THE USE OF PREPROGRAM AND WITHIN-PROGRAM COGNITIVE
ATTRIBUTES TO PREDICT MIDPROGRAM OUTCOMES IN
BACCALAUREATE NURSING EDUCATION

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THE USE OF PREPROGRAM AND WITHIN-PROGRAM COGNITIVE ATTRIBUTES TO PREDICT MIDPROGRAM OUTCOMES IN BACCALAUREATE NURSING EDUCATION

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ABSTRACT

Academic progression through the midprogram period in baccalaureate nursing education programs must meet the future demands of healthcare without wasting academic resources. Using an ex post facto, non-experimental design, a study of 302 students enrolled in one nine-semester baccalaureate nursing program located on eight campuses across the U.S. was conducted to identify predictors of midprogram academic success, as measured by (a) passing grades in the Adult Health II course, and (b) the Adult Health Evolve Specialty Exam HESI scores ≥ 850 as the final exam.

Preprogram cognitive attributes included seven individual Evolve Admission Assessment (A2) exam scores, age, and gender. Only the Anatomy and Physiology exam was statistically significant ($p < .001$), but weakly correlated ($r = .282$) with the Adult Health II ESE; no relationships found with midprogram grades questioning the usefulness of A2 examinations in admission criteria at this program.

Based on Constructivist theory, knowledge building and mastery of domain-specific prior content, logistic regression found that course grades in Health Assessment II and Adult Health I ($p < .05$) predicted success in Adult Health II grades. The Fundamentals II ESE ($p = .001$) and the Adult Health I ESE ($p = .006$) significantly predicted success on the Adult Health II ESE. Significant relationships were identified between the grades between Fundamentals II, Adult Health I and Adult Health II grades ($p < .05$). Customized ESE had higher mean scores and percentages of passing than
standardized ESE. Although significant \( p < .001 \), no perfect correlation was found between HESI scores and conversion scores \( (n = 35; p = .998) \). Independent \( t \)-tests found the Adult Health II ESE \( (p = .001) \) and 4\(^{th} \) semester GPA \( (p = .005) \) were significant in differentiating success and failure with Adult Health II grades.

Suggested future research would: a) expand data collection to include qualitative measurements of socio-cultural factors in the educational experience of today’s students, b) explore the comparison of conversion and standardized exam scores used in student assessment, and c) investigate the role of standardized exams for course credit as compared to self-evaluation, end of program assessment, or simply practice and remediation.
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CHAPTER I
THE PROBLEM

Need for Baccalaureate-prepared Nurses

By 2018, due to increased patient complexity, predicted retirements in nursing workforce, and fewer nursing faculty, a 22% increase in Registered Nurses (RNs) will be needed to fill 581,500 new positions, forecasting a 26% increase from 2010 to 2020 (American Association of Colleges of Nursing [AACN], 2010; Buerhaus, Staiger, & Auerbach, 2009; Bureau of Labor Statistics [BLS], 2012). Other projections have increased that number to 712,000 registered nurses needed to meet the expected healthcare demands. The shortage undermines the effectiveness of health care systems because nurses are the “front line” staff in most health care systems and the “largest segment of the health care workforce” (BLS, 2012; Institute of Medicine, 2010, p. S-1).

Concurrent with the increased need for nurses is a rise in the aging population as well as the needs raised by the approximately 31 million uninsured Americans who will gain access to health care as a result of passage of the Patient Protection and Affordable Care Act of 2010. According to Drury, Francis, and Chapman (2009), “with fewer younger nurses to ‘take over from them’, the profession is vulnerable” (Recommendation section, para. 1).

Besides the increase in numbers of nurses, a call for an increase in the number of baccalaureate-prepared nurses in the workforce from 50% in 2010 to 80% in 2020 was
presented in the landmark report by the Institute of Medicine (IOM) in 2010, “The future of nursing: Leading change, advancing health.” Their call was based on two leading arguments indicating that an increase in the number of baccalaureate-prepared nurses: (a) improves patient safety and reduces untoward events; and (b) will provide a foundation for educational pathways to increase the numbers of advanced practice nurses for practice (e.g., nurse practitioners) and as faculty with doctoral preparation (Institute of Medicine, 2010).

Years of research highlight the demand for increases in baccalaureate-prepared nurses. Aiken (2005) reported a 5% decline in client mortality and failure to rescue post-operatively when the proportion of baccalaureate nurses was increased by 10%. Similarly, surgical patient death rates within 30 days of admission decreased by 26% when more BSNs were employed (Aiken, 2008). A study of 46,993 patients with medical-surgical conditions reported lower 30-day mortality rates. The study identified “a 10% increase in proportion of BSN nurses was associated with 9 fewer deaths per 1,000 discharged patients” (Tourangeau et al., 2007, p. 41). Similarly, “failure-to-rescue” rates had a significant positive relationship with increased nursing education levels of the staff (Friese, Lake, Aiken, Silber, & Sochalski, 2008). A later study in 2009 identified a 4.9% decrease in deaths per every 1,000 intensive care admissions with baccalaureate-prepared nurses providing their care. In addition, a decreased incidence of medication errors also occurred when an increase of up to 54% of baccalaureate-prepared nurses comprised the staff (Chang & Mark, 2009).
Need for Nurses Educated Beyond the Baccalaureate Degree

While mounting evidence supports the benefits of a larger baccalaureate-prepared workforce, the education of nurses is constrained by a growing faculty shortage. The annual survey of nursing programs as conducted by the American Association of Colleges of Nursing in 2011 reported that the major barriers to increased prelicensure baccalaureate enrollments were retirement and insufficient numbers of qualified faculty in 64.5% of schools (Robert Woods Johnson Foundation, 2010). For example, the Texas Higher Education Coordinating Board in 2005 acknowledged a denial of 4,220 qualified student applicants for nursing programs due to limited space and insufficient numbers of prepared faculty (Texas Department of State Health Services, 2005). Later, in 2010, a survey of 367 baccalaureate nursing programs in the United States reported over 52,000 qualified applicants were denied enrollment due to insufficient seats for new admissions, a 20% increase from 2009 (AACN, 2010). More recent data from AACN (2012b) show more than 75,000 qualified applicants were turned away due to insufficient faculty, clinical and classroom facilities, and budget constraints.

The Institute of Medicine recommendations do not exclusively require prelicensure baccalaureate-prepared nurses because licensed nurses may complete baccalaureate education in RN to BSN program. However, there is a critical need for baccalaureate-prepared nurses to provide a pipeline to graduate schools for advanced practice degrees in practice and education (Pittman, Horton, Keeton, & Herrera, 2012). Recommendation Five from the Institute of Medicine’s report “ensures that at least 10% of all baccalaureate graduates matriculate into a master’s or doctoral program within five years of graduation” (IOM, 2010, p. S-11). Therefore, the ongoing needs for the nursing
profession require doubling the number of doctorally-prepared nurses as educators, thus enabling increased enrollments in baccalaureate nursing programs (National Advisory Council on Nurse Education and Practice [NACNEP], 2008).

Need to Assure Academic Success

While a preponderance of evidence exist validating increased patient safety with increased BSN ratios, the ability to increase the number of students admitted has not occurred. This is predominantly due to a lack of faculty, thus limiting seats for enrollment. As a consequence of limited seats, it becomes critical to admit academically qualified students who have the greatest potential for achieving educational success in nursing. Whereas the nation has focused on promoting access to higher learning, a new focus in nursing must be deliberate at maximizing numbers of college students who finish with a degree and obtain licensure. K. Hopkins (2011) in a study of 1,201 institutions, particularly public institutions, found that a mere 40% of first-time, full-time students completed a baccalaureate degree in four years. Acknowledging the present attrition rates in nursing programs, the recent 5.7% increase in national enrollment at entry level prelicensure baccalaureate nursing programs will not meet the demands for a shortage that is twice as large as any nursing shortage in the United States since the 1960s (AACN, 2011a).

Indicators of Success and Failure in Nursing Programs

Several studies exist which have provided predictors for achieving success on the National Council Licensing Examination [NCLEX-RN] (Haas, Nugent, & Rule, 2004; Lavandera et al., 2011). However, relatively little research has examined early academic
outcomes in nursing programs, such as specific nursing course success or failure. Predictors of earlier success and failures would have a strong impact on student debt, program costs, and graduation. Little has been systematically studied about nursing students who have been unable to graduate and obtain licensure or have not been able to complete their educational program, which is ultimately antithetical to the goal of nursing education (Lavandera et al., 2011). Understanding factors supportive (or not) of student success throughout the baccalaureate nursing program is essential for graduating the numbers of students needed to curb the nursing shortage. An analysis of success factors earlier, rather than at the end of the program, provides nursing educators guidance in the wise choice of optimal admission criteria and in curriculum development and support. Such studies, when conducted, have been based only on data within one program (e.g., Underwood, Williams, Lee, & Brunnert, 2013). What is needed are large group analyses.

Supportive strategies toward program completion generate cost savings to universities whose success is grounded in students’ program completion. Successful progression through a program significantly impacts graduation rates, meets community partnerships, supports job placement, conserves student and program costs, and assures the survival of the program itself. For these reasons, review of midprogram success was needed to fill the research, service, and gaps in the literature.

Although pass rates on nursing licensure examinations are monitored by boards of nursing and AACN, only 89.09% of baccalaureate-prepared nursing graduates passed the exam on the first attempt in 2011. However, little systematic research exists about students who are unable to progress through midprogram to be able to graduate and pass
the licensure examination (Lavandera et al., 2011; National Council of State Boards of Nursing ([NCSBN], 2012).

While nursing research has defined predictors of success for end of program outcomes, little information exists on the relationships between or among preprogram entrance cognitive variables (attributes), or markers of baccalaureate student progression from early to midprogram courses, and midprogram outcomes. Yet, having systematic, grounded information about students most likely to succeed, or to succeed with support, is important as every enrollment seat offered to a student who meets the admission criteria is offered goals of meeting the national nursing shortage, regional economic needs, and local university strategic plans. While a review of academic attributes by an admission committee ensures entrance criteria are met, it may not predict future performance, particularly program success through to graduation (Brown & Marshall, 2008; Newton & Moore, 2009; Newton, Smith, & Moore, 2007).

Defining midprogram in nursing education depends on the point of entry, length of program, and curriculum. Midprogram is often the completion of a course with medical and surgical nursing content. This requires students to critically apply and integrate past science-based knowledge from several courses. Safe patient care requires the knowledge developed into congruent whole (Ehrenfeld, Rotenberg, Sharon, & Bergman, 1997). Multiple failures at midprogram often result in academic dismissal from the program. While review of academic attributes by an admission committee ensures entrance criteria are met, it may not predict future performance, particularly program success through to graduation (Brown & Marshall, 2008; Newton & Moore, 2009; Newton, Smith, & Moore, 2007).
Problem Statement

This study proposed to examine the cognitive attributes of students for the predictive ability to achieve midprogram outcomes. Reviews of cognitive attributes by admission committees ensure established objective enrollment criteria are met. However, once admitted, little to no research is available which indicates prediction of success using preprogram or criteria early in the program in meeting success with particular course content at a midpoint in the curriculum (Brown & Marshall, 2008; Newton & Moore, 2009; Newton, Smith, & Moore, 2007). Research to use already available or established preprogram criteria to predict academic success particularly in a medical-surgical nursing course can help with improved understanding of academic success. This dissertation advances the assessment of outcomes beyond the early program period used in recent research by Underwood et al. (2013). Instead, early program assessments will be used to predict midprogram outcomes to fill the gap in nursing research.

Limiting Issues

Definitions of the point at which enrollment occurs is not specified in much of the nursing related research. Moreover, rather than retention rates, aggregate student outcomes in nursing programs may focus, instead, on graduation rates or pass rates on the licensure exam. Compounding the confusion, retention rates were used as outcomes based on data demonstrating 85% of baccalaureate-prepared students were retained after enrollment; however, “enrollment” itself was not defined (National League for Nursing, 2006). That is, some programs only admit into the second year after general education courses are completed while others admit into the nursing program during semester one.
of the entire baccalaureate degree program; therefore, consistency in terminology from which conclusions from research are made can be challenging.

