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Running head: EARLY IDENTIFICATION

UNIVERSITY OF SAN DIEGO

Hahn School of Nursing and Health Science

DOCTOR OF PHILOSOPHY IN NURSING

EARLY IDENTIFICATION OF AT-RISK LPN-to-RN STUDENTS

by

Lisa K. Hawthorne, RN, MSN, PHN, CNE

A dissertation presented to the

FACULTY OF THE HAHN SCHOOL OF NURSING AND HEALTH SCIENCE

UNIVERSITY OF SAN DIEGO

In partial fulfillment of the

Requirements for the degree

DOCTOR OF PHILOSOPHY IN NURSING

Dissertation Committee

Dr. Jane Georges, PhD, RN – Chairperson

Dr. Mary Jo Clark, PhD, RN

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Abstract

Nurse education programs are implementing standardized assessments without evaluating their effectiveness. Graduates of associate degree nursing programs continue to be unsuccessful with licensure examinations, despite standardized testing and stronger admission criteria. This problem is also prevalent for LPN-to-RN education programs due to a lack of research on this group of graduates, who by all accounts should be successful in nursing education based on their work experience and prior nursing education. Findings of this quantitative, non-experimental descriptive correlational study are presented to determine the effectiveness of standardized testing from Assessment Technologies Institute (ATI) as it relates to identifying *at-risk* LPN-RN students enrolled in two mid-western private colleges and predicting their success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN®). The sample consisted of 182 students who took the ATI registered nursing (RN) comprehensive predictor assessment between November 2009 and December 2011. Demographic data and scores on the ATI RN Fundamentals Assessment (composite, nursing process, and thinking scores) were compared with performance on the ATI comprehensive predictor and NCLEX-RN® results. Study findings indicate a statistically significant association between the standardized testing scores and pass rates on the NCLEX-RN® examination, but limited relevance of student characteristics.

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Dedication Page

I have several people that I would like to thank for their endless support and encouragement throughout this writing project. Completion of a doctoral degree is a journey that I had never planned to take when completing my initial licensure program at Arizona Western College, but when I fell in love with nursing education, it was the logical direction to take.

I would like to thank my husband of for his endless support taking over our home duties that kept us in clean clothes and with vacuumed floors while I was glued to the computer. I would also like to thank my sons, Justin and Eric, who teased me along the way, asking if I was a “doctor” yet, and my parents, Virgil and Sue Beavers, who have supported me through everything I have ever wanted to pursue in my life.

I appreciate the support of Dr. Jane Georges who believed in me and allowed me to work with her on this project. She was the faculty member that many of my colleagues and friends in the program sought out for guidance and were privileged to have her accept us under her wing as our committee chair. I would like to thank Dr. Mary Jo Clark for agreeing to be a part of this amazing journey. I knew in PHDN 685 when she provided such detailed critique to each and every student, that she was the type of educator that I aspire to be. Finally, I appreciate the years of mentoring from Dr. Beverley Turner. Even when our paths went different directions, we found ways to remain connected, and I appreciated the friendship.

I would have not been able to complete this research without the support of Assessment Technologies Institute, LLC. Their staff was amazing in ensuring that I had access to the research data. Dr. Michelle Dunham took the time to review my data and

offered support when I could not decide which statistical method to use. Additionally, I have to thank Dr. Andrea Hazen, University of San Diego faculty, for her ability to teach statistics in such a systematic way that I could utilize her course notes to help “jog” my memory and unbury my “stats-brain.”

Finally, I would like to thank my coworkers and friends who listened as I struggled with finding resources and struggling with re-writes. I needed cheerleaders to get through the final stage of this life changing project, and you were all there reassuring me that this journey will be worth it in the end.

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CHAPTER 1

INTRODUCTION

The profession of nursing is deemed highly respected. For the past 11 years nurses have topped the Gallup's Honesty and Ethics ranking every year, except one, as the profession with the highest honesty and ethics ratings. The Gallup survey has been conducted with the general population across the country since 1999 (Jones, 2010). These perceptions of nursing, along with market surveys of growing professions, have helped nursing become a desirable career choice. A U. S. Bureau of Labor Statistics study determined that the occupation of registered nurses (RNs) is projected to grow at an annual average of 10.1% from 2008 to 2018 (Bartsch, 2009). This anticipated growth can be related to the stability of nursing employment, current nursing workforce age, and the aging of the U. S. population. Despite the interest in a nursing career, there is a shortage of registered nurses to care for the U. S. population. Buerhaus (2009) cautioned that a more severe nursing shortage is predicted starting in 2015 related to retirement of an aging nurse workforce and the increasing age of Americans requiring health care services. Nursing education can act now to help ensure there are nurses at the bedside by guiding students appropriately throughout their education to help prepare them for the licensure examination. The purpose of this chapter is to review the background issues in nursing licensure for the future nursing workforce shortage and the relevance of this study as it relates to nursing education.

Background

One solution to help alleviate the registered nursing shortage is to consider advancing the education of licensed practical nurses (LPNs). LPNs are educated in programs that average one year in length and include classroom study and supervised clinical practicum hours (U. S. Department of Labor, Bureau of Labor Statistics [USDL, BLS], 2010a). LPNs care for patients that are sick, injured, and convalescing under the direction of a physician or registered nurse, and primarily work in elderly care facilities (USDL, BLS, 2010a).

Registered nurses (RNs) have varied educational pathways and may enter practice with a baccalaureate degree, or less commonly, with a diploma from a state board of nursing-approved program (USDL, BLS, 2010b). The newest entry point to become a registered nurse is for persons with a baccalaureate degree to seek a master's degree in nursing. The advantage of utilizing LPNs to help increase the RN workforce is that they are familiar with the challenges of working in health care and would remain working as nurses (Porter-Wenzlaff & Froman, 2008).

Regardless of the educational entry point into the profession of registered nursing, nurse education programs struggle to prepare all students for success in a program and to achieve licensure. Nursing education has significantly changed in the past several decades to become a competitive area of study. Admission criteria and entry requirements for nursing programs have been affected by the shortage of nursing faculty, capped enrollments, and budgetary cuts in education funding (Clark, 2009). Much research has been conducted to evaluate admission criteria for registered nurse education programs (Baker, 2009; Grossbach & Kuncel, 2011; Jeffreys, 2007; Murray, Merriman &

Adamson, 2008) in an attempt to ensure only those students who could be successful in a program are enrolled. In addition, multiple research studies (Stuenkel, 2006; Ukpabi, 2008; Wolkowitz & Kelley, 2010) have been conducted to identify students at risk for academic failure in associate and baccalaureate degree nursing programs. The majority of nursing research (Esterhuizen, 2009; Harding, 2010; Morris & Hancock, 2008; Spurlock & Hunt, 2008) has been conducted at the end of nursing programs in the form of exit assessments to evaluate students' readiness to be successful on the National Council of State Boards of Nursing (NCSBN) national licensure examination for registered nurses (NCLEX-RN®). Unfortunately when research is done this late in the educational process, there is little opportunity to provide remediation to assist students to be successful on the NCLEX-RN® and to have the knowledge needed as entry-level nurses. It is important to also evaluate student success and/or lack of success early in the educational process to assist nursing students to meet their goals of obtaining licensure to practice.

Statement of the Problem

Whether there is a correlation between various assessments of nursing knowledge and passing the NCLEX-RN® is unknown. With nurse education programs implementing standardized assessments, there is a need to evaluate their effectiveness, as well as to determine the earliest point of intervention for *at-risk* students. This problem is even more prevalent for LPN-to-RN education programs due to a lack of research on this group of graduates who by all accounts should be successful. NCLEX-RN® predictor assessments are typically administered at the end of a nursing education program.

Despite recent higher program admission requirements, many nursing education programs are not graduating students who are successful on the NCLEX-RN®.

According to the NCSBN (2009a, 2010b, 2011) NCLEX-RN® pass rates remain in the mid- to high-70% range for all candidates taking the assessment and in the high-80% range for all U. S-educated graduates from various program levels (diploma, baccalaureate, associate, special program codes). To evaluate poor outcomes for licensure on a larger scope, the NCSBN (2011) reported that of the 195,307 candidates who took the NCLEX-RN® in January to December 2011, 76.04% passed the examination on the first-attempt; 144,583 of these candidates were educated in the United States. This indicates that 46,796 (23.96%) candidates who took the NCLEX-RN® did not pass on the first attempt, and 17,509 (12.11%) candidates educated in the U. S. did not pass on the first attempt (NCSBN, 2011).

Given recent economic cuts in education funding and capped enrollments, any efforts to identify students at-risk for academic and/or licensure failure early in the program should be considered. If correlations exist among earlier assessments of nursing knowledge, predictor assessments for success with licensure, and the actual licensure examination, nurse education programs need to be proactive and intervene at an early point in the educational process. Early intervention is essential to promote student success. Therefore, this study is designed to determine the relationship between LPN-to-RN students' performance on standardized testing and subsequent performance on the NCLEX-RN® examination.

Gaps in Current Research

There is a current knowledge deficit about how well licensed practical nurses perform in registered nurse education programs and their success with the NCLEX-RN® examination. In reviewing research related to NCLEX-RN® licensure, there is no

information available on the success of LPNs and their completion of RN programs. The majority of recent research has been conducted with entry-level associate degree and baccalaureate nursing students (DeLima, London, & Manieri, 2011; DiBartolo & Seldomridge, 2008; Esterhuizen, 2009; Grossbach & Kuncel, 2011; McGahee, Gramling, & Reid, 2010; Romeo, 2010). However, a review of recent dissertations provides evidence that researchers are beginning to look at admission requirements for LPNs enrolling in RN education programs (Bousquet-Heyne, 2011; McKenzie, 2008).

Although there has been research on issues surrounding academic preparation for entry into a registered nurse education program for those without previous nursing work experience, it is important to look at those with nursing experience as LPNs because many in the RN workforce were previously licensed as LPNs. In a comparison report of entry-level registered nurses conducted by the NCSBN (2010c) of 219 RNs in British Columbia and in the U. S., 18.7% of the U. S. respondents reported working as LPNs for an average of 5.3 years prior to becoming RNs. While this is a limited sample, it is not uncommon to find many RNs in practice today who have worked as LPNs. Therefore, this group needs to be looked at closely as strong contenders for meeting the RN workforce needs of the future. Graduates of LPN-to-RN programs have already had experience of taking a licensure examination, so it could be expected that the anxiety of the unknown is removed in taking the NCLEX-RN® assessment.

Significance of Study

The findings of this study will benefit nursing education, practice, research and the education consumer (e.g., students, parents, payers of education). If it is determined that there is a relationship between standardized testing results and NCLEX-RN® results,

the findings of the study will serve to inform nursing education administrators and educators regarding progression policies as they relate to standardized testing and contribute to positive program outcomes. Nurse educators and education consumers will benefit from findings of a relationship through early identification of *at-risk* students. Early identification of *at-risk* students is necessary to help them be successful in completion of the program of study, as well as to achieve licensure status as registered nurses. Additionally, findings of this research help nursing education programs with a LPN-to-RN option better assess the capability of the students enrolled in their programs. Nursing education programs must prepare students to ensure a level of educational attainment that makes them competent as safe, entry-level practitioners, and active intervention early in the educational process will result in improved outcomes.

The findings of the study may also benefit nursing practice by having nursing graduates prepared to be successful on their licensure examination, thereby entering practice at the earliest possible entry point. In addition, the study lends itself to further research opportunities to address graduate readiness and remediation and may serve as a foundation for improving graduate outcomes. Finally, the significance of this research for the education consumer needs to be addressed. The cost of education continues to rise and consumer debt for education is of grave concern to the U. S. Department of Education (2010) as student loan default rates have increased from 2007 to 2008 from 5.9 to 6% for public institutions, from 3.7 to 4% for private institutions, and from 11 to 11.6% for proprietary institutions. If graduates of nursing education programs are unable to complete their program of study or not successful with the NCLEX-RN® licensure

examination, they are unable to work as registered nurses, thereby decreasing their opportunity to readily repay students loans.

Purpose of the Study

The purpose of this quantitative, non-experimental descriptive correlational study was to evaluate the contributions of a standardized testing program to early identification of *at-risk* students enrolled in LPN-to-RN education programs in efforts to improve NCLEX-RN® outcomes and ultimately lead to an increase in the number of licensed registered nurses. Specifically, the study evaluated the relationship of scores on the Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment and key components of this assessment to scores on the ATI RN comprehensive predictor assessment and the NCLEX-RN®. In addition, this study addressed the following aims and related research questions:

- **Research Aim One:** To determine indicators available early in the educational process that can assist with identification of students *at-risk* for academic failure or inability to pass the licensing examination.
 - **Question 1:** Is there a relationship between student composite scores on the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment scores?
 - **Question 2:** Is there a relationship between student composite scores on the ATI content mastery series RN fundamentals assessment scores and pass/fail results on the NCLEX-RN®?

- **Question 3:** Is there a relationship between student composite scores on the ATI RN comprehensive predictor assessment and pass/fail results on the NCLEX-RN®?
- **Research Aim Two:** To determine if there is a relationship between students' use of the nursing process components and the thinking skills (foundational and critical thinking), as identified early in the educational process, and success in a LPN-to- RN nursing education program.
 - **Question 4:** What are the relationships between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment, and ATI RN comprehensive predictor assessment scores?
 - **Question 5:** What are the relationships between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®?
 - **Question 6:** What are the relationships between the components of thinking skills (foundational thinking and critical thinking) scores, as identified on the ATI content mastery series RN fundamentals assessment, and ATI RN comprehensive predictor assessment scores?
 - **Question 7:** What are the relationships between the components of thinking skills (foundational thinking and critical thinking) scores, as

identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®?

- **Research Aim Three:** To determine if there is a relationship between student characteristics (gender, age, race, previous education level) and success in a LPN-to-RN education program.
 - **Question 8:** What are the relationships between students' total composite scores on the ATI content mastery series RN fundamentals assessment and student characteristics (gender, age, race and previous education level)?
 - **Question 9:** What are the relationships between students' scores on the ATI RN comprehensive predictor assessment and student characteristics (gender, age, race and previous education level)?
 - **Question 10:** What are the relationships between students' pass/fail results on the NCLEX-RN® and student characteristics (gender, age, race and previous education level)?

