Fall 10-17-2016

The Relationship Between Utilization of the Elsevier Online Remediation Tool and the HESI Exit Exam for Student Nurses Preparing for the NCLEX-RN

Judith Egan
judith.egan@shu.edu

THE RELATIONSHIP BETWEEN UTILIZATION OF THE ELSEVIER ONLINE REMEDIATION TOOL AND THE HESI EXIT EXAM FOR STUDENT NURSES PREPARING FOR THE NCLEX-RN

by

Judith Egan

Submitted in partial fulfillment of the requirements for the degree

Doctor of Philosophy

Department of

Seton Hall University

October 2016

SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

APPROVAL FOR SUCCESSFUL DEFENSE

Judith A. Egan, has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ph.D.** during this **Fall Semester 2016.**

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(please sign and date beside your name)

Mentor:
Dr. Robert Kelchen _____ 10/24/16

Committee Member:
Dr. Rong Chen _____ 10/17/2016

Committee Member:
Dr. Kristi Stinson _____ 10-17-16

The mentor and any other committee members who wish to review revisions will sign and date this document only when revisions have been completed. Please return this form to the Office of Graduate Studies, where it will be placed in the candidate's file and submit a copy with your final dissertation to be bound as page number two.

Abstract

Nursing schools are operating at full capacity in order to address an impending shortage of registered nurses that may exceed 500,000 by the year 2025. This pressure on scarce resources elevates the importance of NCLEX-RN preparedness for nursing faculty, nursing students, and the public at large. Additionally, the ability to successfully prepare students to sit for the NCLEX-RN exam can affect the reputation of nursing programs throughout the United States. Nursing schools frequently utilize commercially prepared standardized exams to assess student readiness and identify students in need of remediation. The HESI E2 Exit Exam distributed by Elsevier is one such exam. Built into this exam is a student-centered online remediation tool that allows students to customize their study based on exam results. In response to low NCLEX-RN pass rates, a BSN program in the northeastern United States developed a remediation policy requiring students to complete a prescribed number of remediation hours based on their earned score. General systems theory was the framework that guided this analytical policy analysis. Once a policy is created as a result of a systematic assessment of a problem, it is necessary to evaluate the policy for effectiveness. This ex post facto analysis addresses a gap in the literature of high quality quantitative remediation policies that are reproducible throughout multiple programs. Using multiple regression this study explored the relationship between utilization of the Elsevier online remediation resource and scores on the HESI V2 Exit Exam for senior-level nursing students. Variables explored were GPA, HESI V1 scores, gender, cohort (traditional or second degree), semester (spring, summer, or fall), and hours of remediation. GPA significantly predicted 15% to 18% of the variance in scores on the HESI V2 exam. When additional variables

are entered into the model, the predictive value of GPA was reduced to 3% to 9%. HESI Version 1 significantly predicted 3% to 18% of the variance in scores on the HESI V2 while controlling for GPA. Completion of online remediation hours did not significantly contribute to scores on the HESI V2 Exit Exam for senior-level nursing students in this northeastern BSN program.

Keywords: NCLEX-RN, Remediation, HESI Exit Exam, General Systems Theory, Online remediation, Standardized tests

Dedication

I would like to dedicate this success to my husband David without whose support I would not have survived. From managing the household, taking over the cooking, and allowing me to take over entire rooms of our house with my paperwork your support was invaluable. To my boys Brendan and Nolan. Their willingness to always take the more difficult road in life and to give it their all was my inspiration. I thank you all.

Acknowledgements

To Dr. Robert Kelchen whose unwavering belief in my ability to complete this project and quick response to my many drafts and revisions were integral to the completion of this work. Dr. Rong Chen for her steady guidance throughout the program that kept me on track and focused. Dr. Kristi Stinson who has been a wonderfully supportive colleague throughout.

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Chapter I

Introduction

The Bureau of Labor Statistics (2012) estimated a shortage of between 300,000 and one million registered nurses through the years 2022. An aging nurse workforce, an aging general population, as well as an anticipated increase in individuals' access to health care are expected to exacerbate the situation. Meeting this work force demand is a challenge for nursing schools. The National League for Nursing (NLN, 2014) reports that 22% of qualified nursing school applicants were turned away in 2014. Thirty-one per cent of the reporting baccalaureate schools cited lack of faculty as the reason for the shortfall. An overall shortage of nursing faculty is a significant impediment to the ability of nursing schools to expand capacity and meet the societal demands for nurses (American Association of Colleges of Nursing, 2012; Higgins 2005; NLN 2014; Yordy, 2006). This high demand on scarce resources makes it important to ensure successful completion and licensure for the students who are enrolled.

The nursing profession is regulated by the National Council of State Boards of Nursing (NCSBN). As such, the council is charged with ensuring public safety through the administration of a National Council Licensure Exam for Registered Nurses (NCLEX-RN). The NCLEX-RN is a computer adapted test (CAT) that is individualized to each candidate while staying true to the content as outlined in the NCSBN test blueprint. The CAT exam provides questions of varying levels of difficulty depending upon the applicant's performance (NCSBN, 2013. Eligible candidates are allowed up to 6 hours to answer between 75 and 265 items (NCSBN, 2013). Only students who have graduated from an accredited nursing program are eligible to sit for the NCLEX-RN (NCSBN, 2013).

A survey of entry-level practice is conducted every 3 years to determine the most frequent tasks performed by the newly licensed nurse (NCSBN, 2013). With each survey, it has been determined that the healthcare environment is becoming more complex. In order to preserve their duty to protect the public by ensuring safe practicing nurses, the NCSBN has increased the passing standard with each triennial review beginning in 1998, continuing in 2004, and every 3 years thereafter (Culleiton, 2009; Lavin & Rosario-Sim, 2013). Standards are adjusted in order to ensure both minimal competence and public safety. Upon successful completion of an accredited nursing program, students are granted eligibility to sit for the NCLEX-RN. In December 2012 the board voted to increase pass-rate requirements due to the increased patient complexity seen by entry level RNs (NCSBN BOD vote, 2012).

With the implementation of new standards, however, the national passing percentage in 2013 for first-time candidates fell from 90.35% in the first quarter (January to March 2013) to a disappointing second quarter figure of 83.00% (April to June 2013; NCSBN, 2013). Pass rates for repeat candidates dropped from 48.59% to 29.92% during the same time frame. The final pass rate for 2013 was 83% leaving 26,000 candidates unable to immediately enter the workforce. In 2014 the final statistic was 81.78% leaving 28,000 graduate nurses unable assume the role of registered nurse. This statistical decline is a concern to schools of nursing whose reputation and accreditation are often dependent on passing results from first-time board candidates (Frith, Sewell, & Clark, 2005; Harding, 2010; Horton, Polek, & Hardie, 2012).

Maintaining satisfactory first-time NCLEX-RN pass rates is a significant component to successful accreditation. The American Association of Colleges of Nursing (AACN) is responsible for accrediting nursing schools that offer baccalaureate and graduate degree programs. As part of their evaluation process schools must demonstrate a 70% program

completion as well as an 80% first-time NCLEX-RN pass rate. Associate degree as well as some baccalaureate degree programs are accredited by the National League for Nursing (NLN). The NLN requires that schools report a 75% first-time pass rate in order to maintain accreditation status. Schools are also accountable to their individual state board of nursing. The acceptable pass rate for accreditation can vary from state to state. Seventy-five percent is the required first-time NCLEX-RN pass rate for the state of New Jersey while some larger states such as Texas and Florida require an 80% pass rate to maintain certification (Miller, 2013; New Jersey State Board of Nursing, 2015; Texas State Board of Nursing, 2016). Failure to maintain acceptable pass rates can place a school at risk for probation that can limit their ability to accept new students and may lead to program closure (Hooper, 2016; Kovner & Lee, 2015).

State boards of nursing and nursing programs work continuously to balance the ever-increasing need for nurses with the challenge of educating competent nurses capable of passing the NCLEX-RN. Concern for a nursing shortage led the Florida state legislature in 2010 to allow nursing schools to open without the close monitoring of their state board (Miller, 2013). From 2009 to 2013 NCLEX-RN pass rates fell from 88 to 85% while the national average rose from 88 to 91% during the same time frame (Miller, 2013). Florida state law requires nursing schools to maintain an 89% pass rate placing many of these new schools in a probationary status and at risk for closing (Miller, 2013). In 2014 Fairfield University (CT) saw their NCLEX-RN scores fall to 73%, well below the state requirement of 80% (Kovner & Lee, 2015). This drop places the program on "conditional status" and necessitates that a correction plan be submitted to the state board. In 2013 the state of Texas saw 35 of its 110 RN programs fail to meet the state mandate of 80% NCLEX-RN pass rates (Hooper, 2016). A collaborative relationship between the education programs and the state board was established in order to meet the need for registered nurses

while maintaining high licensing standards. By 2015 the number of schools failing to meet the state mandate dropped from 35 to 31 (Hooper, 2016).

With the pressure to maintain strong board pass rates and meet the need for competent nurses, schools have looked to develop academic policies that seek to identify students at risk for board failure and provide remediation methods to increase first-time NCLEX-RN pass rates (DeLima, London, & Manieri, 2011; Frith et al., 2005; Harding, 2012; Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Lavandera et al., 2011; Morahan, 2011; Norton et al., 2006; Pennington & Spurlock, 2010; Schroeder, 2013; Sewell, Culpa-Bondal, & Colvin, 2008; Sifford & McDaniel, 2007; Stonecypher, 2014; Yeom, 2013). Faculty look at predictors such as admission testing (Higgins, 2005; Underwood, Williams, Lee, & Brunnert, 2013; Uyehara, Magnussen, Itano, & Zhang, 2007; Wiggins, 2011; Wolfowitz & Kelley, 2010), course grades and overall GPA (Alameida et al., 2011; DeLima et al., 2011; Higgins, 2005) as well as scores on commercially prepared standardized nursing exams (DeLima et al., 2011; Higgins, 2005; Lavandera et al., 2011; Schooley & Kuhn, 2013; Spurlock & Hanks, 2004; Underwood et al., 2013; Yeom, 2013) in order to develop academic policies that have a basis of support within the current literature. Nursing schools have an obligation to develop academic policies so that admitted students are able to both successfully complete their program and pass the NCLEX-RN on first attempt.

It is becoming increasingly common for nursing faculty to base academic policies on the use of commercially prepared standardized content exams (Coons, 2014; Sosa & Sethares, 2015). The use of a consistent measurement tool allows faculty to make comparisons without the variability associated with measures such as course grades and faculty-prepared exams (Sewell et al., 2008). Commercial exams are available from multiple vendors such as Kaplan, Mosby, NLN,

and Elsevier (Coons, 2014). The most widely researched of theses exams is the HESI E2 exit exam produced by Elsevier (Coons, 2014; Sosa & Sethares, 2015). The exam has been rigorously vetted for reliability and validity in predicting NCLEX-RN success (Harding, 2012; Morrison, Free, & Newman, 2002; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012) providing faculty with an evidence-based foundation for policy development for testing and remediation (Sewell et al., 2008). This study is focused on a remediation policy developed based on use of the HESI E2 exit exam.

The HESI E2 exit exam was created by Health Education Systems, Inc. (now owned by Elsevier) for use by nursing programs to identify students' areas of weakness and provide them with an individualized remediation program. The HESI E2 is a 160-question (10 of which are pilot items and not scored) comprehensive computerized exam composed of multiple-choice and alternate-format items. The purpose of this comprehensive exam is to measure mastery of content, and it is usually administered in the last semester of the nursing program. The HESI E2 exam scores can range from 0 to 1500 (Schreiner & Brunnert, 2014). Achieving a score between 850 and 899 is considered acceptable; however, a score of 900 has the greatest predictive probability (96.4% to 98.3%) of first-time NCLEX-RN success (Nibert, Young, & Britt, 2003). Elsevier uses a proprietary mathematical model called the HESI predictability model (HPM), which factors in level of difficulty of each item in calculating individual scores (Schreiner & Brunnert, 2014). Students who correctly answer more difficult questions are able to achieve a higher score, thereby increasing their probability of NCLEX-RN success (Langford & Young, 2013). An individual item analysis is then generated, highlighting areas of content weaknesses. This information can be utilized to develop remediation policies to improve student success on first-time board exams.

The literature is robust on the subject of descriptive remediation policies directed at improving NCLEX-RN pass rates (Frith et al., 2005; Harding, 2012; Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Mee & Schreiner, 2016; Morahan, 2011; Nibert & Morrison, 2013; Norton et al., 2006; Pennington & Spurlock, 2010; Schroeder, 2013; Sewell et al., 2008; Sifford & McDaniel, 2007; Stonecypher, 2014; Zweighaft, 2012). The majority of studies are centered around the development and implementation of time-consuming faculty-led courses designed to address gaps in content as identified through standardized testing (Frith et al., 2005; Harding, 2012; Horton et al., 2012; Nibert & Morrison, 2013; Sewell et al., 2008; Sifford & McDaniel, 2007; Zweighaft, 2012). The reported positive results are problematic due to small sample sizes, voluntary nature of participation, and absence of specific descriptive details as well as a lack of rigorous analytical methods (Mee & Schreiner, 2016; Pennington & Spurlock, 2010). The limitations make it difficult to reproduce these interventions across programs (Mee & Schreiner, 2016; Pennington & Spurlock, 2010). Many of the studies focused attention on remediation related to the HESI E2 exam given at program completion (Frith et al., 2005; Lauer, 2011; Lauer & Yoho, 2013; Sewell et al., 2008; Sifford & McDaniel, 2007). Failure to identify at-risk students early in the nursing program leaves little time for successful remediation (Sosa & Sethares, 2015). Additionally, providing individualized faculty interventions to a small number of students is very labor intensive and beyond the scope of the limited resources available at most schools of nursing (Pennington & Spurlock, 2010). Faculty need to look to the development of policies that will benefit students while working within the constraints of limited faculty resources.

The development of a testing policy is supported by organizations that regulate nursing. Spector and Alexander (2006) supported the use of standardized exams as a method of creating

individualized remediation plans to improve student success on board passing. The use of high-stakes testing as an end-of-program requirement and as a bar for graduation is discouraged. Preventing students from graduating and sitting for the NCLEX-RN may pose legal and ethical dilemmas for nursing programs (Spector & Alexander, 2006). The NLN (2012) has also come out in support of a comprehensive testing policy as part of their fair-testing guidelines for nursing education. A fair-testing environment encompasses exams that are valid and reliable. The opportunity for students to identify and remediate their areas of weakness is an important component of testing (Culleiton, 2009; Mee & Schreiner, 2016).The policy should be applied consistently, and students need to be informed of expectations and consequences.

In response to declining NCLEX-RN first-time pass rates, faculty from a private BSN program in the Northeast developed a student-centered total testing policy that utilizes the Elsevier comprehensive testing package. The policy is published as part of both the student handbook and individual course syllabus. Students scoring below a benchmark score of 900 are required to remediate a prescribed number of hours using the Elsevier online remediation resource. The policy requires remediation hours to be completed between two parallel versions of the HESI E2 exit exam administered in the final senior-level nursing course of the program. Failure to remediate the prescribed number of hours results in a "0" for the HESI exam. This policy is specific in that the number of remediation hours are designated based on scores achieved on the exam. Faculty are able to track remediation hours and ensure policy compliance. Consequences apply for failure to complete the required number of study hours. Thus the policy is transparent, published, and enforced on a consistent basis, which is an important aspect of policy development (Morrison et al., 2002).

Statement of the Problem

The need for registered nurses is predicted to increase through the year 2025. Students choosing this career path must successfully complete an accredited nursing program and pass the NCLEX-RN. Students who fail the board exam at first attempt are delayed from timely entrance into the workforce. Nursing schools, who are operating at peak capacity, must properly allocate scarce resources to maximize the ability of students to graduate and to pass the boards on first attempt. Efforts must be made to identify at-risk students early in their programs so as to provide effective remediation techniques toward this objective.

There is evidence to support the use of the HESI E2 exam in predicting first-time NCLEX-RN success (Harding, 2012; Morrison, Adamson, Nibert, & Hsia, 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012). There is a gap in the literature of high quality quantitative remediation policies that are reproducible with the ability to be utilized by multiple programs (Mee & Schreiner, 2016; Pennington & Spurlock, 2010; Sosa & Sethares, 2015). This study attempts to close this gap by analyzing a specific remediation method of calculating online study hours required for HESI exams and investigate the relationship on HESI E2 exit exam scores.

Purpose and Significance of the Study

The purpose of this quantitative research study is to examine the association between study hours completed through the Elsevier HESI online remediation resource and improvement of student scores between Version 1 and Version 2 of the HESI E2 exit exam.

The dependent variable was defined as raw scores on the HESI E2 exit exam. The independent variable was defined as the number of online remediation hours the student completes in compliance with a testing policy that requires a prescribed number of online remediation hours in response to the student's raw score on the HESI (E2) Exit Exam.

This study is significant to the nursing profession because it will add to the literature describing and analyzing methods of student remediation and their impact on student outcomes on the HESI E2 Exit Exam scores and subsequent first-time NCLEX-RN pass rates. It will also add to the body of literature on preparing students for high-stakes exams such as those found in medicine, law, and pharmacy. Improving a school's ability to identify and remediate at-risk students will also serve to improve the school's individual NCLEX pass rate and avoid censure by the accrediting bodies of AACN and NLN as well as state boards of nursing.

Research Questions

To what extent is there a relationship between utilization (hours) of the Elsevier online remediation resource and HESI E2 Exit Exam raw scores for senior-level nursing students?

Subsidiary Research Questions

Is there a gain in the raw score on Version 2 of the HESI E2 Exit Exam after completion of online remediation hours for senior-level nursing students, controlling for ethnicity, gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exam Version 1?

Do students who perform additional remediation hours above what is required see an improvement of HESI E2 scores over and above scores of students who perform only the required remediation hours, controlling for gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exam Version 1?

Chapter II

Literature Review

The purpose of this literature review was to explore the impact of remedial interventions on standardized testing for professional licensure, specifically nursing licensure in the form of the NCLEX-RN. A literature search including the past 16 years (2000–2016) was conducted in the quest for relevant works in higher education related to remediation in nursing, pharmacy, medicine, and law. Literature from the fields of medicine and pharmacy as well as law were included because these professions are also judged by passing rates on national board exams. It was felt that their inclusion was valuable to understanding issues that are relevant to the attainment of professional degrees. The year 2000 was chosen as it reflects a more current response to the increasing complexity of the health care environment.

The databases of Cumulative Index of Nursing and Allied Health Literature (CINHL), Medline, and ProQuest were explored. The search words entered included NCLEX-RN, remediation, developmental education, standardized testing, educational progress, and professional licensure, HESI, and NCLEX-RN success. Peer-reviewed research articles encompassing both associate degree in nursing (ADN) and Bachelor of science in nursing (BSN) programs were included as each program sits for the same licensing exam. Research from the domain of higher education was reviewed in order to capture relevant work in corresponding fields. Using the search terms remediation, health sciences, law, pharmacy, and professional licensures, relevant literature from these fields were obtained. Empirical peer-reviewed studies were analyzed to ascertain the scope of remediation that has been studied. An ancestry review of the pertinent literature was also used to discover salient articles of particular significance to the topic. A summary of applicable literature will follow. Implications as they pertain to higher

education will be discussed. Areas for further research, as well as any gaps in the literature for further study will be identified. This section begins with a discussion of general systems theory which is the theoretical framework used to guide this study.

Theoretical Framework

General systems theory provides the theoretical frame work that guides this study. A system can be either open or closed and is made up of interrelated components that share a common purpose. The organizational components of the system can be broken down into input, output, feedback, and content. An open system functions as an exchange of information between the system and the environment (Potter, Perry, Stockert, & Hall, 2013). The interaction between these parts is unpredictable due to the many variables that can exist within the system (Putt, 1978). The purpose or goal of the system is to organize and deliver a service or a product (Potter et al., 2013).

In nursing this theoretical framework is referred to as the nursing process. Assessment is the first step, which aligns with the concept of input. Input is the collection of data or information, which is then interpreted to formulate a diagnosis or judgment based on the information collected. In the case of this study an assessment was made of program outcomes, and they were found to fall short of expectations. A problem was therefore identified and for which a plan of action could be developed. Upon identification of the problem (diagnosis), a plan of interventions are developed and implemented (Potter et al., 2013; Putt, 1978).

Output is the end product of a system. It is whether or not the actions or interventions implemented as a result of the initial assessment have resolved, stagnated, or improved the goals. Feedback is solicited throughout the process in the form of implementation and evaluation. With each intervention that is implemented, an evaluation of the outcome takes place (Potter et al.,

2013; Putt, 1978). The intervention must be evaluated for negative impact or harm. The interventions must be centered on the individual (Yoost & Crawford, 2016).

The content component of systems theory relies on the information obtained throughout the process. The process itself is cyclical as opposed to linear in nature (Yoost & Crawford, 2016). Because of this feature, a continuous process of evaluation and adjustment takes place.

The process of evaluation and adjustment in systems theory is applicable to nursing education (Carrick, 2011; Simon, McGinniss, & Krauss, 2013). Educational content (input) is delivered by faculty. Unique faculty characteristics and methods (throughput) add complexity to the system and may affect student outcomes (output; Carrick, 2011; Simon, McGinniss, Krauss, 2013). Measurement of student outcomes constitutes the feedback, which is then used to evaluate the effectiveness of the initial intervention (Carrick, 2011; Simon et al., 2013). Carrick (2011) credited systems theory as the framework for identifying the complexity of the interaction between nursing education (input) and student learning (output). This complexity contributes to the persistent problem of maintaining satisfactory NCLEX-RN pass rates.

The recognition of a problem along with the subsequent creation, implementation, evaluation, and analysis of a policy can be thought of in terms of the nursing process. In the assessment phase a situation is assessed (low NCLEX-RN pass rates) and a problem is identified (possible sanctions from board of nursing; Potter et al., 2013). In this case low board scores are the assessment component, and the reputation of the program as well as possible sanctions from the nursing board is identified as the problem. The next phase involves planning in the form of prioritizing, identifying goals and expected outcomes. Once a plan is in place, interventions are implemented in an effort to actualize the goals of the plan. In the final step an evaluation is made to determine whether or not the anticipated goals have been met, and further interventions are

planned accordingly (Potter et al., 2013). In this case a policy was developed with the goal of improving student outcomes through the implementation of a remediation policy. An open system allows for the continual evaluation of outcomes through a cyclical process.

The organization framework of systems theory is used to describe the process of testing and remediation. Time invested in any learning process must be well spent and effective. Analyzing the results of this policy implementation will identify the effectiveness of the specific intervention. The consistent nature of the intervention allows it to be reproducible, while the individualized nature allows it to be student specific.

Remediation

Remediation (also known as developmental education) has been recognized as a tool for impacting success in higher education for decades. Remediation is often described in two comparable yet different meanings dependent upon the timing of the remediation (Culleiton, 2009). One meaning is proactive and the other more commonly utilized is reactive. Culleiton defined remediation as "the process of identifying the need to take action to remedy a situation that, if left unresolved, will result in unfavorable outcomes, whereas implementing intervention strategies will successfully address the situation" (Culleiton, 2009, p. 26). Although educators enjoy thinking that they create evidenced-based solutions based on sound data, the truth is that most remediation efforts are reactive as opposed to proactive (Culleiton, 2009; Pennington & Spurlock, 2010). The challenge lies with early identification of at-risk students who are in need of remediation (De Lima et al., 2011).

Remediation in Health Sciences and Law

As in nursing, professional degrees such as those found in the health sciences and law also require a national or regional exam in order to obtain licensure. Schools offering these

degrees also face pressure either from accrediting bodies or from public perception to maintain high first-time pass rates. While there is a plethora of literature on remediation in nursing, comparable searches for law and health sciences professions were sparse. The findings from this literature are presented here.

Three studies concerning remediation in health sciences were examined for their value in contributing to the challenge of preparing students for national licensure. Students in the health professions often experience attrition rates of up to 15%, with a disproportionate number coming from minority groups (Maize et al., 2010). This creates a disparity of representation in the health care field. Efforts to correct this performance gap are not well defined in the literature.

A literature review outlining progression, early intervention, and remediation practices was assembled by Maize et al. (2010) to assess the status of remediation in the pharmacy profession. Their search led them to study the fields of both nursing and medicine, as literature pertaining to pharmacy was infrequent. Pharmacy and medicine both adhere to stringent admission and progression standards (Maize et al., 2010; Winston, VanDerVleuten, & Scherpbier, 2013). The conventional belief is that by setting a high bar the need for remediation is greatly reduced (Maize et al., 2010). Other traits such as motivation, communication skills, self-control (Maize et al., 2010) and teacher experience (Winston et al., 2013) can also play a role.

Madden, Etzler, Schweiger, and Bell (2012) compared board scores of pharmacy students who were required to remediate with students who were not. Students earning a grade of "D" or "F" in their coursework were required to remediate. The remediation process included an evaluation exam and additional course work. The design of the course was determined by faculty and was often self-directed. A statistically significant difference ($p < 0.001$) existed between the

two groups. Students who required no remediation passed the boards with a rate of 98% compared to a 70% rate for students who required remediation. Identification of specific areas of weakness or the determination of additional factors for poor performance were not explored in this study. These disappointing results led the researchers to search for additional factors that may contribute to board failure.

Winston et al. (2013) found that in medical school it was experienced teachers who significantly contributed to the successful remediation of students. The use of Socratic questioning in small groups leads to higher cognitive understanding and critical thinking abilities. Seasoned educators displayed higher expectations, challenged the students' thought processes, and were not intimidated by conflict (Winston et al., 2013). Inexperienced teachers were less likely to challenge a student's understanding of material and to facilitate discussions that advanced the student's reasoning abilities.

Comparing the difference between experienced and inexperienced educators was a unique approach not studied elsewhere in the literature. Maize et al. (2010) found that the most common remedial approaches consisted of repeating coursework, individualized and student directed plans, summer study, a reduction in course load, simulation experiences, and standardized exams. While evidence suggests that remediation can be cost effective in that it enables an at-risk student to continue in and to complete his or her academic program (Maize et al., 2010), there remains a lack of evidence concerning the types of remediation that promises success.

Law school graduates are required to obtain professional licensure by sitting for and passing the bar exam. The bar exam differs from nursing in that the NCLEX-RN is a national exam that is consistent across the U.S. and Canada. The bar exam has multiple versions, and

their use can vary between states. The most widely used version is the Multistate Bar Examination (MBE), which is administered in all states with the exception of Washington and Louisiana (Trujillo, 2007). A commonality exists with nursing in that both exams seek to measure a student's ability to correctly apply entry-level knowledge. A reported downward trend of first-time bar exam passers from 70% in 1996 to 64% in 2006 is a concern to law school deans who feel an ethical obligation to both the public and to their students (Trujillo, 2007). In 2014 the overall national pass rate for the American Bar Association (ABA) accredited schools ranged from a high of 88% in Alabama and Connecticut to a low of 65% in North Dakota (NCBEX, 2015).

Trujillo (2007) demonstrated that class rank was more indicative of bar exam passing than either the law school entrance exam (LSAT) scores or GPA. This led the researcher to the conclusion that remediation was necessary and that it should begin earlier as opposed to later in the program (Trujillo, 2007). There was no follow-up study that looked at any effects of remediation on bar exam passing rates. First-time test takers who graduate from ABA accredited schools passed the bar at a higher percentage than schools who were not accredited (NCBEX, 2015).

The results of remediation in health sciences, law, as well as in nursing come at a higher stake than in traditional higher education due to the tracking of board scores as a measurement of program success. Remediation continues to be a subject of both extensive study and of mixed results. While researchers have used various methods to analyze the amount of remediation and type of remediation, little is known about the specific pedagogies used for remediation. Without specific analysis on pedagogical styles that enhance success, it will continue to be difficult to provide consistent evidence on the effects of remedial education on higher education outcomes.