Clearly, further research was needed to explore the complex relationships between programs’ methods used to predict success and to measure success, although even the definitions of success vary. The most useful research would examine students’ nursing and scholastic academic profiles correlated with achievement of scores and grades (Clark, Collins, & Taylor, 2011). It would be particularly advantageous if the data, which are largely pragmatic, are grounded in theory. This dissertation proposed to use data as measurements of success both pragmatically and theoretically. This study examined the relationships between selected preprogram and within-program student cognitive attributes supported in the literature with measurements of success at the midprogram point in the nursing curriculum rather than an endpoint as is commonly researched.

**Academic Curricular Components for Analysis**

Preprogram cognitive attributes in education and nursing literature measuring academic success have included selected course grades, science grade point average (GPA), cumulative grade point average (CGPA), and commercially-prepared standardized preprogram exam scores. Such examples of preprogram cognitive attributes assess previously learned knowledge and may be used to predict who will gain the knowledge required for application and future integration within the nursing curriculum. This is consistent with Constructivist theoretical beliefs with the individual as the processor of previous learning to build the knowledge needed for successful outcomes in their life (Merriam, Caffarella, & Baumgartner, 2007).
However, preprogram attributes, particularly those related to knowledge acquisition, may be compromised by lag time between the time of knowledge acquisition and actual enrollment. Moreover, students may not be prepared for the baccalaureate course content or program load or the stressors of program planning and execution. Consequently, preprogram cognitive attributes (e.g., grade point average and course grades) may not accurately predict student success (Newton, 2008; Seldomridge & DiBartolo, 2004).

Within-program Cognitive Attributes

In previous research, cognitive attributes occurring after enrollment have included grades, testing scores, grade point averages, and specific course outcomes. They have been used for exploration of relationships to outcomes at any point during the program through post-graduation (e.g., Beeson & Kissling, 2001; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2003; Seldomridge & DiBartolo, 2004; Underwood et al., 2013). More recent studies using transcripts of within-program attributes have sought correlations between such outcomes as graduation or licensure exam results. However, relationships between attributes including course grades can be explored further to understand achievement of success within the nursing program’s curriculum (Landry, Davis, Alameida, Prive, & Renwanz-Boyle, 2010).

Midprogram Academic Outcomes

Nursing research on academic outcomes is rich in the strength of relationships between preprogram cognitive attributes, scores and grades achieved within a program, and end of program outcomes including the first time pass rate on the licensure exam or
graduation (e.g., Glick, McClelland, & Yang, 1986; Jenks, Selekman, Bross, & Paquet, 1989; Yoho, 2006). Nursing research lacks exploration of earlier outcomes prior to the period when most student academic dismissals occur. Earlier identification of at-risk students at midprogram may support wise use of faculty resources, success planning, and remediation for the most optimum educational outcomes (Harding, 2010; Harding, Rateau, & Reise, 2010; Zweighaft, 2013). This dissertation explored the gap in research between acquisition of these attributes acquired after enrollment with the relationships with midprogram outcomes based in current literature.

**Dissertation Focus and Theory**

While past performance is predictive of future academic success, this is not always the case (Murray, Merriman, & Adamson, 2008; Wang, 2009). Students enrolled in a nursing program have met the minimum admission requirements with the expectation of program completion. Earned course grades and grade point averages prior to admission, and assessment of previously learned foundational knowledge evident in commercially-prepared standardized testing scores, provide preprogram data to evaluate. Similarly, nursing course grades, grade point averages, and commercially-prepared standardized exams provide assessment measures of within-program cognitive attributes which are useful for research. Therefore, both preprogram and within-program data represent application of knowledge for integration into midprogram outcome measurements based on a midprogram medical-surgical nursing course as a foundation for safe provision of patient care in clinical practice. In this dissertation, the reference to the “medical-surgical nursing course” will from herein be identified as an “Adult Health
Nursing course” based on the focus and content of the course in the program studied, and for consistency in terminology.

Academic success is achieved when students integrate previous course knowledge content into their midprogram education. When midprogram failure occurs, the student is not eligible for inclusion in research studies which frequently use outcome measurements only at the end of programs, such as NCLEX-RN passing or graduation. Therein lies the gap in baccalaureate outcomes research (Ehrenfield et al., 1997). Often, the grades, scores, and grade point averages are presented as cognitive attributes predictive of end of program outcome measurements but not midprogram academic outcomes (e.g., Beeson & Kissling, 2001; Daley et al., 2003; Seldomridge & DiBartolo, 2004).

This dissertation explored the gap in research to examine the predictive value of preprogram and within-program cognitive attributes on measurements of success with academic outcomes at midprogram. The relationships included preprogram attributes of testing scores and within-program and midprogram grades, standardized commercially-prepared exam scores, and grade point averages in a large, private, prelicensure baccalaureate nursing program with multiple campuses located across the United States.

**Theoretical Framework**

Research on academic success and need for increased numbers of nursing graduates have often focused on the traditional student in university settings (Wild & Ebbers, 2002). Studies have relied on Tinto’s Theory of Student Departure (Pascarella & Terenzini, 2005). This model describes the most widely used paradigm for understanding student behavior related to departure or persistence as related to college life. The
students’ experience with socio-cultural, internal motivating forces with goals, college programs to increase engagement has been studied for understanding student academic success (Tinto, 1993). However, the Tinto model is not a fit for explaining nontraditional nursing students’ demands of decreased campus life conflicting with demands of work, family, clinical experiences, and campus with electronic classroom environments. The model has not supported today’s various college programs’ settings, nor a focus on prediction of academic success (Wells, 2003).

Definitions of traditional students often include the students who are single between the ages of 18 to 22, while nontraditional students may be married, divorced, or single of any age over 22 and living in an off-campus setting. While many wish that nursing studies on academic success or failure would be guided by explicit nursing theory, concepts in learning can translate across all levels of higher education, including nursing (Kippenbrock, May, & Younes, 1996). Indeed, much of nursing research is based on theory drawn from other fields (Polit & Beck, 2008). In this dissertation, educational theories were derived for application to nursing. The theory is operationalized by variables which are described within this section on the Constructivist theory and further explicated in the section on the research question and variables.

**Characteristics of Constructivist Theory**

The Constructivist theory was used to support this study with the perspective on the individual learner’s attempt to understand and make sense of the received education. Originating with Piaget, meaningful experiences support learning, but Vygotsky explains the addition of social processes to support learning as a social process (Bruner, 1990).
Learning as a reciprocal process is clearly evident in nursing education. The learner explores the content from resources in the didactic environment, hands-on activities in lab settings, textbook readings, clinical experiences, and social interactions in all settings with others. Meaning is created to achieve success on summative, formative, or performance assessments. The learner collaborates socially to support the active assimilation and construction of new ideas and concepts (Bruner, 1990). The collaborative community of peers, clinical and classroom educators, preceptor nurses, health care team members, and clients support the learning that begins in the prerequisite classroom and builds to include learning necessary for safe care of clients, and success on examinations, assignments, and the RN licensure exam (Driscoll, 2005).

Nontraditional age nursing students bring previous life experiences that influence the organization of learning from insights gained through cognition in past life experiences rather than solely on subject matter presented in a classroom. A task of providing care to each unique client diagnosed, for example, with pneumonia requires the learner to apply knowledge from sciences, math skills for medication administration, and communication, assessment, nursing process, and skill application from foundational early nursing program courses. Formative and summative assessments rely on the learner to use internal mental processes with the application of previous knowledge (Hailikari, Nevgi, & Komulainen, 2008; Smith, 1990). Framework variables frame and impact how external social influences are interpreted. The framework variables of age and gender, as used in this study, may affect how changes or variations in the processing and retrieval of information from experiences occur (Merriam et al., 2007).
In 1979, Pearson, Hansen, and Gordon examined the effects of mental organization of prior knowledge based on Constructivist theory. Individuals with well-developed schemata or symbolic mental constructions in a domain or a topic area (domain-specific knowledge) were able to answer more questions correctly than individuals having a weakly-developed schemata. Learning occurs when there are changes to the learner’s schemata. Mental organization facilitates the daily use of the knowledge and construction of all future learning. For example, students with well-developed schemata in the domain-specific cognitive attributes of the sciences can better apply science knowledge in the care of clients, or in the use of case studies using knowledge built from previous learning in Fundamentals of Nursing and Health Assessment nursing courses (e.g., Ausubel, 1968; Dochy, DeRidjt, & Dyck, 2002; Hailikari et al., 2008; Thompson & Zamboanga, 2003). “Truly, one’s knowledge base is the scaffold that supports the construction of all future learning” (Alexander & Murphy, 1998, p. 29).

In this study, Constructivist theory is used to understand the use and transfer of learning, measured as nursing preprogram and within-program student cognitive attributes (e.g., grades and standardized testing scores), to their midprogram outcomes (e.g., Adult Health Nursing course grades and standardized testing scores). This use and transfer of content illustrates learning across the semesters. Based on the Constructivist perspective, students with conflicting or weak prior schemata (represented as unsuccessful grades or examination scores) in core content courses of Fundamentals of Nursing, Health Assessment, and Adult Health Nursing courses may try to assimilate future knowledge based on inconsistent or wrong information or a lack of required
knowledge, while successful students are better able to incorporate, generalize, or transfer prior knowledge to new situations across semesters (Bruner, 1990).

Thus, this dissertation analyzed the relationships between preprogram cognitive attributes, as operationalized by: (a) standardized testing scores on preprogram examinations; (b) within-program cognitive attributes as operationalized as select course grades, commercially-prepared standardized examination scores, and a cumulative grade point average demonstrating previous course learning in selected content areas; and (c) midprogram academic outcomes in a medical-surgical course, Adult Health II nursing. This dissertation applied Constructivist theory to identify the variables representing successful processing of learning that occurs in the early to midprogram period of baccalaureate nursing education.

**Evidence of the Problem Identified in the Literature**

Nursing programs must seek to increase the numbers of admitted students to fill the seats in nursing programs and increase graduations by 90% or more for the one million nurses needed by 2020 (AACN, 2010; Health Resources and Services Administration [HRSA], 2006). In spite of the need, over 52,000 qualified applicants to baccalaureate programs are turned away each year. Many states (e.g., Maryland, Texas, Wisconsin) have acknowledged such facts from task forces assigned to address their looming nursing shortage. Yet, students are admitted based on admission criteria that can result in many being academically unsuccessful, leading to failure and dismissal. The seats wasted on unsuccessful students, rather than awarded to students who would be likely to succeed, thus present a dilemma to the health care world.
Improving student success to progress through nursing programs with research on predictors of success during the midprogram period may prevent the societal losses from student and program debt, wasted educational resources (e.g., classroom, faculty, and clinical space), and fewer nurses to meet the projected targets (Haas et al., 2004; Marklein, 2011). The study sought to understand “success” as a dichotomous variable (pass or fail) representing the progression without failure as a way to provide good stewardship of limited educational resources (Alexander & Brophy, 1997; Higgins, 2004).

In addition to wise enrollment decisions for admission criteria grounded in evidence, identification of within-program predictors of academic success has been useful for early alert or remediation programs to support positive academic outcomes of passing coursework through graduation (DiBartolo & Seldomridge, 2005). Application of the Constructivist approach to nursing education suggests indicators of achieved learning outcomes or well-developed schemata in topics (i.e., math skills, reading comprehension) prior to enrollment as admission criteria would impact success in the program. Baccalaureate nursing programs include clinical courses and supportive courses. Therefore, this study examined the operationalized cognitive attributes of prior learning and understanding, identified as preprogram variables, as one set of independent variables. Then, certain courses of significance in nursing within the program’s semesters were examined as measurements of applied knowledge for later successful outcomes. These independent variables, defined as within-program cognitive attributes, followed the preprogram variables to then be studied in relation to midprogram academic
outcome variables representative of passing the second and last Adult Health Nursing II course.

As most of the literature has focused on graduation rates, end of program testing outcomes, attrition rates, and first time pass rates on the nursing licensure examination, to recognize early program failure, this dissertation focused on earlier success/failure by examining midprogram outcomes. This dissertation addressed the gap using dependent variables including the grade in Adult Health II nursing course, and the commercially-prepared standardized testing scores from Elsevier (Evolve Specialty Exam for Adult Health II). Little research has existed to understand selected framework conditions, preprogram and within-program cognitive attributes, and the midprogram academic outcomes chosen with relationships to academic success. This dissertation explored this gap in the research.

