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Predictive Variables for Success on Licensure Examinations for Practical and Registered Nursing Education Graduates

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PREDICTIVE VARIABLES FOR SUCCESS ON LICENSURE EXAMINATIONS FOR PRACTICAL AND REGISTERED NURSING EDUCATION GRADUATES

by

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This dissertation, submitted by Mary Anne Marsh in partial fulfillment of the requirements for the degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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Signature Mary Ann Marsh

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ABSTRACT

The purpose of this action research was to examine the relationships of demographic and academic variables to student performance in a [illegible]ered practical nursing (PN) and registered nursing (RN) education program. The information gained may be utilized to establish research-based admission, progressi[illegible]graduation criteria to promote students successful completion of the program and pass the nurse licensure examination.

Descriptive statistics were used to summarize data related to the variables that were measured. Pearson correlations and regression analyses were used to examine various relationships and determine which of the admission demographic and academic variables were related to, or predictive of successful nursing program performance. The *t* test was also used to compare mean scores of RN graduates who passed with those who failed the licensure exam.

Predictive relationships that were found to exist in the PN sample between: (1) the American College Test (ACT) comprehensive score and Sandra Smith's NCLEX Practical Nurse / Vocational Nurse (PN/VN) Assessment Test, graduation nursing grade point average (GPA) and cumulative graduation GPA outcomes; (2) age of the student and Sandra Smith PN/VN Assessment Test and graduation nursing GPA outcomes; and (3) admission GPA and the graduation nursing and cumulative GPAs.

Since all of the 120 PN graduates passed the licensure exam on the first attempt, no changes for GPA requirements were suggested. It was recommended the ACT

comprehensive score be considered as an admission screening criterion in addition to GPA.

The RN sample (N = 93) had 78.5% pass the licensure exam and 21.5% failed. Predictive positive relationships in the RN sample were between: (1) admission cumulative and both the graduation nursing and cumulative GPA outcomes; and (2) admission nursing GPA and graduation nursing GPA. A low, inverse relationship existed between age and cum graduation GPA. Graduates who passed the licensure test had significantly higher admission nursing GPAs and Health Education Systems Incorporated Exit Exam scores than those who failed. Recommendations made from these findings were to consider increasing the cumulative and nursing GPAs for admission to the RN program and continue use of the HESI Exit Exam an assessment of preparedness to take the licensure exam.

CHAPTER I

INTRODUCTION

An individual interested in becoming a nurse must complete a nursing education program, obtain a degree, and become licensed in order to practice as a nurse. Career options available in nursing include becoming either a Licensed Practical Nurse (LPN) or a Registered Nurse (RN). Individuals can complete a certificate vocational/technical program or an associate degree program as they progress to becoming Licensed Practical Nurses. Upon graduating from a nursing education program, nursing students become eligible to take their respective licensure examination. The test taken by practical nursing graduate students to be licensed as LPNs is the National Council Licensure Examination for Practical / Vocational Nurses (NCLEX-PN).

The educational options available for registered nursing include completing either a two-, three- or four-year nursing program. The academic degrees included in RN educational programs consist of a college or university associate or a bachelor's degree. Although diploma programs are decreasing in number, hospital-based three-year diploma programs still exist in some states. All graduate registered nursing students, regardless of the type of educational preparation they obtain, are required to take the National Council Licensure Examination for Registered Nurses (NCLEX-RN) licensing examination in order to become registered nurses.

The National Council of State Boards of Nursing develops the licensure examinations for practical and registered graduate nurses. The NCLEX exam is the

licensure test that assesses graduating students' knowledge, skills and abilities at the entry level of practice and is used for licensure decision-making. A pass/fail scoring system is used on the NCLEX examinations. State boards of nursing and licensing authorities require students to pass the examination in order to acquire licenses to practice as nurses. The NCLEX exam, "measures the competencies needed to perform safely and effectively as a newly licensed, entry-level registered nurse" (NCLEX-RN Examination, 2004, p. 1). Students who fail the exam cannot be licensed and, therefore, are ineligible to be employed as a nurse. Students who do not pass are eligible to retest in their effort to pass and, subsequently, obtain their nursing license.

Admission, Progression, and Graduation Criteria

Regardless of the type of nursing education program a student completes, nursing is a rigorous major that includes numerous complex courses within the major in addition to required general education and cognate courses. Administrators and faculty establish admission criteria to identify prospective students who are likely to achieve academically and successfully complete the licensure examination upon graduation. Admission criteria vary among programs in terms of prerequisite coursework with minimal grade achievement, American College Test (ACT) Assessment or Scholastic Aptitude Test (SAT) scores, and high school and/or college grade point averages. It is anticipated that those students who meet the admission criteria will progress to complete the nursing education program, successfully pass the licensing exam and become licensed nurses.

Progression criteria may also be used within nursing education programs to advance those students who continue to be successful academically. At the end of the program, graduation criteria are used to screen prospective graduates for advancement to

graduation. Progression and graduation criteria, including course grades and/or nursing and cumulative grade point averages, exist within nursing education programs in order to advance those students who demonstrate academic success and halt the progression of those students who do not meet criteria. Measurement of students' academic success prior to, during and at the end of the program would seem likely to predict students' success when they take the licensing examination.

Achievement and Assessment Testing

In addition to admission, progression, and graduation criteria, schools of nursing may use various achievement or assessment test scores in order to measure students' progress in attaining the knowledge, skills and abilities needed for nursing. These tests may be comprehensive in nature or relate to a specific nursing content area, such as community health or psychiatric, mental health nursing. These test scores assess students' knowledge and, in some cases, predict the likelihood of passing the licensure examination. Depending on the nursing education program (LPN or RN), admission, progression and graduation criteria vary as do the appropriate assessment and achievement tests that are available.

Statement of Purpose

The purpose of this study was to identify through action research, the relationship of various predictive demographic and academic variables to the outcome of students' likelihood of successfully completing the NCLEX licensing examination at one Midwestern university. The nursing education programs at this university include a two-year Associate in Applied Science in Practical Nursing (AASPN) with a ladder Bachelor of Science in Nursing (BSN) Completion Program, consisting of the third and fourth

years of study. Both high school graduates and students with earned college credit are eligible to apply for the AASPN Program. The BSN Completion Program is for licensed nurses, either licensed practical or registered nurses, desiring to complete the bachelor degree. The independent predictive variables that were analyzed were the admission, progression and graduation factors and achievement and assessment examinations that are used specifically for each nursing education program.

Action research according to Creswell (2002) is research with an applied focus for the study of practical issues. "Research is not undertaken to advance knowledge for knowledge's sake, but for an immediate, applied goal" (p. 614). Creswell defines action research as research that "addresses a specific, practical issue and seeks to obtain solutions to a problem" (p. 602). The results of action research may be applied to improve faculty teaching, student learning and enhance educational programs.

The present action research was intentional, as it allowed focus on what was currently used for admission, progression and graduation criteria for each of the existing nursing education programs. Ultimately, it was possible to enhance and improve admission, progression and graduation practices through this systematic study, which had not been undertaken for over fifteen years at the Midwestern university being studied. This dissertation focus was not uncommon, as many other researchers had conducted action research on local practical issues and concerns pertinent for their own nursing education programs. Their findings had been used to improve programs and raise awareness for students, faculty and administrators alike, which is an ultimate aim of action research.

Research Questions

The research questions in this study related to the respective predictive relationships between variables in each of the practical nursing and registered nursing education programs. Specifically, the research questions included:

1. Which of the practical nursing pre-entrance demographic (age and number of prior semesters in college) and academic variables (admission grade point average, ACT comprehensive, ACT Math and ACT Science scores) significantly predict the PN program performance variables (Critical Thinking in Clinical Nursing Practice – PN Examination, Sandra Smith Practical Nurse/Vocational Nurse (PN/VN) Assessment Test, and graduation nursing and cumulative grade point averages)?
2. Which of the registered nursing program admission demographic (age and number of previous semesters of college) and academic variables (cumulative and nursing grade point averages) significantly predict the RN program performance variables (Critical Thinking in Clinical Nursing Practice – RN Examination, Health Education Systems Incorporated Exit Exam, and graduation nursing and cumulative grade point averages)?
3. What are the differences among the performance variables (Critical Thinking in Clinical Nursing Practice – RN Examination, Health Education Systems Incorporated Exit Exam, and graduation nursing and cumulative grade point averages) between the registered nursing program graduates who passed and those who failed the NCLEX-RN licensing examination?

Operational Definitions

Practical Nursing Education Program

The operational definitions of the variables related to the practical nursing education program included pre-entrance demographic variables. These variables were used to identify the sample of PN participants and included:

Age: Identified as the student's age at the time the student began the practical nursing program.

Number of prior semesters in college: The number of semesters of college student's had completed prior to beginning the practical nursing program. These totals included counting each of the traditional fall and spring semesters, with summer school attendance counted as one additional semester for each summer the student attended college.

Dependent pre-entrance academic variables included measures of academic achievement used for admission purposes to admit students to the PN program. The academic variables integrated:

Admission grade point average (GPA): The student's high school graduation grade point average that was used for admission. To ensure consistency high school GPAs were used regardless of whether or not students had an established college or university GPA upon admission to the practical nursing program.

ACT Assessment Scores: Incorporated student's Comprehensive, math, and science ACT scores on the college entrance exam. In situations where student's had taken the ACT exam on more than one occasion, the latest set of ACT scores (closest to

high school graduation) were used. ACT scores were limited to these three scores to reflect those used for admission by the nursing program.

The PN performance variables included measures of student's academic achievement in completing the PN nursing education program.

Critical Thinking in Clinical Nursing Practice – Practical Nurse Examination (CTCNP-PN): The CTCNP-PN is an achievement test published by the National League for Nursing to assess the critical thinking ability of nursing students. Scores were obtained from students at the end of the spring semester within one month of graduation.

Sandra Smith's NCLEX Practical Nurse / Vocational Nurse (PN/VN) Assessment Test: This test assesses student's preparedness for taking the NCLEX-PN licensure examination and is taken within one month of the end of the practical nursing program.

Graduation nursing GPA: Consisted of the GPA (on a 4.0 scale) at graduation and included only the nursing courses previously taken.

Graduation cumulative GPA: The cumulative GPA incorporated the grade points (on a 4.0 scale) of all classes previously taken up to the point of graduation.

Registered Nursing Education Program

The operational definitions for the admission demographic variables for the registered nursing program included those measures to define the sample:

Age: Identified as the student's age at the time the student began the registered nursing educational program.

Number of prior semesters in college: Included the number of semesters of college the students had completed prior to admission to the registered nursing program. These totals included counting each of the traditional fall and spring semesters, with summer school attendance counted as one additional semester for each summer the student attended college.

The dependent academic variables for the registered nursing program integrated scholastic variables required for admission to the program. These included:

Admission GPA: Incorporated student's cumulative GPA, (on a 4.0 scale) including all previous college/university course work taken prior to beginning the registered nursing completion program.

Admission nursing GPA: Integrated the exclusive cumulative GPA of all nursing courses previously completed by students prior to beginning the registered nursing program. Since this is a completion nursing program which admits licensed nurses wanting to complete a bachelor degree, each student has a nursing GPA from their preceding nursing education program.

The performance variables of the registered nursing program students integrated measures of academic achievement upon completion of the BSN program. The performance variables included:

Critical Thinking in Clinical Nursing Practice – Registered Nurse Examination (CTCNP-RN):

The CTCNP-RN is an achievement test published by the National League for Nursing to assess the critical thinking ability of nursing students. Scores were obtained at the end of the final semester within one month of graduation.

Health Education Systems Incorporated (HESI) Exit Exam: A comprehensive exit exam used to measure student's preparedness for taking the NCLEX-RN licensing exam.

Graduation nursing GPA: Consisted of the GPA (on a 4.0 scale) upon graduation and included only grades earned in nursing courses within the BSN completion program. Nursing course grades attained by students during their first nursing education program were not included.

Graduation cumulative GPA: The cumulative GPA incorporated the grade points (on a 4.0 scale) of all classes previously taken upon graduation.

National Council Licensure Examination for Registered Nurses (NCLEX-RN) Outcome: The pass or fail scores obtained by graduate BSN student's on their first attempt at taking the exam to become licensed as a RN.

Delimitations of the Study

The convenience samples for this study included two separate, distinct groups of nursing graduates. The first sample consisted of practical nursing graduates who had completed a two-year associate degree practical nursing education program. The second group consisted of graduates of a bachelor's degree nursing education program. All of the students had completed their university education and had graduated in the month of May from 2000 through 2004, from a Midwestern university. In addition, each of the subjects had completed their first attempt at passing their respective licensure examination.

Limitations of the Study

The subjects in this study included associate degree practical nursing graduates and bachelor prepared registered nursing graduates in a ladder program at the same Midwestern university. Due to the uniqueness of the ladder program as previously described, generalization of the results should be viewed with caution.

A number of factors relative to graduates' NCLEX examination success exist. These factors include both quantitative and qualitative variables. The parameters of this quantitative study were narrowed to keep the research manageable and obtain relevant information related to each respective nursing education program. Personal student attributes such as ethnicity, fulltime/part time status, self-concept, motivation, test preparation habits, hours of study and family support were not studied.

Faculty and nursing program factors also have the potential to affect students' educational program success and NCLEX examination outcomes. The make-up of the curriculum and the manner in which nursing education programs are delivered varies from one program to another. These factors were not considered in this research.

Rationale for the Study

Previous studies have been conducted related to this topic; this study extends that research. Knowing what variables significantly predict NCLEX success is helpful to faculty, administrators, and nursing students. The information gained from this research will be useful to faculty and administrators in establishing appropriate admission, progression, and graduation criteria. Ostrye (2000) proposed that admission criteria used in nursing education programs should be fair and reasonable. Establishing research-based criteria is more credible than simply estimating what possibilities may exist or be

appropriate. The findings from this action research will enable faculty and administrators to make informed changes where needed.

Students will benefit having the knowledge of these criteria at the outset of their nursing education. The criteria can serve as benchmarks for a student to strive toward, as well as be motivating factors when a student's efforts fall short. In addition, for those students who are unlikely to complete the program or pass the NCLEX exam, the criteria serve as a determinant for denying admission. Faculty and university administrators have an ethical obligation to students, to establish reasonable and fair admission, progression, and graduation criteria, which also serve as effective indicators of graduates' success passing the NCLEX licensure examination. It is more ethical to deny admission to a prospective student who does not meet established criteria than it is to allow a student to complete the nursing education program and not be successful in completing the licensure exam. The student's efforts throughout the program would be for naught, as the student would be unable to practice as a nurse without successfully completing the NCLEX licensure examination. More specifically, this action research identified appropriate research-based levels for admission and graduation GPAs, ACT scores, and assessment and achievement test scores to enhance admission, progression, and graduation criteria which may predict students' success in the nursing program and on their respective NCLEX licensing examination.

The findings of this study also have the potential to support the faculty member's role as an advisor. Faculty will be able to advise students more effectively when the students only nearly meet, or do not meet the established criteria. Assessment of where a

student is at in relation to the criteria will assist faculty in selecting and recommending appropriate educational resources or remediation to promote the student's success.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this action research was to identify the relationship of various demographic and academic variables to students' performance in the nursing education program and successfully completing the National Council Licensure Examination (NCLEX). The focus of the literature review had three parts. The three parts were the NCLEX examination, admission, and nursing program performance variables. This chapter begins with a discussion of the NCLEX examination that was used for each of the practical nursing (PN) and registered nursing (RN) students. How NCLEX pass rates were used and the value of NCLEX predictive variables were discussed in this section.

The second section included a discussion of the admission variables for the PN and RN programs. The admission variables that were studied related to both demographic and academic variables. The characteristics that were focused on in each of these categories included those factors that were screened for admitting prospective students to the respective PN and RN nursing education programs. The academic variables incorporated in the discussion included the American College Test (ACT) Assessment examination and grade point average (GPA) requirements.

Nursing program performance variables were discussed in the third section. Although grade point average (GPA) criteria related to both admission and performance variables, the use of GPAs was only discussed in this third section. The other performance variables that were discussed related to the specific achievement and

assessment examinations that were used in the respective nursing education programs. The PN program performance variables included the Critical Thinking in Clinical Nursing Practice – Practical Nurse (CTCNP-PN) Examination and the Sandra Smith's NCLEX Practical Nurse / Vocational Nurse (PN/VN) Assessment Test. The registered nursing (RN) program performance variables included the Critical Thinking in Clinical Nursing Practice – Registered Nurse (CTCNP-RN) and the Health Education Systems Incorporated (HESI) Exit Examinations.

Previous studies also included an analysis of students in a variety of nursing programs, including all levels of licensed practical nursing (LPN) and registered nursing (RN) education. The research revolved exclusively around each program the study described as it delved into the idiosyncrasies of the students, and the degree requirements of the programs studied. Beeson and Kissling (2001) advocated that each nursing education program conduct research relative to their own program, "Because each program is unique and has its own special student population mix, nurse educators should continue to study the variables that predict success on the NCLEX-RN" (p. 127).

More information was available related to studies done in RN educational programs than there was available for LPN programs. As noted by Ostrye (2001), there was a lack of research related to predictors of success in practical nursing (PN) education and outcomes on the licensure examination taken by PN graduates. The information related to RN education included research conducted in associate, baccalaureate degree and diploma registered nursing education programs. The majority of these studies focused on associate and baccalaureate degree programs rather than diploma RN

programs. The low availability of information about diploma programs likely related to the decline in the number of diploma, hospital-based nursing programs.