Remediation in Nursing

Literature on the topic of remediation in nursing is robust. The ability to educate students who can be safe practitioners with the aptitude to pass the NCLEX-RN is of utmost importance to nursing education. Accreditation status, recruitment of top students, as well as faculty and school reputation are dependent upon the attainment of high board scores (Roa, Shipman, Hooten, & Carter, 2011). Faculty endeavor to find early indicators of failure by assessing scores on entrance exams, key science and nursing courses, and overall GPA as well as GPA in nursing (Alameida et al., 2011; De Lima et al., 2011; Higgins, 2005; Lavandera et al., 2011; Seago, Wong, Keane, & Grumbach, 2008; Spurlock & Hunt, 2008; Underwood et al., 2013; Uyehara et al., 2007; Wiggins, 2011; Wolkowitz & Kelley, 2010). Midprogram exams are often used to set progression standards (Schooley & Kuhn, 2013; Yeom, 2013; Yoho, 2006). Attempts are also made near the end of programs to identify students who are at risk for NCLEX failure through the use of commercially prepared exit exams (Harding, 2010; Lavandera et al., 2011; Nibert & Morrison, 2013; Spurlock & Hunt, 2008; Yoho, 2006; Zweighaft, 2012).

Consequences and their impact on HESI E2 Exit Exam scores has been studied (Lauer, 2011; Lauer & Yoho, 2013; Stonecypher, 2014; Wilson, 2014). Schools that required remediation connected to consequences saw a significant increase in HESI E2 Exit Exam scores (Lauer, 2011; Lauer & Yoho, 2013). These results are not surprising since students, especially those who are at risk, are unlikely to participate in activities that are not required (Wilson, 2014). Remediation methods included faculty-led remedial courses, tutoring, online case studies, and individual online remediation plans generated based on the student's score on the exam (Lauer, 2011; Lauer & Yoho, 2013; Stonecypher, 2014). Consequences ranged from completion of

required hours of remediation (Lauer, 2011), retesting with parallel exams (Lauer & Yoho, 2013), as well as course failure (Lauer, 2011; Lauer & Yoho, 2013; Stonecypher, 2014).

Gaps in end-of-program success are addressed by looking at learning theories and end-of-course remediation. A wide variety of techniques have been utilized, and their outcomes have been studied. This section will explore the literature as it relates to predictors, validity of standardized tests, faculty-guided remediation interventions, and student-centered online remediation, nonacademic variables, and learning styles.

Predictors of NCLEX-RN Success

The search for accurate predictive measures for NCLEX-RN success has been a focus of nursing education researchers since the NCSBN moved to an online test format in 1994 (Culleiton, 2009; Lavin & Rosario-Sim, 2013). The NCLEX-RN ranges from 75–265 items, and they are presented in a computer adaptive (CAT) form where the difficulty level of each question is dependent upon the student's response to the previous question. Items are presented in multiple formats including multiple answer, fill-in-the-blank, drag and drop, and analysis of picture items (Norton et al., 2006). All test items are written at the analysis cognitive level as defined by Bloom's Taxonomy (NCSBN, 2013). With limited faculty resources (Higgins, 2005; Horton et al., 2012), it is always a challenge to correctly identify students at risk for failure who would benefit from remediation (Lavandera et al., 2011).

Admission criteria in the form of high school GPA, SAT, and ACT scores as well as nursing admission tests are used to gauge readiness for the rigors of nursing education (De Lima et al., 2011; Higgins, 2005; Underwood et al., 2013; Uyehara et al., 2007;Wiggins, 2011; Wolkowitz & Kelley, 2010; Yeom, 2013). Demographics such as age, gender, and ethnicity have also been explored for possible relationship to nursing success (De Lima et al., 2011; Lavandera

et al., 2011; Wiggins, 2011). Demographics were found to have no significant influence on student success on NCLEX-RN (Lavandera et al., 2011; Uyehara et al., 2007; Wiggins, 2011). It was noted, however, that this may be due to high attrition rates for these groups. White women (58%) had higher passing results than males (42%) and Blacks (44%) in a study conducted by De Lima et al. (2011) at an associate degree nursing program located in the southern U.S. An s *t* test compared mean scores of the independent variables (GPA at various points in the program, final grades in nursing clinical courses, HESI E2 Exit Exam) of students who passed NCLEX-RN on first attempt versus students who did not pass. The small sample size ($n = 38$) makes it difficult to generalize these results. Age, gender, and ethnicity showed no significant difference on pass rates in a pre-licensure master's program of BSN students at an urban West Coast university (Alameida et al., 2011).

Individual course grades and overall GPA from high school, science, and nursing courses are all thought to contribute to the prediction of success in nursing programs. GPA in prerequisite courses had a significant positive impact on program completion (Higgins, 2005). Overall GPA as well as nursing-specific GPA were found to be statistically significant in predicting first-time NCLEX-RN pass rate (Alameida et al., 2011; De Lima et al., 2011; Harding, 2010; Lavandera et al., 2011; Schooley & Kuhn, 2013; Wiggins, 2011). Achieving a "D" or an "F" in any nursing or science course significantly predicted student failure on first-time NCLEX-RN (Lavandera et al., 2011). Individual nursing courses such as pathophysiology (Alameida et al., 2011; Uyehara et al., 2007), anatomy and physiology (Underwood et al., 2013), and medical surgical nursing courses (Alameida et al., 2011; Schooley & Kuhn, 2013; Yeom, 2013) were all found to have a significant connection to first-time pass rates. Uyehara et al. (2007) found pathophysiology to be a significant predictor ($n = 271$, $p < .0001$) of program

completion. Students who earned an "F" had a predicted probability of .80 for program withdrawal, whereas for students who achieved an "A" the predicted probability of withdrawal was .05. This was not supported by De Lima et al. (2011), who found scores in parent–child (p = .01) and mental health (p = .02) to be the most significantly predictive of successful NCLEX-RN pass rates. It is these inconsistencies that have led nursing faculty to seek more standardized assessment methods.

Preadmission testing is a common tool used by schools of nursing to predict success (Higgins, 2005; Lavandera et al., 2011; Newman, Britt, & Lauchner, 2005; Underwood et al., 2013; Wiggins, 2011; Wolkowitz & Kelley, 2010). The Test of Essential Academic skills (TEAS) is specific to nursing programs and consists of subsets in reading, mathematics, science, and the English language. Assessment Technologies Institute's (ATI) RN fundamentals is taken after the first semester of nursing coursework and is used to measure progress within the program (Alameida et al., 2011; Wolkowitz & Kelley, 2010). All four subsets of the TEAS were found be a significant predictors of success on the ATI RN fundamentals exam, with science noted as the strongest predictor (Wolkowitz & Kelley, 2010). Newton, Smith, Moore, and Magnan (2007) found that the addition of the TEAS to the overall admission criteria of BSN students significantly predicted first semester success in nursing courses, accounting for 35.9% of the variance (F = 29.874, p < .001, n = 173). With the addition of TEAS scores, their model accounted for an additional 4.8% of the variance for first semester GPA in nursing courses.

The HESI A2 preadmission exam has also been studied for its ability to predict early success in nursing (Underwood et al., 2013; Wiggins, 2011). There was a significant relationship between admission scores on the A2 and final course grades leading to the conclusion that the A2 is a strong assessment tool as a measure of student success (Underwood et al., 2013).

Preadmission testing criteria factored into the admission process of schools that consistently achieved above average success with first-time board pass rates (Wiggins, 2011). No statistically significant relationship was found by Yoho (2006) between A2 scores and midcurricular or exit examination scores. Despite adherence to strong admission policies, preadmission testing, GPA, and course grades throughout the curriculum, nursing programs still find themselves struggling to maintain high first-time NCLEX-RN pass rates.

Validity Studies

In an effort to provide a consistent method of evaluation, commercially available standardized tests have been used with increasing frequency by nursing programs to identify and remediate at-risk students (Challenger, 2014; Coons, 2014; Harding, 2010; Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Sifford & McDaniel, 2007; Stonecypher, 2014). The exam most studied in the literature for validity and reliability for predicting NCLEX-RN pass rates is the HESI E2 Exit Exam distributed by Elsevier (Adamson & Britt, 2009; Challenger, 2014; Harding, 2010; Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Morrison et al., 2002; Nibert & Morrison, 2013; Sifford & McDaniel, 2007; Stonecypher, 2014; Yoho, 2006; Young & Willson, 2012; Zweighaft, 2012). The exam was developed in the late 1990s and acquired by Elsevier in 2006 (Nibert & Morrison, 2013).

For 4 consecutive years, beginning in 1996, the reliability and validity of the HESI E2 was analyzed using a total sample of 17,342 RN students from nursing programs throughout the U.S. (Nibert et al., 2006). The HESI Exit Exam is scored using a proprietary mathematical model known as the HESI predictability model (HPM). Raw scores can range from 0–1500 with the level of difficulty for each item figured into the final score. Benchmark scores are often determined by the individual program with a typical range acceptable range of 800–900

(Schreiner & Brunnert, 2014). A score of 900 or greater on the HESI E2 Exit Exam has been established to have an accuracy rating of 96.36% to 98.30% in predicting success on the NCLEX-RN licensing exam (Adamson & Britt, 2009; Alameida et al., 2011; Lauer & Yoho, 2013; Lavandera et al., 2011; Morrison et al., 2006; Nibert et al., 2006; Nibert & Morrison, 2013; Young & Willson, 2012; Zweighaft, 2012).

While the research studies on the HESI E2 Exit Exam are based on achievement of raw score, Elsevier also provides a weighted conversion score that nursing programs often utilize to assign grades based on exam results (Schreiner & Brunnert, 2014). The conversion score considers the difficulty level of the exam as well as the questions answered correctly. Use of the conversion score is an acceptable method when assigning course grades; the raw score is utilized for the purpose of predicting NCLEX-RN success and developing remediation plans (Schreiner & Brunnert, 2014).

Morrison et al. (2006) summarized the data accumulated since 1996 in assessing the reliability (0.86–0.99) and the validity of the HESI E2 Exit Exam. Content validity is based on the review of course syllabi provided by schools of nursing as well as the NCLEX blueprint. Construct validity has been tested by comparing scores on the HESI E2 Exit Exam with final GPAs in senior-level nursing students. An increase in the use of the Exit Exam from 85 schools in December of 1999 to 600 schools in all 50 states by the 2007-2008 academic year demonstrates its acceptance among nursing faculty as a reliable evaluator of student knowledge of nursing content (Langford & Young, 2013; Morrison et al., 2006). Furthermore the authors posited that identifying students with low HESI E2 scores prior to sitting for the nursing board exam allows for remediation to maximize success of first-time pass rates.

Spurlock and Hanks (2004) and Daley, Kirkpatrick, Frazier, Chung, and Moser (2003) examined the predictive accuracy of the HESI E2 and the NCLEX-RN using a "two by two model" frequently seen in clinical diagnostic testing to determine the presence of absence of disease. They looked at *sensitivity,* which is the ability to predict a true positive: those students *predicted to fail* who actually fail and *specificity* as students who were categorized as *predicted to pass* who actually passed. Spurlock and Hanks (2004) summarized HESI E2 data from four annual validation studies performed from 1999–2002. They found that 53% of the students who were "predicted to fail" went on to pass the NCLEX-RN on first attempt. It was also found that the HESI E2 accurately categorized students predicted to pass or predicted to fail only 48% of the time.

Daley et al. (2003) had used this model previously to compare two cohorts of BSN students at a Midwestern university. One group (n = 121) took the Mosby Assess Test, while another group (n = 103) took the HESI E2 in their last semester of nursing school. They found that the HESI E2 showed a greater sensitivity and specificity. The HESI E2 was able to correctly identify students as predicted to pass or predicted to fail with a 91% accuracy compared to a 60% accuracy for the Mosby Assess Test. It was posited that the ability to identify students predicted to fail is of more value to the educator, as remediation can be initiated to change the outcome of failure (Spurlock & Hanks, 2004). These variations in results make using the HESI E2 as a requirement for progression within a nursing program problematic.

Newman et al. (2005) compiled questionnaire information gathered from schools who purchased the HESI E2 during the 1997-1998 school year. The predictive nature of the E2 was confirmed with 98–99% accuracy. Schools that administered the exam in a proctored setting had a pass rate of 98.65% versus a 96.71% pass rate for schools that did not monitor the

administration of the exam. Schools that went on to require remediation based on HESI E2 score saw fewer low-scoring students fail than schools that did not use the E2 for remediation. No information was gathered as to the type and quality of the remediation process.

In 2006, Mary Yoho used classical test theory as a theoretical framework to further describe the predictive accuracy of the HESI E2 exam and NCLEX-RN success in an associate nursing degree program. Yoho employed a descriptive longitudinal design to determine if a relationship exists between student progression through the program using the HESI A2, MC, and HESI E2 and the prediction of passing the NCLEX-RN licensure exam. Her results demonstrated a 95.5% accuracy in predicting NCLEX-RN passing when benchmark (850) HESI E2 scores were achieved.

The sixth and seventh validity studies included multiple versions in their analysis to determine if the predictive nature was altered with retesting of parallel exams (Adamson & Britt, 2009; Young & Willson, 2012). Adamson and Britt (2009) found a decrease in predictability (V1 = 96.44%, V2 = 92.94%, V3 = 82.50%) with the administration of multiple versions. Additionally V3 was found to be significantly ($p < .001$) less accurate in predicting success than either the V1 or V2. This relationship was tested by Young and Willson (2012) in the seventh validity study. All three versions were found to have a significantly ($p < .000$) accurate predictability (V1 = 99.16%, V2 = 95.58%, V3 = 93.24%) for students who achieved a benchmark score of 900. More than half of the responding schools used the Elsevier online remediation for students prior to retesting; however, no information was reported as to how the program was utilized.

Langford and Young (2013) conducted the eighth validity study for the E2 exam. Using the benchmark of 900, it was found that 98.32% ($n = 3758$) of these students passed the NCLEX-

RN on first attempt. Included in this study were students who took multiple parallel versions of the E2 exam. Previous studies provided mixed results on the predictive ability of multiple exams (Adamson & Britt, 2009; Spurlock & Hanks, 2004). From the original sample, 881 students who failed to achieve 900 were required to repeat the exam using V2. Three hundred fifty-five students achieved the 900 benchmark, and 337 (94.93%) went on to pass the NCLEX-RN on first attempt. One hundred and ninety-two students from the original sample took exam V1, V2, and V3. Seventy-three students from this sample achieved the benchmark score of 900. Seventy (95.89%) were successful on their first NCLEX-RN attempt. The overall predictive accuracy of the E2 was 97.44% regardless of whether the student took V1, V2, or V3. This is consistent with the findings of Young and Willson (2012) who also found consistency of prediction between the three versions.

In conducting the ninth validity study of the HESI E2 Exit Exam, Zweighaft (2012) included schools that also used the HESI specialty exams. Students who scored at the benchmark level of 900 on the E2 went on to pass the NCLEX-RN at a rate of 96.61% thus validating previous research, which purported a passing range of the E2 to be 96.36% to 98.30% (Morrison et al., 2006). Zweighaft's was the first study to include the use of HESI content-based specialty exams within a nursing program. Users of specialty exams had an E2 mean score of 865.7 versus 837.3 for non-users ($p < .001$). Critical care, Pediatric, and Medical–Surgical ($p < .001$) were found to be the most predictive of NCLEX-RN success.

Despite these significant results, nursing faculty still struggle with developing policies around a commercially prepared exit exam (Stonecypher, 2014). Emphasis is highly placed on the HESI E2 scores because of the high correlation between benchmark scores on the E2 and

NCLEX pass rates (Higgins, 2005; Morrison et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012).

One concern related to the use of commercially prepared exams is that some programs create progression policies that prevent students from graduating or sitting for the boards if they have not achieved benchmark scores. Although these tests have been accurate in their ability to predict success, it does not predict students who are at risk for failure (Alameida et al., 2011; Harding, 2010; Spurlock & Hunt, 2008). An unidentified portion of students who scored in the predicted to fail range as determined by the ATI predictive model (Alameida et al., 2011) went on to successfully pass the NCLEX-RN exam. Spurlock and Hunt (2008) discovered that 71–78% of students scoring in the HESI predicted to fail range actually went on to pass the NCLEX-RN at first attempt. Therefore using these exams as barriers to progression for graduation is problematic (Alameida et al., 2011; Harding, 2010; Spurlock & Hunt, 2008).

Since many schools of nursing identify their at-risk students based on performance on commercially prepared exams, it is necessary to acknowledge the vetting process through which these exams have been deemed reliable (Adamson & Britt, 2009; Alameida et al., 2011; Lauer & Yoho, 2013; Lavandera et al., 2011; Morrison et al., 2006; Nibert et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Young & Willson, 2012; Zweighaft, 2012). Despite problems with how the HESE E2 is utilized within programs, it is clear that the exam itself has been shown to have consistent reliability and validity as it relates to predicting student success (Sosa & Sethares, 2015). It is therefore not unreasonable to use this exam as a tool for the development and evaluation of successful remediation policies.

Standardized Testing as a Basis for Remediation

Numerous studies have been conducted on the value of remediation based on HESI E2 scores and their impact on both program progression and ultimately NCLEX-RN pass rates (Daley et al., 2003; Mihal, 2006; Morrison et al., 2002; Newman et al., 2005; Nibert et al., 2003). Morrison et al. (2002) surveyed five schools of nursing that used the HESI E2 Exit Exam as an instrument of both progression and remediation policies. Progression policies prevent students from graduation and/or permission to sit for the NCLEX-RN until benchmark scores are achieved. Findings indicated a 9–41% improvement in pass rates at schools that enacted such policies. Remediation policies were uneven, with some schools suggesting students remediate on their own using information from the HESI E2 analysis. Others conducted faculty-led review sessions, while still others assisted students with various computer learning programs.

The ability to predict at-risk students early in the program to allow time for sufficient remediation is useful information for nursing schools (Harding, 2012). The predictive value of the HESI E2 makes it a valuable tool for use in identifying at-risk students in need of remediation (Morrison et al., 2002; Nibert et al., 2003). There was little consistency reported on the type of remediation. Nibert et al. (2003) found that nearly 72% of schools responding reported that they did not require remediation for students failing to achieve a benchmark score (ranging from 770–900). Suggested remediation was optional, and there were no consequences for not completing remediation. Furthermore it was found that many students did not take advantage of the offered remediation.

Newman et al. (2005) found schools that used remediation for low-scoring students significantly improved their ability to pass the NCLEX-RN on first attempt. One hundred and twenty-one low-scoring students were identified. Seventy-nine attended schools that required remediation based on the E2 scores, with 33 (41.78%) of them ultimately failing the NCLEX-

RN. Of the 46 low-scoring students identified in schools that did not require remediation, 26 (61.9%) failed the NCLEX-RN on first attempt. Zweighaft (2012) found that the use HESI specialty exams enhanced student performance on the HESI E2 exam.

In a survey of best practices used by nursing schools with consistently high pass rates, Wiggins (2011) cited early identification of at risk students for the purpose of remediation as a key component to success. DiBartolo and Seldomridge (2005) posited that all students should be considered at risk. The HESI exam package can be a cost effective educational method if it is used for early identification of at-risk students in need of remediation (Lavandera et al., 2011). By requiring mandatory remediation based on HESI scores for both specialty and exit exams, students are identified early, and remediation is consistent.

Researchers have studied the value of remediation based on HESI E2 scores and their impact on both program progression and ultimately NCLEX-RN pass rates (Higgins, 2005; Morrison et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012). Remediation policies have been evaluated for their ability to improve student performance on both the HESI E2 Exit Exam and ultimately the NCLEX-RN. Faculty-guided remedial courses, NCLEX-RN review books, tutoring, case studies, repeating of courses, and the HESI online remediation tool, are some examples (Challenger, 2014; Harding, 2012; Horton et al., 2012; Lauer & Yoho, 2013; Sifford & McDaniel, 2007). A student's concept of self-efficacy (Wilson, 2014) and a student's perceptions of barriers (Challenger, 2014) have also been considered for review as a factor in NCLEX-RN success.

Faculty Directed Remediation

Remediation courses developed and guided by faculty were a common intervention for many programs looking to improve student performance (Challenger, 2014; Frith et al., 2005;

Harding, 2012; Horton et al., 2012; Lauer & Yoho, 2013; Norton et al., 2006; Sewell et al., 2008; Sifford & McDaniel, 2007). Frith et al. (2005) and Sewell et al. (2008) developed a one-credit course with a low faculty to student ratio (1:8) that provided support, motivation, testing, as well as tutoring opportunities for students. Using a HESI pass score of 850, results improved from a 30% pass rate in 2002 to an 89% pass rate for the cohort of 2005 (Frith et al., 2005) with 85% achieving a score of 900 by the spring of 2007 (Sewell et al., 2008). First-time NCLEX-RN pass rates increased from 83% to 90% during the same time frame (Frith et al., 2005).

Senior students from a BSN program who participated in a 15-week faculty-developed remediation course saw a significant increase ($t(46) = -5.228$, $p < .001$) in their mean score of the HESI E2 Exit Exam taken post intervention (Sifford & McDaniel, 2007). The graded two-credit-hour course focused on the improvement of test-taking skills, time management, and test anxiety. The second half of the course focused on group discussion of responses and rationales for NCLEX-RN style questions. Attendance was mandatory. The mean HESI E2 improved from 735.62 to 810.17. Impact on NCLEX-RN outcomes was not reported.

A short-term gain was observed with the addition of a 1-credit supplemental instruction course offered to senior-level students (Harding, 2012). Enrollment was voluntary and 66% (n = 45) of the eligible students participated. During the semester in which supplemental instruction was offered, students succeeded in the course at a higher rate, and their retention in the program was enhanced for one semester. Sixteen of these students did not complete the program (Harding, 2012). The small sample size as well as the voluntary nature of the participation are problematic and are noted as a limitation to the value of this study.

A faculty-developed remediation method allowed for the comparison of results between students in a treatment as usual (TAU) control group and an enhanced-remediation group

(Horton et al., 2012). The course consisted of standardized tests and learning modules. Between two and four self-study tutorials were considered TAU for senior-year students in an associate degree program in the Mid-Atlantic region of the United States. The incoming cohort of students was considered the intervention group and exposed to enhanced remediation. Students in the enhanced course were required to complete 7 to 10 self-study tutorials. In addition, students were given the ATI predictor exam, and remediation hours were assigned based on these scores. The remediation hours were calculated based on the following scoring rubric: 58% or less = 4 hours; 59%–68% = 2 hours; 68% or more = 1 hour. The ATI range of 64%–68% equates to a 0.95 predictive possibility of first-time NCLEX-RN pass rate (Norton et al., 2006). The selection of amount of hours was based upon recommendation by the vendor ATI. The NCLEX-RN pass rate for the TAU group was 80.5% compared to 93.6% for the enhanced remediation group, suggesting that increasing remediation hours yields a positive outcome for NCLEX-RN pass rates (Horton et al., 2012). The small sample size (n = 41, n = 51 respectively) is a noted limitation of the study.

Developing a test plan that involves faculty in evaluating curriculum and creating faculty-prepared exams that add rigor to student assessment and evaluation can lead to improved student outcomes (Schroeder, 2013). An exam evaluation form was created for faculty as a guideline for writing higher level critical thinking questions for their exams. By adhering to the established principles of standardized test construction, faculty from an ADN program in the western U.S. were able to increase their NCLEX-RN pass rates from 89.14% to 97.01%. It was noted, however, that the high attrition rate related to more rigorous testing contributed to the increase in pass rates (Schroeder, 2013). Developing a rigorous test plan of faculty-created examinations addresses many of the concerns that faculty express regarding the use of commercially prepared

tests. Faculty maintain control over curriculum and have the ability to identify at-risk students earlier in the program (Schroeder, 2013).

In addition to the development of a rigorous test plan, Schroeder (2013) has also reported on the inclusion of the HESI specialty and E2 Exit Exam as a measure of external curricular evaluation. Students who scored lower than 850 on the specialty exam were required to remediate using the Evolve HESI online remediation tool. Students scoring less than 850 on the E2 Exit Exam were encouraged to remediate, and no parallel exam was administered. A 3-hour test-taking workshop was required of all students in the first semester of the curriculum, which was faculty designed and administered (Schroeder, 2013).

Schools of nursing that developed and implemented faculty-guided remediation courses saw success with increased NCLEX-RN pass rates. While effective, attention must be paid to the costly and labor intensive nature of these interventions. Limited faculty resources make maintenance of these interventions difficult to sustain. Finding methods that are both effective and require limited faculty involvement is key.

Student Centered Online Remediation

Student-centered online remediation is a tool available as part of the purchased standardized testing package. Wilson (2014) posited that this online remediation package is an underutilized tool within nursing programs. The use of a self-directed tool has the possibility to improve student outcomes with limited faculty supervision. Limited research exists on the use of these programs in nursing education (Lauer, 2011; Lauer & Yoho, 2013; Schroeder, 2013; Wilson, 2014).

Lauer (2011) explored the use of the Elsevier online remediation program to determine if this is an effective tool for improving HESI E2 scores. A comparison was made between schools

of nursing that use the online remediation tool and those that did not. Schools that used the remediation program were then examined based on whether consequences were applied to remediation completion. A significant increase in E2 scores from 781.78 to 873.32 ($t(378) = 18.43$, $p < .001$) was observed in schools that required the Elsevier online remediation between Version 1 and Version 2. Schools that did not use the Elsevier online remediation between Version 1 and Version 2 also experienced a significant difference ($t(473) = 18.24$, $p < .0001$) in scores from 774.87 to 861.38. Furthermore, a significant difference was found between schools that have consequences for remediation versus schools that do not have consequences (880.75 and 825.85 $t(2429) = 13.29$, $p < .001$; Lauer, 2011; Lauer & Yoho, 2013).

The Elsevier online remediation package was one piece of an overall testing policy developed by faculty of an associate degree program in the Midwest (Schroeder, 2013). Students who scored below a benchmark of 850 were asked to utilize the online resources that are part of the HESI standardized testing package. There was no monitoring for completion of the remediation nor any additional testing to evaluate the effect of the remediation. The overall improvement of NCLEX-RN pass rates of 89.3% pre testing policy to 97.2% post testing policy was most likely the result of multiple interventions, making it difficult to quantify any particular intervention.

Wilson (2014) sought to identify a relationship between self-efficacy, remediation, and academic performance utilizing an online remediation tool that is part of an ATI standardized testing package. Performance was measured as the difference in results from a pretest and posttest analysis. Students were asked to self-report their remediation activities in terms of minutes with ranges from a low of 0 to a high of 29,400. A differentiation was not made between the amounts of hours spent with the online program versus time reported as spent on other

remediation activities. Some students reported their remediation time as "a lot" making structured analysis difficult. No significant relationship was found between remediation and academic performance (r = .243, p = .135, n = 39) between students' reported remediation and a change in their test performance. The sample size was small (n = 39), and the remediation activities were self-monitored, making any generalizability of the results difficult.

Barriers, as they relate to examination policies and required remediation, can be felt by both students and faculty (Challenger, 2014; Stonecypher, 2014; Wilson, 2014). Lack of time and lack of control are often perceived as reasons to resist change (Stonecypher, 2014; Wilson, 2014). It is usually the experience of falling NCLEX-RN pass rates that precipitate the need for change (Stonecypher, 2014). Lack of time, confidence, and stress were most often cited by students as significant barriers to success (Challenger, 2014; Stonecypher, 2014).