**Statement of the Purpose of This Research**

The purpose of this study was to describe the predictive relationships among selected preprogram and within-program cognitive attributes with midprogram academic outcomes. The study sample was extracted from enrolled students on multiple campuses across the United States in one private-sector, baccalaureate nursing program delivered in a face-to-face format within a curriculum delivered year-round in three years.

**Research Questions**

Literature suggests a relationship exists between preprogram and within-program cognitive attributes and outcome measurements of success from early or end of program periods. Inability to predict failure with commercially-prepared standardized
examinations has been documented (e.g., Yoho, 2006). In this study midprogram success was measured by passing the Adult Health II course with a grade of C or higher, or a score of \( \geq 850 \) on the Evolve Specialty Exam administered as the final examination in the Adult Health II nursing courses. The exams accounted for 20\% of the course grade and were used as the basis for future development of remediation plans for success later on the NCLEX-RN exam and the Exit Exam at end of program. The goal to achieve a passing score was critical.

Midprogram was identified as the fifth semester course of Adult Health II as the culmination of previous foundational course knowledge in a nine-semester prelicensure baccalaureate nursing program. Data from multiple campus locations were included in the analysis. To facilitate understanding the gaps in relationships among these variables, the following research questions were explored in this study using dichotomous independent variables of success and failure in Adult Health II course’s grade and Evolve Specialty Exam scores calculated by the Health Educational Systems Incorporated (HESI) with the HESI Predictability Model (HPM).

1. What is the predictive value of selected preprogram cognitive attributes (Evolve REACH Admission Assessment A2 individual scores), and demographic characteristics of age and gender on midprogram academic outcomes of success of students enrolled in a prelicensure baccalaureate nursing education program?

2. What is the predictive value of selected within-program cognitive attributes (cumulative GPA through semesters one through four including transfer credits, semester four and first half of semester five course grades, and
semester four and first half of semester five’s Evolve Specialty Exam HESI scores) on midprogram academic outcomes of success of students enrolled in a prelicensure baccalaureate nursing education program?

**Hypotheses**

The hypotheses explored strength of predictive relationships between the preprogram and within-program variables and the midprogram academic outcome variables. The null hypotheses tested included both outcomes.

**Dependent Measure: Adult Health II passing course grade:**

\[ H_0: \text{None of the independent variables utilized are significant predictors of a passing Adult Health II course grade.} \]

**Dependent Measure: Adult Health II Evolve Specialty Exam successful score:**

\[ H_0: \text{None of the independent variables utilized are significant predictors of success on the Adult Health II Evolve Specialty Exam.} \]

**Definitions of Preprogram Cognitive Attributes**

The following definitions contain both theoretical and operational definitions.

**Preprogram Commercially-prepared Standardized Admission Examination**

**Theoretical definition.** The preprogram commercially-prepared standardized admission examination is a summative assessment tool measuring the cognitive attribute of knowledge retention from previous preadmission courses representative of higher levels of education in nursing and other healthcare fields (Murray et al., 2008).

**Operational definition.** The preprogram commercially-prepared standardized admission examination was operationalized in this study as the scores from the Evolve
Reach Admission Assessment (A2) exam. According to Elsevier, the cumulative scores consisted of the average score for all academic exams completed, with subject area composite scores which consisted of all individual test scores completed in subject areas of Math, Science, and English” (Murray et al., 2008). The composite English Language score was inclusive of reading comprehension, vocabulary and grammar individual examination subscores and the Composite Science score was inclusive of the Biology, Anatomy and Physiology, and Chemistry examinations’ subscores (Elsevier, 2012; Murray et al., 2008). The Mathematics score was included in the analyses of relationships. Lastly, the A2 Cumulative Score calculated by Evolve was examined. An “adjusted A2 program” score represents the combined English Language composite scores and the Math score to achieve an “adjusted A2 score.” Only the results on the first attempt at the A2 were used to promote “commonality between the test takers” (Wolkowitz & Kelly, 2010, p. 500).

**Preprogram Selected Framework Conditions**

**Theoretical definition.** For this study, selected Framework Conditions as attributes including age and gender were believed to influence the cognitive appraisal of attained domain-specific knowledge in the Constructivist theoretical approach. Such conditions are a function of the circumstances, values, economic structure, and society affecting who is to benefit from the adult learning opportunities in nursing education (Merriam et al., 2007).

**Operational definition.** Selected framework conditions as the attributes operationalized in this study were age and gender accessed through the electronic
database with data retrieved from student applications at time of enrollment. Age was documented in years; gender was documented as “M” for male and “F” for female.

**Definitions of Within-program Cognitive Attributes**

The following definitions contain both theoretical and operational definitions.

**End of course Commercially-prepared Standardized Examination Scores**

**Theoretical definition.** The end of course commercially-prepared standardized examination scores were administered as the course’s final examination to assess knowledge attainment and evaluation of learned content based on foundational knowledge to meet academic standards in nursing education (Morrison, Adamson, Nibert, & Hsia, 2004).

**Operational definition.** The scores from the end of course commercially-prepared standardized examinations were operationalized in this study as the Fundamentals of Nursing II, the Health Assessment I and II courses’ Evolve Specialty Exam’s HESI scores in the fourth semester, and the customized Evolve Specialty Exam’s HESI scores for the first half of the Adult Health Nursing course (Adult Health I) in the first half of the fifth semester. Customization of the exam content provided testing according to the topical outline for the course.

**Cumulative Grade Point Average (CGPA)**

**Theoretical definition.** Cumulative grade point average is calculated electronically by a nursing program’s academic database system using letter grades
converted to points. The points are derived by multiplying points by credits. Each grade is converted to points multiplied by credits (Lewis & Lewis, 2000).

**Operational definition.** Cumulative nursing grade point average in the electronic academic documentation database program at the completion of the fourth semester was inclusive of the average of all grades through the first four semesters (Fearing, 1996; Lewis & Lewis, 2000). A GPA of ≥ 2.0 was required to remain enrolled in the nursing program.

**Within-program Nursing Course Grades**

**Theoretical definition.** Within-program grade was an evaluation at the conclusion of a course assigned by faculty based on the academic performance measures earned by students using assignments and testing components (CollegeBoard, 2012).

**Operational definition.** Within-program grades were operationalized in this study as the letter grade converted to points recorded in the electronic academic database for each student. Grades ranged from 4.0 points for an A thru the grade of F recorded as a 0. Courses included: Fundamentals of Nursing I and II, and Health Assessment I and II in the fourth semester of a total of nine, and the first half of the Adult Health course (Adult Health I) beginning in the first half of the Fall semester at the beginning of the fifth semester of a total of nine (November of 2011).
Definitions of Midprogram Academic Outcome Attributes

The following definitions contain both theoretical and operational definitions.

Midprogram Commercially-prepared Standardized Examination

**Theoretical definition.** The midprogram commercially-prepared standardized specialty examination was a summative assessment tool measuring the cognitive attribute of knowledge retention with construct, criterion-related, and content validity for the purpose of measuring and predicting outcomes of success (Morrison et al., 2004).

**Operational definition.** The midprogram academic outcome measurement was operationalized in this study as the HESI score earned on the commercially-prepared standardized version of the Evolve HESI Specialty Exam for the fifth semester Adult Health II Nursing course. A HESI score of $\geq 850$ was operationalized as “passing” or success in the Adult Health II course. The scores $\geq 850$ were recoded as a “1”, while scores $< 850$ were recoded as a score of “0”.

To better understand this dissertation study, Figure 1.1 is a visual representation of the variables in the statistical analyses. The progression from preprogram and within-program cognitive attributes through midprogram outcomes can be observed.

Midprogram Course Grades

**Theoretical definition.** Midprogram course grades were measurements of learning assigned as an evaluation of the course included in the required curriculum meeting standards at the midpoint of the prelicensure baccalaureate nursing program. The midprogram is representative of the application of earlier course knowledge noted in Constructivist theory (Merriam et al., 2007).
**Operational definition.** Midprogram course grades were operationalized in this study as the letter grade converted to points for analysis representing evaluation of knowledge at the conclusion of the Adult Health II Nursing course in the second half of the fifth semester during a nine semester baccalaureate nursing curriculum. The grade was represented by points ranging from 4.0 points for an A to 0 points for an F in SPSS v21. Grades of a D, F, or W were operationalized as “failing” and were recorded as a 0 in the SPSS system. A grade of A, B, or C was recorded as a “1” score in SPSS representative of a passing outcome or success. This created the dichotomous outcome variable needed for the logistic regression.
Preprogram Cognitive Attributes (PRE-ENROLLMENT)
- Evolve Reach Admission Assessment A2 Exam Scores
- English Language Composite
  - Reading Comprehension
  - Grammar
  - Vocabulary
- Science Composite
  - Biology
  - Chemistry
  - Anatomy and Physiology
- A2 Cumulative Score
- A2 Program "Adjusted" Score
- Age
- Gender

Within Program Cognitive Attributes (DURING PROGRAM)
- Semester Four
  - Evolve Specialty Exam HESI Scores
  - Health Assessment I
  - Health Assessment II
  - Fundamentals of Nursing II
- Course Grades
  - Fundamentals of Nursing I
  - Fundamentals of Nursing II
  - Health Assessment I
  - Health Assessment II
- Grade Point Average-end of semester Four
- Semester Five
  - Evolve Specialty Exam HESI scores
  - Adult Health I
  - Course Grade
  - Adult Health II

Midprogram Academic Outcomes
- Semester Five
  - Course Grades
  - Adult Health II
- Evolve Specialty Exam HESI Scores
  - Adult Health II

Figure 1.1. Diagram of cognitive attributes and outcomes of success.
Assumptions

Assumptions for this study include the following statements:

- Grades achieved in courses were accurately transcribed into the college’s electronic academic database record-keeping system.
- Selected framework conditions, such as age and gender were accurately transcribed into the college’s academic database record-keeping system from the handwritten application for admission.
- Scores from commercially-prepared standardized examinations taken during within program, and midprogram periods reflected knowledge content of the student at that point in time for that course.
- Data elements of age and gender were completed accurately and truthfully on the enrollment applications
- Course grades and testing scores were a reflection of the individual student’s knowledge without presence of academic dishonesty or integrity violations due to cheating.
- Student population at the private-sector institution is representative of student populations at similar institutions for further research and findings.

Significance to Nursing

National Council State Boards of Nursing (NCSBN) predict a severe nursing shortage by 2025. In 2009, the boards recommended the need for a full-scale assessment so as to recruit students likely to succeed and to use data to further understand the
attrition in nursing programs. Additionally, strategies to retain students are needed (NCSBN, 2009). This dissertation addressed their recommendations.

To ameliorate the nursing shortage, academically qualified students must enter and graduate from nursing programs. The increase in nontraditional older students has presented challenges to nursing education (Drury et al., 2009). Identification of students who will be successful at midprogram will enable increased numbers of students to progress through the midprogram period. Jeffreys (1998) demonstrated the need for exploration of course outcomes during the early program period that “restrict or support academic achievement and retention” to prevent later risk of failure (p. 42). Studies are most commonly using grades as course outcomes and assessing the retention based on the grades (Chen & Voyles, 2013). Supportive interventions are needed to promote retention thereby increasing the numbers of graduated baccalaureate-prepared nurses for the ongoing demand for graduate students pursuing leadership, education, and advanced practice nursing degrees (BLS, 2012; IOM, 2010; Morrison et al., 2002). With only 76% of qualified applicants presented to baccalaureate nursing programs accepted despite significant waiting lists, it is critical to identify criteria describing students most likely to succeed (AACN, 2010).