There was a wealth of quantitative and qualitative information in the literature related to variables used to predict students' success in nursing education. Previous research conducted on this topic related to student characteristics, academic and achievement performance variables and their relationship to student success in nursing education and performance on the licensing exam. The information was further used by faculty to identify which of the characteristics may predict students' success and was utilized to establish appropriate admission, progression and graduation criteria for nursing education programs.

National Council Licensure Examinations

The National Council Licensure Examination for Practical / Vocational Nurses (NCLEX-PN) and the National Council Licensure Examination for Registered Nurses (NCLEX-RN) are the licensure examinations that are used to license nurses. Each of these examinations is described in this section along with the focus on pass rates of first time test takers and the value of the use of predictive variables for NCLEX success.

The agency responsible for the development of the licensure examinations is the National Council of State Boards of Nursing (NCSBN) Incorporated. The NCSBN developed the separate examinations for graduates from both practical and registered nursing programs. Students who were graduated from a practical nursing education program take the NCLEX-PN examination. Successful completion allows the graduates ultimately to receive their license as LPNs. Graduates of a registered nursing education program completed the National Council Licensure Examination for Registered Nurses

(NCLEX-RN). Upon passing this exam, graduates were eligible to receive their license to practice as RNs.

National Council Licensure Examination for Practical / Vocational Nurses

The content of the NCLEX-PN test was established according to a pre-determined research-based test plan. "The Examination Committee of the National Council reviews the results of a PN practice analysis conducted every three years and makes a recommendation on the NCLEX-PN Test Plan to the Delegate Assembly (National Council's policy-making body)" [National Council of State Boards of Nursing, Inc, 2001, n. p.]. The efforts of the committee resulted in a format for the examination that reflected job-related, current entry-level nursing practice of the LPN. This analysis allowed the test plan to guide the selection of current practical nurse behaviors and content to be included in the licensure examination. The goal was to include questions that "...reflects [*sic*] the knowledge, skills and abilities essential for the practical/vocational nurse to master in order to meet the needs of clients requiring the promotion, maintenance and restoration of health" (National Council of State Boards of Nursing, Inc., 2001, p. 1). The test plan was available as a format for preparation for graduates taking the licensure exams, as well as for feedback being provided to individuals who did not pass the examination.

The framework of the NCLEX-PN examination was structured around the concepts of four client need categories, with ten respective subcategories that served to define the need areas. The client need categories and their related subcategories included:

A. Safe, Effective Care Environment

1. Coordinated Care
2. Safety and Infection Control

B. Health Promotion and Maintenance

3. Growth and Development Through the Life Span
4. Prevention and Early Detection of Disease

C. Psychosocial Integrity

5. Coping and Adaptation
6. Psychosocial Adaptation

D. Physiological Integrity

7. Basic Care and Comfort
8. Pharmacological Therapies
9. Reduction of Risk Potential
10. Physiological Adaptation (National Council of State Boards of Nursing, 2001, p. 2)

Furthermore, the concepts and context of practical nursing incorporated in the test content included the nursing process, caring, communication, documentation, cultural awareness, self-care, and teaching/learning across the life span. Pre-established percentages of test items for each of the subcategories were determined by the Examination Committee. The Test Plan also incorporated a more definitive list of topics to specify content that may be included, but not limited, to each of the 10 subcategories.

The format for administration of the NCLEX-PN examination was via computer adaptive testing, allowing each person who was tested to take a customized exam relative

to the individual's performance as they were tested. No two students took the exact same examination. As the individual continued to test, he/she established a competence estimate based on prior answers, until a pass/fail decision was determined. The examination included a minimum of 85 questions and a maximum of 205 questions in a five-hour time limited period.

Effective April 1, 1999, the passing standard for the NCLEX-PN examination was increased by .04 logits. The current passing standard is now at -0.47 units on the NCLEX-PN logistic scale, as determined by the NCSBN. The increase stemmed from feedback received from nurse experts, nurses who worked directly with newly licensed LPNs, and from entry-level practical and vocational nurses themselves. It was decided to increase the standard in part due to "changes in health care delivery modes in the United States, which have resulted in increased acuity of clients and decreased levels of direct supervision of newly licensed nurses" ("Passing Standard Revised," 1999, p.12). These changes were determined to have required a greater depth of knowledge, skills and abilities to be a nurse than in 1996 when the previous passing standard was implemented.

Students who successfully completed the examination obtained their license to practice as LPNs upon consideration from their respective state boards of nursing. Those students who did not pass were required to retake the examination and had the opportunity to retest in an attempt to be successful. Candidates were required to wait for a period of 45 days or longer before retesting, relative to the guidelines established by the state boards of nursing.

National Council Licensure Examination for Registered Nurses

The test plan for the NCLEX-RN exam was revised in 2003 and implemented April 2004. The structure of the NCLEX-RN examination was different from that of the NCLEX-PN, in order to reflect the knowledge, skills and abilities required of the novice RN. "Since the practice of nursing requires application of knowledge, skills and abilities, the majority of items are written at the application or higher levels of cognitive ability, which requires more complex thought processing" (National Council of State Boards of Nursing, Inc, 2003, p. 3). Although the four client need areas and the context and conceptual patterns were similar between the NCLEX-PN and NCLEX-RN examinations, the subcategories and the distribution of test items in the NCLEX-RN subcategories varied. The NCLEX-RN health promotion and maintenance, and the psychosocial integrity need areas were the only two content areas that did not have subcategories. Management of care and safety and infection control comprised the client need for a safe effective care environment. Physiological integrity was defined by its subcategories of basic care and comfort, pharmacological and parenteral therapies, reduction of risk potential, and physiological adaptation. A fundamental difference between the two NCLEX exams was the premise that the LPN is prepared to function in a variety of settings under the direction of other qualified health professionals, one of whom may be a registered nurse. The RN is afforded greater accountability which included assessment of needs of individuals, families and/or groups and the responsibility to develop and implement appropriate plans of care.

The passing standard for the NCLEX examinations was reevaluated every three years to ensure minimal competence of nurses in order to protect the public. The practice

analysis incorporated surveying newly licensed RNs to identify the frequency of performance of job-related activities and their relationship to patient safety. The NCSBN's Examination Committee used this feedback to modify the test plan for the NCLEX-RN examination. The resultant modifications included a reduction in the percentage of test items in the psychosocial integrity, and health promotion and maintenance categories. Increases occurred in the pharmacological and parenteral therapies, management of care, and safety and infection control categories. Wendt (2003) described the focus of determination of the NCSBN was to construct a test plan which will judge "whether graduates can provide safe and effective nursing care at the entry level" (p. 277).

In December 2003, the NCSBN determined that the passing standard for the NCLEX-RN examination should be increased. The determination by the Council reflected the greater knowledge, skill and ability required of an entry-level RN when compared to registered nurses who graduated in 1998. The passing standard was also increased based upon survey information received from entry-level registered nurses. Beginning registered nurses reported increased acuity levels of patients, and changes in nursing and health care delivery, warranting a higher passing standard. The new passing standard that took effect on April 1, 2004, was –0.2800 logits on the NCLEX-RN logistic scale. This included an increase of 0.700 logits from the passing standard of –0.3500 in 1998.

Another change that was made included the timeframe for administering the NCLEX-RN examination. Effective in 2004, the five-hour time limit was eliminated.

This allowed for a future increase in the time limit for candidates to test, without requiring another change in the published test plan (Wendt, 2003).

Morrison, Free and Newman (2002) reported declining NCLEX-RN pass rates from 1994 through 2000. Graduate students' success rate during this period dropped from 90.3% to only 83.8%. The most current quarterly national pass rate, spanning April 1, 2004, through June 30, 2004, for the NCLEX-RN examination was 88.45% and incorporated the outcomes of students who passed the exam since the inception of the higher passing standard (National Council Licensure Examination for Registered Nurses. July 15, 2004, n.p.).

Graduates who successfully completed the examination were granted RN licensure by their respective state board of nursing. Graduates who did not pass the NCLEX-RN test were required to retake it and pass before being licensed as an RN.

Pass Rate of First Time Test Takers

Emphasis was placed on the graduates' first attempt at taking the licensure examinations following their graduation from either PN or RN nursing education programs. The reputation of nursing education programs hinges on the NCLEX pass rate of their first time NCLEX test takers, as pass rates have become a measure of graduates' and programs' success. Although students who did not pass the exam on their first attempt were allowed to retake the licensing test, the pass rate of retakes are not used by accrediting agencies or state boards of nursing in measuring program quality.

The NCLEX pass rates were also used to market a college or university's programs, and prospective students used these figures to compare one program to another when selecting which college or university to attend. Furthermore, schools' with low

pass rates are at risk of being placed on probation by a state board of nursing. Low pass rates of nursing programs also affected the program's accreditation, as an increased emphasis was placed on pass rates as a measurable outcome criterion in program assessment (Byrd, Garza & Nieswiadomy, 1999; Lauchner, Newman & Britt, 1999).

One of the most defining characteristics of a nursing education program was the pass rate of the program's graduates on the NCLEX examination. Since great emphasi has been placed on the pass rate, university faculty and administrators strove to identify variables that predicted students' success on passing the examination on their first attempt. The importance of the pass rate on the first attempt was emphasized by state boards of nursing as well as the National League for Nursing Accrediting Commission. Nursing education programs must maintain a minimum pass rate in order to retain state board approval and accreditation status.

Students' failure on the NCLEX licensure exam is devastating to students, their family members, and faculty alike. Although students who failed the exam may retake the test, the effects of failing as a first time test taker were hurtful. Social, political and economic forces applied pressure for increasing pass rates of first time test-takers. Social pressures on the students were applied by students' themselves and their family members. These pressures related to monies spent to provide nursing education, time and effort while in school, as well as the sacrifices made by the students and their families. In addition, students who failed perceived a sense of loss and lowered self-esteem, as they were unable to work as a nurse and earn more income upon program completion (Lengacher & Keller, 1990). Lauchner, Newman and Britt (1999) described the toll failure takes on graduate nurses. The emotional consequences, lowered self-esteem, the

potential loss of employment and loss of a higher income were factors faced by students who failed.

In a qualitative study by Poorman and Webb (2000), graduates who failed the NCLEX exam on one or more attempts described their perceptions of their lived experiences of failing and preparing to retake the licensing examination. Three major themes emerged related to graduates' that included: living the failure, wanting, and daring to hope. Participants described the daunting pressure brought on by the NCLEX failure that led to personal perceptions of losing their identities as the nurses they had hoped to become. As described by Poorman and Webb, "The failure permeates every part of them, so they doubt who they are and what they have accomplished" (p. 177). The graduates who failed had to deal with strong doubts of their ability to retake the NCLEX test and pass. Many times the participants reported having to do this alone since their family and friends did not understand their situation. Participants felt they had lost the support networks they once had with their class peers and faculty. Since they had graduated, the former students no longer had daily access to these individuals. Some participants reported that as they prepared to retake the exam, they were eventually able to dare to hope that they would pass and that they could envision themselves being successful and see themselves as registered nurses.

Poorman and Webb (2000) described how faculty also perceived a sense of loss and disappointment, related to the time and energy they spent in teaching students who were unable to pass the exam and become licensed. Limited resources in nursing education compounded the need to focus education on those students who could successfully complete the program and pass the licensure examination. The scarce

supply of qualified faculty, lower enrollments due to fewer students who sought a nursing major, inadequate teaching-learning resources, and fewer clinical learning opportunities added stress to the need to educate students who were prepared to become professional nurses. Faculty were also sensitive to the current nursing shortage and the goal of trying to educate quality prepared graduate nursing students who would potentially enter the workforce as either LPNs or RNs. The more students who failed the licensure exam, the fewer nurses there were available to increase the nursing workforce. All of these factors emphasized the importance of determining predictors of success when taking the NCLEX licensure exams.

Value of Predictive Variables

Because nursing is such a rigorous major, requiring complex courses within the major in addition to general education and cognate coursework, most schools implemented admission criteria for selecting students into the program. Reliable admission criteria promoted admission of those students who were more likely to complete the program and pass their respective NCLEX examination. In addition, many schools utilized progression and/or graduation requirements within the program to progress students successfully through the programs' completion and ultimately to pass the NCLEX examination. Lauchner et al. (1999) stated:

> Because of the value attributed to success on the licensure exam, it is important for students and faculty to have a means of determining students' preparedness for the licensure exam so that if remediation is indicated, it can be initiated before graduation. (p.120)

These authors advocated for the use of a computerized NCLEX assessment test that would provide students with feedback that allowed them to identify .eas of strength and weakness for remediation purposes.

Utilizing valid criteria also helped to identify students who were at risk of not progressing in the program and/or not being able to pass the NCLEX licensure examination. Early identification of these students enabled faculty to intervene appropriately to promote the students' success via the use of additional appropriate educational resources.

By using focused action research to evaluate and make intentional changes, Siktberg and Dillard (2001) reported making numerous changes to increase the pass rates of their program graduates. Changes were generated to update and enhance admission, progression and graduation criteria and policies. In addition, course teaching and learning strategies, grading processes, and a thorough NCLEX-RN review tutorial were initiated. The resultant changes included six consecutive years of NCLEX-RN pass rates above the national average.

Numerous quantitative and qualitative research studies conducted in nursing education reflected an array of academic and nonacademic variables. Byrd et al. (1999) studied predictors of successful completion of baccalaureate nursing programs. They contended that more research is needed that is focused on the prediction of the outcome of program completion rather than NCLEX success, since nursing students must graduate from a nursing education program in order to be eligible to take the licensing examination.

Many nursing education programs have attempted to identify those variables that predict students' likelihood of NCLEX success. Multiple academic and nonacademic variables have been used and studied in the past. Waterhouse and Beeman (2003) noted that predictive variables can be sophisticated or simplified. Programs could choose to track performance in specified courses within the major, or various achievement and assessment examinations may be purchased to measure students' performance.

Qualitative Research in RN Education

Eddy and Epeneter (2002) analyzed qualitative variables including test anxiety, self-perception of competence, self-esteem, amount of test preparation, self-acceptance of responsibility for learning and preparing for the NCLEX. The most notable of their findings was students' recognition of test anxiety; students who passed the NCLEX exam were able to identify their anxiousness and positively cope with it before and during the testing process. Students who failed the exam described how they became more anxious as the test progressed and were not able to cope with their mounting nervousness.

When asked to make recommendations regarding suggestions for future change, students who passed the NCLEX exam focused on strategies students could initiate for themselves. "Three participants in the pass group said they would work less while in school and 'dedicate more time to school.' Several said they would take school more seriously" (Eddy & Epeneter, 2002, p. 277). On the other hand, students who failed the NCLEX exam made recommendations having to do with the school, and what others could change for them, rather than characteristics they could change for themselves. They recommended a more intense review course be offered to students and the school

change by offering more intense clinical courses and assist students with preparing to take the NCLEX exam during their final semester in the nursing program.

Poorman and Martin (1991) advocated that further qualitative research should be conducted since their results indicated that mere knowledge of nursing content and academic performance were not the only factors to be considered for predicting NCLEX success or failure. They quantified students' reports of test anxiety using the Test Anxiety Inventory, which was comprised of Worry and Emotionality subscales. Their findings were related to those of Eddy and Epeneter (2002); the level of test anxiety was inversely related to passing the NCLEX exam. The students who failed the NCLEX licensure examination had higher anxiety scores. Using multiple regression analyses, the best predictors of NCLEX success was the second-semester senior's self-perceived student grades, self-predicted NCLEX score and Test Anxiety Inventory total score. Seventy-seven percent of graduates who passed the NCLEX exam perceived themselves to be good test takers, whereas only 20% of the students who failed the NCLEX licensure exam shared this same belief. Thoughts expressed by the students who passed were more positive and problem solving in nature, whereas those of the students who failed were defeatist in nature and were not conducive to facilitating positive test performance.

Mills, Wilson and Bar (2001) conducted a qualitative analysis of journal entries students kept as they participated in an NCLEX preparatory course. Qualitative themes identified by the participants as they prepared to take the NCLEX exam included perfectionism, self-worth and consequence, and meaning of failure. Participants were so intent on passing the first time, failure was not even considered as an option. Students also viewed themselves as having less self worth and being failures if they did not pass.

They voiced concerns of not being able to get a good job and that they would not be good nurses if they failed. Students also worried they would let their family members down if they did not pass on their first attempt at taking the NCLEX examination. Although the focus of this current dissertation was quantitative, the qualitative findings of Eddy and Epeneter (2002), Mills, et al., (2001), and Poorman and Martin (1991) provide evidence that other factors affecting NCLEX success exist.

Admission Variables

The admission variables that were studied related to both demographic and academic variables. The demographic variables that were focused on in this study were age and gender and were discussed relative to both PN and RN education. The academic admission variables included in the literature related to various admission tests as well as GPA requirements used by nursing education programs for admission purposes.

Demographic Variables

There was an array of demographic variables related to students' success and NCLEX outcome described in the literature. Age, gender, race, work experience, number of semesters required to complete the program, status of prior earned degree or previous licensure as a nurse and type of student (e.g. freshman, transfer, second degree) have been studied in the past.

