for generalization to baccalaureate nursing programs utilizing ATI standardized content exams in the first academic year of nursing education. First, it should be noted that, the complete content assessment package offered by ATI includes an on-line remediation option which may or may not be used by the nursing program. Thus, remediation standards across nursing programs vary greatly based on assessments purchased and expectations of use by faculty. Second, this study supports that scores on the Pharmacology assessment provided early in nursing programs can be used to predict with some accuracy pass or fail status on NCLEX-RN. The study finding of the Pharmacology assessment to accurately predict pass or fail outcomes at 73.7% supports careful consideration by nurse educators in both identifying students in need of remediation and developing formal rigorous remedial activities to avoid NCLEX-RN failure.

Scores on the Pharmacology content assessment may be useful for early identification of students at-risk for NCLEX-RN failure. Academic advising and development of remedial activities may be warranted to increase student success on the first attempt on NCLEX-RN. Findings can inform educators to consider that students with lower standardized assessments scores on the Pharmacology content may require rigorous remediation to increase their knowledge level for improved probability of NCLEX-RN success. Treas (2006), Ukpabi (2008) and Vandenhouten (2008) are consistent in findings of predictive ability in the Pharmacology content-specific assessments from ATI as indicators for pass or fail on NCLEX-RN given at various times throughout a nursing program. These findings support the conclusions of this study to recognize that Pharmacology content-specific assessments scores should be carefully considered for implementation of rigorous remediation plans to maximize efforts to decrease the likelihood of failing NCLEX-RN.

Limitations

Retrospective studies have multiple limitations. In this study, the Stepwise iterative process to determine significance in the explanatory variables was used for model selection. Scientists warn that overall classification results for pass or fail status revealed in the logistic regression analysis should be interpreted with caution. One reason is the correct logistic regression model doesn't always yield good classifications for both groups. Ideally, a study with a goal of classification accuracy should fit the model on one group and then apply the model to another group for cross validation to determine generalizability of accuracy across samples (Wright, 1995). Thus, generalizability of the findings in this study should be used with caution until cross validation can be obtained. There is also some risk in using the Stepwise logistic regression procedure as the model fitting is reliant on the algorithms within the program. It is

recommended that the procedure be used as an exploratory analysis for generating hypotheses. Further studies should be used to confirm the relationship found here (L. DeShea, personal communication, April 4, 2012).

This study has little known controls over the testing environment to insure consistency across the multiple graduating classes. Of critical importance would be the activities of students in efforts to increase knowledge levels during the second year of nursing education prior to first-attempt on NCLEX-RN. The remedial activities and individual motivation are extraneous variables not controlled in this study.

The sample of 119 was from one university. A larger sample from multiple schools of nursing would provide support for the findings presented here. Small sample size in the failure category did not lend itself to a predictive analysis on NCLEX-RN failures only. The rarity of failure on NCLEX-RN for the sample may have limited the analysis. A larger sample would provide more information for the logistic regression procedure to perform the model fitting (L. DeShea, personal communication, April 4, 2012).

Recommendations for Practice

The student failure rate in first-time NCLEX-RN takers contributes to the shortage of qualified registered nurses for an increasing need in society. Faculty and students should recognize and understand that waiting until the last semester of a nursing program to prepare for the licensure exam is unwise (Firth et al., 2005). Understanding the implications of performance on standardized content-specific assessments early in the nursing program can contribute to identification of at-risk students during the first year of a nursing program. Identification of areas of weakness beginning with the foundations of nursing practice such as Pharmacology can assist nursing educators and students for success on NCLEX-RN. It is recommended that the findings

of this study be considered carefully as part of the body of literature surrounding standardized content-specific exams.

Recommendations for Future Research

Further research with ATI standardized content-specific assessments in baccalaureate programs is needed as this is the first study utilizing these assessments to predict NCLEX-RN outcomes in baccalaureate nursing students during the first year of a nursing program. Based upon the evidence found in this study and in the existing literature, cross validation of the findings is warranted. A replication of the study is recommended using a larger sample size over multiple baccalaureate programs. Additionally, the enhanced 2010 versions of the ATI content assessments should be used as the instruments to more accurately reflect the current NCLEX-RN exam. The updated versions of ATI include the alternate items now seen on NCLEX-RN exam which was last revised in 2010. A study with a sample using only those students failing NCLEX-RN on the first attempt could prove valuable to educators.