Theoretical Underpinnings and Assumptions

Earl's model of *assessment as learning* (2003) provided the theoretical underpinning for this study. Earl (2003) encouraged educators to view assessment as a multifaceted approach with many purposes, but to change the traditional use of assessment as a summative assessment *of* learning. Rather, assessment needs to be considered a tool *for* and *as* learning and can be applied in this way in relation to standardized testing. Standardized testing, such as ATI testing, can serve as an assessment administered *as learning*. Based on the inferences from Earl's model,

standardized testing can serve to promote improved learning at a deeper level when used properly throughout the educational process.

This study was based on several underlying assumptions. First, some component of anxiety or fear related to taking a national licensure examination would be removed based on the population having successfully completed licensure testing with the NCLEX-PN®. An additional assumption is that in using testing as *assessment as learning* students will be better prepared for their NCLEX-RN® examination, having identified strengths and weaknesses through standardized testing. Finally, an assumption can be made that scoring on the standardized ATI assessments and NCLEX-RN® was not influenced by cheating or student collaboration since the assessments were delivered in a secure, proctored environment.

Explanation of Variables and Terms

For this purpose of this study, the independent variables / terms were defined as follows:

1. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals of nursing assessment individual composite score – a numeric assessment score that indicates understanding of the basic fundamentals of nursing content and provides information for remediation efforts (ATI, 2010)
2. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – nursing process *assessment* individual score – an assessment score evaluating the ability to apply nursing knowledge to the systematic collection of data about clients' health status through client history, interview, vital signs, and hemodynamic measurement (ATI, 2010).

3. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – nursing process *analysis/diagnosis* individual score – an assessment score evaluating the ability to analyze data that has been collected to reach appropriate nursing judgments about clients' health status and coping mechanisms, while recognizing findings that indicate health problems/risks that may require nursing intervention (ATI, 2010).
4. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – nursing process *planning* individual score – an assessment score evaluating the ability to apply nursing knowledge to the development of care plans for clients with health alterations and needs for health promotion or maintenance. This planning score also includes the student's ability to establish priorities of care, delegate appropriately, and establish appropriate client outcomes (ATI, 2010).
5. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – nursing process *implementation/ therapeutic nursing intervention* individual score – an assessment score evaluating the ability to implement interventions based on nursing knowledge, priorities of care, and expected client outcomes. This implementation score also addresses the student's ability to respond to unplanned events or life-threatening situations to decrease clients' risk (ATI, 2010).
6. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – nursing process *evaluation* individual score – an assessment score evaluating the ability to evaluate clients' responses to nursing

interventions and whether or not the desired client outcomes have been achieved.

This evaluation score is related to the student's ability to assess clients'

understanding of instruction, the effectiveness of an intervention, and the need for further interventions (ATI, 2010).

7. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – thinking skills, *foundational thinking* in nursing individual score – an assessment score evaluating the student's ability to recall and comprehend information and concepts that are foundational to delivering quality nursing care (ATI, 2010).
8. Assessment Technologies Institute®, LLC (ATI) content mastery series RN fundamentals assessment – thinking skills, *clinical judgment/critical thinking in nursing* individual score – an assessment score evaluating a student's ability to problem solve a clinical situation using critical thinking skills, such as interpretation, analysis, evaluation, inference, and explanation, in order to make sound clinical judgments (ATI, 2010).
9. Assessment Technologies Institute®, LLC (ATI) RN comprehensive predictor assessment individual score – a numeric assessment score utilized by students and educators to indicate the likelihood of passing the NCLEX-RN® and providing information for remediation efforts in advance of taking the NCLEX-RN® (ATI, 2009b).

For the purpose of this study, the dependent variable was defined as follows:

1. National Council Licensure Examination for Registered Nurses (NCLEX-RN®) – identified by NCSBN as an “examination designed to test knowledge, skills and

abilities essential to safe and effective practice of nursing at the entry level (2011, p. 1). The pass or fail outcome on the NCLEX-RN® is considered the dependent variable.

Additional terminology that requires further definition was as follows:

1. LPN-to-RN student – a licensed practical nurse who is enrolled in an associate of applied science in nursing education program.
2. *At-risk* students – students considered to be in danger of failing in schools and becoming academically disadvantaged when compared to their peers (Ravitch, 2007).

Limitations of Study

This research study had some limitations. First, the study incorporated only two LPN-to-RN education programs with the same curriculum plan. Second, the results of this study are not generalizable to all nursing programs (associate degree entry-level or baccalaureate degree entry-level) because all subjects had experience in nursing as LPNs. Finally, this was the first study noted to include the consideration of the scoring of the ATI content mastery series RN fundamentals subcomponent scoring of the nursing process and thinking skills.

Summary

In summary, this study has the potential to assist in identifying *at-risk* students early in the educational process to allow for remediation efforts to promote success in becoming a registered nurse. Nursing education programs are evaluated on their NCLEX-RN® outcomes and constantly struggle to make improvements in results. The sample of LPN-to-RN students is a group that is worthy of evaluation as they are familiar with the

demands of working in the field of nursing and will bring their experiences forward to augment the RN workforce.

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to review the nursing education literature as it relates to preparation of nursing students for success on licensure examinations and entry into the workforce. To address the identified research questions, it was necessary to conduct a detailed literature review relevant to nursing education, workforce needs, licensure trends, and program outcomes. A systematic approach was used to conduct a review through CINAHL, ProQuest® Nursing, Gale and Ovid databases. Key terms used in the search included: NCLEX, NCLEX-RN, NCLEX success, NCLEX failure, standardized testing, Assessment Technologies Institute, Inc. (ATI), Health Education Systems, Inc. (HESI), nursing education, critical thinking, nursing process, and licensed practical nursing to registered nursing education. References less than five years old cited in articles identified in the search were reviewed. Additional detailed information regarding the ATI assessment products and current research on standardized testing were evaluated to identify gaps in knowledge related to preparation of LPN-to-RN students.

Nursing Workforce Needs

The need for nurses is well documented and has been extensively studied in the past several decades (American Association of Colleges of Nursing [AACN], 2008; Buerhaus, 2009). The United States Department of Labor, Bureau of Labor Statistics (2010a, 2010b) indicated the need for RNs will increase by 22% between 2008 and 2018, while the need for LPNs will increase by 21%. This increase is related to the expected

growth in the number of older people who will require nursing care. It is estimated that the population of people over 65 years of age will grow tremendously over the next several decades. In addition, the older population is not only growing in physical numbers, but is surviving longer and living to older ages (Happell & Brooker, 2001). This significantly influences the need for nursing care, with older adults being more likely to have medical conditions that require care.

The older population will experience physical changes, requiring special consideration and increasing their need for nursing care. Basic physical changes that occur with aging involve all bodily systems and start from the moment of conception (Wold, 2008). There is no prediction of what physiological changes will occur first, and not all persons have identifiable changes within the same decade of life. However, it can be predicted that these physical changes will result in the elderly population requiring assistance with activities of daily living from caregivers. Psychosocial changes will also occur within this population. As aging occurs, there are losses that can result in withdrawal and depression.

With the expected growth of the older population, there is concern that there will not be a large enough nursing workforce to provide care. According to the U. S. Department of Health and Human Services, Health Resources and Services Administration (2010) just over 5% of registered nurses work in extended/long-term care. This percentage is not consistent with the needs of our aging population. A 2008 issue brief by the National Council of Aging (NCOA) discussed the recruitment and retention of direct caregivers as a looming crisis in the care of the elderly. The high vacancies among caregivers in this area have prompted several initiatives, such as nursing

education loan repayments, to entice caregivers into the elderly caregiver role (NCOA, 2008). The 2008 RN practice analysis conducted by the NCSBN reported that newly-licensed registered nurses surveyed work primarily in hospitals (89.2%) and only 5.3% work in long-term care, while the other 3.9% worked in community-based care (2008b). This represents a decrease from 7.6% of registered nurses employed in long-term care, in previous practice analysis surveys (2005b) conducted by the NCSBN. Studies like that of Happell and Brooker (2001) indicated that care of older adults was ranked as the least preferred career choice out of nine potential areas of nursing care in a study of 247 nursing students in Australia. Students preferred career choices in the areas of pediatrics and maternity nursing, while deeming elderly care unchallenging and not using their nursing skills.

In the United States, the lack of available nurses, in general, and for the elderly population in particular, has been well documented to have effects on nursing care (AACN, 2010). According to the American Association of Colleges of Nursing shortage fact sheet (2008), the demographic change of an increasingly elderly population may limit access to health care unless there is growth in the number of new nurses and caregivers prepared to enter the profession of nursing. The need for care of the aging population can be addressed with LPNs experienced in long-term care. According to the 2009 LPN practice analysis conducted by the NCSBN, 52.1% of newly licensed LPNs worked in long-term care facilities (NCSBN, 2009b).

Current and Future Workforce Needs

To meet future workforce needs, LPNs should be considered as a resource to increase the availability of RNs due to their experiences with the older population and

knowledge of the demands of the nursing profession. In a review of current literature, there is limited data about the success of people who have been licensed as LPNs in completing registered nurse education programs. The U. S. Department of Health and Human Services, Health Resources and Services Administration (HRSA) (2010) reported that 21% of RNs were previously licensed as practical nurses.

Impact of Nurse Education Program Outcomes on Future Workforce Needs

Nursing education programs are essential to ensuring that the number of nurses is adequate to meet future workforce needs. With the limitations placed on nurse education programs through capped enrollments and decreased faculty numbers and funding sources, it is imperative to ensure those students who enter a program of study complete the education program and are well-prepared to step into the nursing workforce as safe entry-level practitioners.

Despite increased admission requirements and student screenings, some graduates of nurse education programs continue to struggle with passing their licensure examination for entry into practice. According to the National Council of State Boards of Nursing's (2004; 2005a; 2006; 2007; 2008a; 2009a; 2010b; 2011) annual reports, there has been a steady increase in the number of U. S.-educated testers , with 85.3% to 87.89% of first-time test takers passing NCLEX-RN® from 2004 to 2011. In 2007, there was a 2.6% decrease in the number of candidates passing the NCLEX-RN®, and in 2010 (first three quarters) a decrease of 1.01% was noted from the previous year for first-time testers (NCSBN, 2007, 2010b). The 2007 and 2010 decreases can be attributed to a change in the NCLEX-RN® test plan that occurs every three years with the change implemented in April of those years. This is a typical occurrence with a change in test

plan content and distribution; curriculum plans often take longer to conform to new test plan information.

Overall, from 2004 to 2010, the number of candidates testing has resulted in the addition of more than half a million new registered nurses in the United States.

Unfortunately, there were an additional 104,807 graduates who completed a registered nurse education program who did not pass their licensure examination on the first attempt. During the same period 77.5% of candidates taking the NCLEX-RN® on a second attempt passed the examination. However, the state boards do not consider the passing percentage of second time testers when considering compliance with regulations related to NCLEX-RN® scores as a marker of program success.

Nursing education programs are evaluated by the individual state boards and accrediting bodies on their ability to graduate nursing students who can successfully pass the NCLEX-RN® licensure examination on the first attempt. Programs that do not meet the expected standards set in each state are at risk of losing their approval/accreditation status with continued substandard pass rates. Therefore, administrators of nursing education programs have sought methods and techniques to improve outcomes. One strategy has been the use of secondary testing agencies to ensure students' readiness for the licensure examination upon graduation.

Skills of the Future Nursing Workforce

Nurses in today's workforce and in the future need to utilize the nursing process to aid in critical thinking skills to deal with higher acuity patients and increased workload. In addition, technology expertise is necessary. The Institute of Medicine (IOM) Report on the Future of Nursing (2010) recommended that the skills and education

of nurses need to be advanced beyond that of the 20th century and before. Key recommendations included the advancement of a systems thinking approach in the practice of nursing (IOM, 2010). Preparation of registered nursing students with increased abilities to systematically apply the nursing process and to apply critical thinking skills will directly affect their abilities to perform in today's advanced health care arena.

Nursing process. Nursing graduates are required to approach the needs of patients using a systematic approach. The nursing process is a cognitive (thinking) process that involves the use of intellectual skills in problem solving and decision making to apply knowledge in a systematic and logical way to plan care for a patient (Wilkinson, 2007). The American Nurses Association (ANA) has utilized the components of the nursing process to delineate the standards of practice for nursing (2010). Fero, Witsberger, Wesmiller, Zullo and Hoffman (2008) studied the nursing performance of 2,144 RNs newly hired in a university health system consisting of 19 facilities with varied levels of care. Fero et al. discovered that approximately 25% of the nurses (new graduates and experienced RNs) were not able to identify a clinical problem, safely prioritize care needed, and implement nursing interventions (2008). This is of concern in that these are basic elements of the nursing process used throughout the majority of nursing education programs to systematically address the needs of patients.

Thinking skills of nursing students/new graduates. Patient populations are more acutely ill today than in the past several decades and require nursing students and new graduates to perform at a higher level of thinking. Dorothy del Bueno (as cited in Goodwin-Esola & Gallagher-Ford, 2009) supported a higher level of accountability for

RNs than LPNs based on: (a) the ability to recognize problems from patient's symptoms, (b) awareness of a situation's urgency, and (c) the capacity to modify/develop a plan of care. Each of these levels of accountability requires increased thinking skills that are foundational to the RN's ability to function in the nursing role.

In nursing education, use of the nursing process allows students the opportunity to organize their thinking about nursing care. The nursing process enables students and nurses to: (a) collect objective, and subjective data, (b) develop nursing diagnoses based on data collected, (c) develop a plan of care, (d) implement the plan of care, (e) evaluate the effectiveness of the care, and (f) modify the plan based on evaluation findings (Huckabay, 2009). Having a strong foundational understanding of the nursing process assists students to improve their thinking about the care that they provide to patients. The combination of critical thinking and the nursing process assists students to address the "what if" and "so what" questions they may be faced with in practice (Huckabay).