Results of research related to age and NCLEX success varied. Briscoe and Anema (1999) reported that older students were more likely to pass the NCLEX-RN exam. The mean age of 35 years was indicative of typically older participants in an associate degree RN program, which was the focus of their study. Characteristics of associate degree RN students included their tendency to be older non-traditional students,

more mature and in the process of making a career change. The participants ranged in age between 24 and 56. The Pearson correlation coefficient for age was .373 and was significant at the .05 level for passing the NCLEX-RN examination.

Beeson and Kissling (2001) also researched age at the time of graduation in relation to NCLEX-RN outcome. Nontraditional students aged 23 years or over had a higher pass rate of 95.7% than did the traditional aged students (88.3%). The success of nontraditional students was attributed to their being more self-directed and experienced at balancing multiple roles.

Roncoli, Lisanti and Falcone (2000) compared students who passed the NCLEX-RN exam with those students for whom no records were found, and were assumed to have failed the exam. Their study revealed there was no relationship regarding students' age when these two groups of students were compared. Lengacher and Keller (1990) also found no relationship between the age of students at the time they entered the nursing education program and NCLEX outcome. Endres (1997) and Woodham and Taube, (1984) also researched student's age at the time they took the licensure examination. They also found no relationship regarding age between those students who passed and those who failed the licensure examination.

Byrd et al. (1999) found students at a younger age were more likely to successfully complete the nursing education program than the older students. Age was one of the pre-admission variables that significantly predicted students' successful completion of the program.

Parrish's (1994) multifaceted research compared practical nursing students who did not complete the program to those who completed the program and failed the

NCLEX-PN exam, and those who were successful at both completing the program and passing the licensure examination. This study also focused on a comparison of students who graduated from high school versus those obtaining a General Education Development (GED) certificate, and variables of age, gender and race. The independent variables found to be related to program completion were age and race. The younger students (aged 17-24) had lower success rates than the older students.

Ostyre (2001) also researched prediction of NCLEX-PN performance via preadmission, demographic, and program variables. Demographic variables consisted of students' age, gender, marital status, race, high school completion method and status of needs-based financial aid. Financial aid status was determined by whether or not the students had received federal Pell grant assistance. When students who passed the NCLEX exam were compared with those who had failed, the students who passed the licensure exam were slightly younger, married, and Caucasian.

The mean age of the students who passed was 29.98 compared to 30.77 years of age for those who failed. The highest percentage of students who failed (16.9%) was in the age category of 45 to 54 years old. The smallest percentage (4.7%) of failures included students in the 35 – 44 year old category (Ostrye, 2000). When students who passed the NCLEX exam were compared with those who failed, only minimal differences were reported between those students who had received Pell grants and those who did not. No significant relationships were noted between student's age and race (Ostrye, 2001). Due to the small number of males in the study (5%), gender differences could not be discerned.

Morris (1999) observed the type and amount of healthcare work experiences were positively related with NCLEX-RN success. Type and amount of work were defined as the number of years spent gaining experiences in healthcare such as an emergency medical technician, certified nursing assistant, military corpsman or as an LPN. Students who had no prior work experience related to nursing were more likely to fail the NCLEX-RN. Significant relationships were not found between the ability to pass the NCLEX-RN exam and age, gender and clinical decision making scores. Based on these findings, Morris recommended that faculty should increase the number of clinical practice hours in the nursing program and encourage students to gain healthcare work-related experiences while pursuing a nursing degree.

Academic Variables

An array of previous studies have been conducted to identify successful student outcomes and to identify various predictive variables for students attaining these outcomes. Results may be used to establish appropriate academic admission criteria and remedial programs for students identified as at risk. Academic variables described in the literature vary from the ACT Assessment test, various admission examinations, GPAs and measuring specified course grade outcomes.

American College Test Assessment

The predictive value of the ACT comprehensive and test subscores continued to be researched related to students' success in nursing education and in taking the licensing examination. The ACT Assessment was one of the most widely accepted college entrance exams. It was the only national level college entrance exam that included a science test. The test was comprised of four areas, including English, math, reading and

science reasoning. ACT planned to add a writing test component that will be optional during the 2004-2005 academic year. Proficiency in the ACT Assessment reflected the coursework students completed in high school and was effective in predicting success in college. Students who took the recommended core high school curriculum (i.e., four years of English, three years of math at a level of algebra and higher, and three years each of natural and social sciences) were likely to score higher than those students who had not taken the core-required courses. In addition, students who took courses beyond the core requirements tended to earn even higher scores and were better prepared for college (National Data Release, August 20, 2003).

The ACT Assessment tests were scored on a range of 1-36 in each of the four areas with a composite score computed by averaging the four scores obtained in English, math, reading and science. The national average for the composite score in both 2002 and 2003 was 20.8. The average ACT scores in each of the four content areas for all students of the 2003 high school graduating class taking the ACT in 2002-2003 were 20.3 in English, 20.6 in math, 21.2 on the reading section, and 20.8 in science (ACT High School Profile Report: n.d.). The college readiness benchmarks included scores of 18 in English, 22 in math, and 24 in science (National Data Release, August 20, 2003).

Although the ACT Assessment test was used to predict college performance, Sharp (1984) noted the concern of using these scores to predict licensure examination outcome. The ACT test was taken when individuals were juniors or seniors in high school. This placed these scores at least two or more years away from the time the NCLEX exams were taken. In spite of this point, Sharp found college GPA and ACT math and natural science subscores to be predictive of NCLEX success.

The ACT social science reading subscore was found to have the greatest predictive value for NCLEX success (r = .48), followed by the ACT comprehensive score (r = .42) indicating a moderate correlation (Yang, Glick & McClelland, 1987). The ACT comprehensive score was also significantly related to nursing GPA and NCLEX success. The ACT comprehensive score accounted for four percent of the variance in nursing GPAs and fourteen percent greater variance in NCLEX scores than the other variables that were tested. Their research was performed with baccalaureate students who graduated between 1983 and 1985, prior to the pass/fail scores reported for the NCLEX outcome. Before 1988 NCLEX outcomes had been reported numerically with 1600 the highest score possible. Dichotomous pass/fail scores have been used since July 1988 (Waterhouse, Carroll & Beeman, 1993).

McClelland, Yang and Glick (1992) found ACT scores positively predicted students' performance on the licensure examination. The ACT comprehensive and each of the subscores were significantly related to NCLEX-RN outcomes. The ACT comprehensive score had the highest correlation coefficient, followed by the social science reading, English, natural science and math subscores respectively.

Lengacher and Keller (1990) included an analysis of ACT scores in their research related to predictors of NCLEX success. ACT scores in math and English were not predictive of a student's outcome on the NCLEX exam. Their study was in contrast to Sharp (1984) who found ACT math and natural science scores were significantly related to student's successfully passing the licensure examination.

Practical Nursing Education Program Variables

Ostrye (2001) urged that research to determine variables of student success in PN programs be conducted since these programs differ in many aspects from RN education. Variances noted between the PN and RN programs related to admission requirements, curricula, licensure examinations, and a larger number of older non-traditional aged students enrolled in PN programs. Due to these differences, it was not possible to generalize research findings from RN to PN educational programs. Ostrye defined success as students' satisfactory completion of a nursing education program, attaining an acceptable grade point average and passing the NCLEX-PN licensure examination.

Ostyre (2001) researched prediction of NCLEX-PN performance via the use of preadmission and program academic variables. Preadmission characteristics included use of remedial basic skills courses and sub-scale scores attained on the Psychological Services Bureau-Aptitude for Practical Nursing Examination. Programmatic variables incorporated students' scores in an identified medical-surgical nursing course and cumulative nursing GPA at the end of the PN program. When students who passed the NCLEX exam were compared with those who had failed, only minimal differences were reported between students who earned a high school diploma and those students who earned a General Education Development certificate. Approximately 9.5% of the students who obtained this certificate failed the NCLEX-PN exam compared to 7.6% of those who graduated from high school (Ostrye, 2000).

In Ostrye's (2000) study the variables that were significant for predicting NCLEX-PN outcome were programmatic and pre-admission in nature. These variables included cumulative nursing GPA, the natural science subscale test score on the

Psychological Services Bureau-Aptitude for Practical Nursing Examination and completion of remedial reading as a pre-admission requirement. Students with a higher natural science subscale test score and cumulative nursing GPA at the end of the nursing education program were more likely to pass the NCLEX-PN exam on their first attempt. It was also noted by Ostrye that students who were required to take the remedial reading course were less likely to pass the NCLEX exam than those students who did not take it. Students who failed to even complete the nursing education program were also more likely than those who had graduated to have taken remedial reading. In addition, no statistically significant relationship was found between a specified nursing theory course grade and performance on the NCLEX-PN exam.

Ostrye's research-based recommendations included an emphasis on maintaining the program's more open admission policy, with focused efforts to improve students' success following admission, in an attempt to assist them to attain higher GPAs by graduation. The recommendation was due to finding cumulative nursing GPA as the strongest predictor of NCLEX success and the realization programs would encounter major difficulties in making preadmission improvements that would contribute to NCLEX success.

Research conducted within practical nursing programs by Young-Richardson (1996) showed that the greatest amount of variance on the NCLEX-PN exam was accounted for by academic variables, rather than demographic variables. The academic variable of most importance was performance on assessment and National League for Nursing (NLN) achievement examinations. This variable accounted for 69% of the variance in NCLEX-PN outcome.

Registered Nursing Education Program Variables

Some of the same academic criteria that had been researched in terms of their application to PN nursing education have also been studied in regard to RN programs. Waterhouse and Beeman's (2003) analyses included the identification of high risk students by the high number of C or lower grades attained in designated nursing courses. A greater number of C grades in nursing courses were found to correlate with NCLEX-RN failure. Their analyses included substituting their equivalent nursing courses and student grades in the Delaware Risk Appraisal Instrument to predict students' likelihood of passing the NCLEX exam. By using course grades earned each semester, students were afforded consistent predictive feedback as they progressed through the nursing program rather than having to wait until they had reached the end of the program and were nearing graduation. Waterhouse and Beeman recommended incorporating ongoing feedback in lieu of pressuring high risk students at the end of the program, "at a point in their academic careers when they might be vulnerable or anxious, could weaken their self-confidence and increase their stress" (p. 38), of taking the NCLEX examination.

Results of prior research related to course grades earned in the major, GPAs and their relationship to NCLEX success were mixed. McClelland, Yang, and Glick (1992) discovered RN students' GPAs positively predicted student performance on the licensure examination. These GPAs included high school, prenursing and nursing, as well as GPAs calculated for courses in the major. Three GPAs were compiled according to cognate courses, including Chemistry-GPA, Biology-GPA and Sociology-GPA. All of the grade point averages were significantly related to NCLEX-RN scores. Morris (1999)

concurred with McClelland et al. noting nursing and cumulative grade point averages mildly correlated with NCLEX success.

Brennan, Best and Small (1996) noted that although students were classified as "low risk" when they entered the bachelor's nursing program, during the second year only sixty percent of the students were progressing without interruption. Students who were lagging behind had significantly lower grade point averages. The researchers advocated for the use of effective admission, progression, and graduation criteria in an effort to decrease attrition of nursing students.

Woodham and Taube (1984) found a significant relationship between NCLEX licensure outcome and grades students attained in each of their nursing education courses. They purposely did not determine the correlation of grade point average with NCLEX success, but predicted a relationship would exist since each of the course grades were found to be related to NCLEX outcome.

Admission variables that successfully predicted graduation 77% of the time included a combination of age, ethnicity, science and pre-nursing GPAs in research conducted by Byrd et al. (1999). Students with a higher cumulative science GPA were found more likely to complete the nursing education program successfully than students with a lower GPA. Upon completion of the first and second semesters of the nursing education program, course grades in pharmacology, social sciences, introduction to nursing and medical-surgical nursing courses were found to be successful in predicting graduation.

Mills et al. (1992) found cumulative exit grade point averages were the most useful for predicting NCLEX outcome. Students with a lower cumulative nursing GPA

of 2.0 (C) or 2.5 (C+) decreased their likelihood of successfully completing the licensing exam. Research reported by Endres (1997) indicated students who passed the licensure exam had significantly higher admission, nursing and cumulative grade point averages than students who failed the NCLEX exam. Discriminant analyses did not demonstrate these variables to be predictive of NCLEX performance.

Lengacher and Keller (1990) also found exit GPA along with the ACT comprehensive scores to be the best predictors of NCLEX success. Their study was conducted with associate degree RN nursing students. Although exit GPAs were found to be significant, the admission GPAs were not. Their findings of exit GPA being predictive of licensure exam success was also noted by Sharp (1984). Even though the licensure exam that was used in 1984 varied in format, students' grade point average at the end of the quarter prior to graduation was significant for predicting students' success passing the licensure examination.

A significant difference in the GPA as well as the frequency of obtaining grades of A and B versus grades of C in science pre-requisites and upper division nursing courses existed in Roncoli, Lisanti and Falcone's research (2000). Students who obtained more As and Bs, and consequently had a higher GPA were more likely to pass the NCLEX-RN licensure exam than those students who obtained grades of C and had a lower GPA.

Yang, Glick and McClelland (1987) studied stratified GPAs and NCLEX-RN outcomes. Students with a higher GPA were more likely to perform well on the licensure examination; the greatest gain in NCLEX scores occurred when GPAs ranged from 3.61 to 3.80 to 3.81 to 4.00. Other significant variables of NCLEX success included pre-

nursing GPA, clinical GPA, nursing GPA (at the end of the baccalaureate program) and total GPA.

Research regarding the relationship of GPA and NCLEX success has not always demonstrated a significant correlation. Briscoe and Anema (1999) compared students with grade point averages ranging from 2.25-2.45 with students whose GPAs were greater than 2.50. Their findings were different from other researchers', as they found no significant correlation between the two groups of students in terms of predicting NCLEX success.

Beeson and Kissling's (2001) research demonstrated that students who passed the NCLEX-RN exam were more likely to have higher biology and nursing GPAs at the sophomore level. Sophomore students who even attained one C grade during this academic year were more likely to fail the NCLEX-RN exam later. As students progressed through the junior year and earned more C, D and F grades, their NCLEX pass rates declined further. Students with only one C grade or below had an NCLEX pass rate of 84%; three or more grades of C or less dropped the NCLEX-RN pass rate to 51%. Students who never achieved a grade of C or below had a pass rate of 97%. When Beeson and Kissling compared NCLEX passers and failers, they found those who passed had significantly higher cumulative and nursing GPAs at the end of each of the sophomore, junior and senior years.

The use of ranked versus unranked admission criteria in associate degree RN programs was the focus of Roberts' (2002) dissertation. She discovered a decreasing trend in the use of ranked admission criteria (prerequisite GPA, Mosby Assess Test, National League for Nursing Assessment Test scores and work related experience) from

1992 through 1996 in the fifty statewide community colleges she researched. During this five year period there was an increasing use of nonranked criteria such as the use of a lottery, interview and admission essay. Colleges using ranked criteria decreased from 60.4% to 28.5%, as more schools began to use a nonranked lottery method or a combination of ranked and nonranked criteria.

The relationship of these admission selection changes to student success in the nursing education program and pass rate on the NCLEX-RN examination were measured. Roberts noted the rate of students graduating ranged from 72.3% to 75%, with a significant difference in the rate of graduation between programs that utilized all or partially ranked admission criteria versus those that used unranked methods. The percent of graduating students from programs using ranked criteria were consistently higher than those from programs using nonranked criteria in all five years of the survey. The annual NCLEX pass rate also declined during the five-year period, ranging from 92.8% to 85.1%. Statistical analyses revealed a significant increase in NCLEX failure in those schools which changed their admission criteria from ranked to nonranked methods.

Tests to measure significant differences on NCLEX success of graduates between programs with ranked versus unranked admission criteria indicated no significant differences. Roberts stated, "Percentages varied a little more than 4.0 percent in any given year, and no selection procedure consistently rated a higher percentage for the five year period" (p. 113). Roberts concluded fair ranked selection criteria should be established that would ensure student success for graduation and maintenance of program integrity by utilizing methods to select students who were more likely to succeed than those who were sure to fail. The use of nonranked criteria proved detrimental to the

students and the programs when the students were unable to complete the nursing education program.

Horns, O'Sullivan and Goodman (1991) noted students' characteristics of success during their academic career from years two through four in their nursing education made a difference in their being successful when it came to completing the NCLEX examination. Sixty-seven percent of the variance in NCLEX-RN scores was due to admission GPA. Other characteristics in rank of variance included race, and numerical grades achieved in courses during the second, third and fourth years of the program. The results of this study led to the recommendation for screening students earlier in their nursing program in order to intervene effectively for students identified as being at risk for failing the NCLEX exam.

Graduation grade point index (r - .248) was the most significant predictor of NCLEX success in a study completed by Waterhouse, Carroll, and Beeman (1993). The other significant correlates to NCLEX success included in this study in descending strength were the first senior nursing course grade, pathophysiology course grade, sophomore grade point index, SAT verbal score, physiology grade, second junior nursing course grade and SAT math score. These variables were used to construct a model for predicting NCLEX outcomes that was successful 91% of the time.

In a follow-up cross validation study conducted the following year by Waterhouse, Bucher and Beeman (1994), significant predictive variables were again identified and resulted in 84% accuracy in predicting the likelihood of NCLEX pass/fail outcomes. Although the percentage of students' predicted NCLEX outcome was lower, it was attributed to significant differences between the two samples. The 1991 and 1992

graduates had significant differences in SAT scores, high school percentile and physiology and nursing course grades. The latter graduates were more likely to take a review course, to have been on probation and to have changed their majors. There was no significant difference between the two groups' NCLEX pass rates. The authors stressed the need for faculty to develop and use scientifically sound predictive equations for students' NCLEX outcome in order to identify at-risk students more confidently and earlier within the nursing education program to allow for remediation.