Summary

Nurse scientists continue to strive to identify and predict outcomes for licensure in an effort to meet the elusive 100% pass rate consistently. In this changing health care climate the nursing shortage continues to impact the profession and quality health care. Identifying strategies to increase NCLEX-RN success rates is important to nursing programs and society in general. Predicting NCLEX-RN outcomes continues to be a challenge for nurse educators. Institutions of learning should continue to improve educational strategies to assist students for success. Many schools of nursing are opting to adopt standardized assessments as an integral part of the nursing curricula (Firth, et al, 2005). Early identification of at-risk students with content-specific assessments from companies, like ATI, maximizes the available time to the end of a nursing

program to implement a comprehensive rigorous remediation plan in continued efforts to minimize NCLEX-RN failures.

First year nursing courses provide the foundations of nursing practice. Bondmass, et al (2008) espouse that fundamentals, pharmacology and mental health are critical assessments necessary for progression in acquiring needed nursing knowledge. Without an adequate understanding of nursing foundations, further concepts and knowledge are more difficult to gain. Therefore, first year assessments could possibly predict NCLEX-RN outcomes. Utilizing scores on the Pharmacology content-specific standardized assessment can assist educators in making another step toward predicting NCLEX-RN outcomes.

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Appendix A

Standardized Tests**1. Content Mastery Testing**

All students (except RNs) enrolled in the Eleanor Mann School of Nursing BSN Program will take the secured, computer-generated Assessment Technologies Institute, LLC (ATI) Content Mastery Test(s) at the end of the semester in which they are assigned (See Table 1). For full-time students, these exams will be administered during the 4 semesters of the professional nursing course work.

To be eligible for the RN Comprehensive Predictor at the end of the last semester of nursing studies, a student must have successfully completed ALL required BSN Courses with a grade of C or higher and achieved the National average or higher on the Group Mean final score for all Content Mastery Tests.

Table 1: Content Mastery Tests

| Content Mastery Test | Associated Nursing Course |
|-----------------------------|--|
| RN Fundamentals | NURS 3422: Foundations |
| RN Pharmacology | NURS 3634: Adult Health and Illness I |
| RN Mental Health | NURS 3742: Mental Health and Illness |
| RN Adult Medical-Surgical | NURS 4262: Adult Health and Illness II |
| RN Maternal Newborn | NURS 4154: Children and Family |
| RN Nursing Care of Children | NURS 4154: Children and Family |
| RN Leadership | NURS 4242: Management in Nursing |

The Content Mastery Tests will be used to achieve the following goals: assessment of student progress in achieving professional nursing knowledge as compared to other BSN students, identification of nursing knowledge deficiencies to aid in development of student self-remediation plans, and improvement of student National Council of State Boards of Nursing (NCLEX) passing rates.

a) To be eligible to take a Content Mastery Test, a student must have successfully completed the associated nursing course with a grade of C or higher. Upon completion of each computerized

test, students will receive a computer-generated report that indicates their subset scores within each test as well as their composite final score, as compared to the national average. Students meeting or exceeding the national average on the composite final score on the first attempt will receive an additional 2 percent bonus on their course grade except for NURS 3313, Pharmacology and N3634, Adult Health and Illness.

b) Students receiving a score lower than the national average on the composite final score on the first attempt will enroll in one credit hour of NURS 3171: Independent Study the following semester. For students with more than one ATI content exam lower than the national average in a given semester, he/she must enroll in a one credit hour Independent Study for each Content Mastery Exam they failed. Students will be allowed to progress to the next level while they complete this Independent Study. Content Mastery Exams must be retaken after presenting evidence of remediation. (See Academic Enhancement Policy)

c) If a student is enrolled in a remediation Independent Study during their final semester of the program and do not pass, he/she will need to meet with the Assistant Director or Director concerning the areas in which they need remediation, as indicated by the diagnostic indicators for improvement (nursing process, client needs, critical thinking process, and nursing topics) found on the student report. The Assistant Director or Director will advise the student of resources available for remediation including coaching material, web links, content coaching DVDs provided to each student, textbooks, assignments, and other resources associated with courses. The students are responsible for their remediation plan. The student must complete all content mastery exams at national level before they will be allowed to take the RN Comprehensive Predictor exam.