Summary

This chapter provided an introduction to the independent and dependent variables examined for this research study. As defined earlier, the dependent variables were the midprogram academic outcomes representing success for the Adult Health Nursing II course inclusive of a course grade of C or higher, and the Evolve Specialty Exam’s HESI
score of $\geq 850$. The within-program independent variables included the course grades for the fourth semester courses including Health Assessment I and II, Fundamentals of Nursing I and II, and also the first half of the fifth semester course, Adult Health I. The cumulative grade point average at the end of the fourth semester was accessible data used for prediction of outcome measures in the end of the fifth semester. Finally, the following Evolve Specialty Exam HESI scores earned were used for analysis including the exams upon completion of the fourth semester’s courses of (a) Health Assessment I and II, (b) Fundamentals of Nursing II, and (c) fifth semester course of Adult Health I Nursing. The preprogram variables of Evolve Reach Admission Assessment A2 exam scores prior to admission and the selected framework conditions of age and gender were studied for prediction of success defined as passing the selected midprogram outcomes. The purpose and significance provided support to the proposed research questions and hypotheses.
CHAPTER II
LITERATURE REVIEW

Introduction

The purpose of this retrospective study was to determine the accuracy of preprogram and within-program cognitive attributes in predicting midprogram success in a prelicensure baccalaureate nursing program with multiple campuses across the United States. The aim was to determine if there were significant differences in standardized testing scores, grade point averages, and course grades for students who were academically successful/unsuccessful at midprogram in the Adult Health I and II course. Research has been limited in this area of study, with the majority of research focused on prediction of successful outcomes at end of program, e.g., end of program graduation or passing the RN licensure examination. Recent research has been aimed at prediction of outcomes in early nursing courses including Fundamentals of Nursing (Chen & Voyles, 2013; Underwood et al., 2013).

This study used similar attributes as variables previously used in studies of academic success (Hailikari et al., 2008). The studies described in this chapter defined cognitive attributes within the operational definitions of success as passing the midprogram Adult Health II Nursing course at the conclusion of the fifth semester. In addition, the demographic variables of age and gender, were examined as selected “framework conditions” as used in constructivist theory and terminology.
The studies reviewed in this chapter focused on preprogram and within-program cognitive attributes used in the prediction of outcomes in prelicensure baccalaureate programs. Prior to this study and more recent studies, the majority of research studies focused on final program outcomes, such as success or failure on the RN licensure exam (NCLEX-RN) an end of program or exit examination, or the completion of the program i.e., graduation (e.g., Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Bondmass, Moonie, & Kowalski, 2008; Crow, Handley, Morrison, & Shelton, 2004; Daley et al., 2003; Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2008; Nibert, Young, & Adamson, 2002; Seldomridge & Dibartolo, 2004).

Students who succeeded at midprogram have been studied in outcomes research; however, students who have failed at midprogram have not been studied in academic research using prediction based on testing products. Exploration of academic outcomes at midprogram in this dissertation included students enrolled in a fifth semester course which requires maximum resources (i.e., critical thinking, application of science knowledge, clinical reasoning) to achieve success in the course. This plan captured a student population prior to failure in contrast to other similar outcome studies where they would have been unable to be included in research. As previously stated, understanding success at midprogram has a profound impact on the most optimal redistribution of resources at the student, organizational and national levels.

Thus, the study of midprogram success is as important as is analysis of end of program success. In fact, the National Council of State Boards of Nursing (2010) proposed recommendations that a “full-scale assessment is needed to evaluate the reasons for attrition in nursing education programs.” (Paragraph 4). These data would be used to
develop recommendations to “assist schools in retaining students and recruiting students that have a high chance of successfully completing the program” (Policy Position Statement).

**Consistency of Terminology**

Terms used in nursing education research are typically inconsistent. The current commercially-prepared standardized end of term examinations, and the RN licensure examination statistically explain pass or pass rates, rather than failures (Spurlock & Hanks, 2004). That is, terminology of “success,” rather than failures has been the language or the focus of nursing education research. Consistent with earlier research, this dissertation focused on success, but also examined differences in cognitive attributes for students who failed. Statistical analysis of both groups, successes and failures, was conducted to understand the variance in composition of each group. Thus, predictors of success and failure at midprogram in a prelicensure baccalaureate nursing program were analyzed in this dissertation.

**Midprogram Academic Outcomes as the Dependent Variable**

This review of literature first describes the dependent variable of midprogram cognitive attributes, which epitomize the gap in the literature. The attributes are measured as academic outcomes in this dissertation. Because most studies have cited prediction of outcomes based on success with end of program measurements, this dissertation employed similar independent variables for their merits as predictors of success. The reliability between examination scores and the midprogram outcomes was conducted by determining the positive predictive value of the examinations’ scores with a
95% value considered reliable (Zweighaft, 2013). Thus, several variables used during the end of program period in previous studies were evaluated for their consideration as a midprogram academic outcome attribute in this dissertation.

**Midprogram Academic Outcomes for Measurement**

Midprogram academic outcome attributes as dependent variables were examined in this study. In the past, researchers studied measurable outcomes of students’ academic success from one of four research outcomes: graduation, achieved scores or passing commercially-prepared end of program testing, grades in courses, grade point averages at designated academic periods, or achieved results on the RN licensure examination (e.g., Higgins, 2004; Jeffreys, 2001; Jeffreys, 2004; Peter, 2005; Potolsky, Cohen, & Saylor, 2003; Symes, Tart, & Travis, 2005; Zweighaft, 2013). Although researchers utilized measurements from all academic periods, they correlated these only with the end of program, or with results of RN licensure exam (Adamson & Britt, 2009; Byrd, Garza, & Nieswiadomy, 1999; Horton, 2006; Jeffreys, 1998; Nibert & Young, 2001; Simmons & Haupt, 2003; Symes et al., 2005; Zweighaft, 2013).

This chapter describes this study’s use of two midprogram course outcomes similar to the end of program outcomes found in the research. That is, the use of course grades and commercially-prepared standardized examination scores as outcomes representative of the midprogram course were both researched in this dissertation. Analyses of the various factors to determine the prediction of passing a course or examination during the midprogram period are discussed in Chapter IV.
Midprogram course grades as predictors. The dependent variable so frequently presented in the literature is academic success defined as passing the RN licensure examination known as NCLEX-RN. Studies have used results of the NCLEX-RN as the academic outcome measurement to discover variables predicting success in nursing education. Conversely, Peterson (2009) stated that international research found the majority of “drop outs” occurred at the end of the first year of nursing education. Increased attrition rates up to 30% solely from the first semester of nursing courses have occurred without an understanding of the complexities of the academic and nonacademic student situations, as well as relevant cognitive and noncognitive variables (Peterson, 2009). For example, attrition rates from 7% to 17.3% have been observed in nursing theory courses during the first two semesters of programs. Students who struggled academically to achieve a grade of C became high risk for failure in subsequent courses (Robinson & Niemer, 2010). Moreover, many nursing studies have been conducted within a single program at only one location. Single program research typically used one outcome at a time, failed to include academically-challenged students, or had the limitations of one or few faculty teaching the designated outcome courses, or the program had geographic or ethnic limitations (Harding, 2010; Newton, Smith, & Moore, 2007; Wells, 2003).

Consequently, this dissertation study investigated predictive relationships with midprogram outcomes as measured by test scores and grades in particularly important courses, such as, in this study, an Adult Health Nursing II course grade and the score on the commercially-prepared standardized end of course examination during the fifth of the total of nine semesters. This dissertation sought to advance the research beyond the
single campus paradigm, and instead examined the measurements of midprogram academic outcomes in one large private-sector, prelicensure baccalaureate nursing program with multiple campuses across many states.

The choice of the Adult Health II course in this study stemmed from previous research which examined 188 records compiled from two cohorts within one program each with 94 students (Alexander & Brophy, 1997). Successes on the RN licensure examination with grades in selected courses were analyzed with logistic regression. Included were the independent variables of age, all nursing course grades, nine cognate course grades, and grade point averages. Only the grades in Childbearing, Mental Health, and Adult Health I courses created 80.63% accuracy in predicting the ability to pass the RN licensure examination on the first attempt. Hence, Adult Health I course content as a predictor for a critical outcome validated its use as a predictor in this dissertation; although in this study program, the last of two Adult Health courses became the study’s midprogram outcome variable. Similarly, the choice of cumulative grade point averages and nursing grade point averages were selected based on earlier studies using such variables in end of program outcomes (McKinney, Small, O’Dell, & Coonrod, 1988). Past research results then can be compared to findings in this dissertation study. In those end of program studies, college cumulative grade point average and nursing grade point average predicted not only the RN licensure examination results, but also predicted outcomes prior to graduation. These findings supported the choices of grade point averages chosen for this midprogram outcome study.

Midprogram commercially-prepared standardized exams. In addition to a focus on midprogram course grades, studies included commercially-prepared
standardized examinations for the evaluation of knowledge attainment in predicting success on the RN licensure examination or an end of program exam to analyze program assessment. For example, Payne and Duffy (1986) used standardized examinations to determine the most optimal time for identification of at-risk students. Their study analyzed the end of the first semester of nursing courses, in addition to mid-junior year, end of junior year, and mid-senior year. Although conducted 26 years ago, the study was one of the first to use commercially-prepared standardized examinations to validate success with exam scores as cognitive attributes as early as the mid-junior year in a medical-surgical course.

Later studies (Wong & Wong, 1999) identified significant correlations using preprogram commercially-prepared standardized scores in the Evolve Reach Admission Assessment (A2) scores. (This exam is identified as the Admission Assessment A2 exam in this dissertation, or as A2 scores in tables requiring abbreviated terms.) In the Wong and Wong study, students completed preprogram exams at time of application. The scores were found to be statistically significant with the early program outcome of passing the Nursing Skills or Fundamentals Course ($r = 0.218$). The scores aided in the enrollment decision-making process of the faculty admission committee and understanding factors associated with success. Further analysis of the components of the Admission Assessment A2 exam included the Science scores ($r = 0.184$), Reading scores ($r = 0.517$), and Math scores ($r = 0.129$) which later correlated with end of program completion ($r = -0.518$), as well as passing the RN licensure examination on first attempt. No relationship was identified between age, race, program completion, or passing the RN licensure examination. Therefore, research by Wong and Wong supported the need for
this dissertation’s use of preprogram science and reading exam A2 scores to predict midprogram academic outcomes defined as a passing grade or examination score in the Adult Health II course.

Commercially-prepared standardized exams have been implemented as final examinations in nursing clinical courses in many programs. However, little research has been conducted to determine the exam scores, grades, or grade point averages that predict success in midprogram outcomes. In discussions with researchers at Elsevier, studies are needed to understand the outcomes of future courses and standardized specialty exams based on demonstrated success with HESI scores from preceding courses (Pamela Wilson, personal communication, September 8, 2009).

A study of a random sample of 2,332 nursing students from 97 programs at all levels of nursing programs reported relationships between midprogram test scores and end of program outcomes of HESI exit exam scores and NCLEX results (Zweighaft, 2013). Moreover, the mean Evolve HESI Exit Exam score increased after commercially-prepared standardized examinations at end of courses were added into the curriculum. The results were statistically significant for the BSN-prepared students \( n = 862 \), concluding that the experience of taking such end of course exams during midprogram prepared students for future success on examinations provided in later courses or on testing provided at end of program. There was no relationship between the exam scores and outcomes for the Associate \( N = 1,295 \), nor Diploma program nursing students \( N = 175 \). Zweighaft also found students who completed end of course standardized testing were 2.27 times more likely to succeed in passing the NCLEX-RN licensure examination.
Zweighaft’s findings supported this dissertation’s use of midprogram Evolve Specialty Exam scores to predict success on a specialty examination at the conclusion of nursing course. The study omitted assessment of students who were not successful throughout the program (2013).

In yet another way, Zweighaft’s study aided in the choice of variables for this dissertation in that it was the first study to employ all the Evolve Specialty Exams as end of course exams to predict success on the end of program Exit Exam’s HESI scores as an outcome measurement. Until this dissertation, the scores on the commercially-prepared standardized Evolve Specialty Exams taken from program courses had not been used to predict midprogram outcomes of success.

Zweighaft (2013) further identified significantly higher mean Exit Exam scores ($p < .0001$) when students took one or more of the Evolve Specialty Exams compared to those who had not. Of the eight Evolve Specialty Exams used in the study, scores on the Critical Care, Pediatrics, and Medical-Surgical Specialty exams predicted success on NCLEX-RN. In addition, it was found that the programs that employed Evolve Specialty Exams as the final exams identified a significantly higher mean score on the Exit Exam than programs that only used exams for remediation and practice ($p < .01$). Zweighaft’s study provided the rationale to support this dissertation. The Adult Health Nursing end of course Evolve Specialty Exam HESI score predicted successful outcomes at the end of the program; therefore, this dissertation sought to investigate its use as an earlier outcome variable during midprogram, and thus, the Adult Health course becomes in this dissertation, an outcome dependent variable, rather than the independent variable common in earlier studies. The question to be answered was whether earlier or
preprogram measurements could demonstrate a positive relationship with the Adult Health Nursing course knowledge. Then, a later question might be, in a sample similar to this dissertation sample, what would be the Adult Health course’s relationship, and the strength of that relationship to end of program results?