Nonacademic Factors

"Poor test-taking skills" was the most frequent comment by students as they attempted to navigate through nursing courses and standardized testing (Challenger, 2014; Stonecypher, 2014). Faculty identified students' inability to achieve benchmark scores and loss of control over curriculum as barriers to the implementation of testing and remediation policies (Stonecypher, 2014). Using multiple regression, Challenger (2014) studied the variables of motivation, test-taking skills, study time, knowledge, and stress as predictors of HESI E2 scores. Self-perception of poor test-taking skills (t = 4.601, p < .001) was the only variable found to have a significant negative predictive effect on HESI E2 Exit Exam scores. Students who reported higher confidence of their test-taking skills scored 227 points higher than students who reported very low confidence in their test-taking skills. Based on these findings, a program to assist faculty in teaching test-taking skills was implemented. This study had two significant limitations: small

sample size (n = 87) and single site data collection. Both of these limit the generalizability of the results.

In response to students' complaints of poor test-taking skills as a barrier to success, Wiles (2015) developed an examination review grid to assist with examination feedback. The use of a systematic review approach to test taking can help the students identify at what point in the test taking process they are having difficulty. It would be interesting to see if the use of systematic testing policies (Schroeder, 2013) with a systematic test review policy (Wiles, 2015) could produce an overall improvement of both the understanding of content and improvement of test-taking skills. Although the exploration of test-taking strategies is not remedial in nature, the fact that standardized testing is used to identify students in need of remediation it is not unreasonable to include in the discussion here.

Wilson (2014) used the ATI standardized exam to identify 46 students who were determined to be at risk and in need of remediation. Thirty-nine students went on to successfully complete the required online remediation. A positive significant relationship was identified (r = .341, p = .034, n = 39) between remediation and self-efficacy. The relationship between remediation and academic performance did not show statistical significance (r = .243, p = .135, n = 39). The small sample size of 39 was noted as a limitation in this study.

A systematic review of the effectiveness of remediation was performed by Pennington and Spurlock (2010) to evaluate the status of evidence-based remediation efforts in nursing. Using a strict evidenced-based criteria, they discovered a vacuum of quality reproducible studies that could advance the research into effective remediation. Interventions that were implemented were found to be lacking in rigor and were not adequately structured to allow for replication and generalizability among programs. Retrospective designs along with the absence of control groups

can lead to bias and problems with validity. Most programs added a new course to the curriculum to house the remediation strategy. Participation was often voluntary. Topics for the remedial courses include test-taking strategies, stress reduction, and time management (Pennington & Spurlock, 2010). Culleiton (2009) in her review of remediation studies found that a clear language to describe remediation was missing. Educators considered relaxation and test-taking techniques on the same level as development of study plans and the re-teaching of content. She notes that remediation cannot be a "one size fits all" (p. 26) phenomenon.

Mee and Schreiner (2016) conducted a more recent review of remediation in nursing literature and considerations for future research. Although there is much reported about successful program remediation, there is still a lack of reporting on rigorous and reproducible interventions. That this gap still exists 6 years later most likely speaks to the difficulty in designing and carrying out these types of studies. The authors provided recommendations for policy development such as defining specific activities and individualizing remediation to specific areas of weakness. A mandatory requirement with clear consequences is a consistent area of recommendation for a successful remediation policy. It is also suggested to tailor remediation on a sliding scale so that students at higher risk for poor outcomes will be spending more time on remediation. Once implemented, the remediation policy needs to be evaluated for effectiveness of cost, resources, and outcomes.

Efforts to improve student success on NCLEX-RN has been widely explored (Alameida et al., 2011; De Lima et al., 2011; Higgins, 2005; Lavandera et al., 2011; Schooley & Kuhn, 2013; Spurlock & Hunt, 2008; Underwood et al., 2013; Uyehara et al., 2007; Wiggins, 2011; Wolkowitz & Kelley, 2010; Yeom, 2013). Admission standards such as demographics, GPA, and preadmission testing have been considered. Special courses have been created to assist at-

risk students as they progress through their education (Frith et al., 2005; Harding, 2012; Sewell et al., 2008; Sifford & McDaniel, 2007). Strategies to improve test writing (Schroeder, 2013) and test taking (Challenger, 2014; Wiles, 2015) have been implemented. Psychosocial components such as self-efficacy, anxiety, time management, and stress have also been considered (Challenger, 2014; Wilson, 2014).

Exploration of Learning Styles

Once students have been admitted and are progressing through their program, educational pedagogies are explored in an effort to improve knowledge retention and develop critical thinking (Bonis, Taft, & Wendler, 2007; Carrick, 2011; Lyons, 2008; March & Ambrose, 2010; Morton, 2006). Much work has been done to identify academic variables as predictions of NCLEX success with inconstant data (Carrick, 2011). A look at models of knowledge development can add to the body of information related to NCLEX-RN success. A patented method known as the ACE model (Bonis et al., 2007), problem-based learning (PBL; Lyons, 2008), development of a success measurement tool (Seago et al., 2008), systematic program assessment (March & Ambrose, 2010), and the comparison between systems theory and student approach to learning theory (Carrick, 2011) were some of the methods explored in the attempt to promote student learning and improve NCLEX-RN pass rates. Morton (2006) utilized a structured learning assistance program already established within the university as a method to improve student NCLEX-RN pass rates. Using critical thinking scales to assess learning outcomes can aid in identifying at-risk students and recognizing knowledge gaps before the student is in jeopardy of failure (Lyons, 2008; March & Ambrose, 2010).

PBL focuses on students' active participation to solve problems through critical thinking (Lyons, 2008). Widely accepted in medical schools, it has enjoyed only limited integration into

nursing (Lyons, 2008). While critical skills assessment revealed no significant difference in students, a randomized trial comparing lecture with PBL as a teaching pedagogy found that students who participated in PBL passed NCLEX-RN at a rate 8% higher (85% vs. 93%) than students who were exposed only to lecture (Lyons, 2008).

Many academic institutions have a remediation structure in place that focuses on test-taking and study skills that can be applied to nursing (Morton, 2006). Utilizing an existing structure capitalizes on the familiar nature of these services to students as well as conserving limited resources, which is often a concern of nursing faculty (Morton, 2006). An increase in NCLEX-RN pass rates from 65% to 92% was realized with the utilization of this strategy (Morton, 2006).

Systematic evaluation of curriculum by faculty was also valuable in developing a more student-centered approach to NCLEX-RN success. One tool used to assist in the measure of evaluating the acquisition of knowledge is the Academic Center for Evidenced-Based Practice. (ACE) star model developed at the University of Texas. The ACE star model of transformation is an evidence-based method used to understand the process of gathering knowledge for the purpose of application (Bonis et al., 2007). This is similar to the systems theory approach of assessment, planning, implementation, and evaluation described by March and Ambrose (2010). Both these strategies are effective in highlighting an organized plan for program and student success.

The development of learning strategies is an important component to include in the spectrum of remediation (Bonis et al., 2007; Carrick, 2011; Lyons, 2008; March & Ambrose, 2010). As the health care system increases in complexity, the difficulty of the NCLEX-RN is likely to keep pace (Lavin & Rosario-Sim, 2013). Educators will need to find strategies to keep

pace with this quickly changing environment. Learning theories used in other disciplines can add another dimension to understanding how complex information is learned and processed (Carrick, 2011).

Implication for Higher Education

The implications of successful remediation in nursing and health sciences is more urgent in nature. The precipitous drop in pass rates from 2012 to 2013 and its implications for resource allocation needs to be addressed sooner rather than later. Remediation can be defined as "the process of improving or correcting a situation" (Remediation, 2015). Clearly preparing students to be successful on NCLEX-RN as a pathway toward a career as a professional nurse is a situation in need of a remedy. Throughout the literature there is a heavy reliance on commercially prepared exams as a measure of NCLEX-RN preparedness (Morrison et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012). Coons (2014) found that a full 92% of nursing programs utilized standardized exams at some point within their curriculum. A majority of schools have built their remediation policies around student success on this criteria (Challenger, 2014; Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Sifford & McDaniel, 2007; Stonecypher, 2014). Many of the schools relied solely on this indicator and did not include NCLEX-RN data in their studies (Challenger, 2014; Lauer, 2011; Lauer & Yoho, 2013; Sifford & McDaniel, 2007; Stonecypher, 2014). Although the validity studies for these exams were strong (Morrison et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012) doubt still exists over their ability to predict students who may fail (Alameida et al., 2011; Harding, 2010; Spurlock & Hunt, 2008). High attrition rates associated with success on these exams should also be addressed (Horton et al., 2012; Lauer, 2011; Lauer & Yoho, 2013; Sifford & McDaniel, 2007). Giddens (2009) has posited that this reliance has skewed what is considered

entry level knowledge. It is worrisome that this measure has superseded the measure of NCLEX-RN.

The remediation has also been reactive as opposed to proactive in nature. With every triannual review, the National Council of State Boards of Nursing has increased the standard necessary for passing. This decision is made based on practice surveys, which demonstrate that entry-level nurses are entering a healthcare environment that is becoming increasingly more complex. The standard has increased every 3 years since 1998. The council met on December 9, 2015, and voted to uphold the current passing standard that has been in effect since April 1, 2013. The current passing standard will remain in effect through March 31, 2019 (NCSBN BOD, 2016). This is an opportunity for nursing schools to strengthen their programs and work to fill the void that exists for registered nurses.

Conclusion

The passing of national board exams is important to professional schools such as pharmacy, medicine, law, and nursing. Nursing in particular has seen robust attention in the literature regarding the issue of declining first-time board pass rates and interventions to remedy the situation. Nursing schools develop policies around rigorous admission standards, progression, end-of-program testing and remediation. Despite rigorous progression policies, schools struggle to maintain satisfactory pass rates. Faculty looking to find standardized measurement tools have utilized commercially prepared exams to identify at-risk students and plan remediation. One standardized exam broadly studied in the literature is the HESI E2 Exit Exam produced by Elsevier. This exam has been vetted for validity and reliability and has held up to scrutiny. It is reasonable for a nursing program to develop remediation policies that incorporated this exam. Research devoted to the efficacy of remediation policies in nursing is

abundant. Despite the abundance of research, gaps in the literature remain. The remediation policies studied lack specificity and are nonreproducible.

One gap in the research is the study of a specific, reproducible remediation policy that utilizes the HESI testing products in a consistent way throughout the curriculum. Much of the research has been focused on the HESI E2 designed to be given as an end-of-program assessment tool. Remediation policies have focused on this outcome. However, it is noted that remediation is of greater benefit when at-risk students are identified early in the program and remediated accordingly.

In order to be effective remediation policies need to be transparent and enforceable. Once a policy is in place it behooves faculty to evaluate the policy for effectiveness of intent. Using a theoretical framework of general systems theory, a policy can be assessed and evaluated for efficacy. This study seeks to address the literature gaps by providing a systematic evaluation of a specific policy construct that was used to improve student outcomes on the HESI E2 comprehensive exam.

Chapter III

Methodology

Introduction

The purpose of this ex post facto study was to examine the relationship between the utilization of the Elsevier online remediation program and student scores on the HESI E2 Exit Exam Version 2 for senior-level students in a baccalaureate nursing program in the northeastern United States. In this chapter, the design of the research is described as well as the participants in the study. Data collection and data analysis methodology will conclude this chapter.

Research Design

A quantitative correlational (ex post facto) study using a nonprobability convenience sample is the research design for this study. According to Polit and Beck (2006), correlational research is used to study the relationship between variables. This study is considered ex post facto in that the independent variable has already occurred and is not controlled by the researcher. This lack of control poses difficulty in making a causal conclusion (Polit & Beck, 2006). The existence of a relationship, however strong, is not enough to confirm that one variable caused another. Correlational research studies are useful for the development of a knowledge base (Polit & Beck, 2006). This study seeks to add to the body of knowledge pertaining to the effect of remediation methods on student outcomes.

Senior-level students who are enrolled in their final semester nursing capstone course are required to take two versions of the HESI E2 Exit Exam. The two versions of the E2 exam are parallel exams that follow the same content blueprint. The Exit Exam is 160 questions and is comprehensive of the nursing curriculum content. It is traditionally given in the final semester of nursing programs. Scores on the HESI E2 exam can range from 0–1500 with a benchmark score

of 900 yielding the greatest predictive probability (96.4%–98.3%) of first-time NCLEX-RN success (Nibert et al., 2003; Schreiner & Brunnert, 2014). If a score below the assigned benchmark of 900 is achieved, the student is required to complete a prescribed number of remediation hours based on the following scale: 800–899 = 3 hours, 700–799 = 5 hours, 600–699 = 7 hours, 500–599 = 9 hours, 400–499 = 11 hours, 300–399 = 13 hours. The completion of hours are tracked by faculty through Elsevier's online remediation resource. Failure to complete the remediation hours prior to sitting for E2 exam Version 2 results in a score of 0for the HESI E2 V1 exam. The assignment of course grades are the purview of individual faculty and was not captured here.

In the spring of 2013, at the time of this university's policy creation, an Internet search was done to find any information on methods other nursing schools were using to incorporate HESI remediation into their curriculum. This policy was modeled after policy that was utilized at Towson University and published in their nursing handbook (2011). The testing policy was implemented in the fall semester of 2013 (Appendix A). Prior to policy implementation, students were required to sit for two versions of the HESI E2 Exit Exam, the scores of each exam were then averaged together for 15% of the course grade. Students who achieved a conversion score of 90% were able to use that as their grade instead of the average between the two exams. In the spring of 2014 the policy was revised so that each exam counted as 10% of the course grade. The required hours of remediation remained consistent throughout the implementation period of this policy. There was no expectation of remediation prior to policy implementation, and there were no recorded remediation access on the Elsevier website.

Version 1 of the exam is given at Week 7 of a 15-week semester. All students must sit for the HESI E2 Exit Exam Version 2 at Week 14 of the semester. The actual time between the two exams can be as short as 4 weeks if the student is enrolled in the accelerated program.

Restatement of the Research Questions

The hypothesis explores the research question: To what extent, if any, is there a relationship between utilization (hours) of the Elsevier online remediation resource and Version 2 HESI E2 Exit Exam (HESI V2) raw scores for senior-level nursing students?

Subsidiary Research Questions

Is there a gain in the raw score on Version 2 of the HESI E2 Exit Exam after completion of online remediation hours for senior-level nursing students controlling for gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exit Exam Version 1?

Do students who perform additional remediation hours above what is required see an improvement of HESI E2 scores over and above scores of students who perform only the required remediation hours, controlling for gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exit Exam Version 1?

Setting

The setting for this study was a baccalaureate nursing program at a private Catholic university in the northeastern United States with a Carnegie Classification of Doctoral/Research. Undergraduate enrollment is approximately 5,800 with an ethnicity composed of 10% Asian, 50% White, and 30% Underrepresented Minority (National Center for Education Statistics (NCES), 2016). The nursing program awarded 230 bachelor's degrees in the academic year 2013-2014. Ethnicity within the nursing program follows a similar pattern with approximately 10% Asian, 50% White, and 20% Underrepresented Minority with 15% undefined. Nationally,

nursing schools are composed of 73.5% White (AACN, 2015), making this program more diverse than the national nursing school population.

The program is classroom-based instruction, which consists of both lecture and clinical components. There are three avenues that students attending this school may take in pursuit of a prenursing licensure bachelor's degree. The first encompasses traditional college students who are obtaining their initial baccalaureate degree for prelicensure nursing and who are completing a bachelor of science in nursing degree (BSN). The second group consists of students who have previously completed a bachelor's degree in another discipline. These students are required to complete all upper level nursing courses in four 15-week semesters over the span of 2 years. Another option for a student who has previously obtained a bachelor's degree is a 14-month accelerated program. The requirements are identical to the traditional and second degree but are taken in four sequential semesters including summer courses. The final semester is condensed into an 8-week time frame with students graduating at the end of October. Students who pursue nursing after previously obtaining a bachelor's degree are considered second degree students.

Sample Population

Four hundred and ninety-eight students were enrolled in their final semester capstone course between fall 2013 and fall 2015. This time frame was chosen to capture the effect of the HESI online remediation policy for this group of students. Four students were missing data such as GPA, cohort, and score on HESI V2 and were eliminated from the data set. One student totaled a remediation time of over 700 hours. This would mean that the student would have had to perform 100 hours of remediation hours per week. This was deemed to be out of the norm of possibility and was considered an outlier. Case wise diagnostics revealed three additional outliers in the number of remediation hours completed by students: 155.47, 135.94, and 120.45.

Although these students achieved gains ranging from 33% to 72% on their scores from HESI V1 to HESI V2, these extreme values created a skewed distribution and violated the assumption of normally distributed data. These students were eliminated from the data set yielding a total sample population of 490.

The normal probability plot in Figure 1 depicts the skewed distribution of remediation hours, which does not follow a reasonably straight line.

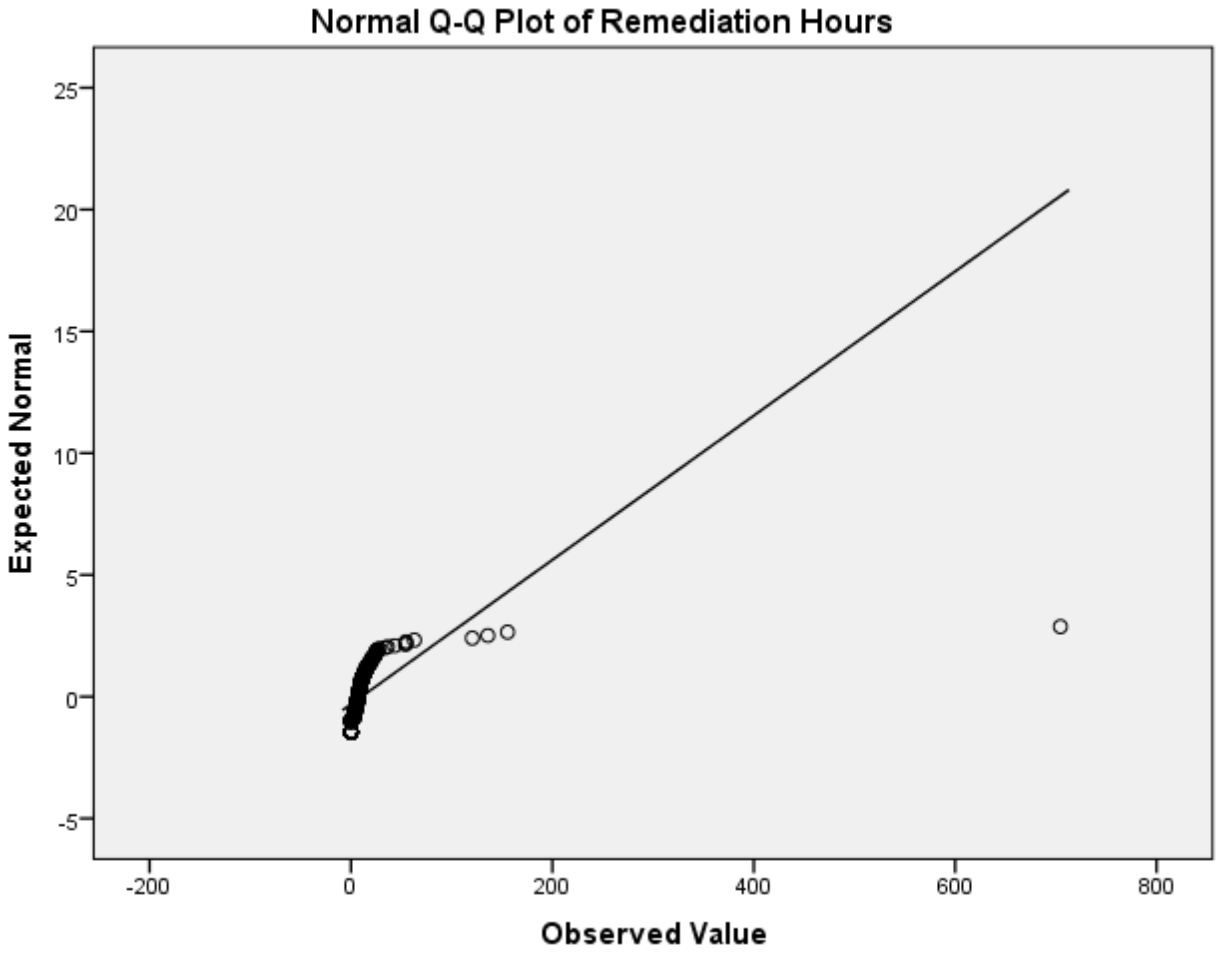

Figure 1. Normal Q-Q plot for normal probability (*N* = 494).

Figure 2 illustrates the normal probability distribution for the sample size of $n = 490$. Although there is still a skewness to the data the observed data plotted against the expected value creates more of a reasonably straight line suggesting a more normal distribution (Pallant, 2013, p. 66).

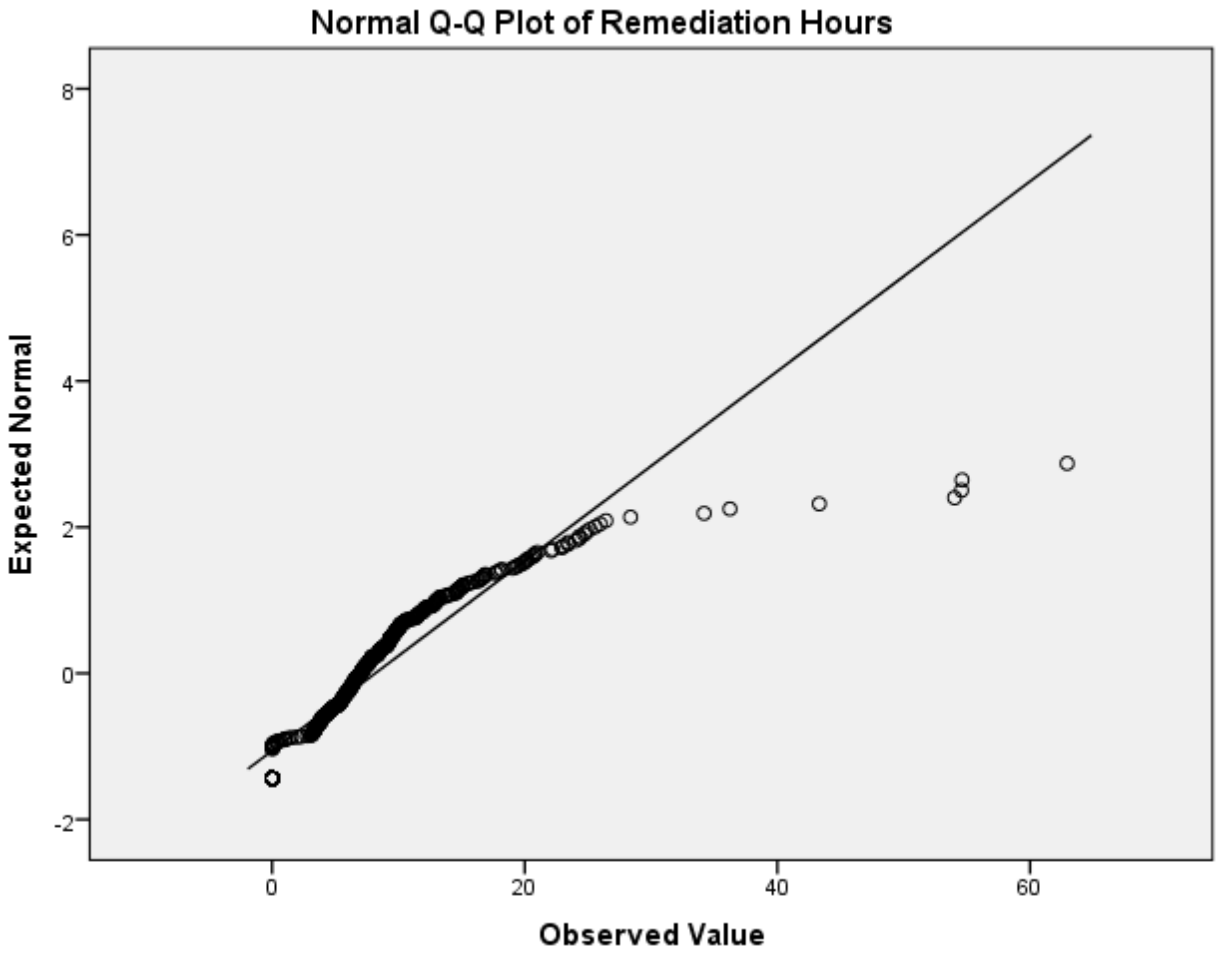

Figure 2. Normal Q-Q plot for normal probability ($n = 490$).

Statistical power, effect size, and sample size calculation were addressed in order to provide information on the sample size necessary to determine differences between groups.

Determination of statistical power will enhance this study's probability of rejecting the null hypothesis when the null hypothesis is, in fact, false.

Conducting an a priori analysis of power allows for the determination of the relationship between sample sizes, effect size, and standard deviation. The alpha was set at an acceptable level of 0.05 (Witte & Witte, 2010, p. 234). This allows for the researcher to state with 95% confidence that the obtained results are due to the influence of the variables studied and not to chance. The level of alpha is set to decrease the likelihood of making a Type I error. A Type I error occurs when the null hypothesis is rejected when it is, in fact, true (Witte & Witte, 2010).

Power was set at an acceptable level of 80% (Witte & Witte, 2010, p. 247). This allows that there is a 20% chance of making a Type II error. A Type II error occurs when the null hypothesis in retained when it is, in fact, false (Witte & Witte, 2010). Setting the power level allows for the determination of the minimum sample size necessary in an effort to achieve the true mean (Witte & Witte, 2010).

Effect size indicates the practical significance of the study in that it indicates the difference between a true and hypothesized population mean (Witte & Witte, 2010). Effect size is computed by dividing the difference between the means by the standard deviation and provides information of the similarity between two groups (Salkind, 2008). A small effect size was used to help determine if the results found are meaningful. The effect size for this analysis was set for 0.2 which is a small effect size according to Cohen (Salkind, 2008, p. 180)

Multiple regression is the method of analysis therefore the sample size was calculated using the following:

Effect size: 0.2 (small)
Alpha: 0.05 (95% confidence)
Power: 0.8

This analysis through G-Power indicated that a sample size of 42 participants was necessary given that the number of predictors is six. The sample sizes described here are well within the acceptable parameters for sample size, power, and effect size.

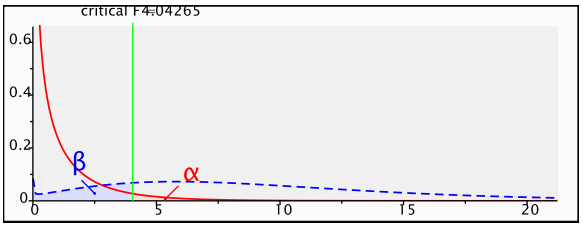

Figure 3. A priori analysis of power using G*power software.

In order to answer the research question of the relationship between remediation hours and HESI V2 scores, the sample population of 490 students was further refined into three distinct sample sets to capture both differences in remediation hours and scores on HESI V2. 1) For Question 1 the data base was refined to include only students who completed a minimum of 3 hours of remediation and a score of less than 900 on the HESI V1 (n = 394). Three hours was selected because it is the minimum number of hours required according to university policy. To answer Question 2 the data set was refined to capture students who performed extra remediation hours defined in as follows: 2) at least 30 minutes greater than the required remediation based on the HESI V1 score (n = 347). Thirty minutes was chosen because it was felt that this number captured students who intended to complete additional hours as opposed to students who exceeded required time by chance, and (b) the data set was refined to include students who

performed two or more hours greater than the required remediation based on the HESI V1 score (n = 184). This was chosen as a robust number of additional remediation hours in which the possibility of a difference in the effect on the HESI V2 scores could be realized.