2. Content Mastery Test for LPN Exemption

LPN students who are admitted to the program will be permitted to receive credit for NURS 3634 Nursing Concept: Adult Health and NURS 3643 Professional Role Implementation II: Caregiver through a validation examination. The Adult Medical Surgical ATI Content Mastery exam will be administered for this validation. The LPN student will have only one opportunity to take this exam; if they do not meet the national average, they will be expected to enroll in both courses.

3. RN Comprehensive Predictor

All students (except RNs) enrolled in the Eleanor Mann School of Nursing BSN Program will take a secured, computerized ATI RN Comprehensive Predictor in the last semester of their program of study and prior to graduation. **Students must achieve the National average or higher before the Eleanor Mann School of Nursing director will sign the student's state board of nursing license examination application.**

The RN Comprehensive Predictor requirement is designed to achieve the following goals: assessment of student progress in achieving a professional nursing knowledge as compared to other BSN students, identification of nursing knowledge deficiencies to assist in student development of a self-remediation plan, and improvement of student passing rates on the National Council of State Boards of Nursing (NCLEX).

- a) To be eligible for the RN Comprehensive Predictor, a student must have successfully completed all required BSN courses with a grade of C or higher and achieve the National average or higher on the composite final score for all content mastery tests listed in Table 1.
- b) Students receiving a score less than the National average on the RN Comprehensive Predictor composite final score will be scheduled for advisement regarding plans to improve their performance on content associated with the National Council of State Boards of Nursing (NCLEX).
- c) The EMSON assistant director or director will advise students about the diagnostic indicators for improvement (nursing process, client needs, critical thinking process, content topics, and client needs subtopics) as found on their student report(s). Students are responsible for developing and implementing self-remediation plans, based upon their identified nursing knowledge deficiencies. The plan will contain the following items:
 - Develop a calendar with detailed accounting of your preparation and time on task (clock hours);
 - Write detailed handwritten notes about the information from the Content Master Exams and the RN Comprehensive Predictor reports identified for remediation;
 - Identify textbook readings related to Content Exams and the RN Comprehensive Predictor

- Describe and implement other activities to achieve NCLEX success such as NCLEX review courses, review manuals, tutoring, and provide proof of your work.

d) The remediation plan will include coaching material web-links found on the student report, content coaching on DVDs provided to each student, specific course textbooks, assignments, and other resources. Students are expected to complete their remediation plan, retest, and obtain a score of the national average or higher.

Appendix B

Assessment Results from ATI

**Individual Performance Profile
RN Fundamentals 2007**



| | | | |
|------------------|------------|---|---------|
| Individual Name: | | Adjusted Individual Total Score: | 60.0% |
| Student Number: | | ATI Proficiency Level: | Level 1 |
| Institution: | | Mean - National: | 69.9% |
| Program Type: | BSN | Mean - Program: | 70.3% |
| Test Date: | 10/29/2010 | Percentile Rank - National: | 15 |
| # of Questions: | 60 | Percentile Rank - Program: | 15 |