Utilization of technology. Many students enrolled in nursing education programs are technologically savvy. Students currently enrolled in nursing education programs can be categorized as the millennials (a.k.a. generation Y, net generation) and as generation Xers. Millennials can best described as those born in the early 1980s or later (Skiba, 2005; Twenge, 2006). The generation Xers are described as those born in the late 1960s to the 1970s (Twenge, 2006) and have been introduced to technology in their mid-20s to early 30s. The millennials have grown up with technology, and it is embedded in their world (Skiba). Use of technology is important to engage both of these generations of students in active learning. Computerized assessment practices and technological presentations to aid learning address the learning needs of these groups. Nursing

graduates surveyed after taking the NCLEX-RN® indicated that online testing experiences were helpful in their preparation (Rees, 2006; Richards & Stone, 2008).

Nursing should consider faculty as “facilitators,” as opposed to lecturers, with an approach to education as collaborative learning (Twenge, 2006). Using technology to facilitate learning with computerized assessments will put the students more at ease with this form of testing. Arhin and Cormier (2007) suggested that the use of technology combined with critical inquiry will lead to increased learner autonomy and can stimulate the motivation to learn for the sake of learning.

Nursing Education

Nurse education has developed significantly in the past several years from service-driven programs to more academic models, and students have different characteristics than in past. Benner, Sutphen, Leonard and Day (2010) discussed the varied pathways for entry into nursing that continue to complicate and confuse the process of nursing education. In order to meet the demands for registered nurses in the United States, nursing education programs, in collaboration with state regulatory boards, have implemented creative educational pathways to increase the number of nurses to meet workforce demands. While many pathways have approached entry into nursing practice (e.g., entry level masters programs, second-degree programs), other avenues for growth have focused on moving other healthcare providers (e.g., emergency medical technicians, paramedics, licensed practical/vocational nurses) through specific programs that build upon prior training. In the publication, *Report of Findings from the Comparison of Entry-Level Registered Nurses in the U. S. and British Columbia, Canada*, the National Council of State Boards of Nursing (2010c) reported that 18.6 % of

candidates taking the NCLEX-RN® examination in the United States have been licensed as LPNs prior to their completion of a registered nursing education program. LPNs bring an average of 5.4 years of nursing experience into their registered nursing studies (NCSBN, 2010c). Despite the number of LPNs who have enrolled in registered nurse education programs, little research that has been conducted to determine their success in passing the NCLEX-RN® examination. This area is worthy of study.

Licensed Practical Nurses (LPNs) as Students

LPNs typically receive 6 to 18 months of education depending upon the state in which they are educated. Generally, LPNs tend to work in long-term care and outpatient settings (USDL, BLS, 2010a; NCSBN, 2010c). While they have previously been employed in acute care settings, this is no longer the trend. Therefore, many LPNs are seeking to further their education to work in these types of settings and to advance their nursing careers by becoming registered nurses.

Porter-Wenzlaff and Froman (2008) suggested that LPNs are the ideal students to enroll in a registered nurse education program as they are familiar with the expectations of the health care professions. The authors acknowledged that the challenge for LPNs is to step out of their former task-oriented role into that of a registered nurse. Nursing education programs have developed LPN-to-RN and LPN-to-BSN programs to accelerate movement through the registered nurse educational program. In addition, some state boards have authorized bi-level, and one-plus-one programs to help increase the number of registered nurses within their states. A one-plus-one program is a nursing program in which an applicant must reapply to enroll in the second year, and a bi-level program does not require re-application (Kansas State Board of Nursing, 2006).

There is limited research available on the success or failure of LPNs in completing a registered nurse education program and/or in passing the NCLEX-RN® for licensure. Suttle and McMillan (2009) discussed their experience with an LPN-to-RN education option, and reported that of 34 students studied, 32 were successful in passing the NCLEX-RN® on the first attempt. With a detailed literature review, there were no additional studies discovered with this population of nursing students. Generally, it would be wise to investigate the movement of LPNs and their success in registered nurse programs. Benner et al. (2010) discussed the need to align nursing education for more consistency, similar to medical students' experiences to ensure each educational program is providing the same knowledge. In addition, there is no consistency in entry requirements for admission to varied types of nursing programs that would allow for clear assessment of best practices to facilitate the success of the student.

Characteristics of Students/New Graduate Nurses

Current nursing students and recent graduates are different from their predecessors, and these differences must be considered in the educational process. Nursing students today continue to be primarily female and are older than their predecessors were at the start of their nursing education. Students today have more responsibilities, such as parenting and work commitments, which present unique challenges for completion of a program. The gender and race of entry-level registered nurses have remained somewhat consistent despite efforts to create a more diverse nurse population. In a recent survey of entry-level RNs conducted by NCSBN (2010c), the U.S. responders were 88.3% female, and 74.7% were of white, non-Hispanic origin. It is also noted that the average age of entry-level RNs was 31.89 years (NCSBN, 2010c).

Porter-Wenzlaff and Froman (2008) asserted that having LPNs become a part of the RN workforce will afford a more ethnically-diverse nurse population because LPNs often represent ethnic and racial minorities.

Current Licensure Trends

Currently, nursing licensure is required in all U. S. states and territories. States continue to have variations in requirements necessary for licensure, however all applicants have to have passed the NCLEX-RN® for licensure as a registered nurse and the NCLEX-PN® for licensure as a licensed practical/vocational nurse. States allow application for RN licensure by two mechanisms – examination or endorsement. Licensure by examination applies to students graduating from a pre-licensure nursing program. For initial licensure, each state board works in conjunction with the National Council of State Boards of Nursing to allow applicants to test for competency, which would then lead to licensure approval at the state level. RNs licensed in another state can apply for RN licensure through endorsement, which does not require retaking the NCLEX-RN®.

Nursing Education Program Outcomes

Nursing education is evaluated as successful or not based, in part, on a program's annual NCLEX-RN® pass rates (Bondmass, Moonie & Kowalski, 2008; Carrick, 2011; Giddens, 2009; McDowell, 2008; Sauter, Gillespie & Knepp, as cited in Billings & Halstead, 2012). When a program has NCLEX-RN® scores below the state or national standards for a continuous period, there can be penalties, such as change of accreditation status or mandates to provide periodic reports on progress, decrease or cease student enrollments, or close the nurse education program. This is not a situation that any

program desires. To prevent such events, nurse education programs have sought strategies to improve student outcomes, with a major emphasis on NCLEX-RN® outcomes. Programs have added more emphasis on standardized assessments to ensure their students are prepared for this high-stakes assessment after graduation. In addition to increasing their assessment practices, nursing education programs have used increasingly rigorous screening and selection processes that preclude some at-risk applicants from being accepted in the program.

Assessment Practices in Nursing Education Programs

Assessment/testing in nursing education programs is the primary method of evaluating student's attainment of knowledge to meet course and program learning objectives. For the purpose of this discussion, assessment was an appraisal or evaluation of student learning as opposed to a nursing assessment, which is the gathering of information as it relates to health status or clinical judgment (O'Toole, 2003). Much of the assessment that takes place in a nursing education program is aimed at ensuring graduates of the program are successful on the NCLEX-RN® examination. The NCLEX-RN® examination attempts to measure the competencies necessary to perform safely and effectively as a newly licensed, entry-level registered nurse (NCSBN, 2010a).

Traditionally, nurse educators have preferred written testing methods over other forms of assessment to evaluate learning as they try to prepare students for high-stakes testing (Clifton & Schriener, 2010; Oermann, Saewert, Charaskia & Yarbrough, 2009). In reviewing the literature regarding assessment/testing of knowledge, it is important to discuss the history, purpose, and types of assessment/testing in nursing education programs. Equally important are the potential effects of students' fear of assessment and

group differences (e.g., previous education experiences, student characteristics) that must be considered when implementing any assessment/testing program in a nurse education program.

History of Assessment Practices in Nursing Education

Assessment/testing for licensure in nursing education drastically changed with the introduction of computerized adaptive testing (CAT), implemented in the mid-1990s. Prior to this type of testing, graduates of nursing education programs were required to demonstrate their competency related to nursing-specific content with the State Board Test Pool Exam (SBTPE), initiated in 1946 (California Board of Registered Nursing, 2009). The SBTPE was a paper and pencil examination that required students to go to a specific location for two full days of testing. Students had to wait a lengthy period to find out if they had passed or failed the examination. With the implementation of the NCLEX-RN® as a computerized adaptive test, the last paper and pencil examination was given in 1994 (NCSBN, 2009c). Since that time more than 2.4 million candidates educated in the United States and eligible for licensure have taken the CAT version of the NCLEX-RN® (NCSBN, 2009c). Currently the NCLEX-RN® is administered in all U. S. states and territories as part of licensure requirements for graduates of nursing programs. In addition, the examination is offered to other graduates outside of the U. S. whose educational requirements meet the testing standards (NCSBN, 2009c).

With the introduction of the NCLEX-RN® administered via computer technology, there has been a growth of testing services that attempt to model this assessment practice to prepare nursing students and graduates for the licensure examination. Nursing education programs have turned to standardized tests from

commercial vendors to prepare students for licensure and practice. Three of the most widely used companies were Health Education Systems, Inc. (HESI), Assessment Technologies Institute®, LCC (ATI), and Educational Resources, Inc. (ERI) (Holstein, Zangrilli, & Taboas, 2006). As of January 2010, ERI has joined with ATI and is no longer providing independent testing services. Other testing services are provided by Kaplan Test Preparation, Mosby Assess Test, and the National League for Nursing. Computer-based testing is utilized to assess readiness for entry into programs and during the educational process. Computer-based testing used in the curriculum is designed to assess student's readiness for licensure examination, evaluate mastery of various course content, and predict program success (Zwirn & Muehlenkord, as cited in Billings & Halstead, 2012, p. 369).

Types of Assessment in Nursing Education

Assessment in nursing education programs tends to be either formative or summative. Formative assessment occurs during the educational process; summative assessment is typically conducted at the end of a course or a program of study. There are advantages and disadvantages to both forms of assessment. Formative assessment has the advantage of allowing faculty to use the results to improve student learning during the educational process (Billings & Halstead, 2005). A disadvantage is that formative assessment may lead to unwarranted assumptions about a student's ability. As an example, faculty using formative assessments can either intervene early if results indicate that certain knowledge has not been attained or they may deem a student incapable of being successful in the remainder of a course or program. The advantage of summative assessment, as identified by Billings and Halstead (2005), is that it provides faculty and

programs with opportunities to evaluate student outcomes. The disadvantage is that students may have deficiencies identified when there is no longer an opportunity for remediation.

High-Stakes Assessment/Testing and Outcomes

A high-stakes test is defined as “a criterion-referenced test that results in serious consequences for those who score low and/or some kind of reward for those who score high” (Ravitch, 2007). High-stakes testing is a common occurrence in nursing to prepare students for the NCLEX-RN® proficiency assessment. The outcome of high-stakes testing can significantly affect nursing students’ progression in nurse education programs.

Applying results of both formative and summative assessment to nurse education programs can be challenging. In nursing education programs, there is a high expectation that students will meet performance standards, such as obtaining an expected course grade, maintaining a preset cumulative grade point average, and meeting specific performance criteria in patient care settings. Students who do not meet these standards may be placed on academic probation or removed from the program of study.

High-stakes testing is not unique to nursing. Other examples of high-stakes testing include:

- College entrance examinations
- High school exit or proficiency examinations
- Driver’s license tests
- Other professional licensing examinations (e.g., the law bar examinations, medical licensing)

The NCLEX-RN® is regarded as a valid and reliable assessment that has strong psychometric properties supporting its effectiveness. It is important that all testing practices in nursing education programs are geared towards preparation of entry-level nurses who can provide competent, safe care to patients, families, and groups. In current practice, testing occurring in programs is often considered to have high stakes based on outcomes and frequently instills fear and anxiety in students. Test anxiety may be alleviated with purposeful learning experiences that promote concept attainment and task mastery (Supon, 2004).

Students tend to delay high-stakes testing out of fear of failure. Recently, the NCSBN concluded a study of the outcome of delays in testing for competency. The study validated what many nurse educators had long assumed – that graduates who delayed their NCLEX-RN® testing by 55 days or longer after graduation had a decreased probability of passing the exam (Eich & O'Neill, 2007). Kelley (2009) proposed that the ATI assessments should not be used as high-stakes testing and were developed on the premise of being a low- to moderate-stakes assessment and should not be used as a condition for graduation. Instead, the ATI assessments should be used to prepare students for taking their licensure examination and boost confidence in their readiness for the high-stakes NCLEX-RN®.

Purpose of Assessment in Nursing Education

Assessment is conducted in higher education for several purposes. Yorke (2008) identified the purposes of assessment in higher education as promoting student learning, verifying achievement, and providing quantitative data about program quality. Assessment is not synonymous with evaluation, but the two are closely linked.

Assessment, in the context of nursing education, is the measurement of student abilities and change in knowledge after participating in a course or during the process of the course (Bourke & Ihrke, as cited in Billings & Halstead, 2012). The state boards of nursing and national accrediting bodies rely heavily on the outcomes of the national licensure examination to indicate the success of a nurse education program (Bondmass, Moonie & Kowalski, 2008; Carrick, 2011; Giddens, 2009; McDowell, 2008; Sauter, Gillespie & Knepp, as cited in Billings & Halstead, 2012).

Standardized Testing in the Current Study

Because Assessment Technologies Institute®, LLC (ATI) testing is used at the two institutions where this study was conducted, ATI testing is further discussed here. ATI has three levels of assessment to guide student preparation. The initial series includes the test of essential academic skills (TEAS), a self-inventory which assesses student learning styles/abilities, and the critical thinking assessment. The second set of assessments comprises the RN content mastery series (CMS) and includes assessment of nursing knowledge in several specific content areas (e.g., fundamentals of nursing, adult medical-surgical nursing, mental health nursing, care of children, maternal-newborn nursing). The third level of assessment includes the RN comprehensive predictor examination. According to Kelley (2009), the purpose of the RN comprehensive predictor examination is to provide a numeric score to students and educators to assess students' readiness to pass the NCLEX-RN® examination and to guide remediation plans to improve areas of deficits.