The a priori power analysis indicated a sample size of 42 is needed to obtain an acceptable power and statistical significance, given the amount of predictor variables of six. Therefore it was determined that the chosen sample sizes would be sufficient for regression analysis.

The population of 490 was first examined for frequency and demographic characteristics that describe the students who are part of this study. Next the existence of any differences that may be present between students who obtained the benchmark score of 900 and those who did not are explored. Frequencies of gender, cohort, semester in which the HESI exams were taken, compliance with the policy in the number of remediation hours completed, and breakdown of scores achieved on the HESI exam by score range. Descriptive statistics for each of the continuous variables of GPA, HESI V1, HESI V2 and remediation hours completed as well as the correlational relationships are presented for each analyzed sample.

The frequencies for gender and cohort for the full sample are presented in Table 1. As is typical of nursing programs, the majority of students are female, and the traditional program had a larger enrollment. Nationally, nursing school enrollments consist of 91% female and 9% male students. This nursing program is composed of a higher percentage of male students than the national average.

Table 1

Frequencies for Gender and Cohort

Gender	*N*	%	Cohort	*N*	%
Male	62	12.7	Traditional	315	64.3
Female	428	87.3	2nd Degree	175	35.7

Note. $n = 490$.

The HESI V1 and V2 frequencies are presented in Table 2.

Table 2

Frequency Scores for HESI V1 and HESI V2

Score	HESI V1	%	HESI V2	%
300–399	1	.2	1	.2
400–499	7	1.4	10	2
500–599	34	6.9	24	4.9
600–699	108	22.0	70	14.3
700–799	154	31.4	151	30.8
800–899	114	23.3	133	27.1
900 >	72	14.7	101	20.6

Note. $n = 490$.

Frequency numbers for the HESI E2 Exit Exam are important because they are used by nursing schools as a comparison to national norms in order to obtain evaluative information for curriculum decisions and remediation policies. Elsevier provides information on national norms through their yearly validity studies. Adamson and Britt (2009) reported that out of 10,147 students who took the HESI E2 V1 exam in the academic year 2003-2004, fifty-four percent

failed to achieve a benchmark score of 900. An analysis of 4,383 students sitting for the HESI V1 in the 2006-2007 academic year by Young and Willson (2012) demonstrated 18% of the students failing to achieve a benchmark score of 900 on first attempt, with 63% of students failing to reach the 900 benchmark on second attempt. The difficulty level of the E2 exam as measured through reliability and validity studies has remained consistent through each of the validity studies reported by Elsevier since 2003-2004 (T. Throckmorton, personal communication, June 07, 2016)

Approximately 85% (n = 418) of the students at this university who have taken the exam failed to achieve the required benchmark score of 900 for V1 on first attempt. This high number of 85% failing to reach the benchmark score of 900 is well below the national average and is a concern for faculty and administration. It was the assessment of low HESI scores that precipitated and supports the decision to enact a remediation policy implemented to improve scores on the HESI E2 exams.

The greatest number of students scored in the 700–799 range both V1 (n = 154, 31.4%) and V2 (n = 151, 30.8%). The number of students in the sample scoring 900 or greater on HESI V2 increased robustly from 72 (14.6%) on V1 to 101 (20.6%) on V2.

The frequency table (Table 3) by semester shows that the majority of students complete the program in the spring semesters (n = 244, 49%) with the lowest number of students completing the program in the summer (n = 26, 5%). This is typical of most nursing programs where fewer students tend to graduate in the off-track semesters. These off-track students also often have lower first-time board scores since they have usually struggled with poor grades, which has put them in the off-track semester (Horton et al., 2012). Students were categorized by whether they tested in the spring, summer, or fall semester.

Table 3

Frequency of Enrollment by Semester

Semester	*N*	%
Fall 2013	61	12.4
Spring 2014	132	26.9
Summer 2014	12	2.4
Fall 2014	76	15.5
Spring 2015	112	22.9
Summer 2015	14	2.9
Fall 2015	83	16.9

Note. $n = 490$.

A correlation matrix (Table 4) was created to check for any relationship between the HESI V1 and HESI V2 scores and the semester in which the students tested. Negative correlations from fall 2013 and spring 2014 could be related to the newness of the policy. Positive correlations were found in spring 2015 and fall 2015 as the policy had been in effect for a longer period of time. Although statistically significant, the correlations are very low representing a very weak to no relationship.

Table 4

Correlation HESI V1 and HESI V2 and Semester

	Fall 13	Spring 14	Fall 14	Spring 15	Fall 15
HESI V1	.085	-.173**	.089*	-.008	.016
HESI V2	-.194**	-.098*	.025	.136**	.101*

Note. $n = 490$, $*p < .01$, $**p < .05$.

Finally each sample was divided into completion of remediation hours. Completion of required remediation is shown in Table 5. Remediation hours were divided into five groups as

follows: (a) no remediation required, (b) remediation required but not completed, (c) required remediation completed, (d) exceeded required remediation hours by 30 minutes or greater, and (e) exceeded remediation by 2 hours or greater. Seventy-two students who achieved a 900 on HESI V1 were not required to complete remediation hours and were excluded from all multiple regression analysis. It was noted that during the timeframe the policy was in effect there were 24 students whose scores on the HESI V1 were such that remediation was required, but they did not complete the required remediation hours. These students did not log in the required remediation hours based on their scores on the HESI V1 according to the policy with some students not accruing any remediation time on the Elsevier website and were excluded from the analysis. The reason is unclear; however, the majority of these students were in the fall of 2013. Therefore it could be due to uneven participation by both faculty and students during the implementation of a new policy that was unfamiliar to both faculty and students. Students who complied with the policy and completed at least 3 hours of remediation were included in the first regression analysis (n = 394). It is worth noting, however, that 71% of the students exceeded the required remediation hours. While some of this can be attributed to students' concerns with completing the required hours to avoid consequences, this could also demonstrate a strong motivation among students seeking to improve their scores on the HESI E2 exam.

Table 5

Required Remediation

Required Remediation	*N*	%
Not required	72	14.7
Required not complete	24	4.9
Required hours complete	47	9.6
Exceeded required hours by 30 minutes	163	33.3
Exceeded required hours by 2 hours	184	37.6

Note. n = 490.

The descriptive statistics for GPA, HESI V1, HESI V2, and remediation hours for the full sample are presented in Table 6.

Table 6

Descriptive Statistics GPA, HESI V1, HESI V2, Remediation Hours

Variable	Min	Max	Mean	Median	*SD*
GPA	2.59	3.96	3.28	3.25	.282
HESI V1	359	1188	764.71	752.50	123.66
HESI V2	354	1298	797.32	793.00	141.55
RemHours	.00	62.93	8.40	7.07	7.95

Note. *n* = 490.

It is noted that the minimum value for HESI V2 is lower than that for HESI V1. The maximum value for HESI V2 is greater as is the mean value between the two versions of the exam. The standard deviation for HESI V2 is higher suggesting greater variability in the scores in HESI V2.

The mean scores of HESI V1 and HESI V2 were compared with a paired sample *t* test.

Table 7

Paired Sample t Test for HESI V1 and HESI V2

				95% CI	
Mean Difference	*t*	df	*p*	Lower	Upper
32.606	-4.903	489	<.001	-45.673	19.539

Note. $n = 490$, $p < .000$.

The results show that there is a significant difference between the mean of HESI V1 and the mean of HESI V2. The moderate (Cohen, 1988) positive correlation, $r = .39$ indicates that the students who score high on the HESI V1 also tend to do well on the HESI V2. The computed effect size of .22 indicates a medium effect according to Cohen (Salkind, 2008, p. 180). The scatterplot (Figure 4) demonstrates the moderate positive relationship that exists between HESI V1 and HESI V2.

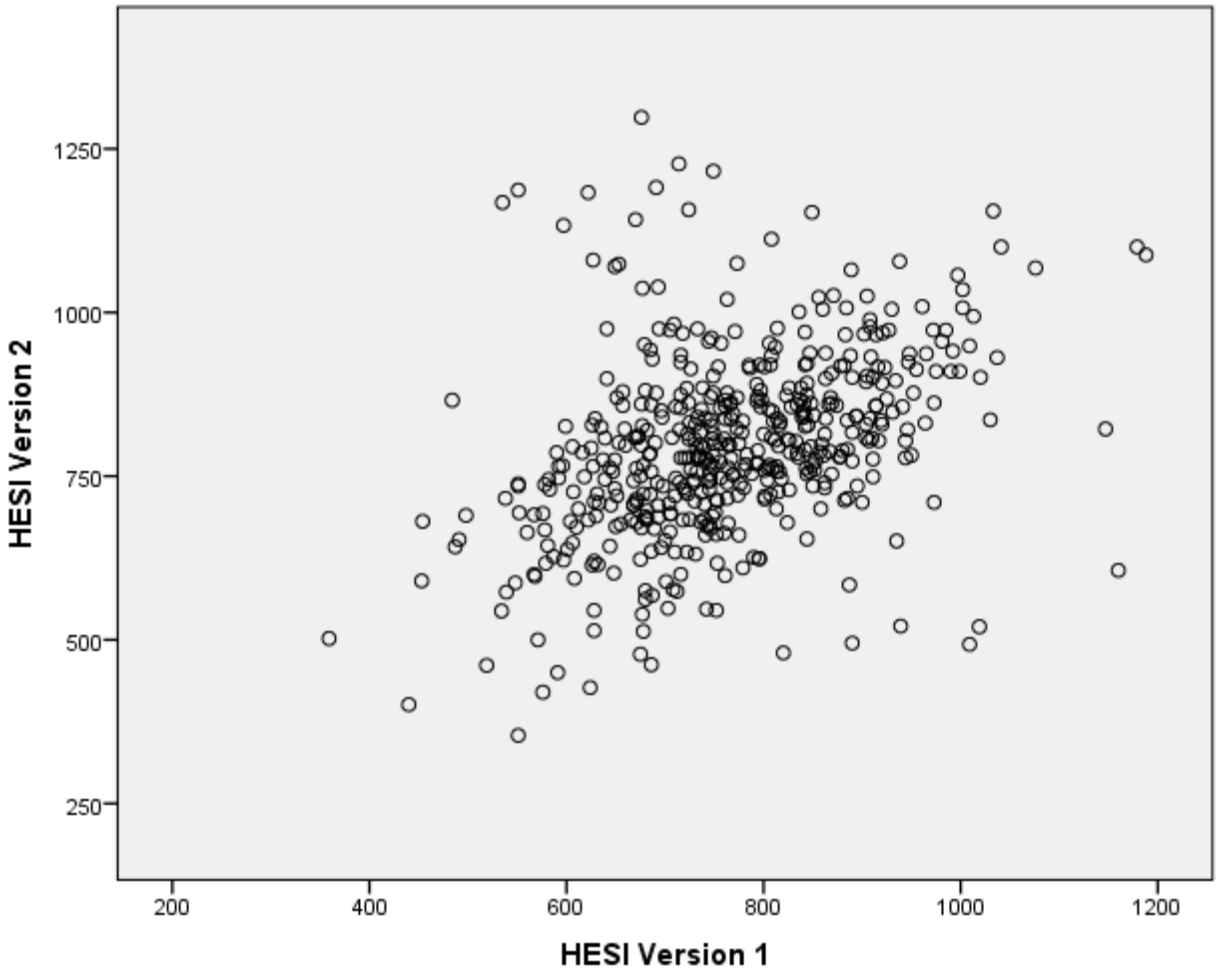

Figure 4. Scatter plot of the relationship between HESI V1 and HESI V2 (n = 490).

The remediation hours range from 0–62.93. The normality distribution is illustrated in Figure 5. The mean of 8.31 is fairly close to the median of 7.17 suggesting a right skewed distribution. Despite the elimination of four outlier data points, the histogram in Figure 5 reveals a strong right skew.

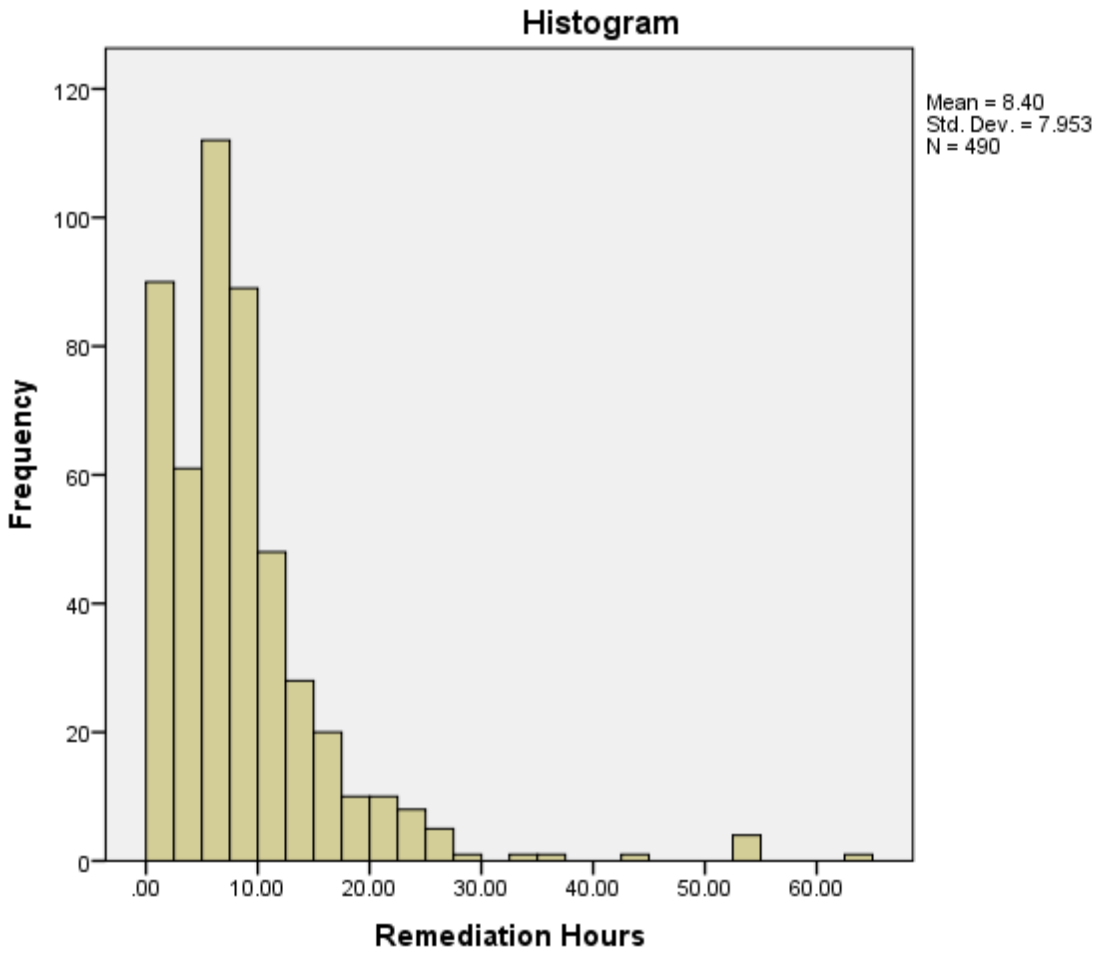

Figure 5. Normality distribution histogram remediation hours (*n* = 490).

Skewed data violate the assumption of normality required for a multiple regression analysis. In order to prevent spurious results due to the right-tailed skewness of the remediation hours this variable was transformed by mathematically modifying the score to achieve a normal distribution. The recommended formula for right skewed data is:

New variable = LG10 (old variable) (Pallant, 2013, p. 97)

The log10 numeric computation returns the base 10 logarithm of the numeric exponent, which must be numeric and greater than 0. The remediation variable was transformed into a new variable of the Log of remediation hours for the sample size (n = 394) as this included only students who completed 3 hours of greater of remediation. A Q-Q plot of normality for the transformed data is shown in Figure 6 and demonstrates a reasonably straight line with no real clustering of points with most points collecting around the zero line (Pallant, 2013).

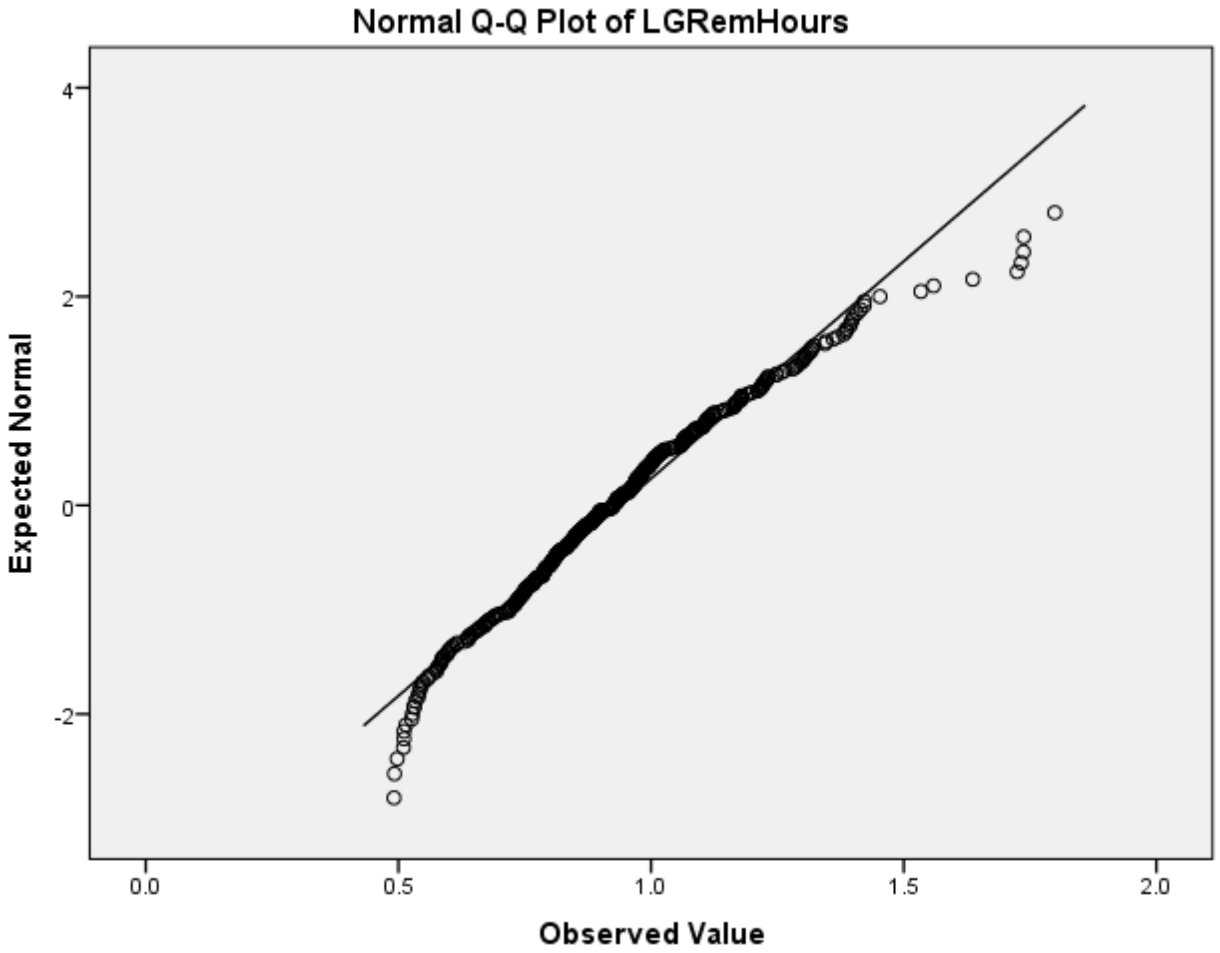

Figure 6. Normal probability plot log remediation hours (n = 394).

A histogram was also created using the transformed variable LG10 (remediation hours) and reveals a normally distributed variable. Therefore by creating a computed variable for remediation hours, it meets the assumptions of multiple regression for linearity and normality.

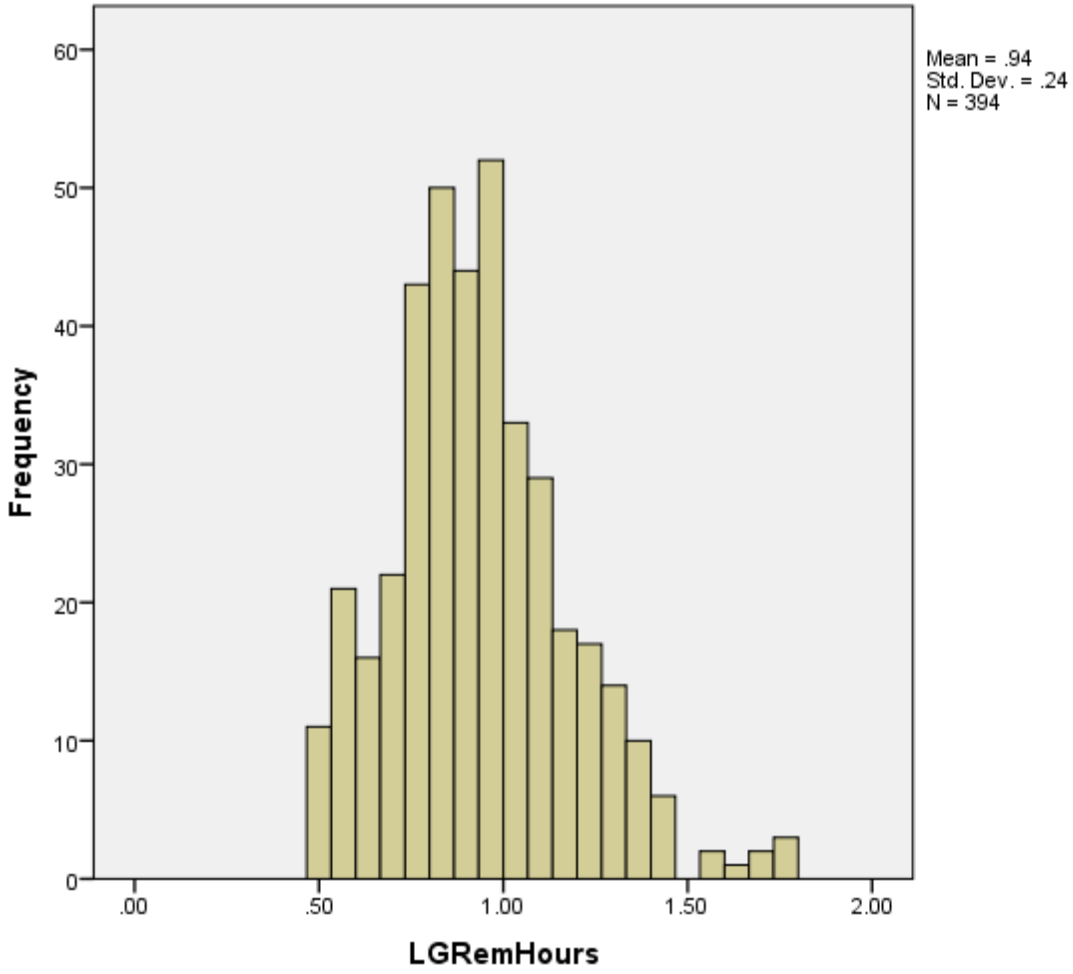

Figure 7. Histogram log remediation hours (*n* = 394).

A correlation matrix (Table 8) was run using all independent variables collected in the study to check for predictors that may be highly correlated such that multicollinearity is likely to create a problem (*n* = 490). Multicollinearity can produce spurious results in running a multiple regression if any of the independent variables are highly correlated with each other. A high

correlation is often considered plus or minus .50 or .60 with a perfect correlation being 1 (Leech, Barrett, & Morgan, 2008, p. 95).

Table 8

Correlations of Variables

	GPA	Cohort	HESI V1	HESI V2	Summer	Fall	RemHours
GPA	1						
Cohort	.270**	1					
HESI V1	.544**	.218**	1				
HESI V2	.465**	.038	.390**	1			
Summer	.004	-.062	.068	.017	1		
Fall	-.123**	.286**	.129**	-.035	-.214**	1	
RemHours	-.336**	.139**	-.548**	-.116*	.039	-.176**	1

Note. $n = 490$, **$p < .01$, $p < .05$.

Significant negative correlations were found between remediation hours and GPA, HESI V1, HESI V2, and fall semester as well as GPA and fall semester, along with fall and summer semester. This could be because students earning a higher GPA and who scored higher on the HESI V1 would be less likely to be required to perform remediation. These correlation values are very low and not likely to cause any concern with multicollinearity. A positive correlation is identified between GPA and traditional students, HESI V1, and HESI V2. HESI V1 and HESI V2 are also positively correlated. The highest correlations are between GPA and HESI V1 and HESI V2. This is not surprising as students with higher GPAs tend to score higher on both versions of the HESI E2 Exit Exam. The positive correlation between HESI V1 and HESI V2 is also expected as students who achieve a high score on HESI V1 tend to also score high on HESI V2. The lack of a stronger correlation between the two scores may suggest that students who

performed well on HESI V1 did not take the HESI V2 exam as seriously and therefore did not put forth their best effort. All correlations are less than .60 so there is no problem with multicollinearity.

An independent samples *t* test was performed to look at the differences between students who achieved a 900 on the HESI V1 exam on first attempt and those that did not. Demographic characteristics of students who passed the HESI V1 exam versus those that did not are presented in Table 9.

Table 9

Demographic Characteristics for Students who Passed the HESI V1 Versus Students who Failed the HESI V1

HESI V1	*N*	%	Male	Female	Trad	2nd Degree	GPA
Pass	72	15%	8%	92%	38%	63%	3.52
Fail	418	85%	13%	87%	69%	31%	3.23

Note. $n = 490$.

Of the 85% of students who did not achieve a 900 on first attempt, 87% were female and 31% were second degree. Fifteen percent of the students passed on first attempt. This passing group comprised 92% female with 63% second degree students. Therefore females and second degree students passed at a higher percentage than males and traditional students. The mean GPA for students who passed was 3.52 compared to 3.23 for students who did not pass, demonstrating the strong relationship between GPA and HESI V1 scores. The correlation value between HESI V1 and HESI V2 of .39 is a moderate value as is the computed effect size of 0.22 (Salkind, 2008, p. 180).

The variables for gender, GPA, cohort, and remediation were explored using an independent samples *t* test for differences between students who passed the HESI V1 exam on first attempt and those that did not. The Levene's test for equal variance for gender is significant

so that equal variance is violated, and equal variance is not assumed. There is not a statistically significant difference between males and females for this sample population. This could be attributed to the overall small representation of males in nursing.

Table 10

Independent Samples t test for equality of variance of Means for Gender Between Students who Passed Versus Students who Failed

	Levene's test							95% CI
Source	*F*	*p*	Mean difference	*t*	df	*p*	Lower	Upper
Equal variance assumed	6.318	.012	-.051	-1.193	488	.233	-.134	.033
Equal variance not assumed			-.051	-1.376	111.204	.172	-.124	.022

Note. n =490.

Levine's test for equal variance is not statistically significant for GPA; therefore, equal variance is assumed. There is a significant difference between GPA of students who passed on first attempt versus students who did not pass on first attempt.

Table 11

Independent Samples t test for Equality of Variance of Means for GPA Between Students who Passed Versus Students who Failed

	Levene's test							95% CI
Source	*F*	*p*	Mean difference	*t*	df	*p*	Lower	Upper
Equal variance assumed	.008	.927	-.2954	-8.848	488	<.001	-.361	-.230

Note. n = 490.

Levene's test for equal variance for cohort is not significant, and the assumption of equal variance is not violated. So there is a statistically significant difference between traditional and second degree students for this sample population.