Beeman and Waterhouse (2001) also discovered a relationship between nursing theory course grades and NCLEX-RN success. The strongest correlation was inversely demonstrated between the number of nursing theory course grades with a C+ or lower and NCLEX success (r = -.394). The other variable inversely correlated with NCLEX success was the number of clinical course grades with a grade of B or lower (r = -.261). Of the twenty-one variables studied, three of them (including gender, SAT verbal and age upon graduation) were not significantly correlated with passing or failing the licensure exam. The remaining variables that were correlated with NCLEX success included specified nursing course grades, course grades within the major and GPA. The GPA for senior students at the end of their first senior semester demonstrated a correlation of .321 ($p < .05$). GPA correlations were calculated at this point to identify students at risk of failing the licensure exam and still allow five months for remediation prior to program completion. When comparing the students who passed the NCLEX-RN with students who failed, those who passed had significantly higher didactic course grades, GPAs, and a lower frequency of low theory and clinical course grades ($p < .0001$). Using a discriminant analysis method for the independent variables, Beeman and Waterhouse

(2001) were able to correctly predict pass rates 94% of the time and failures 92% of the time.

Prior earned GPAs used to assess students for admission to an associate degree program were researched by Yin and Burger (2003). When the students were divided into two groups, those who passed the NCLEX exam and those who failed, GPA prior to admission, introductory psychology grade and natural science grades were significantly different for those who passed. Natural science GPA related to anatomy, physiology, chemistry and microbiology course grades. They found the admission GPA to be the most significant predictor of students' NCLEX success. Other significant predictive variables included introductory psychology grade, natural science GPA and high school rank. Variables that did not correlate to NCLEX success included high school GPA, ACT comprehensive scores, English course grades, ethnicity, age at the time of admission and gender. Yin and Burger stressed the use of the earlier determined GPA rather than using GPAs upon graduation when there is limited to no time left to provide for student remediation.

Endres (1997) demonstrated students' admission, nursing and cumulative GPAs of graduates who had passed the NCLEX were significantly higher than those of students who failed. Students who earned grades of Ds and/or Fs in nursing courses were also more likely to fail the licensure examination. GPAs in medical-surgical nursing courses and the age of the students (at the time of taking the licensure exam) made no significant difference on the outcome of the NCLEX examination.

In research conducted in the practical and associate degree nursing ladder program at Western Michigan University, Johnson (1986) recognized the need to

research variables predictive of NCLEX success based upon the variety of admission, progression and graduation criteria used by the program. The focus of her research was to determine the existence of relationships between these criteria and success of practical nurses admitted to the associate degree RN completion program. She found cumulative and nursing theory and clinical course GPAs in practical nursing (PN) education were positively correlated to NCLEX-RN outcome. The theory PN grade point average demonstrated the strongest correlation, followed by the overall GPA in the practical nursing education program. These admission GPAs were also positively correlated to academic achievement in the RN completion program in terms of theory and clinical GPA outcomes.

Performance Variables

The performance variables that were researched pertained to the achievement and assessment tests that were used in the respective nursing education programs. The PN program achievement exam included the CTCNP-PN examination and the assessment test used was the Sandra Smith's NCLEX PN/VN Assessment Test. The CTCNP-RN and the HESI Exit Exam were the respective achievement and assessment examinations used in the RN program.

Critical Thinking in Clinical Nursing Practice – PN Examination

The Critical Thinking in Clinical Nursing Practice - PN Examination was one of a variety of achievement tests published by the National League for Nursing. The exam used was a 120-item pen and paper, multiple-choice exam that was given to students nearing the end of their practical nursing education program. The purpose of the test was

to assess the critical thinking ability of graduating nursing students as defined by the National League for Nursing.

In addition to CTCNP-PN total test score reports, faculty and students were provided subscale scores to reflect critical thinking skills, nursing process, specified content areas and safe, effective care management feedback. The critical thinking skills included in the exam were interpretation, analysis, evaluation, inference and explanation. The nursing process content areas included four of the five steps of the nursing process: assessment, planning, implementation and evaluation. This section excluded the step of analysis, which is reserved for the registered nurse. Specific content areas of the exam incorporated legal/ethical, communication, and quality improvement/health care systems, cultural/spiritual, leadership/management, health promotion/illness management, and client education/empowerment (National League for Nursing – Assessment and Evaluation, Performance Report, May 2004).

The CTCNP-PN total test score report reflected the raw number of questions the student answered correctly out of the 120 total test items. Subscale score reports included advisory scores, which identified areas of strength and weakness for individual students in each of the content areas. Students were able to use this information to focus their NCLEX preparation efforts on the areas identified as weaknesses in order to customize their studying. These reports also incorporated a norm group comparison with the median percent correct reported. Students who had an advisory score less than the norm group median score were forewarned that these areas were weak subscale portions of the examination that warranted students' further review and study. Furthermore, the National League for Nursing recommended the test results not be used as a "sole measure

of an individual's proficiency in critical thinking" (Critical Thinking in Clinical Nursing Practice LPN Examination, p. 4). Rather, the National League for Nursing advocated that the feedback should be used as just one component of a comprehensive program for measuring students' performance.

In addition to individual student test performance reports on the CTCNP-PN exam, schools of nursing also received a class summary report for the class as a whole, along with item descriptors and a listing of questions answered correctly, incorrectly or omitted. Faculty were cautioned to realize the content of the exam reflects "only a sample of all the possible questions that might have been included from the field being tested" (National League for Nursing, Item Descriptors: Critical Thinking in Nursing OTACHI 38-4501 LPN Exam, p. 1). Therefore, faculty were encouraged to use their professional discretion when using this information to determine whether to make course or curriculum changes.

Sandra Smith's NCLEX Practical Nurse / Vocational Nurse Assessment Test

The Sandra Smith's NCLEX PN/VN Assessment Test was published and marketed by National Nursing Review. The Sandra Smith examination, now in its sixth edition, was taken by sophomore nursing students to assess each student's level of academic achievement and preparedness for taking the NCLEX-PN. The examination had previously been recognized by faculty and nursing school administrators for its' predictive value for measuring NCLEX readiness.

The Sandra Smith exam was a pencil and paper examination that included 240 questions. The content of the test was reflective of 22 categories that related to the subject matter of the NCLEX-PN Test Plan (Smith, 2004). One advantage of the Sandra

Smith exam was that upon completion of the test, individual students received a Student Performance Summary and Student Resource Booklet that provided customized feedback for the individual's continued NCLEX-PN preparation.

The Student Performance Summary included a synopsis of the student's test performance, as well as the number and percent of questions answered correctly and incorrectly. The content areas provided in the Summary replicated the 22 NCLEX-PN topic areas of the NCLEX-PN test plan.

> A recent survey by National Nursing Review determined that a high proportion of those who scored 57% or higher passed NCLEX on their first try. A small number who scored above 60% did not pass. Sandra Smith recommends that all students should pay attention to their weaker areas, and students who score less than 60% should review more thoroughly their areas of relative weakness prior to taking NCLEX for the first time. (Sandra Smith's NCLEX PN/VN Assessment Test, Instructor Guidelines, p. 2)

The recommended national threshold score indicative of graduates' preparedness to take the NCLEX-PN licensure examination was 60%. The national average was inclusive of results of students' taking the Sandra Smith examination from college and university, private, degree and certificate awarding practical nursing education programs. "In 2003, three fourths of the groups scored between 60 and 65%. Most of the remaining groups scored between 57% and 59%" (Sandra Smith's NCLEX PN/VN Assessment Test, Instructor Guidelines, p. 1).

Students were provided with materials they could use to continue their NCLEX preparation after taking the Sandra Smith exam. The Student Performance Summary

included a list of questions that the student answered incorrectly, the answers the student's provided and the correct answers. Each student received a Student Resource Booklet, inclusive of a compendium of each of the 240 questions, correct answers and the related rationale for each answer. Students were able to analyze their own performance and focus their continued NCLEX preparation strategies on their weaker content areas. The Student Resource Booklet also included a description of the type of questions asked on the NCLEX exam, a review of the NCLEX format and test procedure as well as guidelines for continued preparation and test-taking strategies (p. 3).

Faculty received a Group Performance Summary, which included a synopsis of areas of strength and weakness for the overall class performance. The class' composite score, group norm comparison with other schools, individual student scores, along with each of the questions and the percent of students who answered each question correctly were provided to each school. This information was valuable to faculty to determine whether or not content areas were covered in the program and whether or not curriculum changes should be made.

Critical Thinking in Clinical Nursing Practice – RN Examination

The National League for Nursing also published the CTCNP-RN achievement test for measuring a student's critical thinking proficiency near the completion of RN education programs. The exam included 120 multiple-choice questions that assessed critical thinking within the context of the practice of nursing. Senior students used the CTCNP-RN examination approximately one month prior to graduation. The score reports provided for RN program faculty and students were similar to those provided for practical nursing program participants, with the exception of additional content in the

areas of research, quality improvement and health care systems areas. More questions were included in these categories on the CTCNP-RN exam than on the CTCNP-PN test.

Morris (1999) studied the correlation of a critical thinking score with students' success on the NCLEX licensure exam. Although the critical thinking test she used was different from the National League for Nursing test, the research demonstrated a positive correlation between the California Critical Thinking Skills Test score and graduate's success passing the NCLEX-RN exam.

Health Education Systems Incorporated (HESI) Exit Exam

Health Education Systems Incorporated produced an array of assessment examinations for both practical and registered nursing education programs. The HESI Exit Exam was developed to assess students' preparedness for the NCLEX-RN licensing exam near the completion of their educational program (Morrison, Adamson, Nibert & Hsia, 2004). The HESI Exit Exam is available to any registered nursing education entity that educates associate degree, bachelors or diploma prepared students who will take the NCLEX-RN licensure examination.

The 160 critical thinking-item examination was published in four versions to allow for multiple re-testing within the same semester. Ten of the items on the exam were pilot questions and did not impact student's scores. Follow up tests were encouraged to evaluate students at the end of the semester for their preparedness to take the licensing exam. Further testing is available as needed to re-assess remediated students as well as measure the success of the remediation programs that were implemented.

Morrison et al. (2004) described the HESI exam scoring process as:

> The HESI Predictability Model, a proprietary mathematical model, is used to calculate scores for HESI specialty exams and HESI exit exams. All scores provided by these HESI exams are based on the application of this model to the raw data. Test items are *individually* weighted based on their difficulty level, which is determined by dividing the number of correct responses to the item by the total number of responses to that item, thereby deriving a percentage of correct responses to the item. Each HESI specialty exam and HESI exit exam also provides a *conversion score*. This score is presented as a percentage that reflects the *average* weight of all the test items on an exam and the *average* weight of the test items answered correctly. Therefore, this conversion score is a weighted percentage score that faculty can include as a part of the student's final course grade. (p. 222)

Reports of the test results were provided to both the students taking the examination and the respective nursing education programs. The assessment exam was inclusive of 31 content areas that included the nursing process, NCLEX-RN Test Plan categories, and outcome areas as defined in accreditation guidelines from the National League for Nursing Accrediting Commission and the Council of Colleges of Nursing Education categories. Multiple nursing content areas in the exam included critical care, psychiatric, fundamentals, management, maternity, math, medical surgical, operative, pediatric nursing and physical assessment. These nursing content areas were further subdivided to cover the broad realm of nursing within the specified categories (HESI. Exit Exam-E78 Results Scoring Information).

The HESI Exit Exam demonstrated a high degree of accuracy in its predictive value of the NCLEX-RN outcomes regardless of the associate, diploma or bachelor degree preparation of registered nursing students. Nibert and Young (2001) found the exam "continued to exhibit an extremely high degree of accuracy in predicting NCLEX success regardless of the type of program tested: ADN, BSN, diploma, or PN" (p. 176).

The reliability and validity of the HESI Exit Exam was well established as reported recently by Morrison et al. (2004). A Kuder Richardson Formula 20 measure of reliability was recalculated each time the HESI exam was used. The four versions of the Exam had high estimated reliability coefficients (KR-20) ranging from 0.940 to 0.960 (p. 223). Validity of the exams was also measured on an ongoing basis by evaluating content, construct and criterion-referenced validity. These steps were taken to assure the exam effectively measured basic nursing knowledge and skills of graduates at the level of entry into the profession of nursing. The format for the constructs measured in the HESI Exam replicated that of the NCLEX licensure exam test blueprint, as identified by the National Council of State Boards of Nursing. The HESI Summary Reports provided to students and faculty identified individual and aggregate areas of strength and weakness.

Student's test results were provided as a numerical HESI Predictability Model (HPM) score; it is not a percentage score. The HPM reflected application of a mathematical proprietary model applied to students' raw scores to include the difficulty level of each question. The HPM score allowed for an individual's score to be compared with all other test takers within the United States. S. Morrison (personal communication, July 13, 2004) explained the HESI score was multiplied by 10 so faculty would be less likely to confuse the HESI score with a percentage score. Conversion scores were also

developed for programs that use HESI Exit Exams as a portion of student's nursing course grades. "For example, your 2003 HESI score of 85 (it is NOT a percentage score, but rather uses the HPM) is reported in 2004 as 850."

Scoring categories were reported for each student taking the HESI exam, with A being the highest category and H the lowest scoring category. Scoring intervals for each student taking the exam were assigned to each of the alphabetical categories. Nibert, Young and Adamson (2002) reported scoring intervals as:

A/B Scores	90.00 - 99.99
C Scores	85.00 – 89.99
D Scores	80.00 – 84.99
E/F Scores	70.00 – 79.99
G/H Scores	$\leq$ 69.99.

The 2002 data revealed that as students' scoring intervals decreased their incidence of failing the NCLEX licensing examination increased. The recommended achievement score was 90, with an acceptable reported score of 85. As few as 1.70% of the students who scored in category A/B failed the NCLEX, with 5.92% in category C, 10.82% in category D, 23.72% in category E/F, and 50.19% in the lowest scoring category G/H, also failed. There were no significant differences noted in these results for students from the various registered nursing educational programs, that included associate and bachelor degree as well as diploma programs.

Since research regarding the predictive accuracy for all participants taking the HESI Exit Exam was begun (RN and PN students), the accuracy progressively increased from 97.78 to 98.46%. The latest predictive accuracy score for RN program students

reported by Nibert, Young & Adamson, (2002) was 98.30%. More recently, Morrison et al. (2004) noted that for the last four consecutive years, data revealed a 96.36% - 98.46% accuracy rating in predicting NCLEX success in both registered and practical nursing education programs. In addition they demonstrated a 96.42% to a 100% rate of predicting NCLEX-RN licensing exam failure (p. 225).

Nibert et al., (2002) reported students who received a score of less than 85 were advised by Health Education Systems Incorporated to be seriously remediated prior to taking the NCLEX licensure examination. Because the HESI Exit Exam was a computerized exam, students were able to receive their scores as soon as they finished testing. The results enabled the students to begin remediation efforts immediately. When areas of weakness were outlined in the test results they served as a motivating factor that encouraged the students to obtain additional knowledge to reduce their risk of failing the licensing examination.

Faculty monitoring during administration of the HESI Exit Exam was found to significantly impact students' scores in 1996-1997 and in 1997-1998. Monitoring, defined as having a faculty or faculty-designated proctor in place during the exam, resulted in scores being 99.49% accurate in predicting NCLEX success. When a proctor was not in place to maintain security of the testing process, it was assumed students did not take the exam seriously and chose answers randomly. The predictive accuracy dropped significantly lower to 96.82% ($p = .05$) when students' testing was not monitored. Several of the low scoring students (69% and below) who were not monitored during the exam attained scores that were less than those they could have attained by chance alone. This finding emphasized the importance of having a proctor

available during the exam to influence students' attempts in making a concerted effort to take the exam seriously (Newman, Britt & Lauchner, 2000).

It was also noted in Nibert and Young's study that when low students' scores were used against a benchmark to determine the need for remediation, significantly fewer students failed the NCLEX exam than when compared to students' in programs that did not establish remediation benchmarks. Of the 79 low scoring students who reported the use of benchmark scores and remediation practices in their educational programs, 41.77% failed when they took the licensure exam. In contrast, 61.90% of low scoring students who did not have access to required minimum scores and established remediation programs in their nursing program failed the NCLEX-RN exam.

Nibert, Young and Adamson (2003) reported many schools chose to use the benchmark score for progression at 85 rather than 90. In response to this maneuver, HESI researchers conducted a validity study to further separate categories of students' achievement to assess risk of NCLEX failure. Their findings in validity studies conducted in 2003 indicated 98.3% of students scoring in categories A and B (predicted to pass NCLEX) were successful in passing the licensing exam on their first attempt, while students who scored in category G and H had only a 49.81% rate of passing the NCLEX exam on their first attempt.

Lauchner, Newman and Britt (1999) strongly advocated for college and universities' use of the HESI Exit Exam. Their rationale included the results can be used by nursing faculty to measure curricular outcomes, evaluate students by using test questions that were challenging at the application, analysis and critical thinking levels, and student scores can be compared in all content categories with all students who

previously took the HESI Exit Exam. Other advantages they emphasized were the immediate feedback received by students and the score summaries that were provided to the nursing education programs. The summary included individual and group results in each of the testing categories with a comparison performance analysis with students throughout the United States who answered the same questions. These comparisons were useful to students to guide their remediation efforts prior to taking the NCLEX-RN examination as well as to faculty for conducting curriculum evaluation.