**Similar dependent variables in like disciplines.** Research on midprogram measurements as outcomes is sparse in nursing, although it has been studied in other disciplines. For that reason, some results are presented here to support the use of midprogram studies in nursing. For example, like nursing, engineering curriculum has required the reapplication of science as domain-specific knowledge. LeBold and Ward (1988) used an international sample of engineering students to predict midprogram retention from cognitive and non-cognitive variables. The strongest predictors of midprogram success as “retention” were math ability, high school math grades, Scholastic Achievement Test’s (SAT) quantitative scores, and grade point average from the first semester. Bivariate correlations determined the relationship between preprogram variables (e.g., grades and SAT scores) with engineering retention was strongest after six semesters, or at midprogram. The preprogram grades and testing scores demonstrated moderate relationships with prediction of midprogram retention. The study supported the evaluation at midprogram using earlier predictive variables from preprogram testing and foundational courses as the focus of this dissertation (Wong & Wong, 1999).

**Summary of midprogram variables.** In conclusion, research studies to discover the grade point averages, grades, and testing scores predictive of success in nursing have been conducted since the inception of standardized testing for nursing in the 1980s. The results have provided support for their use in understanding the relationships with end of
program outcomes. Use of testing in that manner presumed the students all progressed to the end of the program. When academic dismissal due to course failure occurred, students were not available for inclusion in research. No exploration of the characteristics of the student population who endured lower scores or failed in early through midprogram coursework as exemplified by grades, standardized testing scores, or grade point averages were performed to fully understand the scope of academic outcomes in nursing education. Conversely, little was known about the odds of students passing or failing end of program assessments.

Therefore, in this dissertation, the outcomes studied were measurements of midprogram academic achievements, not those at the end of a program as frequently found. This filled a defined gap identified in the literature. Independent variables in this study, based on earlier studies of end program research and evaluations, include preprogram and within-program testing scores, grades, and grade point averages for the investigation of predictive relationships with the midprogram dependent variables from the fifth semester. This included Adult Health Nursing course grades and HESI scores from a commercially-prepared standardized examination, Evolve Specialty Exam, given at the end of the Adult Health II Nursing course. While this study did not predict failing students, it is important to note that the body of educational research performed on end of program success had not examined the students who failed to progress past midprogram. The failures constitute a waste of human resources (student, faculty, and staff) physical resources (e.g., classroom seats, lab space, clinical resources placement), and financial resources (e.g., student loans, scholarship, program development funds). For these reasons, this dissertation sought to use scores and grades as predictors of success.
achieved during midprogram, so that the odds of success or failure can induce changes in resources and the ultimate graduation of more nurses to fulfill the coming shortage of nurses and other health professionals.

**Preprogram Cognitive Attributes**

The educational research literature from the past 50 years addressed the impact of prior knowledge as a substantial variable significantly influencing the student’s present knowledge achievements (e.g., Ausubel, 1968; Dochy et al., 2002; Portier & Wagemans, 1995). Academicians strongly support the power of prior knowledge to predict academic success. The Constructivist theory supports the learning that occurs from the student making meaning of the world through previous mental frameworks where information is interpreted from previous learning (Muirhead, 2006). Critical to success is the integration and application of knowledge from previous courses, whether in high school or prerequisite to nursing courses, with current information to derive future learning. Research specifically supports domain-specific prior knowledge from which schemata on like knowledge is achieved. Therefore, science schemata created from science course knowledge becomes a foundation for the construction of course content for future success in nursing courses (e.g., pharmacology, disease processes in medical-surgical nursing) (Dochy, 1992).

With the focus on the learner, Constructivism posits retrieval of prerequisite course knowledge in past liberal arts and sciences contextually to build future concepts or skills with the social collaboration that occurs throughout nursing education programs. Research substantiated early nursing course grades as predictive of overall success in
nursing curricula (Gallagher, Bomba, & Crane, 2001; Lin, Fung, Hsiao, & Lo, 2003; Sadler, 2003). Moreover, even though early course success has been predictive of passing the RN licensure examination on first attempt, measurements of successful outcomes prior to end of program must be expanded (Newton & Moore, 2009). Thus, specific preprogram cognitive attributes with their previous relationships with end of program outcomes were reviewed in this dissertation for their possible relationship with prediction of success at midprogram. The preprogram predictors with midprogram outcomes in this dissertation included commercially-prepared standardized admission examination scores, age, and gender.

**Preprogram Commercially-prepared Standardized Examination**

The admission criteria used in the student selection process must be grounded in current research. Commercially-prepared standardized testing scores have been used in higher education for years, beginning with the Scholastic Achievement Test (SAT) and the American College Test (ACT) examinations. Nursing programs now employ testing products for a portion of the nursing enrollment decisions (e.g., Nurse Entrance Test [NET], Evolve Admission Assessment [A2], American Technologies Incorporated Test [TEAS], or Mosby Assess Test©). Studies have demonstrated limited generalizability due to recruitment of only one educational level of student or use of only one testing product or the time frame in the program where research occurred (e.g., end of program testing on seniors with the outcome of success on RN licensure examination). The admission examinations vary among publishers although all purport to assess levels of required knowledge deemed foundational for nursing success (e.g., Alden, 2008; Chen &
Voyles, 2013; Newton, Smith, & Moore, 2007; Newton, Smith, Moore, & Magnan, 2007; Simmons & Haupt, 2003; Simmons, Haupt, & Davis, 2005).

**Preprogram testing products for prediction of future outcomes.** In past years, the Scholastic Achievement Test and the American College Test were employed across disciplines of higher education to identify students capable of superior academic outcomes. Based on Constructivism, the past gained and applied knowledge exhibited on either of the exams can represent a way to foresee future superior outcomes. In more recent years, inconsistent use of such exams administered during high school, as well as an influx of students from nontraditional age groups, have led to enrollment decisions made based on newer strategies and exam products. Still, the decisions grounded in Constructivism find “human learning is an active process in which learners construct new ideas or concepts based upon their current or past knowledge” . . . and leaders in nursing education can make a paradigm shift toward concept-based curricula” (Brandon & All, 2010, p. 89).

This dissertation investigated variables used in current practice and those previously researched. The commercially-prepared standardized nursing examinations used frequently in practice as preprogram cognitive attributes assess levels of presumed required knowledge; but unlike this dissertation, the outcome variables in the research typically were relationships between the end of program measurements and success on the RN licensure examination (Morrison, Free, & Newman, 2002).

Elsevier Company, in conjunction with Health Education Systems Incorporated (HESI), has supported validity studies on their testing products to explore academic outcomes over the past decade with student datasets retrieved from all educational levels.
of nursing. Although supported by Elsevier, the educational research studies conducted on the exams have demonstrated sufficient sample size and sites affording variance and generalizability (e.g., Frith, Sewell, & Clark, 2005; Lauchner et al., 1999; Newman et al., 2000; Nibert & Young, 2008; Simmons & Haupt, 2003; Yoho, Young, Adamson, & Britt, 2007; Zweighaft, 2013).

This review of the literature has attempted to limit research to studies using prelicensure baccalaureate nursing programs. The review of literature has included research on the midprogram outcomes studied; however, the cited preprogram commercially-prepared standardized examinations have been studied previously with outcomes other than variables representative of success at midprogram, e.g. early program success, midcurricular exam success for ADN students, and end of program Exit Exam or RN licensure success.

While research in the engineering discipline suggests that math and science knowledge is deemed to be critical to future learning, nursing has yet to investigate whether preprogram science subscores on commercially-prepared standardized examinations relate to midprogram outcomes. Yet, these exams continue to be administered nationally. Preprogram commercially-prepared standardized entrance exams’ math content scores have not been well studied for prediction of future success, although the required application of mathematics with medication calculations has been established as a critical component of patient safety. Because of these gaps in the literature, all individual, composite, and cumulative Math, English, and Science scores of the Admission Assessment A2 Exam were fully explored in this dissertation for the prediction of success at midprogram.
Using the Admission Assessment A2 Exam’s Science and Math composite scores, Yoho (2006) predicted future HESI scores on the Evolve Midcurricular Exam, Evolve Exit Exam (E2) at the end of program, and first time passing of the RN licensure exam with a sample of 139 ADN students in a single geographic region. Similar to this dissertation, relationships were studied using the Admission Assessment A2 scores. Due to the need for independence of content, the study used the cumulative scores rather than all individual exam scores to predict midprogram academic outcomes. The study used the minimum scores required for the A2 Reading and Math composite scores set at 70% (out of possible 100%), and 850 as the minimum to be achieved on the Midcurricular Exam and end of program’s Exit Exam. The A2 minimum score of 70% was lower than the recommended minimum score of 75% set by the manufacturer, Elsevier Evolve. Yoho identified lower A2 Science scores from students who had not completed prerequisite science courses. The decision was made to omit the science composite scores in the analysis using only the preprogram scores using of English and Math scores. The A2 Science exams created for college entry-level knowledge requirements still demonstrated the lack of science knowledge although science knowledge is essential and foundational as it is integrated throughout nursing curricula. Programs have continued to omit the Science exam scores from the A2 preprogram exam as an assessment of knowledge brought forth into the nursing courses (Yoho, 2006).

Regardless of whether students completed any science prerequisite coursework prior to taking the preprogram Admission Assessment A2 exam, the students still received a score and remediation materials on missed content areas. Recommendations for remedial action prior to admission into the nursing program were made for students if
the earned score was less than the recommended 75% score. Many programs do not enforce completion of the remediation prior to course enrollment. Correlations between the scores earned from each individual A2 examination with midprogram outcomes have not been studied. Like LeBold and Ward’s study of an engineering program (1988), and Yoho (2006) with an ADN nursing program, both identified that low preprogram assessment scores had predicted lower levels of academic achievement later in students’ education. Preprogram exams have been administered, but the impact of the low scores have not been studied for the prediction of outcomes during midprogram.

Yoho (2006) further studied the relationship between preprogram testing scores (Admission Assessment A2 exam) and the midprogram testing scores. The A2 Reading Comprehension score was identified as the only score with a positive correlation with the later outcome of success ($r = .412, p = .01$). Reports exist of inconsistent use of the individual science exams that comprise the entire Admission Assessment A2 exam’s testing scores, as well as the English Language Composite scores, or the individual Reading Comprehension, Grammar, and Vocabulary exams in research or in practice. Just recently, a study of 183 BSN students found that increased Reading, Vocabulary, Math, and Anatomy and Physiology scores correlated with increased grades in Fundamentals and Health Assessment courses as early program outcomes (Underwood et al., 2013). Admission criteria may include the overall A2 cumulative score (inclusive of all exam scores), or the English Composite and Math together without Science scores, or scores from each individual exam which this study used in pursuit of prediction of success.
Similar to the previous study, Chen and Voyles (2013) used five of the A2 exams to create a composite for prediction of success with grades in their early program courses similar to Fundamentals of Nursing content. The scores from the Math Skills, Vocabulary, Grammar, Anatomy and Physiology, and Reading Comprehension individual A2 exams were positively and significantly correlated with two Fundamentals courses (NP1 and NP2), but not with Pharmacology as an early program outcome. Due to medication calculations, the Pharmacology course correlated with Math Skills scores, but was not correlated with the Reading Comprehension A2 Exam score. Their study of 526 students in the ADN program found the A2 Composite score that used the minimum scores of minimum of 70 out of 100 as used by Yoho (2006) resulted in increased retention throughout the early program courses.

Like the previous study, Yoho et al. (2007) again identified only the Admission Assessment’s A2 Exam’s Reading Comprehension scores as having had a significant positive relationship with the Midcurricular Exam scores ($p = .001$). No relationship between the Admission Assessment A2 Math Skills exam scores and the scores from the Evolve Midcurricular Exam were found. The Midcurricular Exam had been created only for use with ADN programs.

Similarly, Murray et al. (2008) conducted a study of the relationship between the preprogram Admission Assessment A2 individual exam scores and within-program scores used for the prediction of within-program, or midprogram outcomes. The Admission Assessment A2 Exam scores were “significantly positively correlated with 88.89% of all nursing course grades within the program, and 100% of the beginning level course grades” within the Associate Degree Nursing program (p. 61S). All students who
graduated had significantly higher individual Admission Assessment A2 Exam’s scores than those who did not graduate.