Differences in Assessment by Student Characteristics

It was necessary to review the influence of student characteristics (e.g., race, gender, age) on outcomes of standardized testing as a part of this study. Kelley (2009) studied student performance on the ATI comprehensive predictor, program type, gender, and race and found that ethnicity was the one variable that resulted in a statistically significant difference in test scores. The results indicated that Asian tester group performance on the predictor examination was underpredicted in comparison to the white/Caucasian group (Kelley). Stickney (2008) demonstrated that ethnicity was significantly correlated with nursing program attrition rates and minority students were more likely to fail the NCLEX-RN® than their white counter parts (Sayles, Shelton & Powell, 2003). In addition, English as a second language (ESL) has been indicated as a factor that decreases the probability of passing the NCLEX-RN® (O'Neill, Marks & Liu, 2006).

Standardized Testing for NCLEX-RN® Preparation – How It All Relates

Standardized testing is becoming a common practice in nursing education programs to promote improvement of program outcomes related to NCLEX-RN® results. The theoretical model utilized for this study incorporates the concepts of Lorna M. Earl (2003) regarding approaches to assessment. Earl identified three approaches to assessment to include: assessment *of* learning, assessment *for* learning and assessment *as* learning. Assessment *of* learning is a summative assessment, performed at the end of something (e.g., course, program) with the intent of making judgments about placement, promotion, or credentialing (Earl, 2003). Assessment *for* learning is a formative assessment used by faculty to inform teaching and instructional decisions and also allows

students to receive feedback for improvement (Earl, 2003). Assessment *as* learning extends the formative assessment in a direction in which learning is emphasized and students are engaged in feedback they receive from the assessment data to enhance their knowledge (Earl, 2003).

Taking into consideration Earl's approaches to assessment, the same concepts can be related to the practice of initiating an assessment plan in a nursing education program. Assessment Technologies Institute®, LLC (ATI) is a provider of a comprehensive testing service for nursing education programs at both practical nursing and registered nursing levels. The ATI RN content mastery series is a battery of assessment and remediation tools that education programs can use for either formative or summative assessment of student knowledge. ATI collaborates with nursing education programs across the country to provide innovative solutions to student assessment and aids in program evaluation by providing reports of outcomes (ATI, 2009a).

The most utilized assessment and remediation package in nursing education program is the ATI RN content mastery series (CMS). The CMS consist of 9 RN-level assessment areas including: fundamentals, adult medical-surgical nursing, nursing leadership, community health nursing, maternal-newborn nursing, nursing care of children, nursing pharmacology, mental health nursing, and nutrition for nursing (ATI, 2009b). The CMS assessments are available in both practice and proctored formats. In addition, the company also offers a test of essential academic skills (TEAS®), a critical thinking entrance assessment, a self-assessment inventory, a critical thinking exit assessment, and a NCLEX-RN® comprehensive predictor assessment (ATI, 2009b). Nursing education programs choose the assessments that will be used with their curricula.

Utilizing testing resources from ATI (e.g., content assessments, comprehensive assessments, remediation plans) and the approaches of Earl (2003) the concepts of both can be aligned to accommodate better outcomes for student's academic success. Table 1 indicates the relationship of Earl's model and the ATI assessments utilized in this study.

Table 1. Relationship of Earl's Model to ATI Assessments

Assessment	Earl's Model (Earl, 2003)	School/Nursing Assessments
Assessment <i>of</i> Learning	<ul style="list-style-type: none"> • Informs judgments about placement, promotion, credentials, and so on. • Reference point is other students/graduates. • Key assessor is the faculty. 	<ul style="list-style-type: none"> • Utilization of the NCLEX-RN® is a summative assessment that equates to Earl's approach to assessment <i>of</i> learning.
Assessment <i>for</i> Learning	<ul style="list-style-type: none"> • Informs faculty about instructional needs, areas of assistance needed for student improvement. • Reference point is external standards or expectations. • Key assessor is the faculty. 	<ul style="list-style-type: none"> • Utilization of the ATI content mastery series PROCTORED assessments for specific content (e.g., fundamentals, adult medical-surgical), and the RN comprehensive predictor assessment equates to Earl's approach to assessment <i>for</i> learning.
Assessment <i>as</i> Learning	<ul style="list-style-type: none"> • Informs students about self-monitoring and self-correction of learning needs. • Reference point is personal goals and external standards. • Key assessor is the student. 	<ul style="list-style-type: none"> • Utilization of the ATI content mastery series PRACTICE assessments for specific content (e.g., fundamentals, adult medical-surgical), equates to Earl's approach to assessment <i>as</i> learning.

Current Research on Testing Preparation in Nursing Education Programs

For the past several decades nursing programs at all levels have struggled to find

predictors for student success in licensure examinations. Success on the NCLEX-RN® is best described as students passing the licensure examination on the first attempt. The first attempt is the primary testing result that state boards of nursing consider in their evaluation of nursing education programs' effectiveness. Lack of success can be viewed as graduates of a program failing to pass the NCLEX-RN® on the first attempt, regardless of passing or failing on subsequent attempts on the examination. There have been many studies conducted to predict success (Murray et al., 2008; Sayles et al., 2003; Stuenkel, 2006), as well as some that attempt to predict failure (Spurlock & Hunt, 2008).

A program's results on the NCLEX-RN® are viewed by potential students, state boards and external accrediting bodies as one indicator of program effectiveness. This has led to multiple research studies to explore the variables that best predict success. A successful program is one that has a high pass rate on the NCLEX-RN®.

With the quest for improved outcomes, higher standards have been established for entry into nursing programs. Programs have instituted restrictive admission criteria and an alarming number of pre-requisites. It is common to have up to two semesters of required pre-requisites to be considered for admission into a nursing program. Admission variables, pre-requisite grades, and prior grade point averages are all variables that have been studied to determine if they predict NCLEX-RN® pass rates. In addition, programs have instituted standardized testing from various vendors (e.g., ATI, ERI, HESI, Kaplan, and NLN) in an attempt to adequately prepare their graduates for success on the NCLEX-RN®. While each test vendor offers valuable resources to help prepare students for the licensure examination, research has varied as to their effectiveness in increasing NCLEX-RN® pass rates. Baker (2009) indicated in her research at several Arizona community

colleges that increased pre-requisites, increased number of science courses, and preadmission standardized testing had no correlation to higher NCLEX-RN® results. Other studies (Sayles et al., 2003; Stuenkel, 2006) have found that these same variables were significantly predictive of NCLEX-RN® outcomes.

An advantage of using standardized testing is that it provides students with opportunities to experience a high-stakes testing situation. The simple act of performance in the computerized, mock testing environment can assist in alleviating students' test anxiety. Reising (2003) studied nursing students who had been exposed to computerized testing (n=180) and those that had not (n=270) to determine if there was an impact on their NCLEX performance. The study demonstrated that students who practiced computerized NCLEX-style testing did not have higher NCLEX-RN® pass rates than those students who did not use computerized testing practice (Reising). In a qualitative study conducted by Jacobs and Koehn (2006), students indicated that the ATI testing was "good for learning as well as for practicing [the act of] testing" and "lets you know areas that you need to study." Basically, any exposure to the testing situation that affords students the opportunity to critically think through a given situation can be seen as an opportunity for assessment *as* learning. Testing practices were also discussed by Mills, Wilson, and Bar (2001) as a mechanism for increasing test-taking skills, decreasing test anxiety, and identifying areas of deficiency in knowledge.

The goal to improve NCLEX-RN® outcomes requires intervention during the educational period rather than after graduation. Hopkins (2008) studied early identification of *at-risk* students based on their performance in one associate degree nursing fundamentals course in hopes of being able to inform practices to promote

student success. Hopkins (2008) investigated various factors (e.g., reasoning, learning styles, analytic, anxiety, commitment, college GPA, age, race, gender) and determined the model utilized did not do a good job of predicting students who would not be successful (5.9%), but did much better with predicting who would be successful (82.5%). Holstein, Zangrilli, and Taboas, (2006) provided a detailed summary of variables measured in multiple studies that claimed to predict NCLEX-RN® success. Ultimately their goal was to determine if these previous research studies could assist in the development of formal, planned remediation for students as a method of continuous quality improvement, but offered only a summary of what types of factors had been looked at previously with limited information to guide educators (Holstein, Zangrilli & Taboas, 2006). Again, the majority of the literature focused on research about post-NCLEX-RN® testing and prevented education programs from intervening with the students prior to their experience of failure on the first attempt to pass the NCLEX-RN®.

Research Implications Based on Gaps Noted in the Literature

In beginning the literature review process relevant to standardized testing in nursing education, the ATI selected bibliography (ATI, 2009c) was reviewed to ensure that this study would not be repetitive of previous studies. This study is not repetitive and would add to the literature relevant and current information regarding the implementation of ATI assessments. There are several research studies (DiBartolo & Seldomridge, 2008; Murray et al., 2008; Rogers, 2010) that have been implemented to assess the outcomes of higher admissions standards, pre-requisites, and standardized testing as predictors of NCLEX-RN® success. While these have proven beneficial to making informed decisions in nursing education, they are not effective in preparing students for the NCLEX-RN®

during a time that an intervention can be applied. It is important to discover deficiencies in knowledge during the educational process rather than after graduation. This study will assist nursing education program administrators and faculty to identify students that have, or have not, obtained the basic knowledge to be successful and to take action on the results while the student is still enrolled in the program. In addition, the study results can be used to inform progression policies that are grounded in evidence as opposed to conjecture.

In a detailed literature review, there appears to be no research related to the use of standardized testing products, such as the ATI RN content mastery series, with licensed practical nurses enrolled in a registered nurse education program to identify of *at-risk* students. As there is a strong desire in most states to have additional registered nurses, this study adds to the knowledge regarding educational outcomes for LPN-to-RN students.

CHAPTER 3

RESEARCH METHODS AND DESIGN

This research study employed a quantitative, non-experimental descriptive correlational design to describe relationships among variables without seeking to establish causal relationships. The sample, inclusion/exclusion criteria, data collection instruments and procedures, and data analysis are discussed below. In addition, the protection of human subjects will be presented as it relates to this study.

Sample and Setting

The convenience sample for this research study was obtained from two nursing programs in a Midwestern state of the United States, identified as nursing programs A and B. Nursing program A has been accredited by the state board of nursing since 2005. Nursing program B has been accredited by the state board of nursing since 2006. Both programs were housed in institutions accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools and both were approved as one-plus-one nursing education programs. The institutions were accredited as a single entity by the Higher Learning Commission; however, the nursing programs were viewed as separate entities by the state board of nursing, with each of them having individualized education codes for NCLEX-RN® testing with the National Council of State Boards of Nursing. Both nursing programs were fully approved by the state board of nursing.

The students enrolled in both nursing programs were required to have active licensure as practical nurses (LPNs), but were not required to have had LPN work

experience. In addition, the students were required to have a minimum cumulative grade point average of 2.4 throughout their LPN education program. The nursing programs accepted students who were graduates of their institutions' practical nursing programs, as well as applicants educated in the surrounding community colleges, state universities, and other private institutions.

Nursing program A was allowed by the state board of nursing to enroll 80 LPN-to-RN students annually; nursing program B was allowed to enroll 64 LPN-to-RN students. Neither program was accredited by the National League for Nursing Accrediting Commission, Inc., or the Commission on Collegiate Nursing Education. The sample of LPN-to-RN students was selected based on completion of the LPN-to-RN program, and having completed the ATI fundamentals of nursing assessment and the ATI predictor assessment.

Human Subjects Protection and Confidentiality

During any research study, the protection of human subjects is considered a priority. This study involved minimal risk to participating subjects. The study did not include any vulnerable subjects, such as children, pregnant women, or incapacitated individuals. All subjects were determined to be as mentally competent to make decisions and had been required to complete an educational assessment for acceptance into the undergraduate nursing program. The researcher has a certificate of completion for the training course, "Protecting Human Research Participants," as issued by the National Institutes of Health Office of Extramural Research. All data related to the study were secured by the researcher in a locked cabinet in a private location to ensure no

information about the sample was compromised. All computerized data were secured through document protection with password requirements for access.

Prior to execution of this study, the researcher obtained approval from the University of San Diego Institutional Review Board (IRB) in accordance with its rules and regulations for protection of human subjects. In addition, authorization was obtained from the vice president of academic affairs for both colleges. The colleges did not have IRBs to oversee research projects. The potential risk for the students in this study was very small. All students were required to participate in the ATI content mastery series of examinations as part of their nursing course requirements. The data had been previously collected as part of the programs' testing requirements and was de-identified for the protection of the graduates. Study results will be shared with administration and faculty upon completion to assist with early identification of *at-risk* students.

Inclusion and Exclusion Criteria

For the purpose of this study, the inclusion criteria included all LPN-to-RN graduates who completed the ATI fundamentals of nursing assessment and the ATI predictor assessment. In addition, graduates' NCLEX-RN® pass or fail results for first-time testers were included. This information was taken from National Council of State Boards of Nursing (NCSBN) NCLEX-RN® reports released from the Kansas State Board of Nursing (KSBN). Data were included for graduates who had an on-time completion of the program, as well as graduates who may have had a delay in the expected completion date. Exclusion criteria included graduates of the LPN-to-RN program that had not appeared on the official KSBN reports as having had taken the NCLEX-RN® at the close of the data collection period.

Operational Definitions of Variables

Key operational definitions of both the independent and dependent variables to be used in this analysis are described below.