Use of Data for Establishing Remediation Plans

Nibert et al., (2002) reported successively declining pass rates for the NCLEX-RN and NCLEX-PN from 1995 through 2000. The pass rate for graduate nursing students taking the NCLEX-RN exam declined from 90.2% to 83.8% in 2000 during this interval. The premise of using the HESI examination is to identify students who are at risk of failure as early as possible to allow for remediation and review prior to taking the NCLEX licensing examination. Morrison et al. (2004) reported that because of the consistent accuracy in predicting NCLEX outcome, more and more nursing education programs were choosing to use the HESI Exit Exam scores as a benchmark for student remediation and the development of progression and graduation criterion.

Some colleges and university nurse administrators reported using HESI benchmark scores attained by students as a measure for instituting progression and remediation strategies and policies. Specifically, 45 of the 158 participating RN program administrators (30.20%) indicated they had adopted progression policies regarding graduation and permission to take the licensing examination based on students' HESI Exit Exam scores (Nibert et al., 2002). Thirty five of these participants reported the

required benchmark score of 85 in order to progress, six required a benchmark of 86-90, and only two administrators reported using scores less than 85, with 77 being the reported lowest acceptable score. Nibert, Young and Britt (2003) reported schools' utilization of consequences related to benchmark scores as an incomplete or failing grade in the capstone course (34.29%), denial of progression to graduation (51.43%) and 14.29% denying program approval to be eligible to take the NCLEX licensing examination.

Morrison et al. (2002) interviewed administrators from five of the schools of nursing regarding their establishment of progression and remediation policies based on students' HESI examination performance. Policies ranged from withholding graduation or permission to take the licensing examination based upon students' minimum HESI scores. Remediation efforts included encouraging students to prepare based on the feedback provided in their scoring summary, meeting with faculty to discuss content areas, use of computer assisted test item review programs with faculty assistance, faculty re-teaching content areas and individual assignments customized to students' deficient content areas. Although strategies were developed to increase NCLEX-RN pass rate for these schools, "All schools reported that students often did not avail themselves of the resources provided" (p. 95). In spite of this report, each of the administrators reported an increase in NCLEX-RN pass rate within two years of implementing the progression and graduation policies.

Of the five schools studied, two offered two separate nursing programs for a total of seven programs participating. The pass rate increased 9% to 41% in the seven programs, with a reported range of NCLEX graduate success from 88% to 97%. It was concluded that the implementation of the policy alone may have been sufficiently

motivating to encourage students to individually prepare on their own time via a preferred means. Students were inspired to make an extra effort in order to graduate, be approved to be eligible to take the licensure exam, and successfully pass to obtain their RN license.

When the researchers investigated the effectiveness of remediation programs, 20 programs reported at least some if not all RN students who were remediated were successful in passing the NCLEX-RN licensing examination. Fifteen of these 20 programs indicated that all of their students who were not successful on their first attempt were indeed successful on their second attempt at taking the licensure examination.

Remediation strategies may be provided within nursing education programs or they may focus on licensing exam preparation strategies. Yellen and Geoffrion (2001) described strategies implemented in their ADN program based upon steadily decreasing NCLEX-RN pass rates. Specific strategies they incorporated were based upon a retrospective review of graduates from 1996-1999. Identified approaches included referrals for reading remediation upon admission based on entrance reading exam scores, intensified student advising, offering additional assistance and carefully tracking students' academic progress throughout their nursing education program. Teaching and learning revisions included the implementation of selecting texts based upon their ease of reading, incorporating more teaching/learning strategies to capture visual, auditory and participatory learners, and enhanced curriculum development.

Newman et al. (2000) advocated the establishment of intentional benchmark scores for the HESI Exit Exam to assist students in becoming successful when they take the licensure exam for the first time. Although the authors did not specify types of

remediation strategies to be implemented, nor do they identify proper resources to be used, they did encourage ongoing research in these areas to promote students' success.

The decision to require remediation strategies as opposed to simply recommend activities to the students was controversial. When recommendations were made to students for referrals, students reported choosing not to follow up, handling their situations in an alternative fashion, or keeping their follow up confidential (Gallagher, Bomba & Crane, 2001). For this reason, Beeson and Kissling (2001) stressed requiring remediation strategies rather than making them voluntary. The rationale they cited for this recommendation were students' poor study habits and problems noted with attendance and punctuality. Suggested remediation strategies included teaching test-taking strategies and positive study habits, computerized NCLEX review, intensified capstone clinical experiences with seniors placed with baccalaureate prepared preceptors and individual counseling as needed.

Summary

Research in practical and registered nursing education programs pertaining to demographic, academic and performance variables to predict students' success in nursing education and the likelihood of passing the NCLEX licensure exams has varied widely. Criteria that have been studied in terms of measuring success included both quantitative and qualitative characteristics. In addition, previous studies have focused on practical and registered nursing education programs.

Researchers varied in terms of how they interpreted success in nursing education with the focus being placed upon successful completion of the nursing education program, passing the licensure examination on the first attempt, or both of these

outcomes. More specific factors that have been studied have included gender, age, race, healthcare work-related experiences, method of high school completion, grade point average requirements and numerous achievement and assessment tests. These factors have been studied to ascertain relationships with nursing education and licensure examination success in efforts to establish models to predict success for nursing students.

Findings related to demographic variables such as age, gender and past experiences varied in their effect on student success in nursing education. More definitive findings related to academic variables such as grade point averages, specific course grades and achievement and assessment exam scores have been linked to success in nursing education programs as well as positive outcomes on the NCLEX-PN and NCLEX-RN licensure examinations.

The majority of studies that have been reviewed have revolved around the unique characteristics of the program and student populations being studied. The research findings were useful for providing information to make potential changes in programs' admission, progression and graduation requirements. It behooves nurse educators to conduct action research within their programs to identify variables that may predict students' success.

CHAPTER III

METHODOLOGY

The purpose of the study was to explore the relationships of demographic and academic variables to students' success. Success included students' performance in respective practical nursing (PN) and registered nursing (RN) education programs as well as the pass/fail outcome on the National Council Licensure Examination for Practical / Vocational Nurses (NCLEX-PN) and the National Council Licensure Examination for Registered Nurses (NCLEX-RN). This chapter describes the (a) selection of the samples, (b) collection of data, (c) scoring of the data, (d) tabulation of the data, and (e) selection of appropriate statistical tests.

Selection of Samples

Two convenience samples were selected for this study. The first included PN program graduates from 2000 through 2004. Only students who had graduated in the month of May from the associate degree program during the selected five-year period of time and had completed the NCLEX-PN licensure examination were studied. There were a total of 125 graduates in this sample. However, those students who were not high school graduates and completed a General Education Development (GED) certificate in lieu of high school graduation were excluded. This resulted in five graduates being removed from the sample for a final total of 120 participants. Participants who had a GED were also eliminated because they did not have a high school GPA and there were too few students in this category to analyze data on the GED admission requirement.

The second sample consisted of RN program graduates. These participants also graduated in the month of May from 2000 through 2004 and completed the NCLEX-RN licensure examination. There were a total of 93 participants in this sample.

Collection of Data

Approval to conduct the research on human subjects under the exempt category was received from the Institutional Review Board of the Research and Program Development Office of the University of North Dakota on June 25, 2004. In addition, written permission to examine the academic records of the respective graduates was obtained from the university's Vice President for Academic Affairs. The letter granting permission is included in Appendix A. Assurance was provided that the subjects' anonymity would be protected during the data collection processes by using a random coding method in lieu of participants' names or identification numbers.

Graduate data were gathered from the permanent computerized and written academic records maintained for students in the registrar's office as well as the department of nursing. Graduate's performance data (related to scores attained on respective assessment examinations) were gathered from the examination record files in the nursing department. Graduate's names and identification numbers were used only for initial retrieval of records and were later deleted to protect confidentiality of the participants. Data were collected confidentially within Microsoft Excel spreadsheets for the respective nursing education programs and coded for analysis purposes when necessary.

The primary dependent variable was the outcome on the relative NCLEX licensure examination for each participant. Pass/fail results were gathered for each

graduate's first attempt at taking the licensure exam. These results were obtained from the National Council of State Boards of Nursing quarterly reports forwarded by the state board of nursing to the university's department of nursing. The NCLEX outcomes for the May 2004 graduates were also obtained from the NURSYS internet website. Graduates who successfully completed the NCLEX licensure exam and were licensed by the state board of nursing were listed in the NURSYS database. This allowed the researcher to complete the data collection process sooner for the May 2004 graduates, since the quarterly report issued by the National Council of State Boards of Nursing would not have been available until after September 2004.

Scoring of the Data

Each of the independent and dependent variables studied were specific to the respective practical and registered nursing education program being studied. This section describes the processes used in scoring the data relative to each of the operational definitions of the variables studied as they pertained to the nursing education programs.

Practical Nursing Education Program

The majority of data related to the pre-entrance and academic variables were available in the student files in the department of nursing. In those cases where students had transferred to the university, the department file did not contain all of the necessary information. Official student files were accessed as needed in the registrar's office to ascertain American College Test (ACT) Assessment scores and high school grade point averages (GPAs) from transfer student's records.

The pre-entrance demographic variables for the PN graduates included age, gender and the number of previous semesters of college. Age was recorded for each of

the students as their age at the time they began the PN education program. Gender was coded as 1 for female; 2 for male. The number of previous semesters in college included the total number of semesters of college completed by graduates prior to admission to the PN program. Some student transcripts indicated prior college completed on a quarterly basis, rather than by semesters. The total number of quarters completed was converted to semesters by awarding one third semester for each quarter completed and was rounded to the nearest whole number.

The pre-entrance academic variables included high school graduation GPA, and ACT comprehensive, math and science scores from the high school transcript. GPAs were recorded numerically on the 4.0 scale. The transcripts were obtained from the admission files within the nursing department. In the case of transfer students where high school GPA was not previously recorded or calculated for admission purposes, the data were obtained from the official high school transcripts on file in the registrar's office and/or calculated when needed on the 4.0 GPA scale. In rare cases when a transfer student came to the university with more than 24 credit hours completed, high school transcripts were not required and, therefore, not available for this research.

Relevant ACT scores were also obtained from the high school transcripts in the student files within the nursing department when able. Again, when students transferred to the university to complete the practical nursing education program, this information was gathered from official high school transcripts filed in the registrar's office. Scores were recorded numerically for each of the participants' ACT comprehensive, math and science test scores, with possible scores ranging from 1 to 36. When participants had two

sets of ACT scores, the data recorded were those of the second ACT testing, closest to the point of high school graduation.

Not all graduates had ACT scores available. Those students who transferred to the university with 24 or more credit hours and/or were born before 1975 were not required to report or have taken the ACT exam if they had not done so. The ACT scores were missing from the data set in these cases.

The performance variables for the practical nursing sample included student's scores attained on the Critical Thinking in Clinical Nursing Practice – PN (CTCNP-PN) Examination and the Sandra Smith's NCLEX PN/VN Assessment Test, graduation grade point averages, and NCLEX-PN Exam results. The NCLEX-PN licensing exam result (pass or fail) consisted of the graduate's first attempt at taking the examination following graduation from the PN program. Results were recorded as 1 for pass and 2 for failure on the licensure examination.

The scores recorded for the CTCNP–PN and the Sandra Smith's NCLEX PN/VN Assessment Test included the scores attained by the graduates when they were tested near the end of the PN education program. The CTCNP-PN scores were available for only three years of the five years being studied. Students who graduated from May of 2002 through 2004 completed the exam, which included 65 of the 120 participants in the total sample. These total test scores reflected the raw number of questions answered correctly. The maximum score possible on the test was 120.

Scores reported for performance on Sandra Smith's NCLEX PN/VN Assessment Test included the student's percentage of the total number of questions answered correctly. There were a total of 240 questions posed on the assessment examination, and

students' scores were reported by National Nursing Review as the percent of those questions answered correctly. Each of the graduate's percentage test scores were collected from the official test score files in the department of nursing.

The graduation GPAs included both cumulative and nursing GPAs on the 4.0 scale for each of the graduates. The cumulative GPA included all college and university credits completed at the time of graduation from the PN education program. The graduation nursing GPA included only nursing courses completed prior to and during the PN program. Those nursing courses taken by transfer students prior to entering and completing the PN program being studied were also included in the nursing GPA calculations. These GPAs were obtained from the graduation records of the students within the department of nursing.

Registered Nursing Education Program

Since the RN program is a separate degree completion program for nurses who have already completed some nursing education and have previously obtained a nursing license, the admission, progression and graduation criteria and assessment tests that are used were different from those used in the PN program. The source of data for the admission and performance variables for the RN program participants was student's academic records maintained by the nursing department.

The admission demographic variables included student's age, gender and the number of previous semesters of college completed prior to admission to the RN program. Participant's age was recorded for each of the students as their age at the time they began the bachelor degree program. Gender was coded as 1 for female; 2 for male. The number of semesters previously completed for participants in the RN program was

totaled in the same manner as that used for the PN education program graduates. The total recorded included the number of semesters completed by students prior to their admission to the RN nursing program.

The admission academic variables included graduate's admission GPAs inclusive of both nursing and cumulative GPAs as calculated on the 4.0 scale. The cumulative GPA included all previous college/university course work, taken before admission to the RN program. Since this was a completion nursing program which admits licensed nurses wanting to complete a bachelor degree, each student also had an exclusive nursing GPA from the preceding nursing education program. The admission nursing GPA included any nursing courses the student had completed prior to admission to the RN program.

The performance variables for the RN sample included student's scores attained on the Critical Thinking in Clinical Nursing Practice – RN (CTCNP-RN) Examination and the Health Education Systems Incorporated (HESI) Exit Exam, graduation GPAs and NCLEX-RN licensure examination outcomes. The data source for the performance test scores were the official test files maintained within the nursing department. Scores on the CTCNP-RN Examination included the scores attained by students near the end of the RN nursing program. These test scores reflected the total raw number of questions answered correctly by the student. The maximum score possible was 120.

The CTCNP–RN Examination was not administered during each of the five years which encompassed the study. Scores were available for only three of the years from 2002 through 2004, when students were tested within one month of graduation. Therefore, scores were available for only 52 of the total number of graduates ($N = 93$) in the sample being studied.

The HESI Exit Exam was utilized during only the fourth and fifth years of the timeframe of the study, and pertained to a total of 32 graduates in the RN sample. The examination may be utilized more than once in a semester to assess student's progression of knowledge and preparedness for taking the NCLEX licensure examination. The HESI Exit Exam scores used in this study were the scores attained by students during the final test administration that occurred within one month of graduation. The scores recorded for the HESI Exit Exam were the HESI Predictability Model (HPM) scores reported by Health Education Systems Incorporated. HPM scores were based on the proprietary model established to include individually weighted scores based upon the level of difficulty for each of the test items answered during the test. The maximum HPM score possible was 1500.

The graduation GPAs included both cumulative and nursing GPAs for each student. The graduation cumulative GPA included all college/university course work previously completed by the student and the graduation nursing GPA was inclusive of only those nursing courses taken during the bachelor degree registered nursing program. Both GPAs were scored on the 4.0 GPA scale.

The NCLEX-RN licensing exam result (pass or fail) consisted of the graduate's first attempt at taking the examination following graduation from the RN education program. Scores were obtained from the National Council of State Boards of Nursing quarterly reports, forwarded by the state board of nursing to the nursing department. Results were recorded as 1 for pass and 2 for failure. The NCLEX-RN outcome results for the May 2004 graduates were also obtained from the NURSYS internet website as previously described for the PN program sample.

Tabulation of the Data

The numerical data gathered for each of the pre-admission, academic and performance independent and dependent variables were entered into Microsoft Excel spreadsheets. Spreadsheet databases were developed for each of the practical and registered nursing program samples being studied. Copies of the tables used to collect the data are located in Appendix B (PN program) and Appendix C (RN program).

Selection of Appropriate Statistical Tests

Descriptive statistics were used in order to summarize data for each of the variables used in this study and to describe both the practical and registered nursing education program samples. The descriptive statistics included the frequency for each of the variables, the minimum and maximum values, means and standard deviations of the independent variables.

The frequency of the pass/fail outcome scores on the NCLEX licensure examination for the RN program sample was also tabulated. This procedure was not performed for the PN education program sample since 100% of the participants ($N = 120$) who graduated in May from 2000 through 2004 passed the NCLEX-PN licensure examination on their first attempt. The remaining statistical tests that were used were relevant to the specific nursing education program being studied and are discussed accordingly.

Appropriate Statistical Tests Selected for the Practical Nursing Education Program

Pearson correlation coefficients were chosen to measure the relationship between the performance variables for the practical nursing program sample. The variables included scores on the CTCNP–PN Examination, Sandra Smith's NCLEX PN/VN

Assessment Test, graduation nursing, and graduation cumulative GPAs. Significance was set a priori at the .01 level.

Regression analysis was used to determine which of the preadmission and academic variables were predictive of performance in the PN education program in terms of graduates' performance on the CTCNP–PN Examination, Sandra Smith's NCLEX PN/VN Assessment Test and on graduation nursing and cumulative GPAs. Each of these performance variables was measured using analysis of variance, ANOVA, to determine statistically significant differences.