The study of ADN students warranted replication with prelicensure baccalaureate students. The most recent research (Underwood et al., 2013), one of the very few in the literature, explored the relationships between early program outcomes and individual A2 Exam scores for 184 BSN students. The study focused on the individual exams and the prediction of early nursing course success outcomes. Results identified significant correlations between the scores earned on the Reading Comprehension, Vocabulary, Grammar, Math, and Anatomy and Physiology A2 Exams with success in three selected early nursing program course outcomes (Underwood et al., 2013). Similar to the study, this dissertation also sought to determine the predictors of success for BSN students but used all individual A2 exam scores with the midprogram outcomes in the Adult Health course.

Yet another admission assessment test, similar to the Admission Assessment A2 Exam by Evolve, is the Nurse Entrance Test (NET), published by Educational Resources Incorporated in 1991, and used to predict nursing academic retention. Scores were found to predict success in certain courses and academic outcomes. For example, Reason (2003) found the Nurse Entrance Test (NET) scores predicted success in the Introduction to Professional Nursing and Basic Concepts of Nursing courses. In addition, math skills, reading comprehension, composite percentage scores, and composite percentile scores predicted academic course outcomes. The predictions using the NET composite score accounted for 10% of the grade in a Health Assessment course, 33% of the total variance in the Basic Concepts course grade, and 28% of the variance in the Introduction to
Professional Nursing course grade. Most research has studied end of program outcomes using various exam scores, whereas Reason employed preprogram exam scores to predict success during the early program period (2003). Their research supported this dissertation’s aim, which was to predict success on midprogram outcomes rather than end of program outcomes.

In seeking methods to assist this dissertation’s analyses, T. Hopkins (2008) research supported the use of dichotomous variables. In that research, preprogram scores from the Nurse Entrance Test were used to predict early program success with nine preprogram variables as a dichotomous variable. Logistic regression was used due to skewness of outcome data and dichotomous variables. The study identified positive correlations between several variables (e.g., Scholastic Achievement Test score, high school grade point average, and Nurse Entrance Test scores) and the passing grades in the Nursing Fundamentals course. Predictors for the 82% of the students who passed the course were identified, and all the variables explained 99% of those who were identified as having “success.” However, as observed in previous studies, there was no ability to predict the outcome of “no success” or “failure” for the 5.9% of the students who failed the course. As previously found in studies, prediction of the negative outcomes of “failure” was not supported in the study.

Various preprogram standardized examinations have been researched for prediction of end of program outcomes with baccalaureate nursing students. Importantly, several studies found that the scores for reading comprehension were significantly related to success on various outcomes. For example, Symes, Tart, Travis, and Toombs (2002) identified positive correlations between the Nurse Entrance Test Reading Comprehension
scores and prediction of “success” as documented by graduation from college. Students with NET Reading Comprehension scores of less than 55% were associated with a 50% “dropout rate.” Nurse Entrance Exam preprogram scores were also used in Simmons and Haupt’s (2003) retrospective study of data obtained from 1,860 students. Consistent with previous research, a t-test analysis found 60% of the 475 “non-completers” (i.e., did not graduate) scored below the mean on the Reading Comprehension exam compared with 48% of the 1385 “completers” scores. The Math exam scores, however, were unable to distinguish with statistical significance the difference between students who successfully completed the program and those who did not.

Bondmass et al. (2008) also examined 187 BSN students’ scores to predict success at the end of the program. Again, the Reading exam scores were a key determinant of the outcome of success for end of program completion and passing the NCLEX-RN exam.

Because of these findings about particular preadmission scores and their ability to predict midprogram course success and end of program NCLEX pass rates, this dissertation sought to include all the individual exams’ scores earned on the Admission Assessment A2 exam. The individual exam scores were used to predict success at midprogram using logistic regression and other statistics in the analyses of several components of a single system’s nursing program.

A few studies used multiple regression analysis to study the relationships between yet another preprogram commercially-prepared standardized examination, known as the Test of Essential Academic Skills Test (TEAS). The TEAS test was created by American Technologies Incorporated (ATI) to assess outcomes of early success (Wolkowitz &
Kelly, 2010). Unlike previous outcomes based on reading scores, their study found the science exam subscore alone accounted for 14.9% of the variance. All other variables accounted for the other 85%. Likewise, earlier research by Byrd et al. (1999) and Phillips, Spurling, and Armstrong (2002) also identified correlations between higher TEAS preprogram subscores and higher grade point averages in semesters heavy with reading and science course content.

This dissertation took into account that yet another preadmission test indicated the relationship between reading, and in this case, science, as important to program success. However, given the prevalence of the Evolve exams for nursing and their use in this study, this dissertation explored the relationships between preprogram exam scores only from the Evolve Admission Assessment A2 and midprogram outcomes.

**Testing standards.** During the 1990s, studies on several preprogram, commercially-prepared standardized exams for nursing were conducted. This prompted a statement in 1999 that no examination should be the sole determinant of program admission by testing industry standards. Subsequently, nursing programs were to determine the criteria prohibiting enrollment for the nursing applicant and to identify the peak time for evaluation of at-risk students (American Educational Research Association, Standard 13.7). The results were supported by researchers who suggested that enrollment testing should rely on more than one score, just as this dissertation sought to include all scores earned on the Admission Assessment A2 exam (Fowles, 1992).

To minimize limitations and increase generalizability, this dissertation addressed the gap in the nursing education literature by studying students’ data from eight campuses in seven states. All were part of one large private-sector, baccalaureate nursing program
with each following one standardized curriculum, syllabi, handbook, mission and philosophy, grading and admission policies. In summary, the inclusion of all individual scores in the Admission Assessment A2 Exam represent the basic foundational knowledge as shown in this review for the study of prediction of midprogram success as measured by standardized exam scores and grades. This review of literature supported the ability of preprogram testing scores from language, reading, and math knowledge to predict academic outcomes later in the nursing program (Evolve, 2011; Underwood et al., 2013).

Not having been studied previously, this dissertation sought to examine predictors of midprogram outcomes using the scores from preprogram standardized testing as in the Admission Assessment A2 Examination. Predictions of midprogram outcomes arose from the statistical analysis based on assessment of science knowledge.

**Science knowledge.** Many nursing programs have omitted the science score on preprogram commercially-prepared standardized exams because the science score is not used as an admission criteria for enrollment. The argument for not including the science exam scores is that the applicants’ science knowledge varies from high school to previous degrees, or because some have already passed college science courses. The argument ignores the examinations’ grounding in beginning science concepts that would indicate minimal competency in science, wherever it may have been acquired (Murray et al., 2008).

As early as 1996, a study of 89 prelicensure baccalaureate nursing students found a statistically significant relationship between prerequisite course grades in mathematics, biology, and chemistry and grades earned in the first year nursing courses of Health
Assessment, Nutrition, Pathophysiology, and Pharmacology. Whereas Chemistry and Pharmacology/Nutrition demonstrated the strongest prediction of early program course grades ($r = .46$, $p < .01$), Brennan, Best, and Small identified Pathophysiology, and Anatomy and Physiology course grades’ ability to predict passing the RN licensure examination on first attempt (1996).

Baker (1994) and Phillips et al. (2002) found preprogram science knowledge represented in exam scores significantly correlated with cumulative grade point average as a measure of end of program success. Both studies demonstrated the limitation found in nursing research because of limited ability to access science courses’ grade point averages for predictive studies. Therefore, both studies used the preprogram science exam score to represent science knowledge acquisition for prediction of success even though science course grades have also been used in past research for the same purpose (e.g., Baker, 1994; Byrd et al., 1999; Lewis & Lewis, 2000; Phillips et al., 2002; Potolsky et al., 2003; Wong & Wong, 1999).

Basic science knowledge acquisition presented as passing grades in Anatomy and Physiology ($r = 0.152$) and Microbiology ($r = 0.191$), and the nursing courses’ grade point averages during the third and fourth years significantly predicted success defined as passing the RN licensure examination ($p < 0.001$) (Wong & Wong, 1999). In another study of only 37 prelicensure nursing students, past science knowledge and passing grades for the first semester of nursing courses in a baccalaureate nursing program were found to be statistically significant, although the study was flawed by its small sample, lack of demographic data, and inconsistent use of tutoring sessions without a control group (Potolsky 2003). In yet a third study, science courses with earned grades less than
a B or prerequisite courses taken one at a time were significantly correlated with failure at end of the first year of nursing courses (Newton, Smith, & Moore, 2007). The importance of application of science knowledge to nursing is supported through these studies.

Results of a five-year retrospective correlational analyses of academic files from 280 students enrolled in a six-semester BSN program examined preprogram and within-program data to understand the relationships between depth of science knowledge, odds of retention, and prediction of passing the RN licensure examination on first attempt (Uyehara, Magnussen, Itano, & Zhang, 2007). The “higher the grade in the Pathophysiology course, the higher the probability of program success” \( N = 271, p < .0001 \)” (p. 35). Of the 20% of students \( n = 56 \) who were academically dismissed, 12% \( n = 21 \) left after the first semester, and almost half \( n = 16 \) of the remainder were dismissed in the third semester during the midprogram period. Only 28% of the total withdrawals occurred later during any of the specialty courses. Analyses of the students who withdrew found science grades during preprogram and Adult Health Nursing course grades during midprogram as predictive of successful outcomes of “passing” during the midprogram outcomes. The findings are supportive of this dissertation’s aim of prediction of success as passing grades and testing scores based on the individual science scores earned on the Admission Assessment A2 Exam. As with other research and similar to other careers, foundational science knowledge predicted future success in nursing programs (Daly et al., 2003; Felts, 1986; Higgins, 2004; Potolsky et al., 2003; Seldomridge & DiBartolo, 2004).
Summary of preprogram attributes. In summary, the inclusion of the scores from each of the Admission Assessment A2 individual science exams acknowledged the importance of assessment of science content for the prediction of midprogram success as measured by passing grades in select courses, and passing scores on the standardized commercially-prepared examinations. This review of literature supported the inclusion of preprogram testing of science knowledge to predict academic outcomes later in the nursing program, but prior to end of program.

The aim of this dissertation was to predict midprogram success defined as passing the Adult Health II nursing course with the statistical analyses of grades, scores, and grade point averages earned in preprogram and within-program periods. However, because this dissertation did not have access to individual science course grades or science grade point averages, science knowledge was measured with the scores earned on the individual A2 science exams, i.e. Chemistry, Biology, and Anatomy and Physiology.

Within-program Cognitive Attributes

In previous academic research, grade point average, grades, and testing scores were independent variables representing within-program cognitive attributes, but the dependent outcome variables included end of program testing or graduation. The following review of variables that occurred during or within a nursing program identified literature gaps suggesting the need to study both midprogram success and various measurements in prelicensure nursing programs (Alden, 2008; Higgins, 2004; Peter, 2005; Symes et al., 2005).
Grade Point Average

Since the 1980s, academic success in nursing has frequently been studied using the outcome of first time passing of the RN licensure examination. The predictors included grade point averages, specific course grades, and testing scores measuring knowledge acquisition in specific nursing courses. This section reviews gaps in midprogram outcomes when using these measurements as predictors of success for the academic outcomes.

A 10-year integrative review and meta-analysis of published U.S. nursing research and unpublished dissertation studies between the years 1981-1990 examined predictors of retention, graduation, and success on the RN licensure examination. The meta-analysis started with 172 titles, of which 47 descriptive, experimental, and quasi-experimental studies met inclusion criteria. The predictor variables studied most frequently were college grade point average (n = 22 articles), pre-nursing grade point average (n = 20 articles), and nursing grade point average (n = 20 articles). Outcomes from didactic courses and clinical nursing courses demonstrated almost equal significance for prediction of success. Although all levels of students were included, approximately 32% of studies came from graduates, 21% from seniors, one study from juniors, and 7% from freshmen. Similar to earlier findings, the meta-analysis of graduates and seniors (53%) included only students who had successfully passed early and midprogram courses without failure or academic dismissal (Campbell & Dickson, 1996).