Table 12

Independent Samples t Test for Equality of Variance of Means for Cohort Between Students who Passed Versus Students who Failed

	Levene's test						95% CI	
Source	*F*	*p*	Mean difference	*t*	df	*p*	Lower	Upper
Equal variance assumed	3.495	.062	-.314	-5.269	488	<.001	-.431	-.197

Note. $n = 490$.

Equal variance for remediation is significant; therefore, the assumption of equal variance is violated. The *t* test is statistically significant in noting that there is a difference between successful and unsuccessful students with regards to remediation. This is the expected finding since students who achieved a 900 on the HESI V1 exam had no requirement to remediate.

Table 13

Independent Samples t Test for Equality of Variance of Means for Remediation Between Students who Passed Versus Students who Failed

	Levene's test						95% CI	
Source	*F*	*p*	Mean difference	*t*	df	*p*	Lower	Upper
Equal variance assumed	28.890	.000	-9.118	-9.824	488	<.001	-10.94	-7.29
Equal variance not assumed			-9.118	-20.00	412.974	<.001	-10.01	-8.22

Note. $n = 490$.

Finally a scatterplot was created to visualize the 4% gain achieved between scores on HESI V1 and HESI V2 for the full sample (n = 490). The graph depicted in Figure 8 reveals that students who initially scored high the on HESI V1 did not score as high on the HESI V2. The students who achieved the highest gain on the HESI V2 achieved a scored in the range of 500–800 on the HESI V1.

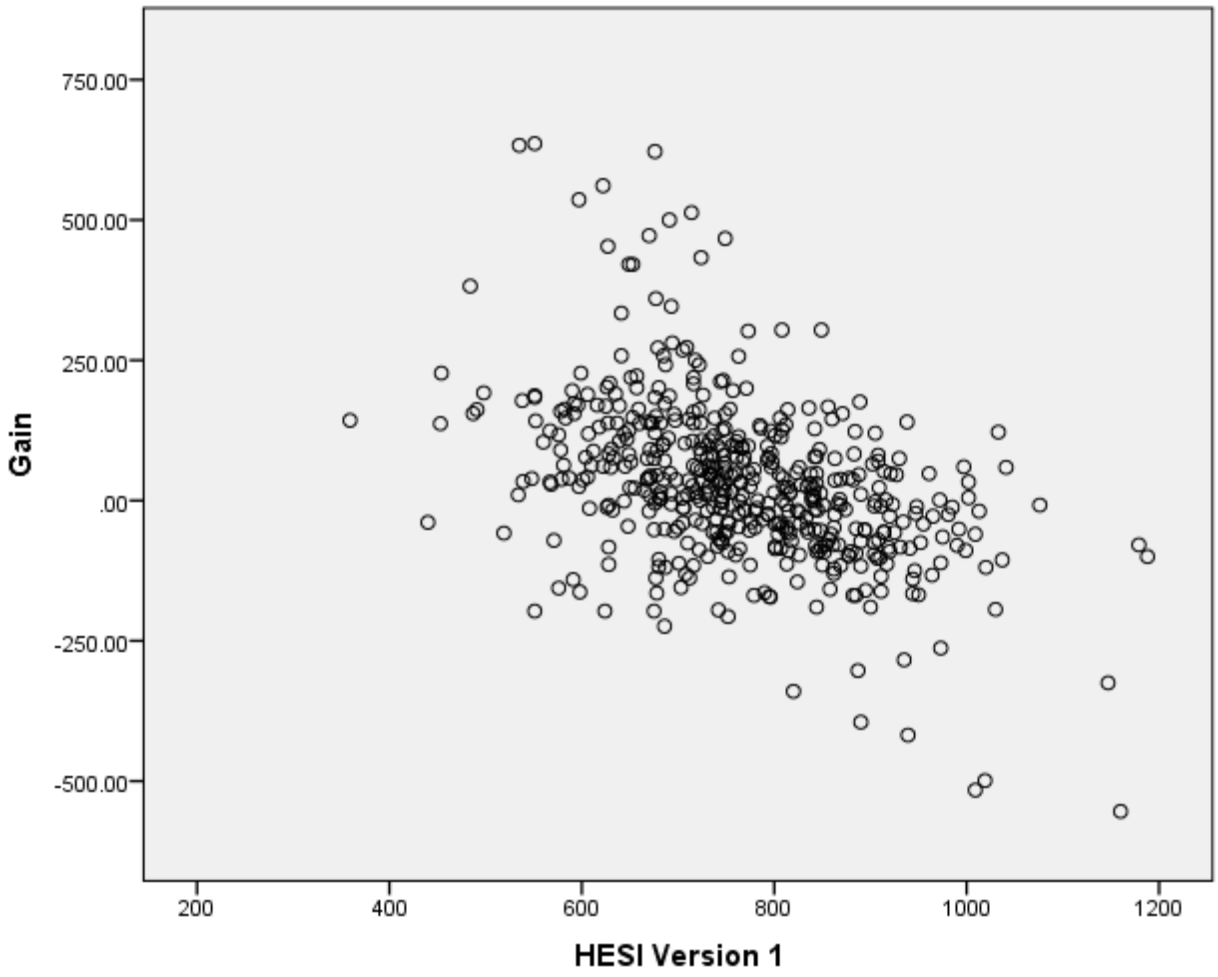

Figure 8. Gain in the score from HESI V1 to HESI V2 (n = 490).

Research Question 1

Inclusion criteria for analysis of the sample population for Research Question 1 was scoring less than 900 on the first HESI exit exam V1, and completing 3 hours or greater of

remediation time as required by the policy. Students who completed the required remediation or completed at least 3 hours of remediation (n = 394) were included in the analysis for Research Question 1.

A correlation matrix with all variables entered (gender, GPA, Cohort, HESI V1, HESI V2, semester, and remediation hours) was conducted and is represented in Table 14.

Table 14

Correlation of all Variables

	Gender	GPA	Cohort	HESI V1	HESI V2	Semester	RemHours
Gender	1						
GPA	-.022	1					
Cohort	-.102*	.221**	1				
HESI V1	-.049	.491**	.062	1			
HESI V2	-.029	.399**	-.010	.297**	1		
Semester	.034	-.034	-.099*	.107*	.142**	1	
RemHours	.011	-.345*	-.061	-.617**	-.143**	-.034	1

Note. n = 394, *p < .05, **p < .01.

A significant negative correlation was found between remediation and GPA, HESI V1, and HESI V2. This negative correlation is suggestive of students who scored lower on the HESI V1 and have lower GPAs to be more likely to perform remediation. The negative correlation between remediation hours and HESI V2 is perplexing; however, it is very small and not highly significant, making it almost meaningless. Significant positive correlations were found between GPA and HESI V1, cohort, and HESI V2, as well as between HESI V1 and HESI V2. It is not surprising that the strongest correlations exist between the HESI exams and GPA, as stronger

students tend to score higher on the exam. The lower correlation between the HESI V1 and HESI V2 could be the result of the students who required remediation starting at a lower lever on the HESI V1. All correlations are small, all less than .60, and therefore are fairly weak so that there is no concern of multicollinearity (Leech et al., 2008, p. 95).

The sample includes traditional BSN students (n = 272) and second degree students (n = 122). Fifty-one of the candidates are male and 341 are female. This is roughly the equivalent frequencies as the original sample population.

Table 15

Frequencies for Gender and Cohort

Gender	*N*	%	Cohort	*N*	%
Male	51	12.9	Traditional	272	69
Female	343	87.1	2nd Degree	122	31

Note. n = 394.

Frequencies for HESI V1 and HESI V2 scores are presented in Table 16. Any students who scored the benchmark of 900 or greater on HESI V1 were excluded from this sample. The largest percentage of students scored in the 700–799 range (37.6%) and (36.3%) on both the HESI V1 and HESI V2. Sixteen percent of students who failed to achieve the benchmark score of 900 on the first exam went on to earn a 900 on the second exam. This is well below the finding for Elsevier's national data base where 38% of students achieved the score of 900 on their second attempt after failing to achieve the score of 900 on their first attempt (Young & Willson, 2012).

Table 16

Frequency Scores for HESI V1 and HESI V2

Score	HESI V1	%	HESI V2	%
300–399	1	.3	1	.3
400–499	6	1.5	3	.8
500–599	30	7.6	14	3.6
600–699	100	25.4	61	15.5
700–799	148	37.6	143	36.3
800–899	109	27.7	109	27.7
> 900			63	16

Note. $n = 394$.

The frequency of enrollment by semester reveals a typical pattern for nursing programs, where the largest number of students graduate in the spring semester, and the smallest number complete in the summer semester.

Table 17

Frequency of Enrollment by Semester

Semester	Frequency	Percent
Fall 13	21	5.3
Spring 14	122	31
Summer 14	6	1.5
Fall 14	63	16
Spring 15	95	24.1
Summer 15	13	3.3
Fall 15	74	18.8

Note. $n = 394$.

According to the remediation status breakdown, all students in this sample either completed or exceeded the number of required remediation hours. Any students who completed less than 3 hours of remediation were excluded from this sample.

Table 18

Remediation Status

Remediation status	*N*	%
Required complete	47	11.9
Exceeded required hours by 30 minutes or greater	163	41.4
Exceeded required hours by 2 hours or greater	184	46.7

Note. $n = 394$.

The HESI V1 and V2, GPA, and remediation hours descriptive statistics are depicted in Table 19. The mean from HESI V2 at 793.62 is greater than the mean on HESI V1 at 732.69 suggesting that performing remediation was somewhat beneficial for this group with an average gain of 61 points.

Table 19

Descriptive Statistics GPA, HESI V1, HESI V2, Remediation Hours

Variable	Min	Max	Mean	Median	*SD*
GPA	2.61	3.90	3.24	3.23	.262
HESI V1	359	895	732.69	740.00	94.60
HESI V2	354	1298	793.62	782.50	130.00
LogRemTim	.49	1.80	.939	.926	.24

Note. $n = 394$.

By creating a computed log value for remediation hours, the distribution is more normally distributed. The mean and confidence intervals for the log value of remediation time

were back transformed so as to create a more meaningful data report. The back transformed mean for remediation hours is 8.68 with a 95% confidence interval between 7.77 and 9.69.

A paired sample *t* test showed a statistically significant difference between the means as illustrated in Table 20. The correlation coefficient of $r = .297$ indicates a moderate relationship with a medium effect size of .45 according to Cohen's guidelines (Cohen, 1988)

Table 20

Paired Sample t Test for Students who Took HESI V1 and HESI V2

				95% CI	
Mean Difference	*t*	df	*p*	Lower	Upper
-60.937	-8.884	393	<.001	-74.421	-47.452

Note. $n = 394$.

A scatterplot was created as a visual representation of the relationship between the HESI V1 and HESI V2 scores. There is a moderate positive correlation seen between HESI V1 and HESI V2. These students also completed the required hours of remediation so this is an expected finding.

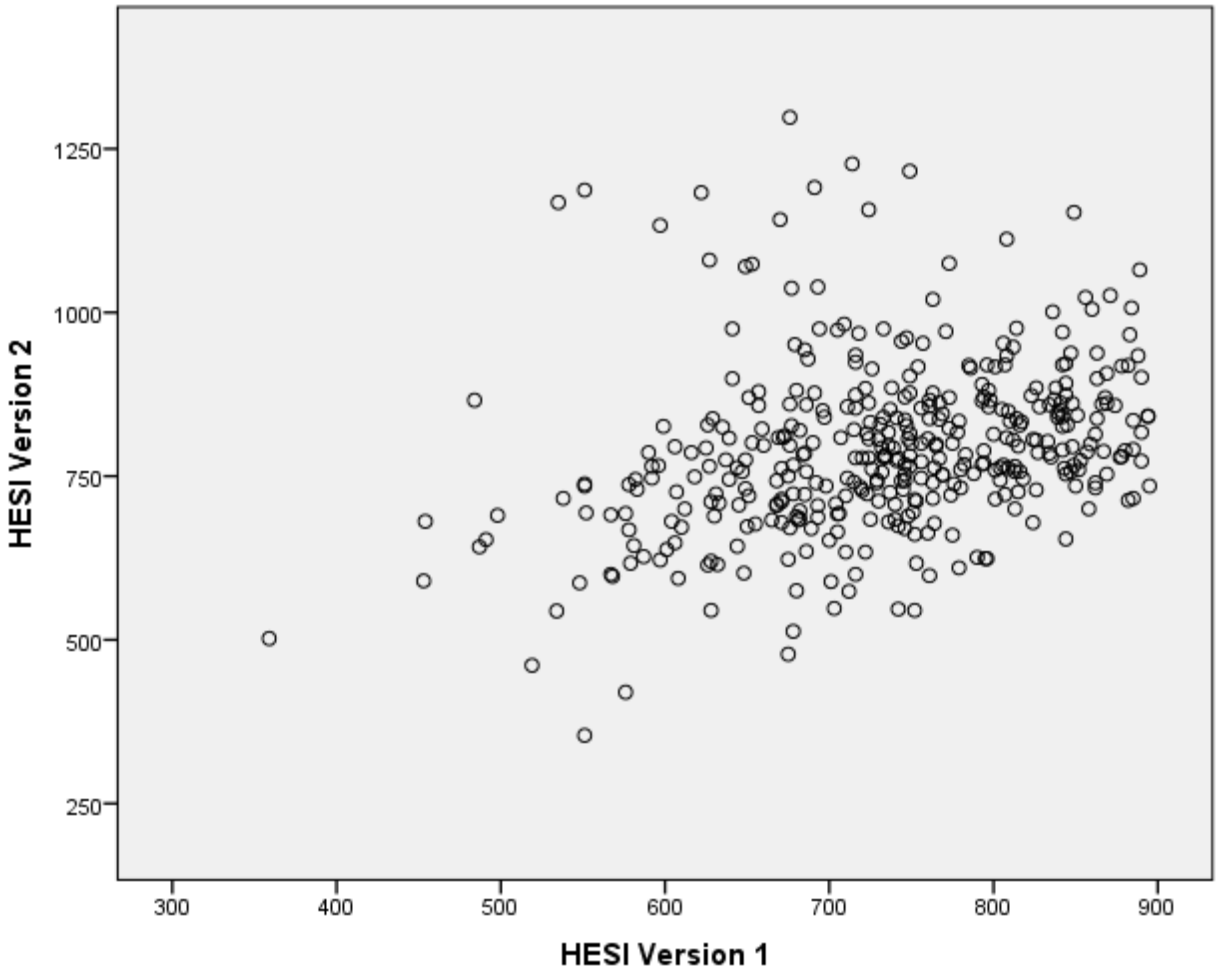

Figure 9. Positive linear relationship between HESI V1 and HESI V2 (*n* = 394).

A scatterplot was created as a visual demonstration of the 8% gain on the HESI V2 in relation to the HESI V1. Students who scored in the 500–800 range were able to achieve a higher gain on the HESI V2. These students also completed the required hours of remediation; therefore, the gain in the HESI V2 score is the desired outcome. Two hundred and sixty-three students achieved gains ranging from 1–636 points. There were, however, students whose scores dropped between HESI V1 and HESI V2. One hundred and thirty-one students lost points ranging from -1 to -207. Two students maintained the same score for the two exams.

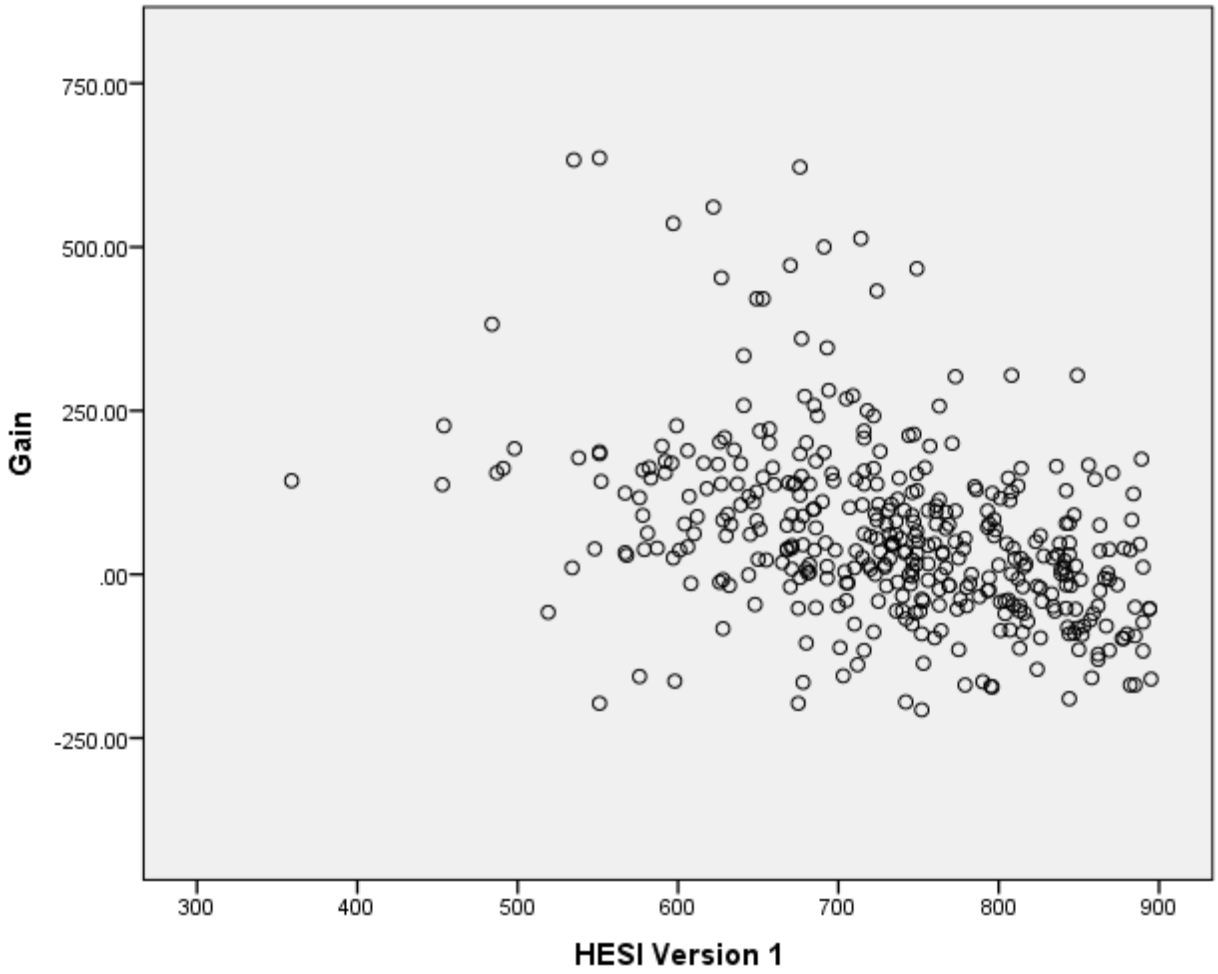

Figure 10. Gain in the score between HESI V1 and HESI V2 (*n* = 394).

Research Question 2

To answer Research Question 2: Do students who perform additional remediation hours above what is required see an improvement of HESI V2 scores over and above the scores of students who perform only the required remediation hours? The sample was further refined to include only students who completed greater than the required remediation hours as stipulated under the university policy (*n* = 347).

The correlation matrix is presented in Table 21

Table 21

Correlation Matrix

	Gender	GPA	Cohort	HESI V1	HESI V2	Semester	RemHours
Gender	1						
GPA	-.050	1					
Cohort	-.125*	.190**	1				
HESI V1	-.081	.495**	.050	1			
HESIV2	-.046	.387**	-.032	.309**	1		
Semester	.053	-.036	-.121*	.115	.155**	1	
RemHour	.012	-.363**	-.060	-.614**	-.160*	-.064	1

Note. $n = 347$,* $p < .05$, ** $p < .01$.

Significant negative correlations are found between cohort and gender, as well as remediation and both GPA, and HESI V1. Since remediation hours are guided by scores on the HESI V1 it is not surprising to see a higher correlation here. As the score on the HESI V1 increased, the number of remediation hours completed decreased. This is consistent with the stated policy, which required a specific number of remediation hours dependent upon HESI V1 scores. Significant positive correlations exist between GPA and cohort, HESI V1, and HESI V2. Significant positive correlations also exist between HESI V1 and HESI V2. Again it is not surprising to see positive correlations between GPA and HESI scores. This is consistent with findings in the literature (Alameida et al., 2011; Higgins, 2005; Lavandera et al., 2011). All correlation values are relatively low and do not indicate any problem with multicollinearity (Leech et al., 2008, p. 95).

The frequency distribution for gender and cohort are depicted in Table 22. It is noted that the percentage of male (12.4%) to female (87.6%), as well as the distribution of traditional (68.9%) and second degree (31.1%) has remained consistent throughout the sample distribution.

Table 22

Frequencies for Gender and Cohort

Gender	*N*	%	Cohort	*N*	%
Male	43	12.4	Traditional	239	68.9
Female	304	87.6	2nd Degree	108	31.1

Note. $n = 347$.

The frequencies for HESI V1 and HESI V2 scores are depicted in Table 24. Students who scored greater than the benchmark score of 900 on HESI V1 were excluded from this analysis. Of the students who completed extra remediation time of 30 minutes or greater than required by the policy, 58 (16.7%) achieved the benchmark score of 900 on the HESI V2.

Table 23

Frequencies for Scores on HESI V1 and HESI V2

Score	HESI V1	%	HESI V2	%
300–399	1	.3	1	.3
400–499	5	1.4	3	.9
500–599	28	8.1	12	3.5
600–699	90	25.9	53	15.3
700–799	131	37.8	123	35.4
800–899	92	26.5	97	28
>900			58	16.7

Note. $n = 347$.

As has been consistent throughout the sampling, the greatest number of students completed the program in the traditional spring semester.

Table 24

Frequency of Enrollment by Semester

Semester	*N*	%
Fall 13	18	5.2
Spring 14	104	30
Summer 14	5	1.4
Fall 14	54	15.6
Spring 15	85	24.5
Summer 15	13	3.7
Fall 15	68	19.6

Note. $n = 347$.

As reflected in Table 25, only students who completed remediation time of 30 minutes or greater than required by the policy are included in this analysis ($n = 347$).

Table 25

Remediation Status

Remediation time	*N*	%
Exceeded required remediation	347	100

Note. $n = 347$.

The GPA, HESI V1 and V2 and the log remediation hours descriptive statistics are depicted in Table 26. The mean HESI V2 score of 795.13 is higher than each of the previous samples and higher than the mean score of 731.70 for HESI V1, an increase of 63 points, for a 9% gain in the HESI score from V1 to V2. The mean GPA at 3.24 is slightly lower than the

GPA of 3.28 calculated for the total sample so that students with lower GPAs were more likely to have lower scores on the HESI V1 and require remediation.

Table 26

Descriptive Statistics GPA, HESI V1, HESI V2, Remediation Hours

Variable	Min	Max	Mean	Median	*SD*
GPA	2.61	3.9	3.24	3.23	.262
HESI V1	359	894	730.36	738.00	94.80
HESI V2	354	1298	794.83	785.00	132.58
RemHours	.54	1.80	.97	.96	.23

Note. $n = 347$.

The created computed log value for remediation hours allowed for a more normally distributed variable. The mean and confidence intervals for the log value of remediation time were back transformed so as to create a more meaningful data report. The back transformed mean for remediation hours is 9.33 with a 95% confidence interval between 8.33 and 10.44.

The results of a significant paired sample *t* test between the mean score for HESI V1 and HESI V2 is depicted in Table 27. The correlation value $r = .309$ demonstrates a moderately strong relationship between the score from HESI V1 and HESI V2. The calculated estimated effect size of 0.47 is a medium effect according to Cohen's guidelines (Witte & Witte, 2010, p. 326).

Table 27

Paired Sample t Test for Students who Took HESI V1 and HESI V2

				95% CI	
Mean difference	*t*	df	*p*	Lower	Upper
-64.470	-8.759	346	<.001	-78.946	-49.993

Note. $n = 347$

The scatterplot for this group of students creates a visual picture of the relationship between the HESI V1 and HESI V2 for this sample group. An overall 8% gain is achieved for this sample of students who performed extra remediation hours. Two hundred and thirty-three students increased their scores between 1 and 636 points. However 112 students lost points on the HESI V2 ranging from -1 to -197 points. This decrease in score between the two versions of the exam complicates the assessment of the value of the remediation hours. Two students achieved the same score on each exam.

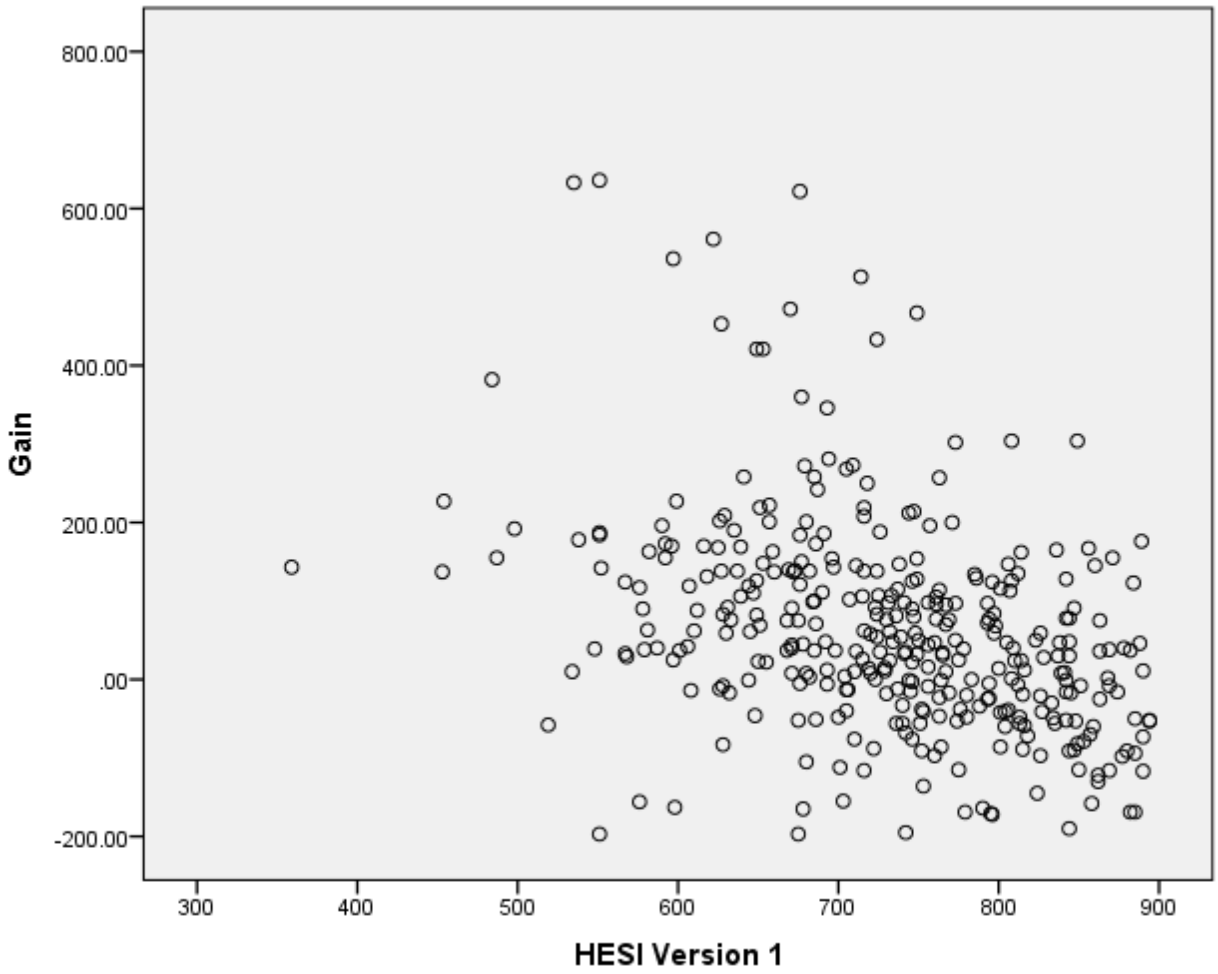

Figure 11. Gain for students who completed extra remediation hours (*n* = 347).