Appropriate Statistical Tests Selected for the Registered Nursing Education Program

Pearson correlation coefficients were chosen again to measure the relationship between the performance variables for the RN program sample. The variables included scores on the CTCNP–RN, HESI Exit Exam, graduation nursing, and graduation cumulative GPAs.

Regression analysis was used to determine which of the admission demographic (age and number of previous semesters of college) and admission academic variables (nursing and cumulative admission GPAs) were predict ormance in the RN education program. Performance variables included s on the CTCNP–RN, HESI Exit Exam, and the graduation nursing and cumulative GPAs. Each of these performance variables was measured using analysis of variance, ANOVA, to determine statistical significance.

The *t* test statistic was used to assess the differences between the mean scores of each independent variable in the registered nursing education sample for those who passed or failed the NCLEX licensure exam. The *t* test compared the mean scores of

each variable of the graduates who successfully passed the NCLEX-RN licensure examination to the mean scores of those who failed to determine whether there were significant differences between these groups.

CHAPTER IV

RESULTS

The results of the study are reported in this chapter. The purpose of this study was to use action research to explore the relationships of various predictive demographic and academic variables to students' performance in selected nursing education programs. The chapter includes the descriptive data for each of the nursing education student graduate samples. Frequency distributions were tabulated for each of the variables and demographic characteristics of each sample. Statistical analyses for each research question are included in this chapter. The chapter ends with a summary of the results.

The variables and respective acronyms that are used in this chapter include characteristics that pertain to the practical nursing (PN) and the registered nursing (RN) programs. The PN program variables included the National Council Licensure Examination for Practical / Vocational Nurses (NCLEX-PN); American College Test (ACT) Assessment scores; admission and graduation grade point averages (GPA); Critical Thinking in Clinical Nursing Practice – Practical Nurse (CTCNP-PN) Examination and Sandra Smith's NCLEX Practical Nurse / Vocational Nurse (PN/VN) Assessment Test. The RN program variables included the admission and graduation nursing and cumulative GPAs, the Critical Thinking in Clinical Nursing Practice – Registered Nurse (CTCNP-RN) Examination and the Health Education Resources Incorporated (HESI) Exit Exam.

Descriptive Characteristics of the Practical Nursing Program Graduates

Contained in Table 1 is the descriptive statistical data for the PN program sample. The PN sample included 120 students who graduated in the month of May from 2000 through 2004 and took the NCLEX-PN examination for the first time.

This research was designed to determine which of the pre-entrance demographic/academic and program performance variables were predictive of NCLEX-PN pass/fail outcome. The results, however, were that 100% of the 120 students in the PN sample successfully passed the NCLEX-PN licensure examination on their first attempt and received their licensed practical nurse licenses. Therefore, it was not possible to analyze the variables and their predictive relationship of the NCLEX-PN outcome.

The students' age at the time they began the program ranged from 18 to 56 years, with a mean of 21.6 years ($SD = 6.13$). Of the 120 graduates in the sample, 8 were males (6.7%) and 112 were females (93.3%). The number of semesters that college students had completed prior to beginning the PN program ranged from zero to 14 with a mean of 3.25 ($SD = 3.17$).

Table 1

Descriptive Statistics of the Practical Nursing Program Sample

Variable	*N*	*Minimum*	*Maximum*	*M*	*SD*
Age	120	18.00	56.00	21.63	6.13
Previous # of Semesters	120	0.00	14.00	3.25	3.17
HS Admission GPA	108	1.96	4.00	3.31	0.49
ACT Comprehensive	104	14.00	30.00	21.35	3.11
ACT Math	104	13.00	29.00	20.68	3.75
ACT Science	104	14.00	31.00	21.76	3.06
Critical Thinking PN Examination	65	73.00	108.00	92.94	7.73
Sandra Smith Test	120	50.00	73.00	61.15	4.90
Graduation Nursing GPA	120	2.25	4.00	2.97	0.47
Cum Graduation GPA	120	2.35	4.00	3.06	0.41

The pre-entrance academic variables for the PN sample included admission high school GPA and ACT Scores. The mean high school admission GPA was 3.31 (SD = .49) and ranged from 1.96 to 4.00. Only 90% of the sample (N =108) had high school GPA data available. The remaining students either had no high school transcript available or were transfer students. Transfer students who came to the university with 24 or more college credit hours completed were not required to provide copies of their high school transcript upon admission to the university.

ACT scores were available for 104 of the students (86.7%). The ACT comprehensive score ranged from 14 to 30 with a mean of 21.3 (SD = 3.11). The math subscore ranged from 13 to 29, and the science subscore ranged from 14 to 31. The mean scores of these two tests were 20.7 (SD = 3.75) and 21.8 (SD = 3.06) respectively. The students who did not have ACT scores available were either transfer students with 24 or more college credit hours completed, were not required to submit their high school transcript, did not take the ACT exam or were born prior to 1975. Students who were born prior to 1975 were not required by the university to take the ACT.

The PN performance variables included the scores that students achieved on the CTCNP-PN and the Sandra Smith's NCLEX PN/VN Assessment Tests. The scores on the CTCNP-PN exam ranged from 73 to 108, with a mean score of 92.9 (SD = 7.73). Only 65 of the 120 PN students in the sample (54.2%) completed the CTCNP-PN exam from 2002 through 2004; prior to 2002 the exam had not been formally adopted for assessment by the nursing faculty.

The Sandra Smith's NCLEX PN/VN Assessment Test was taken by all 120 students in the five-year time span of the AASPN program being studied. The mean percentage score of all graduates was 61.2% (SD = 4.90) and ranged from 50% to 73%. The national threshold score indicative of graduates' preparedness to take the NCLEX-PN exam was 60%.

The graduation and nursing GPAs were also used as performance variables. The graduation GPA included all previous courses taken and the nursing GPA included only the nursing courses taken up until graduation. The mean nursing graduation GPA was

2.97 (*SD* = .47) with a range of 2.25 to 4.00. The cumulative GPA averaged 3.06 (*SD* = .41) and ranged from 2.35 to 4.00.

Descriptive Characteristics of the Registered Nursing Program Graduates

The independent and dependent variables used in the research of the RN sample varied from those in the PN group. The admission demographic variables utilized for the RN program sample included the student's age, gender and the number of semesters of college previously completed. The admission academic variables were the cumulative and nursing GPAs used for admission purposes to the RN program. Each of the students admitted to the program was already licensed as a nurse (LPN or RN) and was seeking to complete a bachelor's degree.

The performance variables for the RN sample also varied from those of the PN sample. These variables reflected the different assessment tests that were administered at the end of the RN educational program and the GPAs achieved by the graduates. These variables included the CTCNP–RN and the HESI Exit Examinations and the graduation cumulative and nursing grade point averages.

Table 2 summarizes the descriptive statistics of each of the variables. There were a total of 93 students who completed the RN educational program in the five years from 2000 through 2004. The majority of the participants were female, comprising 95.7% (*N* = 89) of the total sample, and only 4.3% (*N* = 4) were male. The students ranged in age from 19 to 46 with a mean age of 24.34 years (*SD* = 6.13) when they began the RN program. The average number of semesters completed by students prior to beginning the bachelor program was 8.84 semesters with a range of 5 to 20 semesters. The semesters accrued from student's prior nursing education, taking cognate courses toward the

nursing major as well as taking courses toward or completing another major prior to entering the RN program.

Table 2

Descriptive Statistics of the Registered Nursing Program Sample

Variable	*N*	*Minimum*	*Maximum*	*M*	*SD*
Age	93	19.00	46.00	24.34	6.13
Previous # of Semesters	93	5.00	20.00	8.84	3.17
Cumulative Admission GPA	93	2.47	4.00	3.22	0.38
Admission Nursing GPA	93	2.52	4.00	3.18	0.40
Critical Thinking RN Examination	52	54.00	109.00	94.48	9.56
HESI Examination	32	508.00	1048.00	853.16	135.66
Graduation Nursing GPA	93	2.62	4.00	3.34	0.31
Cum Graduation GPA	93	2.56	4.00	3.30	0.32

The academic admission variables included the cumulative and nursing GPAs used for admission consideration to the RN program. The mean cumulative GPA was 3.22 (*SD* = .38) and ranged from 2.47 to 4.00. The average admission nursing GPA was 3.18 (*SD* = .40) with a range of 2.52 to 4.00.

The CTCNP-RN and HESI Exit Examinations were taken within one month prior to graduation. The CTCNP–RN test was taken by 52 participants from 2002 through 2004. This comprised 56% of the sample in three of the five years of the study in which

the assessment exam was used. Students' scores ranged from 54 to 109 with a mean score of 94.5 (SD = 9.56). The maximum raw score possible on the examination was 120.

The HESI Exit Examination was only used during the 2003 and 2004 academic years being studied. Of the total 93 participants in the sample, only 32 (34%) took the HESI Exit Examination. Students' HESI Predictability Model (HPM) scores averaged 853.16 (SD = 135.66) and ranged from 508 to 1048. The achievement score recommended by Health Education Systems Incorporated to predict NCLEX success was 900 with an acceptable minimum score of 850. A score of less than 850 identified students at an increased risk of failing the licensure exam.

The graduation GPAs consisted of both nursing and cumulative GPAs. The nursing GPA included only the nursing courses taken in the bachelor degree completion program and the cumulative GPA incorporated the grades of all previous courses taken by a student. The mean nursing GPA was 3.34 (SD = .31) and ranged from 2.62 to 4.00. The mean cumulative GPA was 3.30 (SD = .32) and ranged from 2.56 to 4.00.

There were a total number of 93 students in the RN sample. When the students took the NCLEX-RN exam for the first time following graduation, 78.5% (N = 73) of the graduates were successful and passed, while 21.5% (N = 20) failed. Table 3 provides these results.

Table 3

NCLEX Pass/Fail Frequency for RN Student Sample

NCLEX-RN Outcome	*N*	%
Passed	73	78.5
Failed	20	21.5

Results of the Statistical Analyses for the Research Questions

The research questions investigated the respective predictive relationships among the variables as they related to the nursing education programs. There were a total of three questions.

Research Question One

The first research question was:

1. Which of the practical nursing pre-entrance demographic (age and number of prior semesters in college) and academic variables (admission grade point average, ACT comprehensive, ACT math and ACT science scores) significantly predicted the PN program performance variables (Critical Thinking in Clinical Nursing Practice - PN Examination, Sandra Smith's NCLEX PN/VN Assessment Test, and graduation nursing and cumulative grade point averages)?

Multiple Linear Regression was used to answer this question overall. Initial Pearson correlation coefficients were significant and positively related between each of the PN performance variables. Table 4 provides the correlations of the four performance variables. The level of significance was set at $p < .01$.

Table 4

Pearson Correlation Coefficients of PN Program Performance Variables

Variable	Critical Thinking Exam	Sandra Smith Assess	Nursing GPA	Cumulative GPA
Critical Thinking Exam	-	.72**	.62**	.43**
Sandra Smith Assess		-	.55**	.40**
Graduation Nursing GPA			-	.84**
Graduation Cum GPA				-

** $p < .01$ (2-tailed)

The highest correlations existed between the graduation nursing and graduation cumulative GPAs ($r = .84$), the CTCNP-PN and Sandra Smith's NCLEX PN/VN Assessment Test ($r = .72$) and the CTCNP-PN examination and the graduation nursing GPA ($r = .62$). These findings warranted further analyses to determine the relationship of the pre-entrance and academic variables with these same PN program performance variables.

Multiple regression results for each of the PN program performance variables are included in Table 5. Each of the PN program performance variables were entered as a dependent variable and the pre-entrance demographic and academic variables were entered as the independent variables to determine which of them significantly predicted the performance variables. The predictor variables included age, gender, number of semesters of college previously completed, high school admission GPA and ACT Assessment scores including the comprehensive, math and science scores.

Table 5

Multiple Regression Results: Practical Nurse Pre-entrance and Performance Variables

Performance Variable	*R*	R^2	*F*	*Significance*
Critical Thinking Exam	.474	.225	1.74	.126
Sandra Smith Assessment Test	.504	.254	4.53	<.001
Graduation Nursing GPA	.571	.326	6.42	<.001
Graduation Cumulative GPA	.588	.346	7.02	<.001

Overall, significant positive relationships existed between the pre-entrance variables and each of the Sandra Smith's NCLEX PN/VN Assessment Test, graduation nursing GPA and graduation cumulative GPA performance variables. A relationship did not exist between the pre-entrance and Critical Thinking Exam variables.

These relationships were further analyzed by stepwise forward linear regression to determine which of the pre-entrance demographic and academic variables contributed to the individual dependent performance variables. This regression method removed any of the sample participants with missing pre-entrance and academic variables and identified which of these variables were significantly related to the specified performance variable. Once this information was learned, forward multiple regression was conducted to determine which independent variables were possible predictors of the dependent variable being studied.

Dependent Variable: Critical Thinking in Clinical Nursing Practice - PN Examination

When performance on the CTCNP–PN Examination was the dependent variable, all of the pre-entrance demographic (age and number of prior semesters in college) and

academic variables (admission grade point average, ACT comprehensive, math and science scores) were entered. The F test indicated there was no relationship (R = .474, R^2 = .225) between these independent variables and CTCNP-PN exam performance (F (7, 42) = 1.74, p = .126). Therefore, the variables as a whole did not predict CTCNP-PN performance. Although 65 participants completed the critical thinking examination, the total was reduced to 50 when the stepwise forward linear regression method was applied. This low number (N = 50) may have affected the lack of a relationship between the pre-entrance demographic and academic variables and the CTCNP-PN performance variable.

Dependent Variable: Sandra Smith's NCLEX PN/VN Assessment Test

When Sandra Smith's NCLEX PN/VN Assessment Test was entered as the dependent variable, 25.4% (R = .504, R^2 = .254) of the variance in the scores could be attributed to the same pre-entrance demographic and academic independent variables. A positive relationship existed between the set of independent variables and the Sandra Smith exam. The F test revealed an F (7, 93) = 4.53, with a p < .001. Thus, the F test indicated a relationship existed between some of the independent variables and the Sandra Smith's NCLEX PN/VN Assessment Test performance.

This significant relationship warranted a further regression analysis to determine which of the independent variables were contributing to the relationship, and in what order the variables related to the Sandra Smith NCLEX PN/VN Assessment Test result. The two independent variables that contributed significantly to the amount of variance accounted for were the ACT comprehensive test score and the age of students. These two variables accounted for 23.5% of the variance in the Sandra Smith PN/VN Assessment

Test performance. When the two variables were combined in a single stepwise forward multiple regression model they were highly related (F (2, 98) = 15.01, p <.001). Table 6 depicts the results of the analysis of each of these variables.

Table 6

Forward Regression Analysis: Sandra Smith's NCLEX PN/VN Assessment Test

Variables Entered	R	R^2	*Correlation*
ACT Comprehensive Score	.357	.128	.357
Age	.484	.235	.246

Both variables were positively related to the prediction of the Sandra Smith's NCLEX PN/VN Assessment Test. As the ACT comprehensive scores and the age of the students increased, the Sandra Smith's NCLEX PN/VN Assessment Test scores increased. The ACT comprehensive score variable contributed the greater weight of the prediction of performance on the Sandra Smith's NCLEX PN/VN Assessment Test (*Beta* = .427).

Dependent Variable: Graduation Nursing Grade Point Average

When the independent pre-entrance demographic and academic variables were analyzed with the dependent graduation nursing GPA variable, significant relationships were found once again. The amount of variance accounted for by the demographic and academic admission variables was 32.6% of the graduation nursing GPA (R = .571, R^2 = .326). The F test result (F (7, 93) = 6.42. p < .001) indicated a relationship between these independent variables and graduation nursing GPA performance. When stepwise

forward linear regression was applied, the sample total was reduced to 100 because 20 of the students who did not have high school GPAs available were removed from the analysis. Three of the pre-entrance demographic and academic variables were significant in their relationship to students' performance in terms of nursing GPA at the time of graduation from the PN program. In order the significant variables were: ACT comprehensive score, age, and admission GPA. Table 7 summarizes the regression results.

Table 7

Forward Regression Analysis: Graduation Nursing GPA

Variables Entered	*R*	R^2	*Correlation*
ACT Comprehensive Score	.476	.226	.476
Age	.520	.271	.109
Admission GPA	.556	.309	.371

Stepwise forward multiple regression analysis was used to determine the extent to which these independent variables were related to graduation nursing GPA performance. When the three variables were combined, they accounted for 30.9% of the variance in the graduation nursing GPA (F (3, 97) = 14.46, $p < .001$) performance variable. As the ACT comprehensive test scores, age of the student, and admission GPAs increased, so did the nursing GPA at the time of graduation. Of the three related variables, the ACT comprehensive score carried the greatest weight for predicting graduation nursing GPA (*Beta* = .384), followed by age (*Beta* = .287) and admission GPA (*Beta* = .256).

Dependent Variable: Cumulative Graduation Grade Point Average

The same pre-entrance demographic and academic variables were utilized to determine the relationship between any of these variables and the cumulative graduation GPA dependent variable. The analysis revealed a relationship with 34.6% of the variance in the cumulative graduation GPA being accounted for by the demographic and academic variables ($R = .588$, $R^2 = .346$). The F test revealed the relationship was highly significant with $F(7, 93) = 7.02$, $p < .001$.