Independent Variables

The independent variables for this research study included: The ATI content mastery series RN fundamentals assessment total composite score, ATI content mastery series RN fundamentals assessment nursing process scores (assessment, analysis/diagnosis, planning, implementation/therapeutic nursing intervention, and evaluation), the ATI content mastery series RN fundamentals assessment thinking skills scores (foundational thinking skills and critical thinking), the ATI RN comprehensive predictor assessment scores, and the characteristics (gender, age, race, and previous education) of the LPN-to-RN graduates who took the various assessments. ATI developed specific definitions to explain the various components of the nursing process and thinking skills which are referred to as RN outcome definitions. In the RN outcome definitions (2010), ATI defines the components of the nursing process scores as follows:

- **Assessment** – Ability to apply nursing knowledge to the systematic collection of data about clients' health status to identify their needs, as well as the ability to accurately collect data through client history, interview, vital signs, and hemodynamic measurement (ATI, 2010, p. 1).
- **Analysis/Diagnosis** – Ability to analyze data that has been collected to reach appropriate nursing judgments about clients' health status and coping mechanisms, while recognizing findings that may indicate health problems/risks that may require nursing intervention (ATI, 2010, p. 1).

- Planning – Ability to apply nursing knowledge to the development of a care plan for clients with health alterations and needs for health promotion or maintenance. Planning also includes the students' ability to establish priorities of care, delegate appropriately, and set appropriate client outcomes (ATI, 2010, p.1).
- Implementation/Therapeutic Nursing Intervention – Ability to implement interventions based on nursing knowledge, priorities of care, and client outcomes. In addition, implementation/intervention refers to students' ability to respond to unplanned events or life-threatening situations to decrease clients' risk (ATI, 2010, p.1).
- Evaluation – Ability to evaluate clients' responses to nursing interventions and whether or not the clients' outcomes have been achieved. Evaluation also refers to the students' ability to assess clients' understanding of instruction, the effectiveness of an intervention, and the need for further interventions (ATI, 2010, p.1).

In the RN outcome definitions statement (2010), ATI defined thinking skills as:

- Foundational thinking in nursing is the student's ability to recall and comprehend information and concepts that are foundational to delivering quality nursing care (ATI, 2010, p.1).
- Clinical judgment/critical thinking in nursing is the student's ability to use critical thinking skills, such as interpretation, analysis, evaluation, inference and explanation, in order to make sound clinical judgments (ATI, 2010, p.1).

The RN comprehensive predictor assessment scores were evaluated as an independent variable in some research questions and as a dependent variable in others. The programs

had a benchmark set for students to obtain a score of 90% or higher on the first assessment attempt. Only the first attempt score was utilized for this study.

Graduate characteristics were also evaluated as a part of this study. Characteristics considered were gender, age, race, and previous education level. Age was determined in range increments of five years starting at 20 years of age. This age was chosen as the starting point because all graduates would be at least 20 years of age with the KSBN requiring licensure as a LPN to occur after age 18. The age range categories used were as follows:

- 20 years of age to 25 years of age
- 26 years of age to 31 years of age
- 32 years of age to 37 years of age
- 38 years of age to 43 years of age
- 44 years of age to 49 years of age
- 50 years of age and older

Gender was identified as male or female and other when not noted in the CampusVue© data system. Race/Ethnicity categories were identified as African-American, Asian, American-Indian, Caucasian, and other. The education level considered was whether or not a previous college degree had been earned. While all students in the study had earned a diploma or certificate of completion as a part of their LPN education, this was not considered as part of this variable.

Dependent Variables

The dependent variable for this research study was the graduates' first-time testing results on the NLCEX-RN® examination as reported by the state board of nursing

in the NCSBN education program summary report. NCLEX-RN® results are calculated on a quarterly basis and released to nursing education program at the end of the quarter. The dependent variable was evaluated as a dichotomous variable of a pass or fail outcome. Additionally, in some of the research questions the ATI comprehensive predictor assessment is considered as a dependent, continuous variable when appropriate.

Data Collection

For the purpose of this study, data were acquired from three sources (ATI data system, CampusVue®, and state board of nursing NCLEX-RN® reports). The ATI data system does not contain information regarding graduate characteristics, but allowed for easy access to graduates' scores on various assessments. Graduate characteristic data were collected from both colleges' student data system, called CampusVue®. The student characteristics data were maintained as an Excel spreadsheet incorporating data extracted from the CampusVue® system. As previously explained, only official NCLEX-RN® reports were used to ensure accuracy and avoid inaccurate graduate self-reporting of NCLEX-RN® pass or fail results.

Assessment Technologies Institute®, LLC (ATI) Data

The researcher was granted access to ATI testing reports for both nursing program A and B. ATI testing data was disseminated by institution name, as well as by individual students' names. ATI regulates the data distributed in the reports available to the nursing programs. The data are updated within approximately 24 hours of an assessment being delivered at an institution via computer. For the purposes of this study, only proctored assessments administered in electronic format were examined.

CampusVue© Data System

Both nursing programs A and B maintain academic records for all present and past students in a secure electronic database. The CampusVue© data system is a student information system that stores all academic records of students and graduates. The data in the CampusVue© system is highly dependent upon the accuracy of information entered by the college personnel authorized to utilize the system. For the purpose of this research study, the data extracted from the system were delivered to the researcher via electronic files on a secured network. The data collected by the researcher from the CampusVue© data system included each graduate's name, gender, age, race, and previous education level.

NCLEX-RN® Education Summary Report

The NCSBN distributes NCLEX-RN® information to the state boards of nursing on a quarterly basis. Various reports are produced, but the report utilized for this study was the education program summary report. This report identifies graduates who have taken the NCLEX-RN® by name and is released to the state board of nursing by NCLEX-RN® program code as it relates to a specific campus. In addition, the report also includes the tester's name, date of birth, graduation date, testing date, type of test (first-time or repeat test), and the status (pass or fail).

Data Collection Procedures

Data were collected from various resources to ensure accurate data. Data from the ATI content mastery series RN fundamentals assessment scores (total score, nursing process components, and thinking skills), and the RN comprehensive predictor assessment were collected from the ATI results website available to the researcher

through password protected access. Nursing program A had been administering the ATI assessments since June 2009, and nursing program B had been administering the ATI assessments since March 2009. Data collection ended as of September 2011 to ensure that graduates had the opportunity to take the NCLEX-RN® assessment.

Procedures for Data Analysis and Management

The data were analyzed utilizing the Statistical Package for the Social Sciences (SPSS®) Statistics GradPack 20.0 software to perform correlational calculations relevant to identifying the relationships between the dependent variables (ATI RN comprehensive predictor scores and NCLEX-RN® results) and the independent variables. To analyze each research question the following statistical analyses and processes will be utilized:

- **Question 1:** Is there a relationship between student composite scores on the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment scores?
 - This research question was analyzed using a bivariate correlation method with an initial review of a scatter plot to determine if a linear relationship was demonstrated. This data analysis was appropriate since both the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment scores are quantitative, continuous variables. After a linear relationship was established a Pearson's product-moment correlation was performed with a significance value set at $p < .05$.
- **Question 2:** Is there a relationship between student composite scores on the ATI content mastery series RN fundamentals assessment scores and pass/fail results on the NCLEX-RN®?

- This research question was analyzed using a point biserial correlation method with an initial review of a scatter plot to determine if a linear relationship was demonstrated. This data analysis was appropriate since the ATI content mastery series RN fundamentals assessment scoring is a quantitative, continuous variable and the NCLEX-RN® result was a dichotomous/binary variable identified as pass or fail. After a linear relationship was established a Pearson's product-moment correlation was performed with a significance value set at $p < .05$.
- **Question 3:** Is there a relationship between student composite scores on the ATI RN comprehensive predictor assessment and pass/fail results on the NCLEX-RN®?
 - This research question was analyzed using a point biserial correlation method with an initial review of a scatter plot to determine if a linear relationship was demonstrated. This data analysis was appropriate since the ATI RN comprehensive predictor assessment score is a quantitative, continuous variable and the NCLEX-RN® result is a dichotomous/binary variable identified as pass or fail. After a linear relationship was established, a Pearson's product-moment correlation was performed with a significance value set at $p < .05$.
- **Question 4:** What are the relationships between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN

fundamentals assessment, and ATI RN comprehensive predictor assessment scores?

- This research question was analyzed using pairwise correlations between variables. This data analysis was appropriate because scores for each component of the nursing process was compared to the ATI RN comprehensive predictor assessment score variable. After a linear relationship was established, Pearson's product-moment correlations were performed with a significance value set at $p < .05$.
- **Question 5:** What are the relationships between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®?
 - This research question was analyzed using pairwise correlations between variables. This data analysis is appropriate because scores for each component of the nursing process were compared to the NCLEX-RN® result. After a linear relationship was established, Pearson's product-moment correlations were performed with a significance value set at $p < .05$.
- **Question 6:** What are the relationships between the components of thinking skills (foundational thinking and critical thinking) scores, as identified on the ATI content mastery series RN fundamentals assessment, and the ATI RN comprehensive predictor assessment scores?

- This research question was analyzed using pairwise correlations between variables. This data analysis was appropriate as scores for each component of the foundational thinking skills were compared to the ATI RN comprehensive predictor assessment score. After a linear relationship was established, Pearson's product-moment correlations were conducted with a significance value set at $p < .05$.
- **Question 7:** What are the relationships between the components of thinking skills (foundational thinking and critical thinking) scores, as identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®?
 - This research question was analyzed using pairwise correlations between variables. This data analysis was appropriate as scores for each component of the foundational thinking skills were compared to the NCLEX-RN® result. After a linear relationship was established, Pearson's product-moment correlations were performed with a significance value set at $p < .05$.
- **Question 8:** What are the relationships between students' total composite scores on the ATI content mastery series RN fundamentals assessment, and student characteristics (gender, age, race and previous education level)?
 - This research question was analyzed using a one-way ANOVA with post-hoc pairwise comparisons (Tukey). In addition, descriptive statistics was reported and Levene's test was performed to evaluate the homogeneity of variance assumption.

- **Question 9:** What are the relationships between students' scores on the ATI RN comprehensive predictor assessment and student characteristics (gender, age, race and previous education level)?
 - This research question was analyzed using a one-way ANOVA with post-hoc pairwise comparisons (Tukey). In addition, descriptive statistics were determined and Levene's test was conducted to evaluate the homogeneity of variance assumption.
- **Question 10:** What are the relationships between students' pass/fail results on the NCLEX-RN®, and student characteristics (gender, age, race and previous education level)?
 - This research question was analyzed using a one-way ANOVA with post-hoc pairwise comparisons (Tukey). In addition, descriptive statistics were determined and Levene's test was conducted to evaluate the homogeneity of variance assumption.

Summary

These research questions were addressed with statistical data analyses to determine the presence of any significant findings that would assist nursing education programs to identify students *at-risk* for academic failure early in the education process. Specific information about each question and component will be further discussed in Chapter four.

CHAPTER 4

FINDINGS

The purpose of this quantitative, non-experimental descriptive correlational study was to evaluate the contributions of a standardized testing program to early identification of *at-risk* students enrolled in two LPN-to-RN education program in efforts to improve NCLEX-RN® outcomes. This chapter presents the quantitative findings from analysis of existing data. The chapter is organized by data screening methods, sample demographics, and a discussion of each research question. Each of the ten research questions is presented, followed by a statistical analysis based on Statistical Package for the Social Sciences (SPSS) 20.0 data output and a summary of findings.

Data Screening

Data were available for 192 students who took the ATI comprehensive predictor assessment between November 2009 and December 2011. Seven students were eliminated from the study because official NCLEX-RN® pass/fail results could not be discovered. In addition, there were two students for whom scores on the ATI content mastery series RN fundamentals assessment could not be located. Finally, one student who had both an ATI comprehensive predictor score and NCLEX-RN® result could not be located in the CampusVue® student records system, perhaps related to a name change. These ten students and their data were eliminated from the study, which resulted in a total sample of 182 students.

Sample Demographics

Table 2 presents the demographic characteristics of participants. The final sample consisted of 182 students, the majority (95.6%) of whom was female. Subjects' ages ranged from 20 to 56 years, with 34.1% of the sample in the 26 to 31-year age group. All of the subjects had previously attended a licensed practical nursing diploma/certificate program, but only 4.4% held an associate or bachelor's degree unrelated to nursing. The racial/ethnic diversity of the subjects was 78.6% Caucasian, 14.8% African American, 2.7% Asian, 0.5% American Indian, 2.2% Hispanic, and 1.1% self-categorized as belonging to two or more diverse groups.

Table 2.

Sample Demographic Characteristics

Characteristic		n	%
Gender	Female	172	94.5%
	Male	10	5.5%
Age	20 – 25	16	8.8%
	26 – 31	62	34.1%
	32 – 37	52	28.6%
	38 – 43	32	17.6%
	44 – 49	12	6.6%
	50 or >	8	4.4%
Prior College Degree	Yes	8	4.4%
	No	174	95.6%
Race / Ethnicity	Caucasian	143	78.6%

Characteristic	n	%
African American	27	14.8%
Asian	5	2.7%
American Indian	1	0.5%
Hispanic	4	2.2%
Two or More Identified	2	1.1%
Demographic Variable (N = 182)		

Analysis of Data and Findings

Data were analyzed to evaluate information for each of the research questions. A multitude of statistical methods was utilized to properly analyze the data. A brief synopsis of each type of statistical analyses used to address the independent and dependent variables in the questions is presented below. Finally, a summary of the findings is included, based on interpretation of the data.

Research Question One

Research question one was developed to determine if there was a relationship between student composite scores on the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment scores. This question was analyzed utilizing a bivariate correlation. This method was chosen based on both the independent and dependent variables being continuous. Two assumptions had to be met to utilize a Pearson's product moment correlation – assumption of linearity and assumption of bivariate normality. Upon examining a scatterplot (Figure 1) for the continuous variable (ATI Fundamentals Scores and ATI RN Comprehensive Predictor Scores), a strong positive linear, monotonic relationship was noted. However, the

assumption of bivariate normality was not met as assessed by the Shapiro-Wilk's test ($p > .05$). Therefore, a Pearson's Product-Moment Correlation could not be performed.

Figure 1. Scatterplot Fundamentals and Comprehensive Predictor Scores

A Spearman's Rank Order (r_s) correlation was conducted to assess the relationship between student composite scores on the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment. The degrees of freedom were noted at $n - 2$ (180). As indicated in Table 3, there was a significant positive correlation between the ATI content mastery series RN fundamentals assessment scores and the ATI RN comprehensive predictor assessment.