| Individual Performance in the Major Content Areas | | | | | | | Individual Score (% Correct) | | | | | | | | | | | | | |
|---|----|------------------|----------|--------------|-----------------|--------------|------------------------------|----|----|----|----|----|----|----|----|----|-----|--|--|--|
| Sub-Scale | # | Individual Score | Mean | | Percentile Rank | | | | | | | | | | | | | | | |
| | | | National | Program Type | National | Program Type | 1 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | | | |
| Management of Care | 4 | 50.0% | N/A | N/A | N/A | N/A | | | | | | | | | | | | | | |
| Safety and Infection Control | 8 | 37.5% | 63.6% | 63.1% | 12 | 13 | | | | | | | | | | | | | | |
| Health Promotion and Maintenance | 16 | 62.5% | 70.9% | 72.4% | 33 | 26 | | | | | | | | | | | | | | |
| Psychosocial Integrity | 11 | 72.7% | 68.9% | 69.6% | 75 | 73 | | | | | | | | | | | | | | |
| Basic Care and Comfort | 13 | 61.5% | 64.2% | 64.4% | 52 | 51 | | | | | | | | | | | | | | |
| Pharmacological and Parenteral Therapies | 5 | 60.0% | 69.6% | 70.0% | 47 | 46 | | | | | | | | | | | | | | |
| Reduction of Risk Potential | 2 | 50.0% | N/A | N/A | N/A | N/A | | | | | | | | | | | | | | |
| Physiological Adaptation | 1 | 0.0% | N/A | N/A | N/A | N/A | | | | | | | | | | | | | | |

NOTE: Means and percentile ranks are not presented for sub-scales with fewer than five items.

Topics To Review

- Management of Care (4 items)**
- Advance Directives (1 item)
 - Legal Responsibilities: Durable Power of Attorney
- Legal Rights and Responsibilities (1 item)
 - Admission Process: Managing Client Valuables (RM Fundamentals 6.1 Chp 41)
- Safety and Infection Control (8 items)**
- Accident Prevention (1 item)
 - Infant (Birth to 1 Year): Crib Safety
- Safe Use of Equipment (1 item)
 - Client Safety: IV Medication Administration Per Pump
- Standard/Transmission-Based/Other Precautions (2 items)
 - Infection Control: Recognizing Modes of Direct Transmission
 - Urinary Elimination Needs: Home Care of a Client with an Indwelling Catheter
- Use of Restraints/Safety Devices (1 item)
 - Client Safety: Assessing Client Response to Restraints

Please see page 4 for an explanation of the scores and topics to review sections.

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Report Created on: 10/29/2010 11:46 AM EDT

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Topics To Review

- Health Promotion and Maintenance (16 items)**
- Aging Process (1 item)
 - Middle Adult: Abnormal Physical Assessment Findings
- Developmental Stages and Transitions (3 items)
 - Adolescent (12 to 20 years): Client Independence (RM Fundamentals 6.1 Chp 19)
 - Adolescent (12 to 20 years): Therapeutic Communication (RM Fundamentals 6.1 Chp 19)
- Family Systems (1 item)
 - Nursing Care of the Family: Family Structure (RM Fundamentals 6.1 Chp 5)
- Health Promotion Programs (1 item)
 - Older Adult: Planning Education Programs
- High Risk Behaviors (1 item)
 - Adolescent (12 to 20 Years): Nutritional Needs (RM Fundamentals 6.1 Chp 19)
- Psychosocial Integrity (11 items)**
- Grief and Loss (2 items)
 - Grief and Loss: Coping With a Sudden Death
- Sensory/Perceptual Alterations (1 item)
 - Assisting the Client with Sensoriperceptual Alterations: Hearing Impairment
- Therapeutic Communications (3 items)

Appendix C

February 23, 2012

MEMORANDUM

TO: DeAnna Jan Emory
Tom E.C. Smith

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 12-02-499

Protocol Title: *Use of Standardized Mastery Content Assessments Given During the First Year of a Baccalaureate Nursing Program for Predicting NCLEX-RN Failures*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 02/23/2012 Expiration Date: 02/21/2013

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<http://vpred.uark.edu/210.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 250 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.

Appendix D

UNIVERSITY OF
ARKANSAS

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College of Education and Health Professions
Fayetteville, AR 72701
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217 Ozark Hall
(479)575-3904
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February 16, 2012

TO: University of Arkansas IRB

FR: Nan Smith-Blair, PhD, RN 

RE: IRB Request by Jan Emory

This is to verify that Jan Emory has permission to obtain student data including demographic data, ATI testing data and NCLEX-RN report data for her study titled "Use of Standardized mastery Content Assessments Given During the First Year of a Baccalaureate Nursing Program for Predicting NCLEX-RN Failures".