Stepwise forward linear regression analysis was conducted to determine which of the variables were related to the cumulative graduation GPA. Once again the sample size was reduced to 100 because of the missing admission GPA for some of the participants. The admission GPA and ACT comprehensive test scores were related to cumulative graduation GPA via linear regression. Stepwise forward multiple regression analysis revealed that when these two variables were combined, they accounted for 33.3% of the variance in the cumulative graduation GPA. Table 8 presents the results of this analysis of each of the significant relationships.

Table 8

Forward Regression Analysis: Cumulative Graduation GPA

Variables Entered	R	R^2	*Correlation*
Admission GPA	.536	.288	.536
ACT Comprehensive Test	.577	.333	.487

Both variables were positively related to the prediction of the cumulative graduation GPA (F (2, 98) = 24.44, $p < .001$). As the admission GPA and ACT comprehensive test scores increased, so did students' cumulative graduation GPAs. The admission GPA contributed the greater weight for the prediction of cumulative graduation GPA (*Beta* = .382), followed by the ACT comprehensive test (*Beta* = .262).

Research Question Two

The second research question was in regard to the RN nursing education program sample. Correlation and stepwise forward multiple regression analyses were used to determine relationships between the admission demographic and academic variables and the RN program performance variables. Research question two asked:

2. Which of the registered nursing program admission demographic (age and number of previous semesters of college) and academic variables (cumulative and nursing grade point averages) significantly predicted the RN program performance variables (Critical Thinking in Clinical Nursing Practice – RN Examination, Health Education Systems Incorporated Exit Exam, and graduation nursing and cumulative grade point averages)?

Multiple linear regression was used to answer this question. The initial Pearson correlation coefficients were significant and indicated positive relationships between some of the four RN program performance variables existed: CTCNP-RN and the HESI Exit Exam, and the HESI Exit Exam and graduation nursing and cumulative GPAs. In addition, a relationship also existed between the graduation nursing GPA and the graduation cumulative GPA. Table 9 provides the correlations between each of the performance variables.

Table 9

Pearson Correlation Coefficients of RN Program Performance Variables

Variable	Critical Thinking Exam	HESI Exam	Graduation Nursing GPA	Cumulative GPA
Critical Thinking Exam	-	.39**	.22	.26
HESI Exam		-	.53*	.38**
Graduation Nursing GPA			-	.78*
Cum Graduation GPA				-

* Correlation is significant at $p < .01$ (2-tailed)
** Correlation is significant at $p < .05$ (2-tailed)

Significant correlations existed between the CTCNP-RN and the HESI Exit Exam ($r = .39, p < .05$); HESI Exit Exam and both the graduation nursing ($r = .53, p < .01$) and graduation cumulative ($r = .38, p < .05$) GPAs, and the graduation nursing and cumulative GPAs ($r = .78, p < .01$). The highest correlation existed between the graduation nursing and cumulative GPAs. This can be explained in part since the graduation nursing GPA was exclusively calculated using only the nursing courses taken in the RN program and the graduation cumulative GPA was calculated using cognate as well as nursing courses.

The correlation between the CTCNP-RN and the HESI Exit Exam was not as high ($r = .39, p < .05$). The fact that only 52 participants completed the CTCNP-RN exam and a total of 32 students took the HESI Exit Exam may have contributed to this lower correlation. There was no relationship between the CTCNP-RN and the graduation nursing and cumulative GPAs.

The correlation between the HESI Exit Exam and the graduation nursing GPA ($r = .53$) was higher and more significant at $p < .01$, than the correlation between the HESI Exit Exam and the graduation cumulative GPA ($r = .38, p < .05$). Again, these relationships may have been affected by the low number of students who took the HESI Exit Exam ($N = 32$).

Another factor indicative of the higher correlation of the HESI Exit Exam to the graduation nursing GPA is the similarity of the content and context of each of these variables' focus on nursing. The nursing GPA was calculated using only the nursing courses taken in the RN program; the HESI Exam was developed and marketed for measuring students' preparedness for taking the NCLEX-RN licensure exam. This similar focus on nursing content may have contributed to the higher correlation between the HESI Exam and the graduation nursing GPA than the correlation between the HESI Exam and the graduation cumulative GPA.

These correlation findings warranted further analyses to determine the extent of the relationship of the admission demographic and academic variables upon the RN program performance variables. Multiple regression results for each of the RN program performance variables are included in Table 10. Each of the RN program performance variables were entered as the dependent variable and the admission demographic and academic variables were entered as the independent variables to determine which of them significantly predicted the performance variables. The predictor variables included age, gender, number of semesters of college previously completed, admission GPA and admission nursing GPA.

Table 10

Multiple Regression Results: RN Admission and Performance Variables

Performance Variable	*R*	R^2	*F Ratio*	*Significance*
Critical Thinking Exam	.355	.126	1.33	.270
HESI Exit Examination	.525	.276	1.98	.115
Graduation Nursing GPA	.637	.406	11.89	<.001
Graduation Cumulative GPA	.893	.798	68.53	<.001

Overall, positive relationships existed between the admission demographic and academic variables and the graduation nursing GPA and graduation cumulative GPA performance variables. A relationship did not exist between the admission variables and the CTCNP-RN and the HESI Exit Exam performance variables. These relationships were further analyzed by stepwise forward linear regression to determine which of the independent variables were related to the individual dependent performance variables.

Dependent Variable: Critical Thinking in Clinical Nursing Practice - RN Exam

The CTCNP-RN Exam was entered as the dependent variable and the admission demographic (age, gender and number of previous semesters of college) and academic variables (admission cumulative and nursing grade point averages) were entered as the independent variables. The *F* test indicated there was no relationship ($R = .355$, $R^2 = .126$) between the independent variables and the CTCNP-RN performance variable ($F(5, 46) = 1.33$, $p > .05$). Therefore, the admission demographic and academic variables as a whole did not predict CTCNP-RN Examination performance.

Although there were 93 participants in the RN sample only 52 completed the CTCNP-RN Examination. The sample total was reduced to 52 when the stepwise forward linear regression method was applied to the critical thinking performance variable. This low number ($N = 52$) may have affected the results of this analysis.

Dependent Variable: Health Education Systems Incorporated Exit Exam

When the HESI Exit Exam was entered as the dependent variable, 27.6% ($R = .525$, $R^2 = .276$) of the variance in the scores was attributed to the admission demographic and academic variables. The F test indicated no significant relationship existed between these variables and the HESI Exam performance variable. The F test result (F (5, 26) = 1.98, $p > .05$) indicated that there was no significant relationship between the admission demographic and academic variables, and these variables as a whole, did not predict HESI Exit Exam performance. These findings may be due to the low number of RN program participants who completed the HESI Exit Exam ($N = 32$). The assessment exam was only used in 2003 and 2004.

Dependent Variable: Graduation Nursing Grade Point Average

When the graduation nursing GPA was entered as the dependent variable, 40.6% ($R = .637$, $R^2 = .406$) of the variance of the GPA was attributed to the five admission demographic and academic variables. The F test indicated a relationship existed between the independent variables and the graduation nursing GPA (F (5, 87) = 11.89, $p < .001$).

This relationship warranted further regression analysis to determine which of the independent variables were significant and in what order the variables were related to the graduation nursing GPA result. Relationships were found to exist between admission

GPA and admission nursing GPA and the dependent variable of graduation nursing GPA. Table 11 summarizes these results.

Table 11

Forward Regression Analysis: Graduation Nursing Grade Point Average

Variables Entered	R	R^2	Correlation
Admission GPA	.612	.374	.612
Admission Nursing GPA	.636	.405	.561

Stepwise forward multiple regression analysis was used to determine the extent to which the two variables related to graduation nursing GPA. These two variables accounted for 40.5% of the variance in the graduation nursing GPA outcome (F (2, 90) = 30.60, $p < .001$). Both variables were positively related to the prediction of the graduation nursing GPA. As the admission cumulative and nursing GPAs increased, the graduation nursing GPA increased. The admission cumulative GPA had the greater influence with *Beta* = .432, followed by admission nursing GPA's *Beta* = .250.

Dependent Variable: Cumulative Graduation Grade Point Average

When the cumulative graduation GPA was entered as the dependent variable, a greater proportion of variance was accounted for by the independent variables than was for the graduation nursing GPA previously described. A total of 79.8% (R = .893, R^2 = .798) of the variance of the cumulative graduation GPA was attributed to the admission demographic and academic variables. The F test indicated a relationship

existed between the admission demographic and academic variables and the cumulative graduation GPA (F (5, 87) = 68.53, $p < .001$).

Stepwise forward linear regression analysis was conducted and determined that a relationship existed between the admission GPA and age variables and the cumulative GPA. Stepwise forward multiple regression identified the extent to which these independent variables significantly related to the cumulative graduation GPA. Table 12 demonstrates these results.

Table 12

Forward Regression Analysis: Cumulative Graduation Grade Point Average

Variables Entered	R	R^2	Correlation
Admission GPA	.883	.779	.883
Age	.889	.790	-.034

When the variables were combined, they accounted for 79% of the variance in the cumulative graduation GPA (F (2, 90) = 169.63, $p < .001$) outcome and were predictive of cumulative graduation GPA, although in opposite directions. As a student's admission cumulative GPA increased so did the cumulative graduation GPA. Conversely, the age variable demonstrated a low negative relationship to cumulative graduation GPA. As student age increased the student's cumulative graduation GPAs decreased. The higher of the two variables for predicting cumulative graduation GPA was the admission cum GPA (*Beta* = .891), followed by age (*Beta* = -.106).

Research Question Three

Research question three asked:

3. What are the differences among the performance variables (Critical Thinking in Clinical Nursing Practice – RN Examination, Health Education Systems Incorporated Exit Exam, and graduation nursing and cumulative grade point averages) between the registered nursing program graduates who passed and those who failed the NCLEX-RN licensing examination?

Originally the intent was to answer this question with regression. However, only 52 of the students completed the Critical Thinking examination between 2002 and 2004, and only 32 students completed the HESI Exit Exam between 2003 and 2004. Since there were too few students who completed the assessment performance tests in the RN program, this research question could not be answered adequately through correlation techniques.

Differences between students who passed and those who failed the NCLEX-RN licensure exam were compared using *t* tests for independent samples. The NCLEX outcomes were those of the graduates' first attempt taking the licensure examination following their graduation. The *t* tests compared the mean scores of the two subgroups of the RN program sample of students, those who passed and those who failed the licensure examination. These results are presented in Table 13.

Table 13

The t-Test Comparisons for Admission Academic and Performance Variables of Students Who Passed or Failed the NCLEX-RN Exam

	Passed			Failed				
	N	*M*	*SD*	*N*	*M*	*SD*	*t Value*	*Sig.*
Admission Variables								
Admission Cum GPA	73	3.25	.39	20	3.11	.33	1.45	.151
Admission Nursing GPA	73	3.23	.41	20	2.97	.24	2.74	.007**
Performance Variables								
Critical Thinking Exam	42	95.33	9.76	10	90.90	8.14	1.33	.190
HESI Exit Examination	26	881.15	107.52	6	731.83	185.92	2.66	.013**
Graduation Nursing GPA	73	3.38	.32	20	3.22	.258	1.97	.052
Cumulative Graduation GPA	73	3.33	.33	20	3.18	.301	1.79	.077

** $p < .05$

Only two of the variables were significantly different between the students who passed and those who failed the NCLEX-RN licensure examination on their first attempt. The admission nursing GPA (p =.007) and the HESI Exit Exam (p =.013) outcomes were significantly different between those students who passed and those who failed the NCLEX exam. Students who passed the NCLEX-RN examination on their first attempt had higher admission nursing GPAs and scored higher on the HESI Exit Exam than those students who failed the NCLEX.

Summary of the Practical Nursing Program Results

There were 120 participants in the PN sample who completed the practical nursing program in the month of May and took the NCLEX-PN licensure examination during the five-year timeframe that was studied. The majority of the students were female (93.3%) and completed a mean of 3.25 semesters of college prior to admission to the practical nursing education program. Participant's ages ranged from 18 to 56, with an average age of 21.6 years. All 120 of the students who graduated in the month of May successfully passed the NCLEX-PN licensure examination on their first attempt following graduation.

Statistically significant findings varied among the performance variables and predictive results of the pre-entrance demographic and academic variables. Three of the seven pre-entrance variables were positively related to the Sandra Smith NCLEX PN/VN Assessment Test, graduation nursing and graduation cumulative GPA performance variables.

The ACT comprehensive score was positively related to three of the four PN performance variables: Sandra Smith's NCLEX PN/VN Assessment Test, graduation nursing and graduation cumulative GPAs. The ACT comprehensive score was the most significant predictor of Sandra Smith's NCLEX PN/VN Assessment Test and graduation nursing GPA, and was the second highest variable predictive of the graduation cumulative GPA, superceded by only admission GPA. As student's ACT comprehensive score increased, so did the score on Sandra Smith's NCLEX PN/VN Assessment test and the nursing and cumulative grade point averages upon graduation.

The other pre-entrance variables that were predictive of PN performance outcomes were age and admission GPA. Positive relationships were found between age and the Sandra Smith PN/VN Assessment Test outcomes and age and the graduation nursing GPA performance variables. Therefore, older students attained a higher score on the Sandra Smith exam and earned higher nursing GPAs than their younger counterparts at the end of the PN program. Age was not significantly related to the cumulative graduation GPA.

Admission GPA was positively related to both the graduation nursing and cumulative grade point averages. Consequently, students with a higher high school graduation GPA used for admission to the PN program, scored higher graduation nursing and cumulative GPAs than students with a lower admission GPA.

Summary of the Registered Nursing Program Results

There were 93 participants in the RN sample who took the NCLEX-RN licensure examination from May 2000 through May 2004. The majority of the students were female (95.7%) and completed a mean of 8.84 semesters of college prior to admission to the bachelor degree RN completion program. Participant's age ranged from 19 to 46, with an average age of 24.3 years old. When the graduates took the NCLEX-RN licensure examination 78.5% ($N = 73$) passed on their first attempt, and 21.5% ($N = 20$) did not pass.

Significant findings varied among the predictive results of the admission demographic and academic variables, as not all of them were significantly related or predictive of student's performance. A positive relationship was found to exist between admission GPAs and the graduation nursing and cumulative grade point averages. The

admission cumulative GPA was the highest significant predictor of both the graduation nursing and graduation cumulative grade point averages. The admission nursing GPA was also significantly predictive of the graduation nursing grade point average. Therefore, as student's admission cumulative and nursing GPAs increased, the graduation nursing GPAs increased.

Admission cumulative GPA and age were significantly related and found to predict the cumulative graduation GPA. The admission cumulative GPA was found to have a higher, positive relationship, whereas a lower, negative relationship was found between student's age and cumulative graduation GPA outcome. Consequently, as student's age increased the cumulative graduation GPA decreased.

Two significant variables were found when the sample means of the RN graduates who passed the NCLEX-RN licensure exam were compared with those of the graduates who did not pass. The admission nursing GPA and the HESI Exit Exam scores were both higher for students who passed the licensure exam than for those who failed. The relationship of the admission nursing GPA was more significant than that of the HESI Exit Examination, between those students who passed and those who failed the NCLEX-RN exam.

CHAPTER V

DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

Research findings pertinent to describing the relationships among significant preadmission and performance variables in the practical nursing (PN) program and the admission and performance variables in the registered nursing (RN) program are discussed in this chapter. The findings are discussed along with pertinent information from the review of literature and their implications for practice based on the action research that was conducted. Limitations and recommendations for further research are also presented in the chapter.

Discussion

Previous research on nursing education included both practical and registered nursing educational programs. The action research that was conducted in this study was intentional; it included both practical and registered nursing programs in a ladder nursing education program at a Midwestern university. The purpose of the study was to determine the relationship of various demographic and academic variables to students' success in the nursing program and the likelihood of successfully completing the respective National Council Licensure Examination for Practical / Vocational Nurses (NCLEX-PN) and the National Council Licensure Examination for Registered Nurses (NCLEX-RN) tests. Byrd, Garza and Nieswiadomy (1999) encouraged research related to the identification of predictors of nursing program success rather than NCLEX achievement. They stressed the need to focus on identification of factors leading to

successful completion of the nursing program since students were not eligible to take the licensure examination until they had graduated.

This study set out to determine predictive factors of NCLEX success for graduates in a PN and RN ladder program. As the data gathering and research progressed, it became evident that this was not possible to accomplish. All of the 120 PN students who graduated in the month of May in the years of the study successfully passed the NCLEX licensure exam on their first attempt. In addition, 78.5% of the RN program graduates who took the licensing exam passed on their first attempt. Although there was a disconcerting discrepancy between these percentages it was not possible to adequately conduct correlation and multiple regression statistics for the RN group since too many variables were missing in the RN sample. For example, during the five year time frame encompassing the study there were only 32 (34%) graduates who completed the Health Education Systems Incorporated (HESI) Exit Exam and 52 (56%) took the Critical Thinking in Clinical Nursing Practice – Registered Nurse (CTCNP-RN) Examination. Therefore, the research focused instead on determining the relationship of various pre-entrance and admission demographic and academic factors with respective program performance variables.

Demographic Variables

The demographic variables that were measured in this study related to the age of students when they began the nursing education program and the number of semesters they had completed prior to entering the respective nursing major. The number of semesters of college previously completed was not related to success for either of the PN and RN program participants when regression statistics were applied.