Table 3.

Spearman's Rank Order Correlation, ATI Fundamentals Scores and Comprehensive Predictor Scores

Spearman's rho		ATI Fundamentals Scores	ATI Comprehensive Predictor Scores
ATI Fundamentals Score	Correlation	1.000	.522**
	Coefficient		
	Sig. (2-tailed)	.	.000
	N	182	182
ATI Comprehensive Predictor Score	Correlation	.522**	1.000
	Coefficient		
	Sig. (2-tailed)	.000	.
	N	182	182

**Correlation is significant at $p < 0.01$ (2-tailed).

Research Question Two

Research question two addressed the relationship between student composite scores on the ATI content mastery series RN fundamentals assessment (scores) and pass/fail results on the NCLEX-RN®. A point biserial correlation indicated a significant association. Students who passed the NCLEX-RN on the first attempt had higher scores on the ATI content mastery series RN fundamentals assessment (Table 4).

Table 4.

Point Biserial Correlation of ATI Fundamentals Scores with NCLEX-RN Results

Measure		1	2
1. ATI Fundamentals Score	Pearson Correlation	1	.343
	Sig. (2-tailed)		.000
	N	182	182
2. NCLEX-RN® First Attempt	Pearson Correlation	.343	1
	Sig. (2-tailed)	.000	
	N	182	182

Note. Correlation is significant at $p < 0.01$ level (2-tailed).

Research Question Three

Research question three determined the relationship between student composite scores on the ATI RN comprehensive predictor assessment and pass/fail results on the NCLEX-RN®. Again using a point biserial correlation, a significant association was noted between the variables, with higher scores on the ATI comprehensive predictor related to passing the NCLEX-RN® examination on the first attempt (Table 5).

Table 5.

Point Biserial Correlation of Comprehensive Predictor Scores with NCLEX-RN

Measure		1	2
1. ATI Fundamentals Score	Pearson Correlation	1	.363
	Sig. (2-tailed)		.000
	N	182	182
2. NCLEX-RN® First Attempt	Pearson Correlation	.363	1

Measure	1	2
Sig. (2-tailed)	.000	
N	182	182

Note. Correlation is significant at $p < 0.01$ level (2-tailed).

Research Question Four

Research question four was developed to determine what relationships, if any, existed between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment, and the ATI RN comprehensive predictor assessment scores. It was determined that a multiple regression method would be most appropriate to determine if a relationship existed, as the dependent variable (ATI RN comprehensive predictor assessment score) and the independent (assessment, analysis/diagnosis, planning, implementation and evaluation) scores were all continuous variables (Laerd Statistics, 2012). A simultaneous multiple regression analysis was conducted utilizing SPSS 20.0.

To have an effective analysis with a multiple regression method, several assumptions must first be met (Field, 2005; Mertler and Vannatta, 2005). The assumptions and the findings were as follows:

- **Variable Type:** Simultaneous multiple regression analysis was determined to be appropriate as the variables (independent and dependent) are all continuous variables.
- **Independent Errors:** A Durbin-Watson test result of 2.086 determined the data were independent of errors (residuals).

- **Linearity:** Upon examination of a scatterplot, positive linear relationships were noted between the nursing process scores (assessment, analysis/diagnosis, planning, implementation and evaluation) and scores on the ATI RN comprehensive predictor assessment.
- **Homoscedasticity:** The assumption of homoscedasticity was evaluated with the examination of the same scatterplot utilized to verify linearity. The independent variables and the dependent variable in this analysis were determined to not be heteroscedastic in form, and therefore have met the assumption of homoscedasticity.
- **Multicollinearity:** To investigate conditions of multicollinearity, a correlation matrix and the tolerance/Variance Influence Factor (VIF) were reviewed. Examination of the correlations table (Table 6) confirmed none of the independent variables had a correlation of greater than 0.7. Results with a tolerance of < 0.1 or a VIF of > 10 indicate collinearity (Laerd Statistics, 2012). As indicated in Table 7, tolerance and VIF results indicated no collinearity among the independent variables.

Table 6.

Pearson Correlation - Comprehensive Predictor and Nursing Process Scores

Variable	Nursing Process Scores					
	1	2	3	4	5	6
1. Predictor	1.000	.160*	.199**	.251***	.451***	.387***
2. Assess	.160*	1.000	.110	.014	.044	.161*
3. Analysis	.199**	.110	1.000	.063	.230***	.201**

Nursing Process Scores						
Variable	1	2	3	4	5	6
4. Plan	.251***	.014	.063	1.000	.096	.136*
5. Implement	.451***	.044	.230***	.096	1.000	.281***
6. Evaluation	.387***	.161*	.201**	.136*	.281***	1.000

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. Nursing process scores are from ATI RN Fundamentals Assessment.

Table 7.

Collinearity Statistics – Nursing Process Components with ATI RN Comprehensive Predictor Assessment Scores

Constant	Tolerance	Variance Influence Factor (VIF)
Assessment Score	.967	1.034
Analysis / DX Score	.920	1.087
Planning Score	.977	1.023
Implementation	.887	1.128
Evaluation Score	.872	1.146

Note. Dependent variable – ATI Comprehensive Predictor Score

- Detecting Outliers: The casewise diagnostics table was reviewed for cases having greater than a ± 3 standard deviation and identified them as outliers. Case 119 and case 169 were noted as having a standardized residual out of range. These cases were removed to continue with the analyses.

- **Leverage Points:** Laerd Statistics (2012) suggested considering leverage values of < 0.2 as safe, 0.2 to < 0.5 as risky and values ≥ 0.5 as dangerous to the analyses. For the dependent and independent variables in this situation leverage points were noted with a minimum of .004 and a maximum of .119, with a mean of .028.
- **Influential Points:** Consideration for influential points was determined based on Cooks Distance values (Laerd Statistics, 2012). After sorting the Cook's Distance values, the values were visually examined and no highly influential points (≥ 1) were noted.
- **Evaluation for Normality / P – P Plot (Probability – Probability Plot):** A visual inspection was conducted of a frequency histogram and a symmetrical distribution was determined. The P – P Plot was visually examined and noted to have residuals that are normally distributed along the diagonal line.

Final Interpretation Summary. Visual inspection of the scatterplots indicated that the relationships for ATI RN comprehensive predictor assessment scores and from the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, were all linear. Therefore, the assumptions of linearity, independence of errors, homoscedasticity, unusual points and normality of residuals were met. As indicated in Table 6, assessment scores for each of the nursing process components were significantly correlated with ATI comprehensive predictor scores. Students who had higher scores on the nursing process categories had higher scores on the ATI RN comprehensive predictor assessment. In addition, students who had lower scores on the nursing process categories had lower scores on the ATI RN comprehensive predictor assessment.

A simultaneous multiple regression analysis was conducted to evaluate how the nursing process categories (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment) scores, were associated with scores on the ATI RN comprehensive predictor assessment. The nursing process category scores (assessment, analysis/diagnosis, planning, implementation and evaluation) predicted 30% of the variance in scores on the ATI RN comprehensive predictor assessment ($F[5, 174] = 16.467, p < .05, \text{adj. } R^2 = .302$) (Table 8).

Table 8.

Multiple Regression Analysis of Comprehensive Predictor Scores on Nursing Process Assessment Scores

Model	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Regression	1798.951	5	359.790	16.467	.000
Residual	3801.830	174	21.850		
Total	5600.781	179			

Note. Predictors: (Constant), Assessment Score, Analysis/Dx. Score, Planning Score, Implementation Score, Evaluation Score (from ATI content mastery series RN Fundamentals Assessment). Adjusted $R^2 = .302$

As noted in Table 9, scores on the planning, implementation, and evaluation components of the nursing process contributed to the prediction of the ATI comprehensive predictor assessment scores. Students who scored higher on these nursing process categories scored higher on the ATI RN comprehensive predictor assessment.

Table 9.

Multiple Regression Analysis of Comprehensive Predictor Scores on Nursing Process

Assessment Scores

Variable	<i>B</i>	SE _B	Beta	Sig.
Intercept	45.030	3.474	.	.000
Assessment	.033	.022	.099	.122
Analysis/Diagnosis	.020	.027	.048	.458
Planning	.049	.017	.180	.005
Implementation	.184	.035	.351	.000
Evaluation	.119	.033	.238	.000

Note. $p < .05$; *B* = unstandardized regression coefficient; SE_B = Standard error of the coefficient; β = standardized coefficient.

Research Question Five

Research question five addressed what relationships, if any, existed between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores and pass/fail results on the NCLEX-RN®.

Logistic regression was used to evaluate the relationship because the dependent variable (NCLEX-RN®) was dichotomous and there were more than two continuous independent variables. This method is utilized to estimate the probability of an event occurring (in this case, NCLEX-RN® pass on first testing attempt). The sample size of 182 cases yields an appropriate number of cases per independent variable (36.4 cases per variable) to utilize this multivariate analytic technique (Laerd Statistics, 2012).

Several assumptions must be met to ensure logistic regression is the appropriate analysis to evaluate the relationship between variables. Laerd Statistics (2012) identified the following assumptions as necessary for logistic regression: (a) independence of errors, (b) linearity, (c) absence of multicollinearity, (d) absence of significant outliers, and (e) mutually exclusive/exhaustive categories. Each of these assumptions was evaluated and found to be met.

A logistic regression was performed to evaluate if a relationship existed between the components of the nursing process (assessment, analysis/diagnosis, planning, implementation and evaluation) scores, as identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®. The logistic regression equation fit significantly better than the null model ($\chi^2 [5] = 25.306, p < .005$). The model explained 20.6% (Nagelkerke R^2) of the variance in NCLEX-RN® pass/fail results and correctly classified 83.5% of cases (Table 10). Sensitivity was 97.9%, specificity was 25%, positive predictive value was 84.12%, and negative predictive value was 25%. That is, that of all the SPSS cases predicted as having passed the NCLEX-RN®, 84.12% were correctly predicted and of all the SPSS cases predicted as having failed NCLEX-RN®, 25% were correctly predicted.

Table 10.

Classification Table with Variance in NCLEX-RN Pass/Fail Results

Observed	Predicted		
	1	2	% correct
1. NCLEX 1 st Attempt Failure	9	27	25%
2. NCLEX 1 st Attempt Pass	3	143	97.9%

Overall Percentage

83.5%

Note. The cut value is .500.

Of the five predictor variables (assessment, analysis/diagnosis, planning, implementation and evaluation scores), only three variables, analysis/diagnosis, planning, and implementation scores, added significantly ($p < .05$) to the model/prediction. The assessment and evaluation scores did not add significantly to the model/prediction (Table 11).

Table 11.

Model/Predictor NCLEX-RN on Nursing Process Scores

Variable	B	S. E.	Wald	df	Sig.	Exp(B)	95% CI
Assess	-.001	.012	.003	1	.953	.999	[.976, 1.023]
Analysis	.038	.016	5.556	1	.018	1.039	[1.006, 1.072]
Planning	.021	.010	4.744	1	.029	1.021	[1.002, 1.041]
Implement	.054	.021	6.620	1	.010	1.055	[1.013, 1.099]
Evaluation	.017	.018	.862	1	.353	1.017	[.981, 1.055]
Constant	-7.448	2.142	12.096	1	.001	.001	

Note. Variable(s) entered on step 1: assess, analysis, planning, implement, and evaluation scores from ATI content mastery series RN fundamentals assessment.

Based on the model, an average of 1.017 to 1.039 percentage increase in the subcategory scores for analysis/diagnosis, planning and implementation increases the likelihood that students will pass the NCLEX-RN® on the first testing attempt.

Research Question Six

Research question six was developed to determine what relationships, if any, existed between the components of thinking skills (foundational thinking and critical thinking) scores, as identified on the ATI content mastery series RN fundamentals assessment, and the ATI RN comprehensive predictor assessment scores. To evaluate these variables a simultaneous multiple regression analysis was conducted utilizing SPSS 20.0.

To have an effective analysis with a multiple regression method, several assumptions must first be met (Field, 2005; Mertler and Vannatta, 2005) as follows:

- **Variable Type:** Simultaneous multiple regression analysis was determined to be appropriate as the independent and dependent variables are all continuous variables.
- **Independent Errors:** A Durbin-Watson test value of 2.143 determined the data was independent of residuals.
- **Linearity:** Upon examination of scatterplots, positive linear relationships were found between foundational thinking scores and the scores on the ATI RN comprehensive predictor scores and between critical thinking scores and the comprehensive predictor scores.
- **Homoscedasticity:** The assumption of homoscedasticity was evaluated with the examination of the same scatterplots. The independent variables and the dependent variable were found not to be heteroscedastic in form, and therefore have met the assumption of homoscedasticity.

- **Multicollinearity:** To investigate conditions of multicollinearity the correlations table, and the tolerance/VIF were reviewed. Examination of the correlation matrix (Table 12) confirmed that none of the independent variables had correlations greater than 0.7. The foundational thinking scores and the critical thinking scores exhibited no evidence of multicollinearity with a Pearson's correlation of .424. Examination of the collinearity statistics indicated a tolerance of .820 and a VIF of 1.219, indicating no collinearity between the foundational thinking scores and the critical thinking scores.

Table 12.

Pearson Correlation of Comprehensive Predictor Scores with Foundational and Critical Thinking Scores

Variable	1	2	3
1. Comprehensive Predictor	1.000	.505*	.413*
2. Foundational Thinking	.505*	1.000	.424*
3. Critical Thinking	.413*	.424*	1.000

Note. * $p < .001$. $N = 181$ for all variables; case 119 removed as an outlier having a residual at -3.997.

- **Detecting Outliers:** A review of the casewise diagnostics table indicated that Case 119 was an outlier with a standardized residual of -3.997. This case was removed to continue on with all diagnostics.
- **Leverage Points:** For the dependent and independent variables in this situation leverage points were noted with a minimum of .000 and a maximum of .056, with a mean of .011.