Finally in an attempt to further refine the question of additional remediation hours and their relationship to HESI V2 score, students who completed remediation greater than 2 hours as required by the policy were analyzed (n = 184).

The correlation matrix analysis is presented in Table 28

Table 28

Correlation of Variables

	Gender	GPA	Cohort	HESI V1	HESI V2	Semester	RemHours
Gender	1						
GPA	-.104	1					
Cohort	-.198**	.112	1				
HESI V1	-.109	.472**	-.026	1			
HESI V2	-.078	.336**	-.062	.311**	1		
Semester	.101	.072	-.238**	.132	.187*	1	
RemHours	-.010	-.328**	-.010	-.546**	-.114	.072	1

Note. n = 184, $^{**}p < .01$, $^{*}p < .05$.

A significant negative correlation exists between remediation and both GPA and HESI V1. This is expected as students with higher GPAs and HESI V1 scores will, on average, perform less remediation hours. HESI V1 and HESI V2 are positively correlated indicating that a higher score on the HESI V1 is related to a higher score on the HESI V2. A significant positive correlation was found between GPA and both HESI V1 and HESI V2. This is consistent with the earlier findings where students with strong GPAs did well on the HESI V1 and HESI V2 exam. All correlations are, however, small; therefore, there is no concern of multicollinearity (Leech et al., 2008, p. 95).

The frequencies for gender show that males are represented at a lower rate than in the full population with 10.9% male compared to 12.8% male for the full population. Traditional students are represented at a slightly higher rate of 72% compared to 64.3% for the full population of 490

Table 29

Frequencies for Gender and Cohort

Gender	*N*	%	Cohort	*N*	%
Male	21	11.4	Traditional	133	72.3
Female	163	88.6	2nd Degree	51	22.7

Note. $n = 184$.

The frequencies for HESI V1 and HESI V2 are presented in Table 30 and include students who remediated 2 hours greater than the policy requirement. Although there are still two students who scored under 500 on the HESI V2, there is a trend toward increasing the overall scores toward the 900 range. The number of students scoring below 700 on the HESI V2 decreased while the number of students scoring 800 or greater increased.

Table 30

Frequencies for HESI V1 and HESI V2 Scores

Score	HESI V1	%	HESI V2	%
300–399	1	.5	1	.5
400–499	4	2.2	1	.5
500–599	18	9.8	9	4.9
600–699	57	31	33	17.9
700–799	69	37.5	62	33.7
800–899	35	19	52	28.3
>900			26	14.1

Note. $n = 184$.

When examining this sample of students by semester, the largest numbers finished in the spring semesters of 2014 and 2015. This is consistent with the full sample and typical of most programs where the greater number of students finish in the spring semesters.

Table 31

Frequency of Enrollment by Semester

Semester	*N*	%
Fall 13	6	3.3
Spring 14	65	35.3
Summer 14	4	2.2
Fall 14	29	15.8
Spring 15	44	23.9
Summer 15	8	4.3
Fall 15	28	15.2

Note. $n = 184$.

All of the students in this sample (100%) exceeded the required remediation hours as stipulated by the policy.

Table 32

Remediation Time

Remediation	*N*	%
Exceeded Required Hours	184	100

Note. $n = 184$.

Descriptive statistics for GPA, HESI V1, HESI V2 and remediation time are depicted in Table 33.

Table 33

Descriptive Statistics GPA, HESI V1, HESI V2, Remediation Time

Variable	Min	Max	Mean	Median	*SD*
GPA	2.64	3.80	3.2	3.2	.25
HESI V1	359	888	710.49	719.00	94.50
HESI V2	354	1298	785.09	778.00	140.15
LogRemHour	.77	1.80	1.12	1.09	.200

Note. $n = 184$.

The mean and confidence intervals for the log value of remediation hours were back transformed so as to create a more meaningful data report. The back transformed mean for remediation hours is 13.15 with a 95% confidence interval between 13.15 and 15.03.

A paired sample *t* test depicted in Table 34 demonstrated a significant difference between the means of the two exams. The exams were moderately correlated ($r = .311$) in a positive direction, suggesting that students who were able to score higher on the HESI V1 also scored

higher on the HESI V2 (Cohen, 1988). The estimated effect size of .52 is a medium effect size equivalent to .52 standard deviations (Witte & Witte, 2010, p. 326).

Table 34

Paired Sample t Test for Students who Took HESI V1 and HESI V2

				95% CI	
Mean Difference	*t*	df	*p*	Lower	Upper
-74.598	-7.096	183	<.001	-95.339	-53.856

Note. $n = 184$.

This group of students achieved some of the highest gains as compared to the previous groups of students. Some of the gains range from 200 to over 600 points. In looking at this group it is useful to compare their mean score from HESI V1 with their mean score from HESI V2. There is an increase of 74.60 points in the mean between HESI V1 and HESI V2, a gain of 10%. This gain is only slightly higher than the 8% gain from the students who remediated 30 minutes or more than required. In this sample group 131 students achieved gains ranging from 1–636. However, there were 51 students who saw a decrease between V1 and V2 ranging from -1 to -197, with two students achieving the same score for each exam. Again this net loss makes it difficult to assess the value of the remediation program.

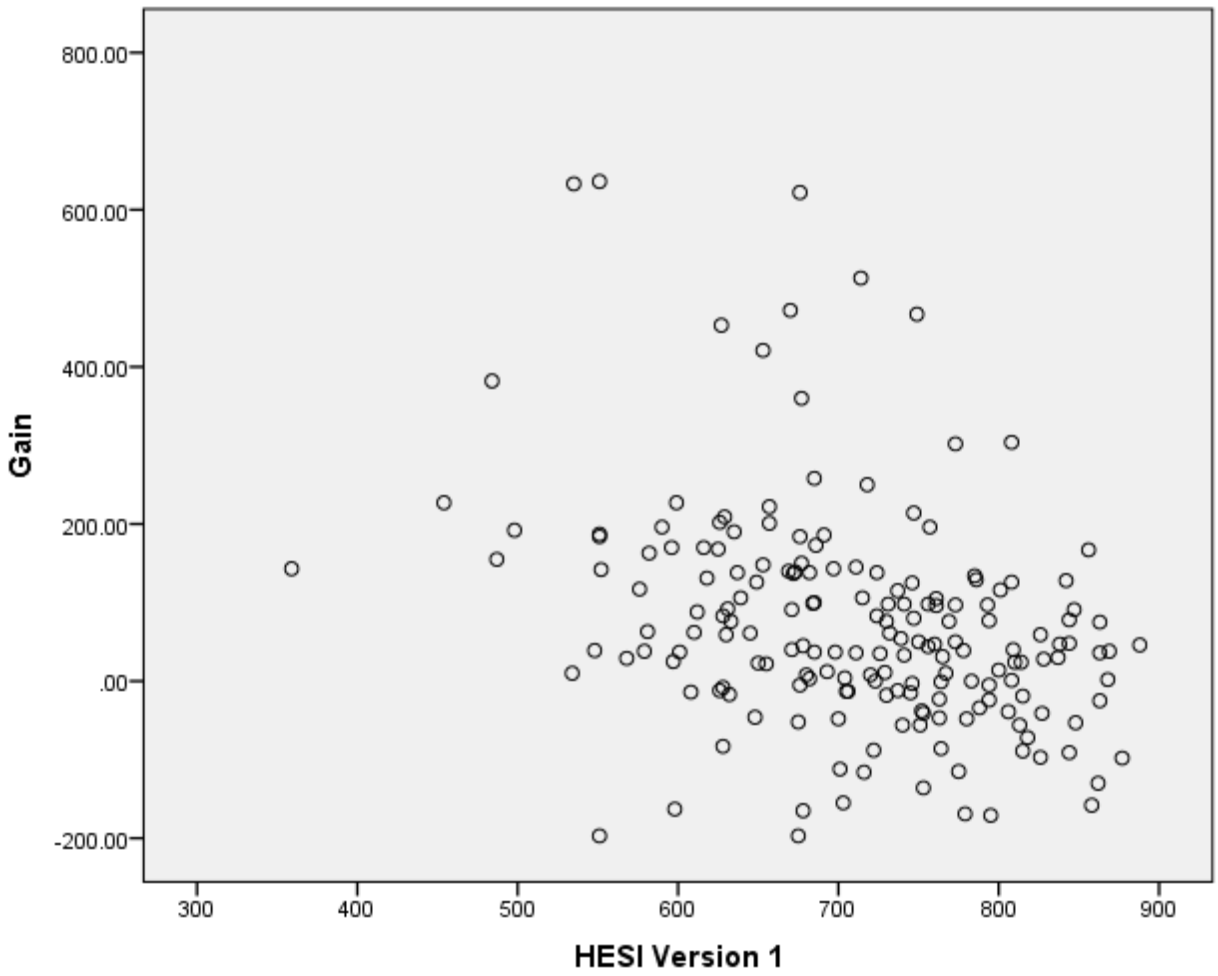

Figure 12. Gain between HESI V1 and HESI V2 (*n* = 184).

Data Collection

Data were collected using the Elsevier online faculty site with password-protected access with permission from Elsevier research deperment. The data were generated through student activity of accessing their remediation material, and the time spent engaged in the online activities is captured by the Elsevier website. Information regarding cohort type (traditional, second degree), GPA, and gender were obtained from department records. Original collection was done on an Excel spreadsheet. Coded data were then downloaded into SPSS Version 23

software. All data were numerically coded to remove any identifying information so that student anonymity was protected. All data are stored on a password-protected USB memory key.

Data Analysis

Chapter 3 encompasses the descriptive statistics utilized to describe data in terms of center, variability, and spread. Frequencies were obtained for gender, cohort, scores on HESI V1 and HESI V2, as well as semester in which each student was enrolled in the final capstone course. Mean, median, and standard deviation were obtained for the continuous variables of GPA, HESI V1, HESI V2, and remediation time. Paired sample *t* test was utilized to determine the significance between mean scores of HESI V1 and HESI V2. An independent samples *t* test was performed to determine the significance between students who achieved a first-time passing score on the HESI V1 exam and those who did not. Demographic data are included to add to the descriptive detail of the sample population as it relates to student population in typical nursing programs.

For Research Question 1: Is there a gain in the raw score on Version 2 of the HESI E2 Exit Exam after the completion of online remediation hours for senior-level nursing students controlling for gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exam Version 1?

The dependent variable is the HESI E2 Version 2 raw score post remediation. Students who completed 3 hours or greater of remediation (n = 394) were included in the analysis. The independent variables are online remediation hours, gender, GPA, semester, and cohort type (traditional or second degree). Multiple regression was used to answer this question. Multiple regression is the statistical analysis used to explore the relationship between a single dependent variable and more than one independent variable (Allison, 1999). Independent variables can be

continuous or dichotomous. Multiple regression equations provide more accurate predictions for the dependent variable than can be found with a simple regression equation (Witte & Witte, 2010, p. 165).

Remediation hours, GPA, and scores on the HESI V1 are all continuous variables. Dichotomous variables are dummy coded to represent separate categories of nominal scale. Gender is coded as 0 = male and 1 = female. Cohort type is coded as 0 = traditional students and 1 = second degree students. Semester was coded as a dummy variable for each spring, summer, and fall with spring omitted as the reference variable.

For Research Question 2: Do students who perform additional remediation hours above what is required see an improvement of HESI E2 Version 2 scores over and above scores of students who perform only the required remediation hours, controlling for gender, GPA, cohort (traditional or second degree), semester, and score on HESI E2 Exam Version 1?

To answer this question a multiple regression was performed. The dependent variable was the raw score on the HESI E2 Exit Exam Version 2. The independent variable was the completion of additional hours a student performs over and above the required remediation hours. Remediation hours was entered as a continuous variable. Two sample sets were refined to answer this question (a) students who complete 30 minutes or greater than the remediation hours as required by the university policy (n = 347) and (b) students who completed 2 hours or greater than the remediation hours as required by the university policy (n = 184). This distinction was made to determine if merely exceeding the number of remediation hours was effective or if it was necessary to exceed the remediation hours by a substantial amount. The remaining variables are those that have been previously described.

Assumptions of multiple regression were checked to ensure that there was no violation in the data. Multicollinearity was checked using correlation statistics. No correlation was greater than .610 which indicates that multicollinearity is not a problem (Leech et al., 2008). Cooks distance was examined as a measure of influence (Pallant, 2013). All values were less than 1 indicating no undue influence on the data.

Normality, linearity, homoscedasticity, and independence of residual were checked with a residual scatterplot, histogram, and Normal P-P plot of the residual as illustrated in Figures 13, 14, and 15.

The scatterplot in Figure 13 shows the residuals form a rough rectangular distribution with most points concentrated in the center near the 0 point. Deviations from this rectangular distribution may be suggestive of outliers and violation of assumptions (Pallant, 2013, p. 165). This distribution suggests no violations of assumptions and meets the test for homoscedasticity (Pallant, 2013).

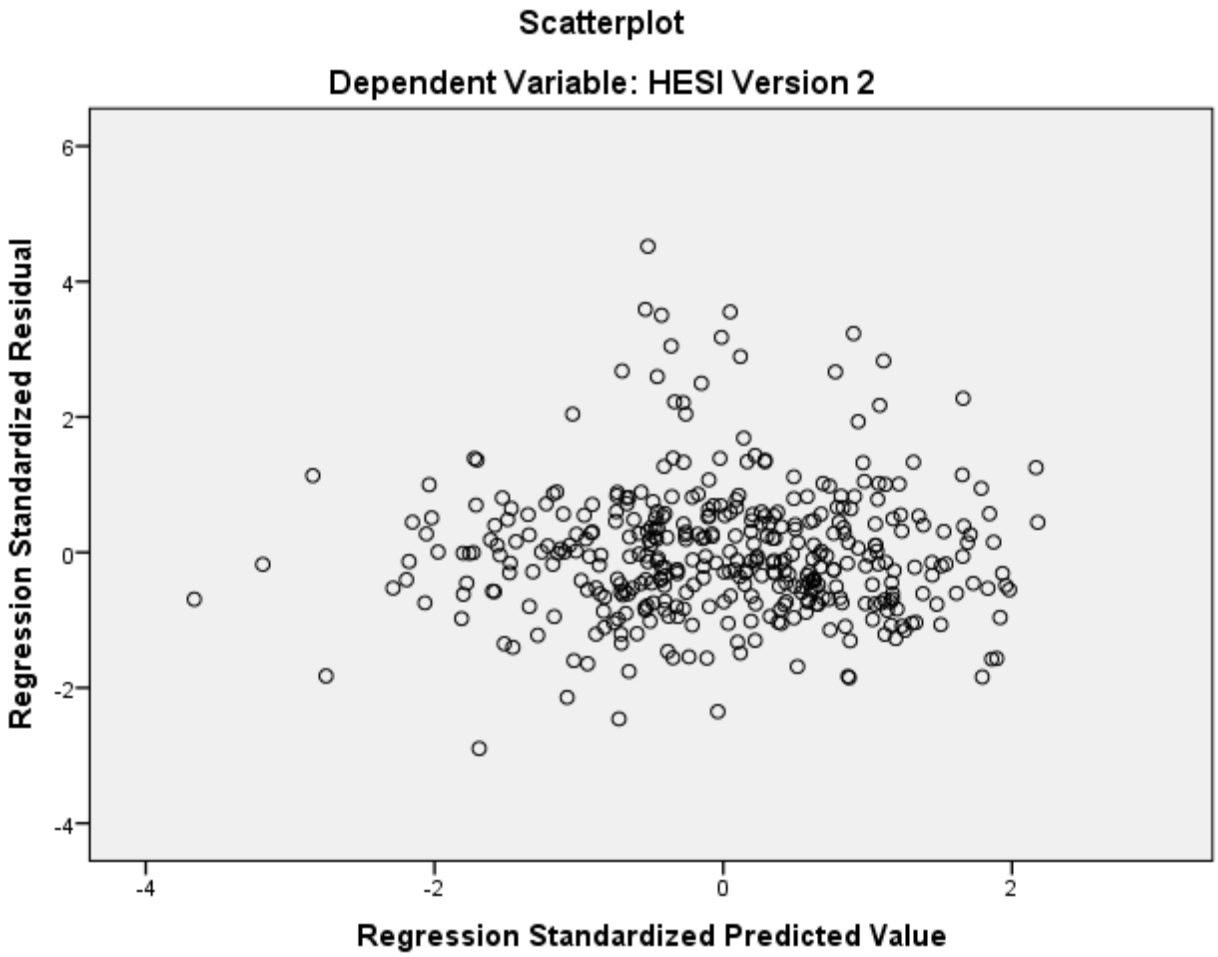

Figure 13. Regression standardized residuals (*n* = 394).

The histogram depicted in Figure 14 shows a normal distribution of the residual data so the assumption of normality is not violated.

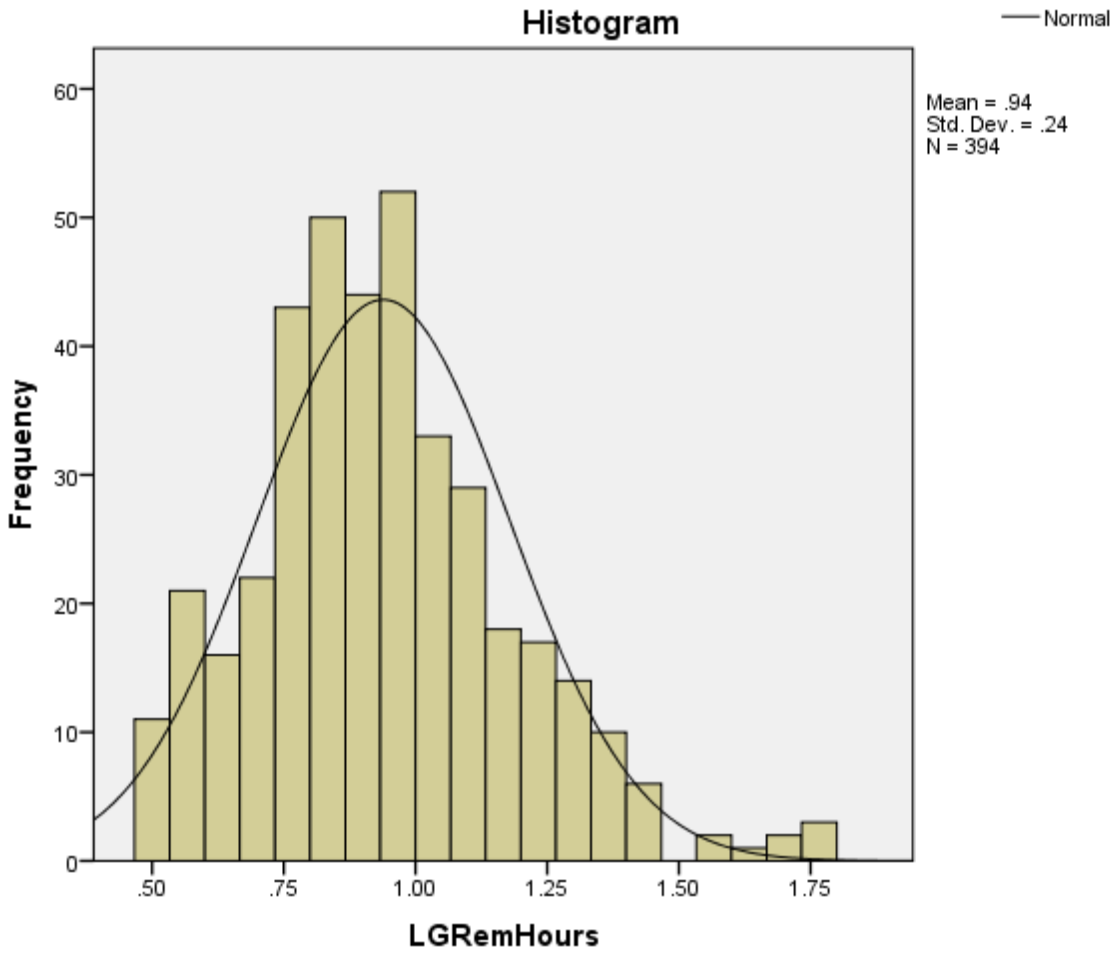

Figure 14. Histogram showing normal distribution of residual data (n = 394).

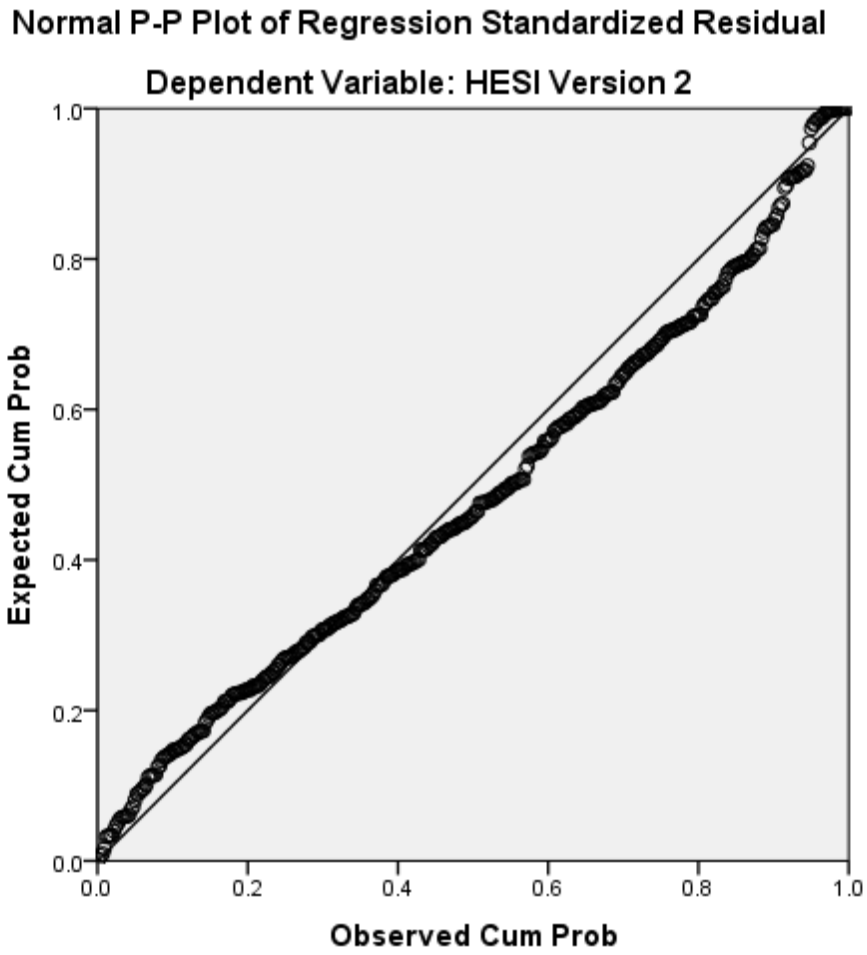

Figure 15. P-P plot showing normal distribution of the data (*n* = 394).

The normal P-P plot in Figure 15 demonstrates that data points lie in a reasonably straight diagonal line from bottom left to top right suggesting no major deviation from normality (Pallant, 2013, p. 164). Therefore the assumptions of linearity, normally distributed errors, and uncorrelated errors were checked and met.

Data Limitations

Data for this study are limited to senior-level students at a BSN program in the northeastern United States who require remediation after completing the HESI E2 Version 1 and

before sitting for HESI E2 Version 2. Nonacademic factors such as motivation, test-taking skills, stress, or test anxiety are not considered in this study. Students who used additional resources such as case studies, online quizzing, or other NCLEX-RN preparation tools are also not captured here. The possibility of students remediating through alternate means could make the task of measuring only the remediation hours less valuable.

An assumption was made that the students who completed the online remediation hours did so in good faith and performed the required reading, questions, and other activities associated with the program. Since the remediation effort was measured as time spent, if students allowed time to accumulate without active participation, the results would not be truly representative of the value of the remediation resource. Therefore, attributed findings to the value of the actual tool as opposed to the manner in which the tool was utilized may produce spurious results.

Finally there was no effort made to connect students' remediation hours to their passing or failing the NCLEX-RN licensing exam. Although high scores on the HESI V2 Exit Exam has demonstrated a strong relationship to NCLEX-RN pass rates; that relationship was not explored with this group of students.

Treatment of Human Subjects

Informed consent was not required for this study as existing data was utilized. Approval to access data was obtained from Elsevier/HESI in the form of a contract. Exempt status was sought and obtained from the university Institutional Review Board due to the fact that the study involves no deception, vulnerable population, sensitive information, or unethical treatment of subjects.

Chapter IV

Analysis of Data

An ex post facto correlational quantitative study was conducted to (a) determine if there was a relationship between utilization (hours) of the Elsevier online remediation resource and the HESI E2 Exit Exam raw scores for senior-level nursing students and (b) determine if students who perform additional remediation hours above what is required see an improvement of HESI V2 scores over and above scores of students who perform only the required remediation hours.

Research Question 1

Is there a gain in the raw score on Version 2 of the HESI E2 Exit Exam after the completion of online remediation hours for senior-level nursing students controlling for GPA, gender, cohort (traditional or second degree), semester, and score on HESI E2 Exit Exam Version 1?

To investigate how well HESI V1, cohort, gender, semester, and hours of remediation predict scores on HESI V2 when controlling for GPA, a hierarchical linear regression was completed. In order to determine the value of remediation time, the data set was refined to include only students who scored less than 900 on HESI V1 and performed 3 hours or greater in remediation (n = 394). Three hours was chosen because it is the minimum number of remediation hours required for a HESI V1 score of 800–899. Excluded were students who scored greater than 900 on HESI V1 and were not required to remediate as well as any student who performed less than 3 hours of remediation.

A hierarchical multiple regression was performed to determine how well gender, HESI V1, remediation, semester, and cohort predict HESI V2 scores when controlling for GPA. The

model summary is statistically significant, adjusted R^2 = .16, $F(1,392) = 74.05$, $p < .001$. As indicated by the R^2 about 16% of the variance in HESI V2 scores can be explained by GPA. When the other variables are added they significantly improved the percent of variance explained, R^2 change =.03, $F(6,386) = 2.62$, p <05. Although significant, the 3% R^2 change is very small and adds little meaningful insight into the relationship. Therefore, the combination of the additional predictor variables of gender, cohort, HESI V1, semester, and remediation hours do little to advance student progress beyond a strong GPA. The entire model is statistically significant $F(7,386) = 13.09$, $p < .001$.

Table 35

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, GPA, Cohort, Semester, and Remediation Hours, Predicting HESI V2

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.16	.16
GPA	197.73	(22.98)	.40**		
Constant	153.29	(74.66)			
Step 2				.19	.03
GPA	179.15	(26.76)	.36**		
HESI V1	.25	(.09)	.18*		
Cohort (2nd Deg=1)	-29.79	(13.72)	-.11*		
LogRemHour	50.06	(31.63)	.09		
Gender (F=1)	-7.93	(17.90)	-.02		
Summer	-42.58	(28.37)	-.07		
Fall	3.27	(12.92)	.01		
Constant	-.156	(104.18)			

Note n=394, *$p < .05$, **$p < .01$.