Age was a significant factor in the analysis of both the PN and RN program samples in this study. Age was positively correlated and a significant predictor of PN students' Sandra Smith's NCLEX Practical Nurse / Vocational Nurse (PN/VN) Assessment Test score and graduation nursing grade point average (GPA). The average age of students in the PN sample was 21.6 and ranged from 18 to 56. As student's age increased, their scores on the Sandra Smith PN/VN exam increased as well as the graduation nursing GPA.

Beeson and Kissling (2001), Briscoe and Anema, (1999), Ostrye (2001), and Parrish (1994) found older students were more likely to pass the NCLEX exam than traditional aged, younger college students. Students in these studies were older and ranged in age from 24 to 56 (Beeson & Kissling, 2001) and 23 and over (Briscoe & Anema, 1999). The finding was attributed to older students being more self-directed and experienced at balancing the multiple roles of being a student than their younger counterparts, contributing to their success. These findings concurred with the results obtained in the PN sample in the current study.

Age of the student was found to be negatively related to RN student performance in terms of the cumulative graduation GPA in this study. Students in the RN sample had an average age of 24.3 and ranged from 19 to 46 years. When age was combined with admission grade point average the two variables were significant for predicting cumulative graduation grade point average. The negative relationship of the age variable indicated that as the age of the student increased the cumulative GPA decreased. Byrd et al., (1999) also found students at a younger age were more likely to successfully complete their nursing program than their older classmates. Several other researchers

determined age was not correlated with NCLEX success (Endres, 1997; Lengacher & Keller, 1990; Morris, 1999; Roncoli, Lisanti & Falcone, 2000; Woodham & Taube, 1984).

The predictive result regarding the age of RN students in terms of a negative impact on cumulative graduation GPA is of value to students and faculty. The findings should be disseminated to students and faculty to increase awareness of the relationship. In addition, faculty should be cognizant of the potential need for increased academic resources and tutoring necessary to enable older students to succeed throughout the RN program in an effort to attain higher graduation cumulative grade point averages. Faculty awareness of this information is also important for the advisor role assumed by faculty. As teachers advise older RN program students they should be conscientious of the student's age and the effects of age on the attainment of cumulative GPA. Older students may need additional faculty guidance and learning resources to be successful.

Overall, the information obtained related to age is interesting to note and will be used when disseminating the research findings. Although age was a significant predictor of performance in aspects of both the PN and RN programs, changes in terms of admission criteria related to age are not warranted at this time. Prospective students are already required to either be a high school graduate or complete the General Education Development (GED) certificate for admission to the PN program and be at least 18 years old. Age is not included in the criteria for admission to the RN program. It is not necessary to include an age requirement since the RN program is a BSN degree completion program for licensed nurses; prospective students are admitted at various ages via other academic criteria.

Significant Academic Variables in the PN Educational Program and Their Implications

The significant variables that were positively related to students' performance in the PN program were ACT comprehensive scores, age and admission GPA. The mean ACT test score of the PN sample was near the 2003 national average for each of the comprehensive, math and science scores. The national average comprehensive score in 2003 was 20.8 (National Data Release, August 20, 2003); students in the PN sample in this study had an average comprehensive score of 21.3, with scores ranging from 14 to 30.

The ACT comprehensive score was the most frequent significant predictor in the regression analyses conducted for the PN sample. The ACT comprehensive score was positively related and a predictive variable in terms of PN student performance on Sandra Smith's NCLEX PN/VN Assessment Test and the graduation nursing GPA. It was also the second highest predictive variable of cumulative graduation GPA, with admission GPA being the highest predictor.

This ACT test finding concurred with McClelland, Yang and Glick's (1992) research results. They found ACT comprehensive scores as well as the English, math, reading and science subscores to be positively related to passing the NCLEX exam. Lengacher and Keller's (1990) findings varied in that math and English scores were not predictive of NCLEX outcome. The current research findings regarding ACT math and science scores contrasted with these results; the math and science ACT scores of the PN sample participants were not predictive of any of the PN program performance variables.

Young and Richardson (1996) found academic variables significantly affected variance on the NCLEX-PN exam more than demographic variables, which was related

in the case of this PN study. The admission GPA consisted of student's high school graduation grade point average and was used for admission consideration to the PN program. The admission GPA was positively related to both the graduation nursing and cumulative GPAs. The admission GPA was also predictive of the cumulative graduation GPA and contributed to the predictive model for graduation nursing GPA.

Cumulative nursing GPA at the end of the PN program was the highest predictor of NCLEX success in Ostrye's (2000) research. Ostrye could not discern a relationship between any specific nursing course grade and NCLEX success; therefore, she recommended the program continue open enrollment practices and work with students after they are in the program to enable them to attain higher GPAs to subsequently pass the NCLEX licensure examination.

The independent predictive variables that were analyzed in this study included the admission criteria used in the PN program and the existing achievement exams and graduation criteria were used as the dependent variables. The significant results of the study have implications to be considered for use in the PN program. The current admission GPA for the PN program requires a minimum high school GPA of 2.25. Students with a GPA lower than 2.25 can be admitted with a minimum ACT comprehensive score of 20 or higher. Students in the PN sample had an average admission GPA of 3.31, ranging from 1.96 to 4.00. A suggested change to be considered is to screen both high school GPA and the ACT comprehensive score criteria for admission to the PN program rather than using ACT comprehensive score only as a default when warranted. Since the ACT comprehensive score was positively related and significantly predictive of the Sandra Smith PN/VN Assessment Test and both of the

graduation nursing and cumulative GPAs, it carried greater weight in terms of its usefulness than the admission GPA. At the same time, the admission GPA should not be discounted since it was also predictive of both the graduation nursing and cumulative GPAs.

Significant Academic Variables in the RN Educational Program and Their Implications

Admission criteria for the RN completion program in this study included both nursing and cumulative GPAs of 2.50 or higher. In terms of performance in the RN program, each of these admission GPAs were found to be related to student achievement. The admission cumulative GPA was related to and a strong predictor of both graduation nursing and cumulative GPA at the end of the RN program. The admission nursing GPA was also related to and predictive of the graduation nursing GPA. In addition, when the mean GPAs of students who passed the NCLEX exam were compared with the means of those who failed, the admission nursing GPA was significantly higher for students who passed than those who failed the licensure exam on the first attempt.

More often than not, a positive relationship between course grades, admission, nursing or cumulative grade point averages and student success in completing the nursing program and passing the licensure examination has been demonstrated to various extents in past research. Brennan, Best and Small, (1996), McClelland, Yang and Glick, (1992), Morris, (1999), Roncoli, Lisanti and Falcone, (2000), Woodham and Taube, (1984), and Yang, Glick and McClelland (1987) found significant relationships between achieved course grades and GPAs, many of which were also predictive of outcomes on the licensure examinations.

Although the research did not discern significant predictive variables for NCLEX success, Endres' (1997) research findings were similar to those of the current study. She also found students with significantly higher admission, nursing, and cumulative GPAs at the end of the nursing program were also the students who passed the NCLEX licensure examination. In contrast, Mills (1992) found the use of the cumulative exit GPA the most useful predictor of NCLEX outcome. Students with a nursing GPA of 2.0 to 2.50 decreased their likelihood of passing the licensure exam. The findings in this study did not agree with the exit GPA having the highest relationship. In contrast, the admission nursing GPA demonstrated a stronger relationship when means of students who passed the NCLEX exam were compared with graduates who failed.

Yin and Burger (2003) recommended admission GPAs be used rather than GPAs earned at the end of the nursing education program to predict NCLEX success. Their study revealed students with significantly higher admission GPAs were more likely to pass the NCLEX exam and the admission GPA was found to be a significant predictor of NCLEX success. Horns, O'Sullivan and Goodman (1991) determined that 67% of the variance in the NCLEX outcome was due to admission GPA. The action that they initiated based on their findings led them to begin to screen students earlier in the course of their nursing education careers at the end of each of the second, third and fourth years to identify any students who may be at-risk. These findings in terms of the relationship of the admission GPA and student performance were similar with the findings of the current study.

The ladder format of the PN and RN programs that were studied should also be considered for implications. Johnson (1986) studied the relationship of criteria and

success of graduates in a practical nursing education program and their progression and completion of a laddered associate degree RN program. She determined cumulative and nursing GPAs in the PN program were positively correlated to successful completion of the RN program and NCLEX-RN outcome upon graduation from the RN program. The strongest correlation noted by Johnson was the didactic course GPA, followed by the overall GPA earned in the PN program. The current study replicated these findings.

Based on the findings in this study regarding the relationship between the admission GPAs and RN student performance, and the fact that 78.5% of the RN program graduates passed the NCLEX and 21.5% failed, deliberations to increase admission GPA levels should be considered. Both the admission cumulative and admission nursing GPAs should be scrutinized for recommended increases, with greater focus given to increasing the required admission cumulative grade point average since it demonstrated a higher degree of relationship to performance in the RN program than did the admission nursing GPA.

The HESI Exit Exam

Although the HESI exit exam was taken by only 32 students in the RN sample, it was positively correlated to multiple performance variables. The strongest correlation was found between the HESI Exit Exam and the graduation nursing GPA, followed by the correlations with the Critical Thinking in Clinical Nursing Practice – Registered Nurse (CTCNP-RN) Exam and the graduation cumulative GPA. In addition, the HESI Exit Exam scores were significantly higher for students who passed than those who failed the NCLEX-RN licensing exam.

The HESI Exit Exam has demonstrated a high degree of accuracy in predicting NCLEX outcomes in terms of passing or failing, regardless of the type of RN program using the exam in terms of offering an associate, bachelor or diploma RN program (Nibert and Young, 2001). The reliability and validity of the HESI exams has been well established. As student scores decreased on the pre-established scoring intervals, the incidence of failing the NCLEX exam increased. It was recommended students attain a minimum score of 85 to predict NCLEX success. Students scoring less than an 85 (HPM score of 850) had a 23.7% to 50.2% chance of failing the licensure exam. Therefore, students who attained a score of less than 85 were advised to be seriously remediated prior to taking the NCLEX exam (Nibert, Young & Adamson, 2002). There were 13 students in the RN sample who scored less than the 85 minimum recommended score. Nine of these students (69%) successfully passed the NCLEX exam while four (31%) did not pass.

Researchers recommended the HESI exam be administered on more than one occasion to allow students and faculty to determine the likelihood of NCLEX success, provide time for remediation, and re-assessment of NCLEX preparedness. More time and focused efforts for remediation can be made possible by administering the HESI exam earlier in the educational program and using the feedback to construct individualized and course plans accordingly. Because the exam was computerized, the students were given immediate feedback related to their areas of strength and weakness. Nibert, Young and Adamson (2002) and Lauchner, Newman and Britt (1999) recommended these data be used to immediately begin individualized remediation programs prior to graduation and students taking the NCLEX licensure exam.

The high predictive value of the HESI Exit Exam and the research findings have numerous implications to be considered. The HESI exam should continue to be used by the RN nursing education program. In addition, it should be used to assess students in a pre- and post-test format with academic resources and teaching/learning strategies used to allow for structured remediation prior to the administration of the second HESI Exit Exam.

The HESI Exit Exam scores should also be used by faculty during individualized student advising sessions to inform students of their individual score, review identified areas of strength and weakness, and develop an individualized remediation plan to address the areas where the student's performance was weak. Class trends noted as a whole can be used by faculty to enhance teaching and learning activities during the spring semester of the senior year to focus on content areas related to low HESI Exit Exam performance prior to graduation and NCLEX testing. In addition, HESI program reports can be used by faculty to make informed curriculum and course content changes where applicable.

Newman, Britt, and Lauchner (2000) determined that when a faculty monitor was present in the room while the students took the HESI computerized exam, the results were more significantly related to predicting NCLEX success than when the students were left to take the exam unmonitored. Faculty should consider direct monitoring of the students while they take the exam in the future. The researchers found that when students were monitored during testing they took the exam more seriously and were more deliberate in their testing.

Research Limitations

The limitations of this study related to the difficulty in generalizing the research findings, RN program sample size, and the quantitative focus. The nursing program that was studied was a unique ladder program consisting of an associate degree PN and bachelor degree RN completion program. Therefore, the findings should be generalized with caution to other types of programs.

The research was also limited in the number of RN program participants who completed the performance achievement and assessment examinations that included the CTCNP-RN and the HESI Exit Exam at the end of the program. This fact made it difficult to measure the correlations and predictive value of these outcomes with success in completing the RN program and impossible to measure the effect on the outcome on the NCLEX-RN licensure examination.

This study included only quantitative research in terms of the admission demographic and academic variables and program performance and graduation variables. It did not take the personal characteristics and attributes of the students, faculty, and program factors into consideration that could also impact student performance in the nursing education program and NCLEX success.

Recommendations for Further Research

Recommendations for further research are warranted in addition to the previous suggestions made for program changes related to admission and graduation criteria. The recommendations are relevant in each of the individual PN and RN educational programs and in the context of their relationship as a laddered nursing education program.

This study discovered that all students who graduated from the PN program in the month of May were successful on their first attempt at passing the NCLEX-PN licensing exam. In order to graduate, students needed to attain minimum cumulative and nursing GPAs of 2.25 or higher. Students who do not meet the minimum GPA requirements do not graduate until they repeat or take additional courses in order to meet the graduation criteria. This study should be replicated to include the students who did not graduate until July or December to ascertain the relationship of delayed graduation on the PN performance variables as well as the NCLEX-PN outcome.

It was also recommended that the research relevant to the RN program continue to be replicated. With an expected increasing emphasis on the use of the HESI Exit Exam, ongoing research is needed to continue to measure the outcomes related to the use of the exam in terms of RN program performance and NCLEX-RN outcomes. The effectiveness of remediation programs that may be implemented based on the current research findings and ongoing use of the HESI Exit Exam also warrant follow-up research. It may even be possible in the future after larger sample sizes are available to construct a model for predicting NCLEX-RN outcome that can be useful to students, faculty and administrators.

Other research possibilities to be considered relate to the uniqueness of the ladder program itself. The current study examined the admission, performance and graduation criteria of each of the individual PN and RN programs that make up the entire nursing curriculum. It would be very interesting to examine the significance of the relationship of the high school graduation GPA and ACT scores on the program performance and NCLEX variables for students in the RN program. These criteria are currently used for

admission consideration for the PN program only. Since the ACT comprehensive score and the GPA earned in high school were significant and predictive of PN program performance it would be fascinating to see if there was transference of this relationship to the RN program participants as well.

It is shortsighted to believe only quantitative factors were related to student success in nursing education programs and licensure testing. Therefore, it is also recommended that qualitative research be conducted along with future quantitative studies to answer the rich question of "What is going on here?" Qualitative research relevant to the lived experience of the student as well as the faculty is recommended. Student-centered research focused on their experiences as they complete their nursing education program and prepare for the licensure examination, as well as the NCLEX experience, and the outcome of the exam itself are recommended areas to be studied. In addition, the lived experience of nursing faculty who become personally and professionally vested in students, their views of experiencing student success and failure, and the impact of NCLEX outcomes should be researched further.

Summary

Siktberg and Dillard (2001) described using their research findings to enhance and improve their nursing education program. When they used action research to assess needed changes for increasing NCLEX success they were able to accomplish six consecutive years of pass rates above the national average. They initiated changes in admission, progression and graduation policies, teaching and learning strategies and an NCLEX review program as a consequence of their research. Siktberg and Dillard were able to accomplish a great deal from the implementation of their action research.

It is also hoped great accomplishments can stem from the completion of this action research. Efforts should be undertaken to apply the findings of this study to implement informed, research-based changes to enhance the use of the admission, progression and graduation processes used by the university. Such actions may include, incorporating the ACT comprehensive score along with high school GPA as the criteria for admission to the PN program, or raising the required cumulative GPA for admission to the RN program. Based on this study, these changes could result in enhanced student performance in terms of higher assessment test scores in the respective nursing education programs and higher graduation cumulative and nursing GPAs. Ultimately, it is hoped the current NCLEX pass rate for graduates of the PN program would continue, and the pass rate of the RN graduate's could be substantially increased. Of course, the only way to know is to conduct further research to evaluate the effectiveness of any changes that were made – with further research.

APPENDICES

Appendix A
University Approval

May 20, 2004

To Whom It May Concern,

Ms. Mary Anne Marsh, Assistant Professor of Nursing at Dickinson State University, is currently working on her doctorate degree at the University of North Dakota. As part of her dissertation research for her topic entitled "Predictive Variables for Success on Licensure Examinations for Practical and Registered Nursing Education Graduates," Ms. Marsh has requested access to student records at

As Vice President for Academic Affairs, I am granting Ms. Marsh access to the student records that she needs. The Registrar will be directed to comply with her requests for student record review. Please contact me if there is any question about this authorization to review student records.

Sincerely,

Richard D. Brauhn

Dr. Richard D. Brauhn,
Vice President for Academic Affairs

cc: Mr. Marshall Melbye, Registrar
Files

Appendix B
PN Sample Data Gathering Table

#	Age	Gender	# of Prior Semesters of College	Adm. HS GPA	ACT Comp.	ACT Math	ACT Science	CTCNP - PN Score	Sandra Smith Assess Test	Grad. Nursing GPA	Grad. Cum GPA	NCLEX Result 1- Pass 2 - Fail

Appendix C
RN Sample Data Gathering Table

#	Age	Gender	# of Prior Semesters of College	Adm. College GPA	Adm. Nursing GPA	CTCNP - RN Score	HESI HPM	Grad. Nursing GPA	Grad. Cum GPA	NCLEX Result 1- Pass 2 - Fail

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