- **Influential Points:** After sorting the Cook's Distance values, the values were visually examined and no highly influential points were noted at ≥ 1 .
- **Evaluation for Normality / P – P Plot:** A visual inspection of a frequency histogram was conducted and determined to have a symmetrical distribution. The P – P Plot was visually examined and noted to have residuals that were normally distributed along the diagonal line.

Final Interpretation Summary. Visual inspection of the scatterplots for relationships between ATI RN comprehensive predictor assessment scores and scores for the components of thinking skills were all linear. Therefore, the assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were met.

As indicated in Table 12, the correlations between the foundational thinking scores and ATI RN comprehensive predictor assessment scores and between critical thinking and the comprehensive predictor assessment were found to be statistically significant. Students who had higher scores on foundational thinking also had higher scores on the ATI RN comprehensive predictor assessment. Similarly, students with higher critical thinking scores scored higher on the ATI RN comprehensive predictor assessment.

A simultaneous multiple regression analysis was conducted to evaluate the relative contribution of foundational thinking and critical thinking scores to scores on the ATI RN comprehensive predictor assessment. Investigation of the collinearity statistics suggested that collinearity was not a problem (all tolerance values $> .2$, at .820). Foundational thinking and critical thinking scores predicted approximately 30% of the

variance in scores on the ATI RN comprehensive predictor assessment (Table 13). The F ratio from an ANOVA was used to test if the regression model was a good fit for the independent variables (foundational thinking and critical thinking scores) to predict the dependent variable (ATI RN comprehensive predictor assessment).

Table 13.

Multiple Regression of Comprehensive Predictor Scores on Foundational and Critical Thinking Scores

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1757.641	2	878.820	38.644	.000*
Residual	4047.968	178	22.741		
Total	5805.609	180			

Note. * Predictors: (Constant), Critical Thinking Scores and Foundational Thinking Scores (from ATI content mastery series RN Fundamentals Assessment). Adjusted $R^2 = .295$

Partial regression coefficients indicated both foundational thinking and critical thinking scores contributed to prediction of comprehensive predictor scores (Table 14). Students who scored higher on the foundational thinking and the critical thinking assessments scored higher on the ATI RN comprehensive predictor assessment.

Table 14.

Summary of Multiple Regression Analysis

Variable	B	SE_B	Beta	Sig.
Intercept	44.690	3.414		.000
Foundational Thinking	.264	.045	.402	.000

Variable	<i>B</i>	SE _B	Beta	Sig.
Critical Thinking	.147	.042	.242	.001

Note. $p < .05$; *B* = unstandardized regression coefficient; SE_B = Standard error of the coefficient; β = standardized coefficient.

Research Question Seven

Research question seven addressed the presence or absence of relationships between the components of thinking skills (foundational thinking and critical thinking) scores and pass/fail results on the NCLEX-RN®. Logistic regression was used because the dependent variable (NCLEX-RN®) was dichotomous and there were two continuous independent variables and an appropriate number of cases (91) per independent variable (Laerd Statistics, 2012).

The logistic regression was performed to evaluate if a relationship existed between the components of thinking skills (foundational thinking and critical thinking) scores, as identified on the ATI content mastery series RN fundamentals assessment, and pass/fail results on the NCLEX-RN®. The logistic regression equation fit significantly better than the null model ($\chi^2 [2] = 23.529$, $p < .005$). The model explained 19.2% (Nagelkerke R^2) of the variance in NCLEX-RN® pass/fail results and correctly classified 80.8% of cases (Table 15). Sensitivity was 97.3%, specificity was 13.9%, positive predictive value was 82.08%, and negative predictive value was 44.44%. That is, that of all the SPSS cases predicted as having passed the NCLEX-RN®, 82.08% were correctly predicted, and of all the SPSS cases predicted as having failed NCLEX-RN®, 44.44% were correctly predicted.

Table 15.

Variance in NCLEX-RN Pass/Fail Results with Thinking Scores

Observed Variable	Predicted		
	1	2	% correct
1. NCLEX 1 st Attempt Failure	5	31	13.9%
2. NCLEX 1 st Attempt Pass	4	142	97.3%
Overall Percentage			80.4%

Note. The cut value is .500.

Of the two predictor variables, only the foundational thinking score, added significantly ($p < .05$) to the model/prediction (Table 16). In summary, based on the model a 1.108 percentage increase in the subcategory scores for fundamental thinking skills increased the likelihood that students would pass the NCLEX-RN® on the first testing attempt.

Table 16.

Model/Prediction of Thinking Scores and NCLEX-RN

Variable	B	S. E.	Wald	df	Sig.	Exp(B)	95% CI
Foundational Thinking	.103	.028	13.116	1	.000	1.108	[1.048, 1.172]
Critical Thinking	.025	.024	1.103	1	.294	1.025	[.979, 1.075]
Constant	-7.463	2.086	12.797	1	.000	.001	

Note. Variable(s) entered on step 1: Foundational Thinking and Critical Thinking scores from ATI content mastery series RN fundamentals assessment.

Research Question Eight

Research question eight examined relationships between students' total composite scores on the ATI content mastery series RN fundamentals assessment and student

characteristics (gender, age, race and previous education level). An independent-samples t-test was utilized to evaluate the relationship of the ATI content mastery series (CMS) RN fundamentals assessment and the independent variables of gender and prior education, while an one-way ANOVA was utilized to evaluate the relationship of total composite scores on the ATI CMS RN fundamentals assessment to two additional independent variables (age of student and self-identified race).

Independent-samples t-test. An independent-samples t-test was an appropriate analysis because the dependent variable (total composite scores on the ATI content mastery series RN fundamentals assessment) was a continuous variable and the independent variables (gender and previous education level) were dichotomous variables with only two categories (male/female and no prior degree/prior degree). An independent-sample t-test is utilized to identify if there are differences between two groups when the groups are completely independent of each other (Laerd Statistics, 2012).

In conducting an independent-samples t-test, the assumptions of normality and independence must first be evaluated (Laerd Statistics, 2012). For the dependent variable, total composite scores on the ATI content mastery series RN fundamentals assessment and the independent variable of gender (male/female categories), a boxplot was examined, and no outliers were identified. The data met the assumption of normality based on review of the Shapiro-Wilk's test for the classification of female ($p = .138$), but it was not met for males ($p = .037$). Due to the assumption of normality not being met, a Mann-Whitney U test was conducted to determine if there was a difference between the two groups (Laerd Statistics, 2012). No statistically significant differences in total

composite scores were noted between females ($Mdn = 73.33$) and males ($Mdn = 72.5$) (Table 17).

Table 17.

Mann-Whitney Results for RN Fundamentals Assessment and Gender

Total N	182
Mann-Whitney U	686.500
Wilcoxon W	741.500
Test Statistic	686.500
Standard Error	161.418
Standardized Test Statistic	-1.075
Asymptotic Sig. (2-sided test)	.282

For the dependent variable, total composite scores on the ATI content mastery series RN fundamentals assessment and the independent variable of previous education level (prior degree/no prior degree categories), a boxplot was examined and there were no outliers identified. The data met the assumption of normality based on review of the Shapiro-Wilk's test for the classification of students having a prior degree ($p = .851$), but it was not met for students not having a prior degree ($p = .006$). A Mann-Whitney U test was therefore used. There was no statistically significant difference in the total composite scores on the ATI content mastery series RN fundamentals assessment between students having no prior degree ($Mdn = 73.33$) and those having a prior degree ($Mdn = 76.67$) (Table 18).

Table 18.

Mann-Whitney Results for RN Fundamentals and Educational Level

Total N	182
Mann-Whitney U	717.500
Wilcoxon W	753.500
Test Statistic	717.500
Standard Error	145.213
Standardized Test Statistic	.148
Asymptotic Sig. (2-sided test)	.882

One-way ANOVA. One-way ANOVAs were used to examine the relationships between the continuous variable of ATI composite scores and the categorical independent variables of age and race. For the one-way ANOVA to provide reliable results three assumptions must be met for each of the categories. The assumptions include (a) absence of outliers in the data for each group, (b) normally distributed data for all groups, and (c) homogeneity of variances (Laerd Statistics, 2012).

For the dependent variable, total composite scores on the ATI content mastery series RN fundamentals assessment and the independent variable of age (categorized in six subsets), a boxplot was examined and one outlier found (case 110). It was determined that the case included data that were coded correctly and this outlier would not significantly affect the result of the analysis. Five of the six age categories met the assumption of normality based on review of the Shapiro-Wilk's test, but the age group of 44 – 49 years of age did not. A Kruskal-Wallis H Test was conducted to manage the lack

of normality. The Kruskal-Wallis H test is used to determine if there are differences between three or more independent groups (Laerd Statistics, 2012). The RN fundamentals assessment scores increased in the 44 – 49 age group (Mdn = 78.33) (Table 19), but the differences among groups were not statistically significant (Table 20).

Table 19.

ATI Fundamentals Score and Student Age

Age of Student	Mean ATI Fundamentals Assessment Score
20 – 25	70.00
26 – 31	73.33
32 – 37	73.33
38 – 43	76.67
44 – 49	78.33
50 or >	73.33
Total	73.33

Table 20.

Test Statistics for Fundamentals Assessment and Age

Total N	182
Median	73.330
Test Statistic	5.271
Degrees of Freedom	5
Asymptotic Sig. (2-sided test)	.384

Note. Grouping Variable: Age of Student

For the dependent variable, total composite scores on the ATI content mastery series RN fundamentals assessment, and the independent variable of race (categorized in

six subsets), a boxplot was examined with two outliers present in the data (case 110 and 135). It was determined that the cases included data that were coded correctly and these outliers would not significantly affect the results of the analysis. Each of the race categories met the assumption of normality, as assessed by Shapiro-Wilk's test ($p > .05$). The highest mean scores on the assessment were found in the American Indian group at 76.67% (Table 21), however there was only one student in this category, and for the two students identified as having two or more races at 75.84%.

Table 21.

Descriptive Statistics for Fundamental Scores and Ethnicity/Racial Categories

Variable*	N	<i>M</i>	<i>SD</i>	<i>SE</i>	95% of CI	Min.	Max.
1	143	74.5336	6.68291	.55885	[73.4289, 75.6384]	58.33	93.33
2	27	70.1841	7.79422	1.50000	[67.1008, 73.2674]	55.00	88.33
3	5	68.6660	8.02759	3.59005	[58.6984, 78.6336]	60.00	80.00
4	1	76.6700	.	.	[NA]	76.67	76.67
5	4	67.5000	8.44152	4.22076	[54.0677, 80.9323]	60.00	78.33
6	2	78.5350	5.89020	4.16500	[22.9137, 128.756]	71.67	80.00
Total	182	73.5986	7.11287	.52724	[72.5583, 74.6390]	55.00	93.33

* 1 = Caucasian; 2 = African American; 3 = Asian; 4 = American Indian; 5 = Hispanic; 6 = Two or more racial/ethnic groups.

The mean total composite scores on the ATI content mastery series RN fundamental assessment noted by race are presented in Table 21. The assumption of homogeneity of variances was met, as assessed by Levene's Test of Homogeneity of Variance ($p = .918$) (Table 22), therefore an ANOVA was conducted.

Table 22.

Levene's Statistic for ATI Fundamentals Scores

Levene Statistic	df 1	df 2	Sig.
.236 [*]	4	176	.918

Note. * Groups with only one case are ignored in computing the test of homogeneity of variance for ATI Fundamentals Score.

The results of the ANOVA indicated the total composite scores on the ATI content mastery series RN fundamentals assessments were statistically significantly different between the various race categories (Table 23). No Tukey *post-hoc* test was conducted because one of the categories (American Indian) had fewer than two cases noted.

Table 23.

ANOVA for Fundamentals Assessment and Ethnicity/Racial Categories

Model	Sum of Squares	df	Mean Square	<i>F</i>	Sig.
Between Groups	729.677	5	145.935	3.048	.012
Within Groups	8427.648	176	47.884		
Total	9157.325	181			

Note. Predictors: (Constant), Caucasian, African American, Asian, American Indian, Hispanic, and Two or More Identified.

Research Question Nine

Research question nine was developed to determine what relationships, if any, existed between students' scores on the ATI RN comprehensive predictor assessment and student characteristics (gender, age, race and previous education level). Independent – samples t-tests were used to evaluate the relationship between ATI RN comprehensive

predictor assessment scores and previous education level and the ATI RN comprehensive predictor assessment scores and the independent variables of gender and previous education level. One-way ANOVAs were conducted to evaluate the relationships between the ATI RN comprehensive predictor assessment scores and two additional independent variables (age and self-identified race).

Independent-sample t-test. For the dependent variable, ATI RN comprehensive predictor assessment scores and the independent variable of gender (male/female categories), a boxplot identified one outlier. Data for the case were visually examined and it was determined that the case included data that were coded correctly would not affect the result of the analysis. The data did not meet the assumption of normality based on review of the Shapiro-Wilk's test for the classification of female ($p = .006$), but it was met for males ($p = .644$). Therefore, a Mann-Whitney U test (Table 24) was run to determine if there were differences in the ATI RN comprehensive predictor assessment scores based on gender. No significant differences were noted between females ($Mdn = 74.67$) and males ($Mdn = 72.665$).

Table 24.

Mann-Whitney Results for Comprehensive Predictor and Gender

Total N	182
Mann-Whitney U	656.000
Wilcoxon W	711.500
Test Statistic	656.000
Standard Error	161.824
Standardized Test Statistic	-1.261

Asymptotic Sig. (2-sided test)	.207
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For the dependent variable, ATI RN comprehensive predictor assessment scores and the independent variable of previous education level (prior degree/no prior degree categories), a boxplot indicated the presence of two outliers. Data for the cases were coded correctly, and it was determined these outliers would not affect the result of the analysis. The data did not meet the assumption of normality based on review of the Shapiro-Wilk's test for students not having a prior degree ($p = .006$), but it was met for students having a prior degree ($p = .851$). A Mann-Whitney U test (Table 25) was run, with no significant differences noted. Based on the data analyses, neither gender nor prior education level had a statistically significant association with students' scores on the ATI RN comprehensive predictor.

Table 25.