This dissertation sought to employ all within-program variables from the literature review for prediction of success of passing at the midprogram period compared to studies
with end of program as the outcome measurement. Drawn from the literature, this dissertation used preprogram and within-program scores from commercially-prepared standardized examinations (Evolve A2 and Specialty Examinations), course grades, and cumulative grade point averages as predictors of midprogram success defined as passing the second Adult Health course during the fifth semester and scoring minimally recommended HESI scores on the Evolve Specialty Exam for the Adult Health course.

**Course Grades**

Nursing course grades and cumulative grade point averages were used as predictors of success for positive end of program outcomes of passing the RN licensure exam. Higher final cumulative grade point averages or higher grades in midprogram Adult Health Nursing or other nursing courses were positively correlated with success, i.e. passing the RN licensure examination on first attempt. Conversely, nursing course grades of a D or F were significantly correlated with failure on first attempt on the RN licensure exam (Crow et al., 2004; Endres, 1997).

In a similar study, but one which addressed failure rather than success on the first attempt at passing the RN licensure examinations, course grades and grade point averages were strongly correlated to failure (Beeson & Kissling, 2001). In that study of 505 prelicensure nursing students, the greater the number of Cs, Ds, and Fs as earned course grades during the program’s junior year, the greater the odds of failure on the first attempt on the RN licensure examination. Higher grade point averages ($x = 3.37$) and grades higher than a C significantly predicted success, while lower grades predicted failure. This study was noted as one that sought prediction of failure rather than more
frequently identified prediction of success (Alden, 2008; Crow et al., 2004; Foti & DeYoung, 1991).

When midprogram cognitive attributes during the program (within program) and outcomes of success including grades, grade point averages, and passing the RN licensure examination were examined together, only the Fundamentals of Nursing course grade predicted success (Uyehara et al., 2007). Vandenhouton (2008) examined several courses’ grades as within-program cognitive attributes, but only the grades of a C or higher in Adult Health, Pharmacology, and Community Health Nursing courses were positive predictors for success on the RN licensure examination. These studies also included only those students who were successful up to the point of the courses, rather than all inclusive of failing students.

In a multivariate study predicting success on first attempts at the RN licensure exam in a sample of 746 Midwestern college students, Siktberg (1998) used t-test and discriminant analyses to examine 13 within-program variables, 9 preprogram variables, and 11 program variables as independent variables. Although the study is 15 years old at this writing, the results found Physiology and nursing course grades as strong predictors of success. In addition, this study used the National League for Nursing Diagnostic Readiness Test, a commercially-prepared standardized exam, and identified it as the most significant predictor of success on the RN licensure examination. Even earlier, Foti and DeYoung (1991) identified higher within-program course grades and cumulative nursing grade point average as strong predictors of passing the RN licensure exam.

While most studies investigated success, or possibly success and failure, only a few made a conscious effort to predict the number of students who might succeed or fail.
One of these studies (Waterhouse, Carroll, & Beeman, 1993) used discriminant function analysis of 15 variables including senior level nursing course grades to predict passing the RN licensure examination on first attempt. The study of 257 prelicensure baccalaureate nursing students predicted 80% of the students who failed the RN licensure examination compared to 91% of the students who passed the exam. Grades at the conclusion of the specialty courses, or near midprogram predicted the students who were at-risk of failing.

A similar study in 2001 by Beeman and Waterhouse, using data from a sample of 289 baccalaureate nursing students, identified 21 cognitive attributes from first year nursing courses as predictors of end of program outcomes, such passing the NCLEX-RN examination. Students’ passing grades in Nursing Foundations, Wellness Nursing, Restorative Nursing, and Pathophysiology II predicted 94% of those who passed the NCLEX-RN examination. Conversely, grades lower than a C+ predicted 92% of students who failed the RN licensure exam on first attempt. Logistic regression in that study predicted higher chances for success than for failure.

Similar research by Alexander and Brophy (1997) examined two groups of 94 students’ data inclusive of course grades, exam scores, age, grade point averages, and general cognate course grades for the prediction of passing the RN licensure exam on first attempt. Logistic regression was used to seek prediction of the dichotomous outcome of success and failure. Only the commercially-prepared end of program examinations’ scores and grades for the Childbearing, Mental Health, and Adult Health nursing courses predicted success with 81% accuracy on the RN licensure examination.
Because of these studies, this dissertation included grade point averages, grades in specific courses, and specialty examinations as within-program predictors of the selected outcome, passing the Adult Health Nursing course. Because of the use of logistic regression, failure rates may also be calculated and presented.

**Challenges with academic research.** For the most part, studies on student retention have used measures from within program or have used commercially-prepared standardized examinations to predict measurements of end of program success. Few have focused on student failures or dismissals at any point during a program.

This dissertation explored the gap in the literature by focusing on preprogram and within-program data to predict only midprogram outcomes, and to use statistical analyses that would address variables associated with both success and failure. To limit variance, this dissertation held constant variables that have affected earlier academic research. In this dissertation, the following variables were constant for all student participants: (a) curriculum, (b) admission matrices and policies supporting enrollment decisions, (c) books and resources supporting courses, (d) policies and standardized commercially-prepared examination products in courses, (e) grading scales, (f) faculty and student handbooks, (g) clinical requirements and evaluation tools, (h) syllabi, (i) rubrics for course assignments, and (j) course management system. Perhaps the most important inconstant variable in this dissertation is the faculty who create their unique teaching and clinical strategies and three course examinations per course.

Constructivist beliefs acknowledge the best predictor of future academic success was based on previous learning (Campbell & Dickson, 1996; Middlemas, Manning, Gazzillo, & Young, 2001). The findings in the review of the nursing literature conclude
that students with higher academic achievements in the program were associated with positive end of program measurements and successful academic outcomes. This dissertation not only is based on Constructivist theory, but also replicated previous research and their variables in a new model using midprogram outcomes. From the earlier research came the idea to explore course grades, grade point averages, and standardized end of course examinations as potential predictors of within-program variables and within-program dependent variables in the Adult Health II course.

End of course commercially-prepared standardized examination. The administration of commercially-prepared standardized examinations at the conclusion of nursing courses have provided course and program evaluation with statistics on the achievement of learning outcomes. Test reliability and validity have provided benchmarks between students’ outcomes across campuses within a college and across other nursing programs in the U.S. Subsequently, outcomes of research have also provided support and understanding of potential interventions and their implications for improving education of nurses; however, further research was suggested for development of strategies to support success (Thomas & Baker, 2011).

Developed from the demand for end of course assessments offered by several publishers, Elsevier’s Review and Testing Division created 55 item content-focused “Specialty” examinations for 11 select nursing courses. The Evolve Specialty Exams provided end of course assessments with thorough remediation plans for success planning on missed content. Used as an opportunity for students to experience the NCLEX-RN testing environment, the Exams provided practice and the ability to predict success on the Exit Exams and success on the RN licensure examination (Zweighaft, 2013).
Stuenkel (2006) conducted a study with scores from commercially-prepared standardized examinations used to assess knowledge acquisition at the end of nursing courses. Consistent with earlier research, the Evolve Specialty Exams’ scores from 241 students were used for the prediction of success defined as passing the RN licensure exam. Only 58% \((n = 140)\) passed the RN licensure examination on the first attempt, while 29% \((n = 71)\) failed. By using discriminate analysis, only 24% \((n = 17)\) of the 71 who failed the licensure exam were able to be identified by the scores from the end of course standardized examinations. Not studied, but of interest, were course grades, admission test scores, and other available outcome measurements that could have explained such a large percentage of licensure exam failures.

Later, Bondmass et al. (2008) analyzed scores from end of course commercially-prepared standardized exams that predicted success on the RN licensure examination. Higher scores on 13 of the 16 end of course examinations predicted an 8.5% increase in passing the RN licensure exam \((p < 0.001)\) compared to results from the previous 5-year academic period. As in other studies, the emphasis on outcomes was based on success on the RN exam. Students successful on the licensure exam had achieved significantly higher scores on the end of course exams compared with lower scores for students who failed the RN licensure exam.

As the first to predict results of exams based on earlier exam scores from the same commercial provider, Zweighaft’s research employed end of course Evolve Specialty Exam scores to predict end of program Exit Exam scores (2013). However, the study was unable to predict failure on the RN licensure exam. Additionally, the researcher was unable to assert predictions based on data that represented more than one attempt to pass
the RN licensure exam. Using odds ratio analyses with the benchmark set at ≥ 850, eight Evolve Specialty Exams administered at end of courses were significantly predictive of success on the RN licensure exam (p ≤ .0001 to .0034). While eight Specialty Exams’ content areas were studied, only the Critical Care, Pediatrics, and Adult Health Nursing end of course Evolve Specialty Exam scores predicted success on passing the RN licensure exam on first attempt. Because of the strength of the Adult Health Nursing exam to predict future outcomes, it was used as one of the two critical midprogram outcome for this dissertation.

**Summary of within-program examination attributes.** No study has explored the use of scores on end of course Evolve Specialty Exams to predict success in the midprogram period measured by earned Evolve Specialty Exam scores ≥ 850, or a course grades of a C or higher. Both outcome measurements were supported in previous studies in the literature review. Moreover, research has identified significant relationships between midprogram attributes and end of course, or end of program outcomes (e.g., Alexander & Brophy, 1997; Bondmass et al., 2008; Zweighaft, 2013). However, prior to this dissertation, there was a void of research to further understand relationships among available within-program standardized examination scores, course grades, grade point averages, and potential midprogram academic outcome measurements. Furthermore, Evolve Specialty Exams were “developed to assess students’ knowledge and their ability to apply concepts within specific content areas”, yet statistical analyses have not been used to explore the relationships between exams’ scores and midprogram outcomes (Morrison, Adamson, et al., 2004, p. 220).
In this dissertation, Evolve Specialty Exams were used to evaluate the students’ progressive learning throughout the curriculum up through midprogram in the fifth semester. No research findings explain the impact or meaning of an earned score of $\geq 850$ on an Evolve Specialty Exam in relation to the achievement of a midprogram academic outcome. No relationship to midprogram success in a baccalaureate prelicensure program has been documented. In addition, no study has examined the relationship between any of the scores on Evolve Specialty Exams early in the “within program period” after enrollment with the ability to achieve success at the midprogram period, operationalized in this study as the Adult Health II Nursing course in the second session of the fifth semester out of a nine-semester program (Morrison, Adamson, et al., 2004). This dissertation sought to address these gaps in academic research.

Nursing programs have implemented procedures with use of commercially-prepared standardized testing products at various points in the curriculum. Similar to previously described studies, this dissertation hopes to add to the body of literature on nursing student success by extending the scope of findings on relationships between student cognitive attributes achieved on the testing products and academic outcomes (Hardin, 2005; Zweighaft, 2013). In the baccalaureate programmatic research, with which this dissertation is consistent, Evolve Specialty Exams have been implemented. Predictor variables and end of course testing are used in this dissertation; because of the ubiquity of end of course examinations, this dissertation’s methods or findings may also be adaptable to other academic settings.
Selected Framework Conditions

Within Constructivist theory, provisional factors for learning have included variations of one’s external environment and one’s living arrangements. These variations have framed one’s “structure”, which has been correlated to education, its access, and its benefits. Framework conditions have included such variants as geographical determinants, age, and gender. In addition, structure may include such variables as funds for educational and tuition expenses, class and work hours of students, locations for education, and work settings with time and distance traveled. These variables have not typically been associated with educational outcomes, but have implications that warrant further research (Merriam et al., 2007). In this study, only gender and age were considered within structural framework variables.

Gender and Age

Gender and age have been commonly reported together in annual reports on nursing. As acknowledged by the Health Resources and Services Administration (HRSA) in 2010, diversity in gender is indicated by the small percentage of males in the total nursing population. In 2010, of all nurses under the age of 50, only 7.7% were males. However, of the nurses over age 50, only 5.3% were males. Of all the nurses in 1990, only 4.1% were males, whereas males comprised 9.6% of all nursing graduates after 1990 (HRSA, 2010). This was a 14.5% increase in males from 2000 data, but a 273.2% increase from the data in the 1980s (Department of Health and Human Services, 2004).
Despite their increased proportions in the nursing profession, academic withdrawals for males were at higher rates than females (Pryjmachuk, Easton, & Littlewood, 2009). Due to findings such as these, increased research on topics unique to the educational needs of male nurses has grown (Pham, 2013). This dissertation sought to explore the relationship of gender to outcome measurements of midprogram success and adds to this growing body of research on gender and educational constructivism.