The beta weights, presented in Table 35 suggest that when entered with HESI V1, gender, cohort, semester, and remediation, GPA (.36, $p < .001$) and HESI V1 (.18, $p < .05$) significantly contribute to predicting scores on the HESI V2 in a positive direction. Students with higher GPAs and higher scores on HESI V1 each tend toward a higher score on HESI V2. It is not surprising to see that the contribution of the HESI V1 scores are second only to GPA. The literature reports a higher predictive ability of the HESI V1 and NCLEX-RN success than any

other version of the HESI exam (Young & Willson, 2012). It therefore follows that a high score on the HESI V1 significantly predicts a high score on the HESI V2. The regression coefficient reveals that a 1-point increase in HESI V1 yields a .25 increase in score on the HESI V2. So while the relationship is significant, its magnitude is not great.

The regression coefficient shows that a 1-point increase in GPA produces a 179-point gain in the HESI V2. Given that a 1-point increase in GPA is extremely large, it makes more sense to interpret the standardized coefficient. Using this measure one can see that for every increase in the standard deviation of GPA (.26), there is a corresponding (.36) increase in the standard deviation (130.00) for the HESI V2 exam (.36 X 130.00 = 46.80). For a student who is able to increase their GPA by .26 there is a predicted increase to their HESI V2 score by 46.80 points. A student who earns a grade of A is awarded a 4.0 GPA while an A- is calculated at a 3.67 for a difference of .33. This small incremental increase in GPA (.33) is greater than 1 standard deviation (.26) making it plausible a student can increase their GPA sufficiently to improve HESI V2 scores.

Remediation hours produced no statistical significance in the contribution of the variance in HESI V2 scores. This was certainly not the expected finding and is disappointing. Students were monitored by faculty based on the number of hours spent logged into the remediation tool on the Elsevier website. No attempt was made to ascertain the manner in which the students were using this resource. This lack of guidance from faculty could contribute to the overall lack of significance found by the remediation hours. It may also signal deficiencies in the remediation tool itself in that it does not provide enough individual direction for independent student use.

The standardized coefficient for the second degree cohort was significant (-.11, $p < .05$) but in a negative direction suggesting that second degree students scored lower on the HESI V2

than traditional students. Second degree students, on average, scored 29.79 points lower on the HESI V2 than their traditional student counterparts after controlling for GPA, gender, cohort, remediation hours, and HESI V1 scores. After controlling for GPA there seems to be less of an advantage for the second degree cohort in achieving higher scores on the HESI V2 exam. This number is very small representing only 1% of the variance and while significant it is not particularly meaningful. Second degree students comprised 31% of this sample (n = 394) compared with 35.8% of the full sample (n = 490). The original independent samples t test showed that of the 83% of students who were initially unsuccessful on the HESI V1 only 31% of them were second degree students. This smaller number could indicate that the overall weaker students composed this group and can explain why the cohort has a negative relationship with HESI V2 scores.

No statistical significance was found for gender or semester. In addition the correlation coefficient for gender is a small -.02 demonstrating almost no relationship to the scores on the HESI V2. There is very little in the literature on gender in nursing. Nationally BSN programs are composed of 91% female and 9% male students. This particular program encompasses 12% male students, which is higher than the national average. Of the 83% of students who failed to reach 900 on the HESI V1, 13% were male. This has held consistent throughout the sample analysis. The small representation of males in nursing could be why the data do not produce statistically significant results. Despite the known differences between students who traditionally graduate in the spring versus those in the off-semesters of summer and fall, there were not significant findings in this study while controlling for the predictor variables in this group of students.

When all variables are entered together, the variance is explained by GPA (13%), HESI V1 (3%), and second degree cohort (1%). All collinearity tolerance statistics were high,

confirming that multicollinearity is not a problem. The high value achieved with GPA demonstrates the single most influential relationship with HESI V2 is GPA. The increase in GPA has a greater contribution to the variability in HESI V2 scores than any of the other predictor variables.

To further explore the relationship of remediation hours and the HESI V2 exam, the data set was filtered to include only those students who achieved a gain in the score between HESI V1 and HESI V2 (n = 263). Gains for this sample of students ranged from 1–636 points. There were, however, 131 students who lost points ranging from -1 to -207. These students were excluded from the regression analysis to determine if the model was sensitive to the effect of remediation hours on students who achieved gains in their scores between the two exams. A hierarchical multiple regression was employed to determine how well gender, HESI V1, remediation, semester, and cohort, predict HESI V2 scores when controlling for GPA. The model summary is statistically significant, adjusted R^2 = .18, $F(1,261) = 59.02$, $p < .001$. As indicated by the R^2 about 18% of the variance in HESI V2 scores for this model can be predicted by GPA. When the other variables are added they significantly improved the percent of variance explained, R^2 change =.12, $F(6,255) = 6.986$, p = <01. A 12% increase in the contribution of variance is fairly robust, demonstrating that the additional predictor variables made a meaningful contribution to the variance in HESI V2 scores. The entire model is statistically significant $F(7,255) = 15.579$, $p < .001$.

Table 36

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, GPA, Cohort, Semester, and Remediation Hours, Predicting Gains on the HESI V2

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.18	.18
GPA	204.14	(26.57)	.43**		
Constant	173.14	(86.26)			
Step 2				.30	.12
GPA	138.64	30.16	.29**		
HESI V1	.54	(.098)	.39**		
Summer	-83.25	(30.92)	-.15*		
Gender	14.42	(19.52)	.04		
Cohort	-26.63	(15.61)	-.10		
Fall	12.97	(14.74)	.05		
LogRemHour	70.01	(36.33)	.12		
Constant	-69.16	(116.74)			

*Note.n=263, *p* < .05, **p* < .01.*

The beta weights presented in Table 36 suggest that when entered with all predictor variables, only GPA (.29, $p < .001$) and HESI V1 (.39, $p < .001$) significantly contribute to predicting to HESI V2 scores in a positive direction. Again students with higher GPAs and higher HESI V1 scores had higher scores on the HESI V2. The standardized coefficient for summer semester was significant (-.15, $p < .05$) but in a negative direction, suggesting that students who took the HESI E2 exam in the summer months scored, on average, 83.25 points lower than students who tested in the spring semester. Even after controlling for additional variables, this is not an unexpected finding as students who finish in the off semester of summer tend to score lower than students who finish in the traditional spring semester (Horton et al., 2012).

In this model that includes only students who gained in their scores from HESI V1 to HESI V2, the HESI V1 score explained 15% of the variance in HESI V2 scores while GPA explained 9%. This is reversed from earlier finding where GPA was a stronger predictor than HESI V1. The HESI V1 mean for this group (708.75) is lower than the mean (732.69) for the larger sample (n = 394). And the HESI V2 had a higher mean (833.77) than the V2 mean for the larger sample (793.62).These students started with a lower HESI V1 score, which would have required them to complete a higher number of remediation hours.

Despite this higher number of remediation hours, there was no significant contribution to the variance that can be attributed to remediation hours. Even with the inclusion of only students who achieved gains between HESI V1 and HESI V2, remediation hours were found to have no relationship with scores on the HESI V2, a disappointing but meaningful finding as it relates to the successful evaluation of policy administration. No other variable contributed in any significant way to the variance in HESI V2 scores for this model.

Because of the consistent significance of GPA, it was decided to run a model using only HESI V1 and remediation hours to determine if any significance could be obtained from remediation hours. The linear combination of HESI V1 scores and remediation hours is statistically significant $F(2,260) = 35.79$, $p < .001$. When HESI V1 is entered alone, the model is significant adjusted $R^2 = .21$, $F(1,261) = 70.72$, $p < .001$, with HESI V1 explaining 21% of the variance in HESI V2 scores. When remediation hours are added to the model, it is no longer significant (p = .347). Thus there was no benefit obtained with the addition of remediation hours in this model.

Table 37

Hierarchical Multiple Regression Analysis Summary for HESI V1and Remediation Hours Predicting Gains on Scores for HESI V2

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.21	.21
HESI V1	.632	(.075)	.46**		
Constant	385.62	(53.75)			
Step 2				.22	.003
HESI V1	.683	(.092)	.50**		
LogRemHour	35.06	(37.24)	.06		
Constant	315.59	(91.78)			

*Note. n=263,*p* < .05, **p* < .01.

Research Question 2

Do students who perform additional remediation hours above what is required see an improvement of HESI E2 scores over and above scores of students who perform only the required remediation hours, controlling for GPA, gender, cohort (traditional or second degree), semester, and score on HESI E2 Exit Exam Version 1?

In order to answer this question the sample set was filtered so that two data bases with differing numbers of remediation hours were created. 1. Students who completed extra remediation hours as defined by 30 minutes or greater than required by the university policy were included in the first analysis (*n* = 347). Thirty minutes was chosen because it was felt that this number captured students who intended to complete additional hours as opposed to students who exceeded required time by chance. 2. Students who completed extra remediation hours as defined by 2 hours or greater than required by the university remediation policy were included in the second analysis (*n* = 184). Two hours was chosen as a robustness check of additional

remediation hours in which a difference in the effect on the HESI V2 scores could possibly be realized.

A hierarchical linear regression for the first sample (n = 347) was employed to investigate how well gender, cohort, HESI V1, semester, and remediation hours predict scores on the HESI V2 exam when controlling for GPA. The linear combination of the predictor variables to the HESI V2 scores is statistically significant $F(7,339) = 11.22$, $p < .001$, indicating that the linear combination of the predictor variables has a significant relationship to HESI V2 scores. When GPA score is entered alone, it significantly predicts HESI V2 scores, $R^2 = .15$, $F(1,345) = 60.69$, $p < .001$, indicating that GPA explains 15% of the variance in the HESI V2 scores. Therefore most of the variance in HESI V2 scores can be attributed to GPA. With the addition of the remaining variables, the model is significantly improved, R^2 change = .04, $F(6,339) = 2.676$, $p < .05$. These findings are similar to the findings from Question 1 where GPA explained 16% of the variance, demonstrating that GPA is the strongest predictor of scores on the HESI V2. The R^2 change is once again a very small number (.04), demonstrating that the additional predictor variables contribute little to the variance in HESI V2 scores and that GPA remains the strongest predictor.

Table 38

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, Cohort, GPA, Semester, and Remediation Hours, Predicting HESI V2 Scores

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.15	.15
GPA	195.86	(25.14)	.39**		
Constant	161.03	(81.62)			
Step 2				.19	.04
GPA	171.29	(29.14)	.34**		
HESI V1	.27	(.09)	.19*		
LogRemHour	46.257	(35.59)	.08		
Cohort (2nd Degree)	-32.15	(14.78)	-.11*		
Gender	-9.80	(19.96)	-.02		
Summer	-43.85	(29.93)	-.07		
Fall	3.26	(14.00)	.01		
Constant	16.61	(116.49)			

Note. n=347, *p < .05, **p < .01.

The beta weights, presented in Table 38, suggest that when all variables are entered together, GPA (.34, p < .001) and HESI V1 (.19, p < .05) significantly predict scores on HESI V2 with GPA remaining the strongest predictor. These are very similar to the results from the regression analysis for Question 1 with GPA contributing slightly less to the variance (11% versus 13%). Students who performed a greater number of remediation hours had generally lower GPAs and lower HESI V1 scores requiring them to perform additional remediation hours. The HESI V1 contributed slightly more (4% versus 3%) than the first sample (n = 394) to the variance in scores on the HESI V2. The mean (732.69) for the HESI V1 for the first sample (n = 394) is very close to the mean (730.36) of the second sample (n = 347). This small difference in the mean HESI V1 scores with similar contribution to the variance produced minimizes the

importance of the HESI V1 as a predictor of the HESI V2 score for this sample. Students who performed close to 900 on the HESI V1 may have been less likely to take the preparation for the HESI V2 as seriously.

Cohort was again statistically significant in a negative direction (-.11, $p < .05$). When controlling for all predictor variables, second degree cohort students scored on average 32.15 points lower on the HESI V2 exam than traditional degree students. Even with controlling for the predictor variables, this is not the expected finding as second degree students tend to have higher scores and GPAs. While controlling for these factors the relationship becomes small and weak. Results of the original independent samples *t* test showed that of the 85% of students who were initially unsuccessful on the HESI V1 only 31% of them were second degree students. This smaller number could indicate that the overall weaker second degree students composed this group and can explain why the cohort has a negative relationship with HESI V2 scores. Additionally the difference of 32 points and the contribution to the variance of only 1% does not constitute a strong relationship.

When entered alone it can be seen that every one-unit increase in GPA results in a 195.86 point increase in the HESI V2 score. Again it is quite large to consider a 1-point increase in GPA. When we consider the standardized coefficients we can see that each standard deviation increase in GPA (.262) produces on average a .338 standard deviation increase in the HESI V2 score (.338 X 132.581 = 44.81). As previously explained, a student who earns a grade of A is awarded a 4.0 GPA while an A- is calculated at a 3.67 for a difference of .33. This small incremental increase in GPA (.33) is greater than 1 standard deviation (.26) making it plausible that a student can increase their GPA sufficiently to improve HESI V2 scores.

As was found in the analysis for Question 1 there was no statistical significance for remediation, gender, or semester. Once again GPA was found to possess the strongest predictive value on HESI V2 scores, explaining 11% of the variance when controlling for all predictor variables.

This sample set was also refined to include only students who achieved a gain in scores between HESI V1 and HESI V2 (n = 233). This was done in an effort to further explore the relationship of remediation hours and scores on the HESI V2 exam. The linear combination of all predictor variables is significant ($F(7,225) = 13.92$, $p < .001$). When entered alone GPA is significant ($F(1,231) = 49.11$, $p < .001$) explaining 17% of the variance in HESI V2 scores. When all variables are entered, the model is significant, R^2 change = .13, $F(6,225) = 6.82$, $p < .001$ suggesting that when controlling for GPA the additional variables explain 13% of the variance in scores on HESI V2.

Table 39

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, Cohort, GPA, Semester, and Remediation Hours, Predicting Gains in HESI V2 Scores

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.18	.18
GPA	200.22	(28.57)	.42**		
Constant	189.15	(92.69)			
Step 2				.30	.13
GPA	132.33	(32.18)	.28**		
HESI V1	.537	(.105)	.40**		
Summer	-.83.85	(31.41)	-.16*		
Gender	13.58	(21.55)	.04		
Cohort	-32.28	(16.65)	-.12		
Fall	15.52	(15.74)	.06		
LogRem	55.48	(40.21)	.10		
Constant	-30.22	(128.23)			

*Note. n=233, *p* < .05, **p* < .01.*

The beta weights presented in Table 39 suggest that when all variables are entered together, GPA (.28, $p < .001$) and HESI V1 (.40, $p < .05$) significantly predict scores on HESI V2 with HESI V1 now presenting as the stronger predictor. Interpreting the standardized coefficient we see that a standard deviation (.27) increase in GPA yields, on average, a .277 standard deviation increase in HESI V2 (.277 X 129.019 = 35.74). Also a one standard deviation increase in Version 1 (93.63) may result in .39 increase in the standard deviation in HESI V2

(.39 X 129.02 = 50.32). While these are modest increments, they are significant, demonstrating how small gains in both GPA and HESI V1 scores can affect scores in the HESI V2.

Because of the consistent influence of GPA, it was decided to run a regression model to explore the relationship of remediation hours on HESI V2 scores, controlling for scores on the HESI V1. The linear combination of variables is significant, $F(2,230) = 32.34$, $p < .001$. When HESI V1 is entered alone, the model is significant, adjusted $R^2 = .22$, $F(1,231)$, $p < .001$, suggesting that scores on the HESI V1 score contribute 22% of the variance in scores on the HESI V2 exam. When remediation hours are added, the model is no longer significant $F(1,230) = .202$, $p = .654$. Despite the completion of additional remediation hours and achieving gains on the HESI V2 exam, remediation hours did not contribute in any significant way to scores on the HESI V2 exam.

Table 40

Hierarchical Multiple Regression Analysis Summary for HESI V1 and Remediation Hours Predicting Gains in HESI V2 Scores

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.22	.22
HESI V1	.645	(.080)	.47**		
Constant	380.10	(57.23)			
Step 2				.22	.001
HESI V1	.670	(.099)	.49**		
LogRem	18.47	(41.15)	.032		
Constant	343.19	(100.24)			

*Note. n=233, *p < .05, **p < .01.*

In the final analysis students who completed extra remediation hours defined as 2 hours or greater than required by the university policy were included in the sample (n = 184). Since the lowest number of required hours was 3, students in this sample all completed remediation hours totaling 5 or greater. Any student completing less than 5 hours of remediation was excluded from the sample. Again, 2 hours was chosen as a robust number of additional remediation hours in which a difference in the effect on the HESI V2 scores could possibly be realized.

A hierarchical multiple regression was performed to determine how well gender, cohort, remediation, semester, and HESI V1 scores predict HESI V2 scores when controlling for GPA. The linear combination of all predictor variables was statistically significant, $F(7,176) = 5.240$, $p < .01$. When GPA is entered alone, the model is significant, adjusted $R^2 = .11$, $F(1,182) = 23.19$, $p < .01$, with GPA explaining 11% of the variance in the scores on the HESI V2. When additional variables of gender, cohort, remediation, semester and HESI V1 scores are entered, the model is no longer significant, adjusted $R^2 = .14$, $F(6, 176) = 2.107$, $p = .055$.

Table 41

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, Cohort, GPA, Semester, and Remediation Hours, Predicting HESI V2 Scores

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.12	.12
GPA	190.48	(39.55)	.34**		
Constant	176.40	(126.77)			
Step 2				.17	.05
GPA	153.39	(44.79)	.27*		
HESI V1	.368	(.13)	.25*		
Gender	-16.22	(31.25)	-.04		
Cohort	-30.73	(22.30)	-.10		
LogRem	76.29	(58.20)	.11		
Fall	-20.09	(21.02)	-.07		
Summer	-55.05	(39.91)	-.10		
Constant	-18.64	(183.33)			

*Note. n=184, * p* < .05, ***p* < .01.

The beta weights presented in Table 41 suggest that when entered alone, GPA significantly predicts 12% of the variance. For every one-unit increase in GPA there is a 190.48 increase in HESI V2 scores. When all predictive variables are entered, GPA contributes slightly more (7%) than HESI V1 (6%), but with the additional variables added, the model is no longer significant. Remediation hours, cohort, gender, and semester are not significant in contributing to the variance in HESI V2 scores in this model. Therefore students who completed remediation hours of 2 hours or greater than required by the policy did not see any significant gain in their HESI V2 score as it relates to remediation hours.

Again to further explore the relationship of remediation hours to scores on the HESI V2 a sample set was filtered to include only those students who achieve a gain in the score between HESI V1 and HESI V2 (n = 131). Excluded from this sample are the 51 students whose score decreased ranging from -1 to -197 points. The exclusion of these students allowed for a regression analysis of only students who completed additional remediation hours and who achieved gains between scores on the HESI V1 and HESI V2.

A regression analysis was employed utilizing all predictor variables, and the results are presented in Table 42. The linear combination of all variables in significant ($F(7,123) = 6.71$, $p < .001$). When GPA is entered alone, it significantly predicts scores on the HESI V2, adjusted $R^2 = .11$, $F(1,129) = 17.58$, $p < .001$ contributing 11% to the variance in scores on the HESI V2. When all variables are entered, the model is significant, R^2 change = .16, $F(6,123) = 4.43$, $p < .001$, with the additional variables explaining 16 % of the variance in HESI V2 scores.

Table 42

Hierarchical Multiple Regression Analysis Summary for HESI V1, Gender, Cohort, GPA, Semester, and Remediation Hours, Predicting Gains in HESI V2 Scores

Variable	B	SEB	*β*	R^2	ΔR^2
Step 1				.12	.12
GPA	179.78	(42.88)	.35**		
Constant	251.56	(137.51)			
Step 2				.28	.16
GPA	116.44	(46.83)	.22*		
HESI V1	.581	(.144)	.42**		
Summer	-94.58	(38.96)	-.19*		
Fall	4.33	(23.91)	.02		
Gender	22.99	(32.20)	.06		
Cohort	-39.94	(24.11)	-.13		
LogRem	77.95	(65.00)	.11		
Constant	-41.06	(197.89)			

*Note. n=131, *p* < .05, **p* < .01.

In interpreting the standardized coefficients one can see that for every one standard deviation increase in HESI V1 scores (98.114) there is a corresponding .421 standard deviation increase in HESI V2 scores (.421 X 135.478 = 57.04), producing on average a gain of 57 points on the HESI V2. For every standard deviation increase in GPA (.26) there is on average a .224 standard deviation increase in HESI V2 scores (.224 X 135.478 = 30.35). According to this

regression, small increases in HESI V1 scores are more likely to produce robust increases in HESI V2 scores than small changes in GPA.

Lastly, a regression model was employed to explore the relationship of remediation hours on HESI V2 scores when controlling only for scores on the HESI V1. The linear combination of the variables is significant $F(2,128) = 15.63$, $p < .001$. When entered alone HESI V1 significantly predicts scores on the HESI V2, adjusted $R^2 = .19$, $F(1,129) = 30.785$, $p < .001$, indicating that scores on the HESI V1 contribute 19% to the variance in scores on the HESI V2. When remediation is added to the model, it is no longer significant ($p = .450$). Once again remediation hours has not made a significant contribution to the variance in scores of the HESI V2 exam when controlling for predictor variables.

Table 43

Hierarchical Multiple Regression Analysis Summary for HESI V1 and Remediation Hours, Predicting Gains in HESI V2 Scores

Variable	B	SEB	β	R^2	ΔR^2
Step 1				.19	.19
HESI V1	.606	(.109)	.44**		
Constant	404.74	(76.72)			
Step 2				.20	.004
HESI V1	.663	(.132)	.48**		
LogRem	49.62	(65.45)	.07		
Constant	308.98	(147.85)			

Note n=131, ***p* < .01.

Summary

An ex post facto quantitative design was employed to examine the relationship between utilization of the HESI online remediation program and student scores on the HESI E2 Exit Exam Version 2. Senior-level nursing students as part of a private, Catholic BSN program in the northeastern United States were the participants of this study. The convenience sample consists of students who were required to complete remediation as part of a policy that was implemented in the fall semester of 2013. A total of 493 students have taken the HESI E2 Exit Exam since the fall of 2013 and three outliers were excluded. Four hundred and ninety students made up the original population and are included in this study. A total of 418 students (85%) scored less than 900 on HESI Exit Exam V1 and were required to complete remediation hours. Hierarchical multiple regression statistical analysis was employed using SPSS software. Inclusion criteria are students who took the HESI E2 Exit Exam Versions 1 and 2 from fall 2013 to fall 2015. Students who were not required to complete remediation as well as students who were required to complete remediation but failed to do so were excluded from analysis.

Students from this program had a higher ethnic diversity ratio and a higher male population ratio than the general nursing school population. Fifty percent of the students are White compared to 73.5% nationally, and males represent 12.6% of the sample compared to 9% nationally. Although ethnicity was not included as a predictor variable, this overrepresentation could have contributed to the mean HESI scores below the national average for this sample as minority students traditionally perform lower on standardized exams (Alameida et al., 2011). The overall smaller representation of male students in nursing makes statistical inferences problematic. Of the 72 students who passed the HESI E2 on first attempt, 8% were male. Male

students represented 12.6% of the nursing school population for this university; therefore, they were slightly less successful than their female counterparts initially.

A paired samples *t* test confirmed that a significant difference existed between the mean scores of HESI V1 and HESI V2 (t(-4.903), df = 489, $p < .001$) for this population. There exists a moderate positive correlation ($r = .39$) and a medium effect size (.22).

An independent samples *t* test confirmed significant differences between students who passed the HESI E2 exam on first attempt and those who did not. The group of students who were unsuccessful on first attempt were comprised 88% female and 31% second degree students. Students who passed achieved an overall GPA of 3.52 compared to an overall GPA of 3.23 for students who failed. This difference in GPA was confirmed throughout the study and was consistently the strongest predictor for HESI V2 scores. There was no significant difference in scores based on gender. This has also been confirmed throughout the study as gender was not a significant predictor in any regression model.

The hierarchical multiple regression employed for Question 1 was statistically significant at the $p < .001$ level ($n = 394$), but remediation hours as a predictor variable contributed neither significance nor variance to the scores on HESI V2. GPA explained 13% of the variance, and HESI V1 explained 3% when controlling for all variables. In an effort to further explore the relationship between remediation hours and scores on the HESI V2, the sample set was filtered to include only students who achieved a gain on their scores between HESI V1 and HESI V2 (n = 263). The linear relationship of all variables was significant ($p < .001$) with HESI V1 explaining 15% of the variance and GPA contributing 9% to the explanation of the variance in scores on the HESI V2. There was no significance to remediation hours; therefore, the researcher

fails to reject the null hypothesis and conclude that there is no relationship between remediation hours and the HESI V2 Exit Exam.

A final regression model was employed for this sample of students with only HESI V1 and remediation hours entered into the model. When HESI V1 was entered alone, the model was significant ($p < .001$), and HESI V1 explained 21% of the variance in scores of the HESI V2. With the addition of remediation hours, the model was no longer significant thereby confirming the decision to fail to reject the null hypothesis.

Two sample sets were created for hierarchical multiple regression analysis to address Question 2. The first model included students who completed remediation hours 30 minutes greater than required by the university policy ($n = 347$). In this model the linear combination of all predictor variables was statistically significant ($p < .001$), but remediation hours contributed no statistical significance. GPA remained the strongest predictor contributing 11% of the variance when controlling for additional variables with scores on the HESI V1 contributing 4% to the variance in scores on the HESI V2. Further exploration of remediation hours was performed on a refined sample that included only students who achieved a gain between scores on HESI V1 and HESI V2 ($n = 233$). When controlling for all predictor variables, the model is significant ($p < .001$). HESI V1 explains 15% of the variance, while GPA contributes 8% to the variance of scores on HESI V2. This is a reversal from previous models where GPA has been the strongest predictor. A hierarchical regression model was employed to explore the relationship of remediation hours to scores on the HESI V2 exam while controlling only for HESI V1 scores. When HESI V1 scores were entered alone, the model was significant ($p < .001$) with scores on the HESI V1 significantly explaining 22% of the variance in scores on the HESI V2 exam. Upon adding remediation hours, the model was no longer significant ($p = .654$). Once again we fail to

reject the null hypothesis that there is no relationship between utilization of the Elsevier online remediation resource and scores on the HESI E2 Exit Exam Version 2.

The final hierarchical regression model was significant $p < .001$ ($n = 184$) and includes students who completed remediation time in excess of 2 hours over and above what was required by the university policy. When entered alone, GPA contributed 11% to the variance in the score of HESI V2. When all predictor variables were entered the model was no longer significant ($p = .055$). This sample set was also filtered to include only those students who achieved a gain on their HESI V2 exam ($n = 131$). The combination of all variables while controlling for GPA is significant ($p < .001$) finding that score on HESI V1 contributes most to the variance at 18% while GPA contributes 5%. A model was again created including only HESI V1 and remediation hours. When entered alone, HESI V1 explained 19% of the variance ($p < .001$). With the addition of remediation hours, the model was no longer significant ($p = .450$). Again this is not the expected finding and is disappointing. The researcher must again fail to reject the null hypothesis and conclude that remediation hours were not a significant contributing factor to scores on the HESI V2 for this sample.