Mann-Whitney for Comprehensive Predictor and Prior Education

Total N	182
Mann-Whitney U	918.000
Wilcoxon W	954.000
Test Statistic	918.000
Standard Error	145.579
Standardized Test Statistic	1.525
Asymptotic Sig. (2-sided test)	.127

One-way ANOVA. One-way ANOVAs were used to assess relationships between the dependent variable (ATI RN comprehensive predictor assessment scores) and the categorical independent variables of age and race. A boxplot for the dependent variable, ATI RN comprehensive predictor assessment scores and the independent variable of age (categorized in six subsets), identified multiple outliers in the data set. It was determined that there would be no value in progressing with the exploration of the relationship between these independent variables (six categories of age), and the ATI RN comprehensive predictor assessment scores. This decision was based on the non-statistical relevance of age and the total scoring on the ATI content mastery series RN fundamentals assessment and age. Practically speaking, age would not be used to determine *at-risk* status, so failure to test this relationship did not undermine the purpose of the study.

For the dependent variable, ATI RN comprehensive predictor assessment scores and the independent variable of race (categorized in six subsets), a boxplot was examined with several outliers present and two categories underrepresented (American Indian and Two or More defined Races). It was determined that there would be no value in progressing with the exploration of the relationship between these independent variables (six categories of race), and the ATI RN comprehensive predictor assessment scores. This decision was based on the limited statistical relevance of race and the total scoring on the ATI content mastery series RN fundamentals assessment and race. The data would not be utilized to consider a student *at-risk* solely based on the category of race. Again, at a practical level, race would not be used as a lone indicator of risk status.

Research Question Ten

Research question ten addressed relationships between students' pass/fail results on the NCLEX-RN®, and student characteristics (gender, age, race and previous education level). Initially, it was proposed that a one-way ANOVA would be utilized to evaluate if relationships existed or not. However, upon further investigation it was determined that an ANOVA application would not be appropriate as the dependent variable and independent variables were categorical. To successfully conduct an ANOVA at least one of the variables must be continuous. A Chi-square test was performed for each of the four independent variables (gender, age, race and previous educational level) with the dependent variable of NCLEX-RN® pass/fail results.

Gender and NCLEX-RN®. Analyses of a crosstabulation table indicated that the data set had one category (males with first time NCLEX-RN® failure) with a cell count below five. Therefore, a Fisher's Exact test, rather than Chi square, was conducted (Huck, 2008). The Fisher's exact test determined that the null hypothesis of no difference in NCLEX-RN® pass/fail results on first attempt based on gender should be accepted ($p = .417$).

Age and NCLEX-RN®. Crosstabulation analysis indicated that three age groups (38-34, 44-49, and 50 or >) had cell counts below five in the NCLEX-RN® fail on first attempt category so Chi square could not be used. A Fisher's exact test was not appropriate as the variables produced more than a 2 x 2 contingency table (Laerd Statistics, 2012). In order to complete the analysis, it was decided to collapse the six age categories into two (ages 20 – 37 and 38 and >) resulting in cell counts of greater than five for both the NCLEX-RN® pass and fail results. A Chi-square test for differences in

NCLEX-RN® performance (pass/fail) by age group was performed. No statistically significant differences were noted between age groups and NCLEX-RN® pass/fail results on the first testing attempt ($\chi^2[1] = 3.116$, $p = .056$). A Phi coefficient was used to further examine the variables; again, there was no difference in NCLEX-RN® pass/fail results on first testing attempt by age group (Phi = 0.131, $p = .078$).

Ethnicity/Race and NCLEX-RN®. In the crosstabulation table, four of six of the racial categories (Asian, American Indian, Hispanic and two or more identified) had cell counts below five. Collapsing the categories into three main groups based on sample demographics (Caucasian, African American and Other) was considered, but there would have still been a cell count less than five for NCLEX-RN® failure on the first attempt. Given this information, the analysis was not run.

Previous education level and NCLEX-RN®. Analysis of a crosstabulation table indicated that the data set had one category (students with previous degrees and NCLEX-RN® failure on first attempt) below a cell count of five. Therefore, a Fisher's Exact test, rather than a Chi square was conducted. The Fisher's exact test determined that the null hypothesis of no difference in NCLEX-RN® pass/fail results on first attempt based on having or not having a prior degree should be accepted ($p = .658$). In this sample, there were no differences in NCLEX-RN® pass or fail results based solely on students having had a previous degree (associate or bachelor).

Summary

In summary, scores on the ATI content mastery series and the ATI RN comprehensive predictor were significantly related to each other and NCLEX-RN® pass/fail results on the first testing attempt. Overall, student characteristics (gender,

previous education level, age and ethnicity/race) were not found to be relevant in predicting outcomes related to assessments or NCLEX-RN®. Further interpretation of these and other findings are presented in Chapter five.

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

The purpose of this chapter is to summarize the findings from the study and interpret their meaning for nursing education, practice and future educational research. The research study was developed to address the concern of students continuing to graduate from associate degree nursing programs and not being successful in passing the NCLEX-RN® to become registered nurses despite increased use of standardized testing. Specifically, this problem required investigation of the sample population of licensed practical nurses enrolled in registered nursing programs. This quantitative, non-experimental descriptive correlational study was designed to address the research aims and research questions related to the early identification of *at-risk* LPN-to-RN students. The research questions were addressed utilizing various statistical analysis methods, appropriately based on the type of variable (continuous or categorical) and the number of categories for each.

Significance and Discussion of Findings

The goal of this study was to identify *at-risk* students early in the educational process to assist with remediation strategies to prepare them for success with the NCLEX-RN® on the first testing attempt. The findings of the study are presented based on the research aims and relevance of each finding as it relates to LPN-RN students.

Research Aim One

Research aim one was to determine indicators available early in the educational process that can assist with identification of students *at-risk* for academic failure or inability to pass the licensing examination. It was determined that standardized testing is a predictor of NCLEX-RN® success. The findings of this study are similar to other studies (DiBartolo & Seldomridge, 2008; Murray et al., 2008; Rogers, 2010) indicating standardized testing is a predictor of NCLEX-RN® success. These findings are significantly different from the findings of Reising (2003), which indicated students who had computerized NCLEX-style testing did not have a higher pass rate on NCLEX-RN®. However, it is important to note that none of these prior studies addressed standardized testing among LPN-to-RN students.

Findings from this study indicate that higher scores on the ATI content mastery series RN fundamentals assessment were significantly related to higher scores on the ATI RN comprehensive predictor assessment. In addition, higher scores on both the fundamentals assessment and the comprehensive predictor assessment were associated with increased pass rates on the NCLEX-RN® examination for first-time test takers. Research aim one was met when this data is considered. Students testing low on the initial assessments should be considered *at-risk* and remediation efforts should be focused on these students.

Research Aim Two

Research aim two was to determine if there was a relationship between students' use of the nursing process components (assessment, analysis/diagnosis, planning, implementation, and evaluation) and the thinking skills (foundational and critical

thinking), as identified early in the educational process, and success in a LPN-to-RN nursing education program. This aim was evaluated looking at the relationships of scores on the subcategories of nursing process and thinking skills on the ATI content mastery series RN fundamentals assessment of the sample to ATI RN comprehensive predictor scores and results on the NCLEX-RN®. There were no other research studies discovered through a comprehensive literature review that looked at subcategories of standardized testing.

The research findings from this study have indicated value in looking at the subcategory scores to identify *at-risk* students early in the educational process. Students with higher scores in the nursing process categories of planning, implementation, and evaluation (from the ATI content mastery series RN fundamentals assessment) had higher scores on the ATI RN comprehensive predictor assessment. In addition, students with higher scores in the nursing process categories of analysis/diagnosis, planning, and implementation had an increased likelihood of passing NCLEX-RN® on their first attempt.

Similar findings were noted with the thinking skills categories from the ATI content mastery series RN fundamentals assessment. Students with higher foundational thinking and critical thinking scores had higher scores on the ATI RN comprehensive predictor assessment. Students with a higher foundational thinking score had an increased likelihood of passing NCLEX-RN® on their first attempt. Therefore, research aim two has been met. The nursing process and thinking skills scores should be utilized to consider a student *at-risk* for lack of success in a LPN-to-RN program and obtaining licensure to practice as a registered nurse.

Research Aim Three

Research aim three was to determine if there were any relationships between student characteristics (gender, age, race, previous education level) and success in a LPN-to-RN education program. This aim was evaluated looking at the relationships between the student characteristics and results on the ATI content mastery series RN fundamentals assessment (composite scores), the RN comprehensive predictor assessment (composite scores) and the NCLEX-RN®. The research findings based on the student characteristics were very mixed and added limited value to the study.

The selected student characteristics did not predict the outcomes for the variables (ATI content mastery series RN fundamentals assessment, the ATI RN comprehensive predictor assessment and/or the NCLEX-RN® first time pass/fail results). Therefore, based on these characteristics, students should not be categorized as *at-risk* simply based on gender, age, race, or previous educational level. These findings vary from those of Stickney (2008) in an earlier study which indicated ethnicity was significantly correlated with NCLEX-RN® failure. The differences simply could not be reproduced with the student information in this current study.

Theoretical Underpinnings and Assumptions

Earl's model of *assessment as learning* (2003) provided the theoretical underpinning for this study. Results of this study indicate the use of standardized testing, such as the ATI content mastery series RN fundamentals assessment and the ATI RN comprehensive predictor assessment, provided the foundation to use assessment as a way of learning. Increased exposure to the expected format of testing methods provides students with the confidence of their knowledge base and can only add to their comfort.

The standardized testing allows students to know their strengths and weaknesses to help them remediate early on in the academic program to improve the possibility of success on the NCLEX-RN® examination. The study findings indicate there is added value in utilizing standardized testing through a nursing education program, rather than merely at the end of the program.

Limitations of the Study

The major limitation of this investigation was related to the sample being from two similar mid-western private colleges offering LPN-to-RN education. The programs utilized the same curriculum structure offered in an accelerated manner. Generalizability may be limited to nursing education programs similar to these two. Subsequent research on standardized testing should be conducted in LPN-to-RN programs that do not have similarity in curriculum, grading policies, admission criteria, and instructional strategies. Another limitation to this study was based on student characteristics. The sample was not as diverse as desired with regard to race and previous educational levels. Because the sample had all completed a practical nursing program and had experience with high-stakes testing, a larger sample would have been able to provide further information. Other factors that could affect scoring on standardized assessments based on student characteristics (e.g., employment patterns, other socio-economic factors, commitments, etc.) would need to be considered in subsequent studies.

Implications for Nursing Education

This study has the potential to be most influential for nursing education programs in decisions to use or not use standardized testing. The findings of this study support early engagement in remediation for students with lower scores on the RN fundamentals

assessment. In addition, students scoring lower in the planning, implementation, and evaluation subcategories of the nursing process and on thinking skills (foundational and critical thinking) should be engaged for remediation efforts. Students should not be penalized based on standardized testing results, but rather provided additional support to be successful in their LPN-to-RN educational program by addressing the gaps in knowledge.

Educational programs that utilize standardized testing have the opportunity to evaluate their policies and practices with regard to testing outcomes. Some programs have begun to limit graduation of students completing all courses, but not passing comprehensive examinations. This practice is discouraged and results in complaints to nursing boards across the United States (Spector & Alexander, 2006). The findings of this study must be considered as support for eliminating the practice of preventing graduation and promoting remedial action earlier in the educational program to decrease the frequency of end-of-program failures. In addition, programs participating in strong early remediation and student improvement processes may produce students that are more comfortable with the testing process and better prepared for success on NCLEX-RN®. Overall, the findings of this study indicate empirical evidence to invest in the use of a standardized testing program, such as the Assessment Technologies Institute products, from the start to end of a nursing program.

Implications for Nursing Practice

The study findings have the potential to affect nursing practice from various directions. Because the students included in this study were all licensed practical nurses they are currently employed in healthcare environments. The benefits of ensuring success

in a registered nursing program is an added bonus to the employers of the LPNs. The employers will have the advantage of an employee with more nursing knowledge. Employers of LPNs returning to school often help support the students financially and emotionally. With the use of standardized testing, and the value added from them, the LPNs will be better prepared to take the NCLEX-RN® and begin their employment as registered nurses. This is a win-win situation for the employer and the employee. The employer gets a newly licensed RN with previous nursing experience who is familiar with the work of nurses and the work environment.

Implications for Future Nursing Research

There are several opportunities for future nursing research surrounding the use of standardized testing programs and the education of LPNs enrolled in RN education programs, to include, but not limited to:

- Research should be conducted regarding the effects of remediation based on standardized testing results. Students who are identified as being *at-risk* for academic failure or testing low on standardized assessments need to participate in structured remediation activities. The outcomes of these activities need to be studied to determine the effectiveness of faculty and student actions.
- Research needs to be conducted examining the success of LPNs enrolled in RN programs. LPNs should be desired students in any RN program, as they are familiar with the work of nurses, the healthcare system, and the commitment needed to be successful on licensure examinations for entry into practice.

- Research is also needed on factors that contribute to LPNs' success or lack of success in RN programs and the supports they need to be successful. LPNs need to be educated about scope of practice differences between a RN and LPN.

Conclusion

This study focused on the effectiveness of standardized testing in identifying LPN-to-RN students at risk for failure on the NCLEX-RN® examination. The findings support the use of standardized testing as an evaluation tool to find gaps in knowledge to support the student early in their educational endeavors. Specifically, the Assessment Technologies Institute RN fundamentals assessment, and its subcategories – nursing process and thinking skills – were found to be useful in identifying students with lower scores as *at-risk* for academic failure and/or NCLEX-RN® failure. The findings suggest that early intervention with students would be to the advantage of the student and to the nursing program as both would have better outcomes of licensure and improved pass rates. Using the findings of the study to develop student remediation programs has limited risk, and can only improve faculty-student interactions. It is essential that further research be conducted regarding licensed practical nurses enrolled in registered nursing programs to ensure their contribution to meeting the demands for an expanded nursing work force. LPNs bring knowledge of the work of nurses and the experience of interacting within the healthcare system, and should be supported appropriately in furthering their nursing careers.

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