The effect of cohort was similar between Question 1 and Question 2. Both revealed a negative 30 points on the HESI V2 for the second degree cohort, accounting for 1% of the variance. As previously stated, of the 83% of students who were initially unsuccessful on the HESI V1, only 31% of them were second degree students. Again this smaller number could indicate that the overall weaker students composed this group and can explain why the cohort has a negative relationship with HESI V2 scores. Cohort did not significantly contribute to the variance in the third regression model of students who completed remediation 2 hours greater than required by the policy. When the data sets were filtered to include only students who

achieved a gain between their scores between HESI V1 and HESI V2, the summer semester was significant, and these students earned on average 83 to 95 points lower than the spring cohort, explaining 2% of the variance. This is not unexpected as students who finish in the off semester of summer tend to have lower outcomes than students who graduate in the traditional spring semester (Horton et al., 2012). The number of summer graduates represented in this sample was 14 for the first two models (n = 263, n = 233) and 8 for the final model (n = 131). This small number of representative students and small contribution to the variance lends little meaningful information to these findings. No significant relationship was found for gender in any of the regression models. It could be that the overall smaller representation of male students was not sufficient to elicit any inherent differences between the genders. It could also indicate that the male and female students for this sample possessed similar qualities.

Significant to this study is the finding that 71% of the students performed greater than the required number of remediation hours, and 35.7% completed remediation hours more than 2 hours above what was required by the policy. It is possible that these students found value in the program and were willing to utilize it over and above what was required and tracked. It is also possible that these students possessed additional motivational qualities that were not addressed here. Further studies are needed to explore this aspect of the remediation policy. Three outliers were identified that completed an extreme number of remediation hours (155.47, 135.94, and 120.45) and achieved gains on the HESI V2 ranging from 33% to 72%. These outliers were excluded from the data analysis because of their outsized influence on the regression models.

As each sample of participants increased their number of remediation hours, there was a corresponding increase gain in the score of the HESI V1 to the HESI V2. The original population of 490 students realized a gain of 4% between the two HESI exams. The students who

participated in the required number of remediation hours (n = 394) doubled this gain to 8% between the two exams. Students who completed greater than the required remediation hours (n = 347) also realized a gain of 8% from HESI V1 to HESI V2, while the students who completed a greater number of remediation hours (n = 184) realized a gain of 10%. These are relatively small increments that do not provide a meaningful insight into the value of remediation hours. Along with the gains achieved, there were also losses in points between the HESI V1 and HESI V2, which confounds the ability to determine the effectiveness of remediation hours. To add insight into this relationship, data sets were filtered to include only those students who completed remediation and achieved gains between scores on the HESI V1 and HESI V2. Remediation was again not significant as a contributing factor to the variance in scores on the HESI V2 exam.

Chapter V

Conclusion

Summary of the Study

The purpose of this quantitative ex post facto convenience study was to examine the existence of a relationship between online remediation hours and scores on the HESI V2 Exit Exam distributed by Elsevier. This research study explored the predictive relationship of academic and demographic variables of senior-level nursing students and scores on the Elsevier E2 Exit Exam Version 2. Four hundred and ninety-eight students were enrolled in a senior-level nursing capstone course from fall 2013 to fall 2015. Only students who took Version 1 and Version 2 of the HESI E2 Exit Exam and completed remediation hours (n = 394) were included in the analysis for Question 1. Students who completed 30 minutes of additional remediation hours than what were required by university policy (n = 347) and students who completed 2 hours of additional remediation time than required (n = 184) were included in the analysis for Question 2. Study findings indicated that when controlling for all other variables, GPA was the strongest predictor of scores on the HESI V2 Exit Exam explaining 13% to 12% of the variance. HESI V1 explained 3% to 4% of the variance when controlling for additional variables. Remediation was not significant in any of the regression models; therefore, the researcher fails to reject the null hypothesis that there is no relationship between utilization of the Elsevier online remediation resource and HESI E2 Exit Exam raw scores for senior-level nursing students. In this sample, remediation hours did not contribute to the variance in score on the HESI V2 exam.

The problem facing nursing schools of preparing competent nurses capable of passing the NCLEX-RN licensing exam is expected to persist through the year 2025 (National Institutes of Health, 2012). This problem is exacerbated by an inability of nursing schools to increase their

capacity due in part to a shortage of nursing faculty (AACN, 2012; Higgins, 2005; NLN, 2014; Yordy, 2006). This makes it important for nursing schools to develop policies to enhance the students' abilities to pass the NCLEX-RN while maintaining an effective use of scarce resources.

The duty of nursing faculty to assess program outcomes and develop academic policies that focus on testing and remediation to improve students' success is supported in the literature (Spector & Alexander, 2006). In order to successfully implement academic policies, educators must consider the impact on faculty resources (Pennington & Spurlock, 2010). Once an assessment and intervention are determined, the policy must be implemented in a consistent fashion. It is then incumbent upon educators to evaluate the results to determine the effectiveness of the intervention (Yoost & Crawford, 2016).

General systems theory was the theoretical framework used to guide this research project. Open systems are composed of interrelated components that share a common purpose (Potter et al., 2013). The process begins with assessment and the identification of a problem. Once identified, an intervention is formatted and implemented (Potter et al., 2013; Putt, 1978). In order to complete the cycle, the intervention must undergo an evaluation process to determine effectiveness and to evaluate for any negative effect or harm (Yoost & Crawford, 2016). A policy was developed with the goal of improving student outcomes through the completion of remediation hours using the Elsevier online remediation resource.

Although much has been written regarding the connection between HESI E2 Exit Exam scores and NCLEX-RN pass rates, there is scant research available to support the use of online remediation hours to improve HESI V2 scores (Allen, 2009; Lauer, 2011; Mee & Schreiner, 2016; Wilson, 2014). There is a lack of specific detail as to how the remediation resource was utilized (Lauer, 2011), negative findings associated with the utilization of this resource (Allen,

2009), as well as reliance of students self-reporting their compliance with this resource (Wilson, 2014).

This study fills a gap that exists in the literature for a measurable and reproducible remediation intervention. The completion of online remediation hours are monitored by faculty for compliance with a university policy. Consequences exist for students who fail to comply with required remediation hours. This study contains quantitative measures and is reproducible for other institutions.

The Elsevier online remediation resource is embedded in HESI E2 Exit Exam that is widely used throughout the United States (Langford & Young, 2013; Young & Willson, 2012). Providing nursing programs with an analysis of a specific remediation measure allows schools of nursing to not only replicate the study but also to use this evaluation method to modify and make decisions of how to develop best practices of remediation in their own programs. For that reason this study is a valuable addition to nursing schools and to the nursing profession.

Findings

Through multiple regression analysis it was found that both GPA and HESI V1 scores were significant predictor variables in explaining the variance in scores on the HESI V2 Exit Exam. When entered alone, GPA explained anywhere from 11% to 18% of the variance in scores on the HESI V2 Exit Exam. With the addition of all predictor variables, the influence of GPA is diminished only slightly explaining 5% to 13% of the variance between scores of two parallel versions of the HESI E2 Exit Exam. GPA , both for admission and graduation, has been consistently reported in the literature as demonstrating a strong relationship both with high HESI E2 scores and NCLEX-RN pass rates (Alameida et al., 2011; De Lima et al., 2011; Harding,

2010; Lavandera et al., 2011; Schooley & Kuhn, 2013; Wiggins, 2011). This finding supports decisions for the requirement of minimum GPA attainment for progression in nursing programs.

In regression models that were employed for students who remediated according to policy requirements and included all predictor variables, HESI V1 scores contributed 3% to 4% of the variance in scores on the HESI V2 Exit Exam. When sample sets were filtered to include only students who completed remediation and achieved gains between scores on the HESI V1 and HESI V2, the role of GPA as a predictor diminished in comparison with HESI V1 scores. The contribution of GPA to the variance fell from 5% to 8% when controlling for all predictor variables, while HESI V1 contribution increased to 15% to 18%. The HESI V1 is reported in the literature as having the highest predictability of NCLEX-RN success (Young & Willson, 2012). Students who are able to achieve a high score on the HESI V1 demonstrate a stronger knowledge base that can be attributed to long-term preparation throughout the nursing program and not as much to remediation of weak content as defined by the HESI remediation tool. Although this may seem inconsistent with earlier findings, it still reinforces the importance of accumulated knowledge as opposed to knowledge obtained in a shorter period of time between two parallel exams.

Cohort contributed 1% of the variance in HESI V2 scores but in a negative direction with second degree students scoring on average 30 points below traditional students. Second degree students made up a smaller percentage of the remediation samples possibly indicating that the overall weaker students were in this group. Additionally the contribution to the variance of 1% ($p = .031$, $n = 394$) and the difference of 30 points are both small numbers. Therefore this finding contributes little to the meaningfulness of the analysis.

Gender was not found to have any predictive value for scores on the HESI V2. This may suggest that either there was no appreciable difference between male and females for this sample or that the number of males was too small to elicit a significant difference. Semester was significant only when the sample sets were refined to include those students who completed remediation hours and achieved a gain between scores on HESI V1 and HESI V2. Summer graduates scored between 83 and 95 points lower in this sample than students who finished in the traditional spring semester. This is in keeping with the literature, which finds that students who complete programs in the off-track semesters tend to score lower overall than students who complete programs in the traditional spring semester (Horton et al., 2012). Additionally the smaller number of students graduating in the off semesters of summer and fall could be a contributing factor.

Remediation hours did not contribute significantly to the variance in any of the regression models. This is a disappointing finding. Despite monitoring by faculty for completion and compliance with the remediation policy, there were little positive effects that can be attributed to the remediation hours. It should be noted that students completed the resource activities independently without faculty guidance. This lack of guidance is a possible contribution to the lack of significant findings. It is possible that students allowed time to accumulate without actually engaging in the activities provided through reading, viewing animations, and answering questions. Students who required remediation may be overall poor test takers, contributing to this lack of a significant finding. This is an area that warrants further exploration.

Students who performed remediation hours achieved gains ranging from 8% to 10% between HESI V1 and HESI V2. Students who performed remediation hours 30 minutes or greater than required by the policy increased their hours by 7% over students who completed

only the required hours and achieved a 9% gain in score from the HESI V1 to the HESI V2. When the sample of students who performed remediation of 2 hours or greater than required by the policy was analyzed, their 41% increase in remediation hours resulted in only a 10% gain in score between the HESI V1 and HESI V2. While the steady progression of gains corresponding with an increase in remediation hours is somewhat encouraging, the gains are very small overall in relation to the amount of remediation hours performed in order to achieve those gains. This is an area where further investigation is warranted into methods to improve outcomes. In addition, while some students achieved gains between HESI V1 and HESI V2, there were also students who saw their scores decrease from Version 1 to Version 2.

Significant to this study is the finding that 71% of the students performed greater than the required number of remediation hours, and 37.6% of students completed remediation time greater than 2 hours over and above what was required by the policy. This may suggest that these students found value in the program and were willing to utilize it over and above what was required and tracked. The possibility exists that students allowed time to accumulate without active participation. Additional exploration in the form of a student survey on how the program has been used would add insight to this finding. Three outliers were identified and completed 120.45, 135.94, and 155.47 hours of remediation. Although this could be a spurious finding, it is noted that these students achieved gains of 48%, 72%, and 33% respectively. Due to the outsized influence of these data points, they were excluded from the regression analysis. Whether the abilities of these students to substantially improve their scores while completing additional remediation hours is related to the remediation program or some other characteristics and resources is an area for further exploration.

Only a small portion of the variance in HESI V2 scores is explained by the variables in this study. Additionally the overall performance for these students on the standardized exit exam was lower than national averages. Demographics may explain some of the difference; however, other factors need to be considered. While overall GPA was found to be significant, focusing on individual courses in nursing or science could help to explain further the effect of GPA on HESI E2 exams. Soft skills such as time management, study skills, and learning styles are areas that would benefit from further exploration. In addition to utilizing standardized exams for progression and remediation, nursing programs also use information from these exams as an external evaluation of curriculum (Carr, 2011; Coons, 2014; Schroeder, 2013). As part of the overall testing policy evaluation, it is wise to assess for possible curriculum deficiencies that may be contributing to a lack of student preparedness.

Strengths and Limitations

This quantitative ex post facto research study had both strengths and weaknesses. A strength of this study is that it evaluates a specific method of utilization for the Elsevier online remediation resource. By describing and analyzing a specific method, the study becomes reproducible allowing other programs to duplicate the study and compare results. The hours of utilization were tracked by faculty on a password-protected access website that allowed for consistency and accuracy of data collection. Furthermore the policy in effect had specific consequences to encourage participation thereby increasing the compliance with utilizing the program. Another strength to be noted is the robust sample size of 490 students who sat for the HESI E2 exam during the time frame of this study. Allowing for refinement of sample sizes to capture the various remediation times, the sample groups of (n = 394, n = 347, n = 184) still encompassed robust numbers for statistical regression analysis. The goal of this study was to

analyze the effect of a specific remediation resource on student outcomes for a standardized exam. To this end, the study was successful in accomplishing this task.

Limitations include analysis of a one-site program, which makes generalizability of the results problematic. No measures were taken to include other factors that can affect test results such as motivation, stress, test-taking anxiety, or poor test-taking skills. Alternate measures of remediation such as NCLEX-RN review books, online quizzing, case studies, or other NCLEX-RN preparation tools were not considered. This study did not track the NCLEX-RN success of these students.

The structure of the policy changed slightly in the time frame in which this study took place. Initially the average score of each HESI exam was calculated and weighted as 15% of the course grade. Students who achieved a 90% conversion score could use that as their course grade instead of the average of the two scores. In the spring of 2014 the policy was revised so that each score was individually counted as 10% of the course grade. While this may have had some influence in the way the students approached the exam, the requirement of remediation hours was unchanged throughout the timeframe of the study.

Implication for Health Sciences and Law

Professional education studies such as pharmacy, medicine, and law are also obligated to produce students who are capable of passing licensing exams. Literature for these professions is sparse, and nursing literature is often explored (Cleland et al., 2013; Maize et al., 2010) for insight on this issue. A review of the literature in health sciences also reveals a lack of specificity as to type, length, or follow-up of remediation interventions (Cleland et al., 2013). Law schools also find their programs judged by strong bar exam pass rates and seek to find methods to improve outcomes (NCBEX, 2014; Trujillo, 2007). Providing additional insight through a

quantitative analysis of a specific intervention fills a gap in the literature for professional education studies.

This study has demonstrated the importance of GPA in predicting scores on standardized exams. This finding can assist programs in setting minimum grade requirements and progression policies. The finding that the HESI V1 score was the second strongest predictor points to the value of learning obtained throughout the program as higher value than learning obtained through short time-frame remediation policies. It also reveals that remediation taking place in the later part of a program can be problematic and highlights the difficulty of significantly moving students in a positive direction. Therefore this study can benefit educators from health science professions as they look to improve remediation strategies and increase pass rates on licensing exams.

Implications for Nursing Education

This study has important implications for the nursing profession. The ability to graduate nurses capable of passing the NCLEX-RN exam on first attempt has consequences for the strength and viability of nursing programs. The inability to produce safe practicing nurses and maintain strong first-time NCLEX-RN pass rates can result in censure by the state board of nursing and of loss of accreditation from the nursing accreditation bodies. Such censure limits a program's ability to attract both strong students and competent faculty. The reputation of the school as a whole may suffer as a result of negative NCLEX-RN results from the nursing program.

The HESI E2 Exit Exam is widely used by nursing programs throughout the United States and Canada. A benchmark score of 900 on this exam has been repeatedly connected to success on the NCLEX-RN exam with 96% to 98% accuracy (Harding, 2012; Morrison et al.,

2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012). It is therefore relevant for nursing programs to explore methods of successfully remediating students who score below established benchmarks in order to improve their scores, as well as exploring factors that may affect first-time scores on the HESI E2 Exit Exam. Developing a remediation program that is highly correlated to increase scores on the HESI E2 Exit Exam is a benefit to both nursing programs and students. Failing the NCLEX-RN on first attempts can have both financial and emotional consequences for students. Helping students to improve their ability to pass the NCLEX-RN on first attempt is a desirable outcome.

The utilization of the Elsevier online remediation tool was chosen in part as a student-directed resource that required minimum faculty intervention, thereby preserving limited faculty resources. Previous studies of successful remediation outcomes involved intensive faculty-directed supplemental courses (Frith et al., 2005; Sewell et al., 2008; Sifford & McDaniel, 2007), as well as faculty-guided student success strategies (Bonis et al., 2007). Winston et al. (2013) found that experienced faculty promoted higher cognitive attainment for medical students in need of remediation. The limited success of a student-directed remediation tool may be suggestive of the importance of faculty guidance for effective remediation.

Once a policy is in place it is important for faculty to evaluate if outcomes meet the desired goal. In nursing this cycle of assessment, implementation, and evaluation is referred to as the nursing process (Carrick, 2011; Potter et al., 2013; Simon et al., 2013). Reporting on these findings allows other programs to utilize this information in their own planning as they look for methods to improve student outcomes.

Recommendations for Further Research

First of all an important follow up to this study would to be to tie into NCLEX-RN pass rates for these students. While the completion of remediation hours may not have been a significant predictor in improving HESI V2 scores, it is possible that students benefitted from the remediation as they prepared for their NCLEX-RN exam. Expanding the current study to examine remediation impact on NCLEX-RN pass rates is important for this student population.

A qualitative analysis to investigate the process by which students are utilizing the remediation resource may uncover why, after many hours spent in remediation, the results were disappointing. Were there areas that students found helpful? Were there areas that were lacking? How are the students utilizing this resource? Did they take an active or passive approach? How did they perceive the value of the remediation tool?

Parallel studies could be conducted at other schools of nursing to determine if similar results exist among nursing programs. As stated earlier, the HESI E2 Exit Exam is widely used among nursing programs across the United States (Harding, 2012; Morrison et al., 2006; Nibert & Morrison, 2013; Yoho, 2006; Zweighaft, 2012). The remediation tool is embedded in the HESI exam resource, making it accessible to a robust number of nursing programs. This policy analysis provided an analytical intervention that may be duplicated. This duplication would be beneficial to elicit information on the use of this remediation tool.

Assessment of learning styles is also an important area for further exploration. The use of a computer-based remediation program may be counterintuitive to students who benefit from a more active leaning style. Lyons (2008) reported success in increasing NCLEX-RN pass rates using an active problem-based learning approach instead of traditional lecture format. Additional

study is needed to evaluate the effect learning styles may have on the choice of remediation programs.

Also of importance is to investigate the use of resources other than the online remediation tool from Elsevier. Did students utilize any other types of remediation tools such as NCLEX-RN review books, online quizzing, case studies, or study groups? Exploration of other remediation methods may add insight into methods that students may find valuable.

An exploration of nonacademic factors such as test anxiety, test-taking skills, and self-efficacy as an enhancement to remediation hours is also warranted. Students with higher perceptions of their test-taking skills increased their performance on standardized exams (Challenger, 2014). The perception of better test-taking skills was also demonstrated to reduce test anxiety with the possibility of improved standardized testing scores (Sifford & McDaniel, 2007).

The possibility of increasing the number of remediation hours should be explored. Although remediation hours were not significant in any of the analyses, the three students who performed an outsize number of remediation hours achieved gains ranging from 33% to 72%. While these outliers had an undue influence on the regression models for this study, it cannot be discounted that their completion of copious amounts of remediation hours had a positive effect for these students. It needs to be determined whether the weak relationship between remediation hours and HESI V2 scores are the result of the tool itself or the manner in which it is used.

This online remediation resource is structured to provide an individualized program that students can complete independently at their own pace. It required minimal intervention from faculty thereby saving faculty resources. The lack of a significant relationship between student utilization of this tool could indicate that independent access is not the optimal use of this tool.

Examining methods of faculty monitoring through face to face meetings could be explored. Working with students individually to guide their remediation activities, faculty members may direct students on how to best strategize their activities to maximize results.

Conclusion

The purpose of this study was to examine the relationship of study hours completed through the Elsevier HESI online remediation resource and scores on the HESI E2 Exit Exam Version 2. This study is an attempt to add to the literature regarding remediation methods and standardized test scores. The quantitative analysis provided a consistent measure of monitoring student remediation and resulted in a quantifiable result. While each regression model was statistically significant, remediation hours did not significantly contribute to the variance in scores on the HESI V2 exam. Despite 71% of the students completing a greater number of hours that stipulated by the university policy, only 57 students were able to achieve the benchmark score of 900 on the HESI E2 Exit Exam Version 2. The predictor variables examined in this study accounted for at most 18% of the overall variance in the HESI V2 scores. This leaves over 80% of the variance unexplained by these predictor variables.

There are many additional factors that influence student scores on exams. Nonacademic factors of test anxiety, test-taking skills, study habits, or stress were not measured or considered in this study. The demands of other courses taken in the same semester as the capstone course and time constraints that are imposed can affect the attention that students give not only to the remediation hours but to the importance of sitting for the second exam. Although ethnicity was not explored as a predictor variable, the student body as a whole is fairly diverse with 50% Caucasian and 50% of an ethnicity other than Caucasian. This diversity ratio is higher than the

national average of Caucasian (AACN, 2015). Ethnic diversity can impose difficulties with student success on standardized tests (Alameida et al., 2011).

The HESI E2 Exit Exams also serve as an external curriculum evaluation tool for nursing programs (Carr, 2011; Coons, 2014; Schroeder, 2013). The exams are structured to align with the NCLEX-RN blueprint and can highlight areas of weakness within a program in meeting the competencies as outlined by the NCLEX-RN blueprint (Young & Willson, 2012). It is incumbent upon faculty to utilize these tools a part of an overall curriculum assessment. Forming educational policies on evidence-based quantitative research advances the scholarship of nursing education (Bonis et al., 2007)

This policy meets the accepted norms of transparency and enforceability. The requirements are clearly communicated to the students and published in the student handbook and course syllabi. It also provides consequences for noncompliance by affecting the student's grade in the class. Student activity is monitored by faculty. The fact that 71% of students completed remediation hours above those required by the policy demonstrates a clear motivation on the part of the student to succeed.

However disappointing the results, it is useful to know the effect of a policy that takes up time and effort on the part of both faculty and students. General systems theory posits that the interaction of parts within a system is unpredictable due to the many variables involved. The results of this study support that premise. Designing and implementing an intervention in response to an assessed need is the correct strategy when faced with a problem in need of a remedy. Performing an analysis of the expected outcomes is a critical step in the evaluative process. Once the results of analysis are known, the stakeholders are able to move forward with changes to better maximize goal attainment. This cyclical process of implementation and

evaluation is a necessary component of policy development so that anticipated outcomes have the best chance for success.

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Appendix A

Nursing Student Handbook (2013-2014)

COMPREHENSIVE TESTING POLICY

The College of Nursing has adopted a testing package to provide comprehensive diagnostic reports detailing student performance in many content areas, critical thinking phases, cognitive levels and nursing process steps. Testing is administered via the Internet with immediate results.

Total Testing Policy

Policy: All pre-licensure students enrolled in the College of Nursing are required to take nationally - normed specialty exams throughout the curriculum and exit exams in the last semester. The conversion scores achieved on exams with the exception of Synthesis will account for 10% of the course theory grade in the course where the exam is administered. The College of Nursing requires all students to take all HESI exams as scheduled in each course. Where two equivalent versions of the same exam are required, conversion scores from both exams will be averaged to obtain the test grade for the course as indicated in the course syllabus. The only exception to averaging the test scores is as follows. If a student achieves a conversion grade of 90.00 or higher on either of the HESI exams then that grade may serve as the test grade, rather than averaging both exam scores.

Purpose: The purpose of the TOTAL TESTING PROGRAM is to assess student competency and evaluate achievement of curricular outcomes, to evaluate the student's ability to apply nursing concepts within specific content areas and in the overall program, and to contribute data for the systematic program evaluation. In addition, it increases student's familiarity with computerized test methodology that is similar to NCLEX testing style.

Procedures: Students will use the following guidelines to comply with Nursing Program requirements for Total Testing.

Progression-to-Graduation Requirements:

1. Students will receive a booklet containing a user name, password, and instructions for enrollment in the EVOLVE Learning System during orientation to the Health Assessment Course.

a. Specialty exams are administered after at least 80% of the theoretical content has been presented.

b. All Evolve Specialty exams will account for 10% of the theory grade in the course where the exam is administered.

i. Students are required to take 1 (one) version of each specialty exam when 80% of the content is delivered. Students will be required to remediate according to the Total Testing Remediation Policy. Remediation must be handed to faculty on day of Final Exam. Failure to hand in remediation will result in a grade of "0" for the HESI Exam.

ii. Evolve Specialty Exams are secure computerized assessments. Course faculty will provide mandatory testing dates in the course syllabi.

iii. Students should refer to the Total Testing Remediation Policy for remediation.

2. HESI Exit (E2) RN Exam

a. The HESI Exit (E2) RN Exam is a computerized, comprehensive exam that is highly predictive of NCLEX success.
b. The HESI Exit (E2) RN Exam is administered during the final semester of study in the nursing major and will account for 15% of the theory grade in the course where the exam is administered.
c. Students are required to take 2 versions of the HESI Exit (E2) RN exam. If a student achieves a conversion grade of 90.00 or higher on either of the HESI exams then that grade may serve as the test grade, rather than averaging both exam scores. Students will receive immediate feedback on each exam with detailed scoring explanation for each item missed. Exam scores are equally weighted and the average of the two exams will determine the grade used in the course.
d. HESI Exit (E2) RN-BSN exams are secure, computerized assessments. Course faculty will provide mandatory testing dates in the course syllabi.
e. Students should refer to the Total Testing Remediation Policy for remediation between the two exams.

Definition of Terms:

Specialty Exams are nationally- normed tests designed to measure the student's ability to apply concepts related to specific clinical nursing content areas. Content areas include: For example: Health Assessment, Fundamentals, Maternal, Pediatric, Psychiatric, and Medical Surgical Nursing.

A conversion score is a weighted percentage score that considers the average difficulty of the exam and the average difficulty of the test items answered

HESI: Health Education System Incorporated

The HESI Exit (E2) RN Exam is a comprehensive exam which measures preparedness for the NCLEX-RN licensure exam.

HESI Score: Using the HESI Predictability Model scores are calculated in which test items are individually weighted based on their difficulty level. HESI score ranges from 0 to 1500.

Total Testing Remediation Policy

All students enrolled in the undergraduate nursing program at Seton Hall University will take the nationally normed HESI specialty exams in each course and two versions of the Exit (E2) RN Exam in a course in the final semester of the program. Students should aim to achieve a score of 900 or higher on each exam. Research demonstrates that scores in this range on the HESI Exit (E2) RN Exam are highly predictive of NCLEX success. To prepare for the comprehensive E2, students are required to remediate according to the prescribed plan of study that accompanies the HESI feedback. Students must provide documentation of remediation after each specialty exam, prior to sitting for the respective course final examinations.

Purpose: The purpose of remediation is to improve student's critical thinking, reasoning skills and test taking strategies to achieve NCLEX-RN® success.

Procedure: Students, faculty and appropriate staff will use the following guidelines for Total Testing remediation.

I. Specialty examinations

A. Specialty: Exams are administered in various clinical courses. Following test administration, students receive a score and an online remediation plan for each question missed. Remediation for each question has multiple content items and may include practice questions.
B. The following remediation is required in each specialty course. Study plans for remediation must be printed out and handed to the instructor for admission into the final exam. Failure to hand in remediation will result in a failing grade for the HESI Exam

HESI score	Hours of remediation
800-899	2 hours
700-799	3 hours
600-699	4 hours
500-599	5 hours
400-499	6 hours
300-399	8 hours

II. **HESI Exit (E2) examination**

A. The HESI Exit examination is administered during the second semester of the senior year. An online remediation plan is developed for each question missed.

B. Students scoring less than 900 on the exit examination must remediate according to the following
guidelines and submit proof of remediation to their clinical faculty before taking a second exit examination. Students should aim for a 900 or higher benchmark score on the HESI exam before sitting for the NCLEX-RN® examination.

HESI score	Hours of remediation
800-899	3 hours
700-799	5 hours
600-699	7 hours
500-599	9 hours
400-499	11 hours
300-399	13 hours