Age as a selected framework condition has been a variable that has accompanied other external factors affecting academic performance. The terms “older” and “younger” have been acknowledged in research studies, but results have varied among the studies and have been relative to the time period when the studies were conducted. Because of lags in completing courses or being on long-standing wait lists, nursing applicants are increasingly likely to be nontraditional, older students at time of enrollment into nursing. Older students may have family or work commitments which preclude their having chosen a career earlier in their lives, while others have changed careers to nursing for a desire for more job security or to fulfill an unmet earlier desire. Still others have chosen a career path using the convenience of community colleges as a vehicle to jump start their higher education degree. Second-degree nursing students commonly enroll during their mid-40s and beyond (McCarey, Barr, & Rattay, 2006; Salamonson & Andrew, 2006).

The results of research on the academic performance of baccalaureate nursing students based on age alone have been inconsistent because of the wide array of measured outcomes. Campbell and Dickson (1996) found age as a demographic variable in six of the 47 studies included in their integrative review; age was significant in five of the six studies predictive of success on the RN licensure exam. Time periods including
early or preprogram, within program, and end of program were studied, using age as a variable.

**Older students.** With consideration of all factors, research studies on increased age at the time of enrollment have identified wide variations in academic outcomes. An investigation of early program success by Schafer in 2002 reported older students earned higher grade point averages in prerequisite courses, although there were isolated cases of lower grades in some early nursing courses. Later, a retrospective analysis of 154 transcripts of baccalaureate nursing students over the age of 26 years found higher grades and stronger academic performances present compared to participants under the age of 26 (Salamonson & Andrew, 2006). Conversely, nontraditional age “older” students were defined as an average age of 26 years. They had a higher rate of passing the RN licensure examination than younger students under the age of 26 years. Then, older students were found to have a 30% higher chance of failure on their first attempt at the RN licensure examination than the traditional age students. Upon further review, the mean age for traditional students was reported to be only 23 years. On the contrary, most research studies defined traditional as “under 26 years” (Harris, 2006; Sabharwal, 2005). Similar to national mean ages, this dissertation study had a mean of nearly 26 years compared to the prior study findings representing increased numbers of nontraditional age students.

Several studies reported outcomes of success achieved by older students. They encountered documented delays in their educational path based on external obligations from work, finances, personal, or family; however, the researchers considered the older students to have succeeded beyond the academic achievements of the younger students.
Differences have been found in the success during either early or end of program. Whereas older students excelled in early program courses, the younger students achieved greater success in end of program (AACN, 2005; Beeson & Kissling, 2001; Campbell & Dickson, 1996; Daley et al., 2003; Manifold & Rambur, 2001; Wong & Wong, 1999). The definitions of success in academic outcomes research varied, but commonly were associated with grades relative to retention or persistence. When testing outcomes were used, the options were success on the RN licensure examination or an exit exam.

**Traditional students.** Several studies have underscored the effects of younger age as a demographic variable associated with academic outcomes. Beeson and Kissling’s (2001) study of 505 BSN students found younger students had higher grade point averages in prerequisite courses and higher pass rates on the RN licensure examination. Similarly, earlier studies associated younger age with higher grades as a measurement of success within the program (Byrd et al., 1999; Jenks, Selekman, Bross, & Paquet, 1989; McKinney et al., 1988). This dissertation researched students enrolled in a program where minimal options for on-site housing existed, most students commute, and the ages ranged from 18 to 53 years.

**Summary of age as a factor.** The evidence from research of baccalaureate nursing students based on age alone has been inconsistent regarding outcomes, ranging from timing in the program, educational degree, levels of success, age categories, and outcome measurements. Studies in the past two decades using preprogram cognitive attributes and selected framework conditions of age to predict academic outcomes have found like terminology that must be weighed carefully. Definitions should include consistent terminology drawn from comparable conclusions in studies. There was little
replication regarding age as a predictor; therefore, summative conclusions have been nonexistent.

**Summary of Review of Literature**

The pragmatic value of this dissertation appeals to those involved in roles associated with educational leadership, teaching, and evaluation of students to be enrolled in baccalaureate nursing programs. Research must be more fully developed to understand the ability of tools to aid faculty and leadership in the creation and use of meaningful enrollment criteria for admission decisions. The study of the relationships of cognitive attributes of nursing students with measurements of academic outcomes is needed. Use of scores from commercially-prepared standardized examinations from preprogram through end of program must be judiciously analyzed.

The knowledge acquired from this dissertation advises faculty who prudently participate in the admission process and faculty who wisely create policies to govern the use of commercially-prepared standardized examinations for assessment of student learning anywhere from preprogram throughout the entire nursing program to achieve expected program outcomes. Integration of exam scores, grades, grade point average, select framework conditions, and outcome measurements can provide an analysis of the entire academic student profile. In addition, findings have implications for identification of the at-risk student.

By using student profile characteristics researched and known during preprogram, faculty may then make sensible decisions regarding prediction of success at midprogram when failure rates are increased. Students’ grades, grade point averages, and testing scores explored as preprogram and within-program cognitive attributes may predict who
succeeds at midprogram and who does not. As an area not researched, this dissertation sought to fill the gap previously described in this review.

In addition to who will succeed, the analyses conducted in this dissertation hope to provide alerts to educators for at-risk students in need of academic support prior to failure because they will not fall within the outcome measurements of success. Many commercially-prepared standardized exams provide feedback on the student’s acquisition of learned content in a course and its relationship to future success at end of program (e.g., Underwood et al., 2013; Yoho, 2006). No study has explored the minimum scores in early program testing to acquire success on midprogram’s commercially-prepared standardized course exams. For example, what are the odds that the student who achieves only a 600 on an Evolve Specialty Exam in Fundamentals of Nursing will achieve success on the Adult Health Evolve Specialty Exam at the end of the course?

Providing early interventions to identified at-risk students may craft new ways to prevent failure. Research on such strategies can then generate early supports for students (e.g., mentors, remediation, support groups) who may become at risk using the scores from the end of course exams, or perhaps at time of enrollment.

The relationships between preprogram, within-program, and midprogram examination scores have been little researched nor published, yet the exams have been administered repeatedly in nursing programs throughout the United States. Recent studies have continued to analyze the relationships between preprogram, within-program, and midprogram academic attributes with outcomes at the end of the nursing program. However, research using the midprogram outcome of a medical-surgical nursing course that requires the individual’s construction of the knowledge from the integration and
application of previous course content to be academically successful has not been conducted. No analysis of minimal scores required for future achieved success has existed aside from success at the end of the first year courses, end of program exams, or success on the RN licensure examination (e.g., Chen & Voyles, 2013; Underwood et al., 2013; Zweighaft, 2013).

Outcome data have been abundant using RN licensure pass rates and end of program exam scores. Yet, the students who were unsuccessful and academically dismissed were not able to be participants in end of program research. This dissertation sought to identify the grades, scores, and grade point average during the preprogram and within program to predict successful midprogram outcomes in the fifth semester of a nine-semester private-sector baccalaureate nursing program with students from multiple campuses across several states.
CHAPTER III

METHODS

Design and Objectives

The objectives for this study with an ex-post facto correlational approach featuring logistic regression were to examine the relationships and prediction of various preprogram and within-program cognitive attributes with measurements of midprogram academic success. The aim was to retrospectively compare students’ data for group constitution and performance measures for those who were successful in an Adult Health II course as a midprogram academic outcome to determine existing differences. In this chapter, research methodology is organized by research design, hypotheses, setting, sample, protection of human rights, instrumentation, procedures, limitations, and summary.

The majority of predictive studies on nursing education have been descriptive or correlational in design. Regression analysis is used “to identify factors that are predictive of early student success and retention” with meaningful information as they “refine admission criteria to reflect the changing profile of applicants” (Alden, 2008, p. 11). However, much of the research has used outcomes at the end of programs, as described in Chapter II, after many unsuccessful students have already failed and could not be included in the research (e.g., Englert, 2009; Yoho, 2006).
Hypotheses

The hypotheses explored strength of predictive relationships between preprogram and within-program variables and the midprogram academic outcome variables. The null hypotheses tested included both outcomes.

Dependent Measure: Adult Health II passing course grade:

H_0: None of the independent variables utilized are significant predictors of a passing Adult Health II course grade.

Dependent Measure: Adult Health II Evolve Specialty Exam successful score:

H_0: None of the independent variables utilized are significant predictors of success on the Adult Health II Evolve Specialty Exam.

Setting

The setting for this study was a private-sector, prelicensure baccalaureate nursing program delivered in a face-to-face format with a year-round curriculum taught over three continuous calendar years. Each of the eight campuses has individual programmatic approval from their State Boards of Nursing. The retrieved students’ data represent the diversity observed in the Midwest, Southeast, Southwest, and East regions of the United States. All campuses hold accreditations by the Commission on Collegiate Nursing Education (CCNE, One Dupont Circle, NW, Suite 530, Washington, DC 20036), and by the Higher Learning Commission of North Central Association of Colleges and Schools as one of the six regional institutional accreditors in the United States with membership in the North Central Association of Colleges and Schools.
**Inclusion Criteria**

Students who were enrolled and received a grade in the Adult Health II nursing course representing the medical-surgical nursing content during the fifth semester taught in the second half or “B” session of the Fall semester in 2011 were included. The course began January of 2012 as the Fall semester included the months of November through February with each session within being eight weeks in length. Only those students who were enrolled in that course and received an entry for a grade during that specific session were included. This selection method ensured: (a) representation from several campuses; (b) several faculty; (c) students’ familiarity with the Evolve HESI products in their curriculum for the previous months; (d) use of Evolve HESI products for over a year; and (e) no change in policies, testing procedures, or curriculum to affect outcomes.

**Sample**

The sampling process began by accessing the program’s academic database for all students who were enrolled and received a grade in the Adult Health II nursing course in the course that began January of 2012. This semester was selected because the Evolve Specialty Exams had been used as final exam grades for more than a year. Students with grades of A thru C experienced successful completion of the course on first attempt. Grades of D, F, and W (for withdraw) represented the lack of success in completion of the course on first attempt.

The sample included students enrolled in the courses taught at eight campuses in seven states. This sample included students who were taught with the same books, computerized Evolve Specialty Exams as their final exams, handbooks, syllabi, clinical
hours while it allowed representation of diverse populations across the eight U.S. campuses in seven states.

**Sampling Plan**

The data collection from the college-wide electronic academic database included 307 students in an anonymous convenience sample. All students who were enrolled in the Adult Health II course on any of the selected program’s campuses during the second half of the Fall semester of 2011 (January, 2012) met inclusion criteria. Five students’ data were omitted because there were missing data elements of grades or scores. If a student had failed in an earlier semester, they were not accessible for this study as no grade was present for the Adult Health II course. If a campus was recently opened and did not have students enrolled yet in the fifth semester, the campus was excluded from participation.

The data chosen for the study were accessed using the student’s unique ID known as the D#. This created a study database with grades, grade point averages, and selected framework conditions of age and gender. The D# was replaced with consecutive numerical digits for each of the remaining 302 participants. The researcher was provided access to the Elsevier Evolve database for the scores on the Admission Assessment A2 preprogram exams, and HESI scores on the Evolve Specialty Exams through Report Builder program from Elsevier.

For a stable prediction for regression, it was suggested that a minimum of 10 participants per independent variable were measured (Plichta & Kelvin, 2012). Based on Peduzzi et al. (1996), a formula whereby the number of covariates is multiplied by 10 and
divided by the proportion of positive cases (e.g., percent of success in the null logistic regression model) would thus require \( N = 10 \times (18)/.58 \), or a total of 310 students. The second regression for success with grades would thus require only 197 students (e.g., 10 \( \times (18)/.91 \)). As formulas are not absolute, the sample of 302 students was sufficient for the study (Janosky, 2013).

**Protection of Human Rights**

**Approvals.** This dissertation study was approved by the Chamberlain College of Nursing Institutional Review Board (Appendix A) followed by the Institutional Review Board by The University of Akron (Appendix B). The study provided statistical analyses of age, gender, grades, and scores of participants’ previously recorded data with campus specific identification numbers (D#s) replaced with numerical digits (1-302). Missing data elements were the only exclusion criteria.

**Risks and benefits.** No recruitment of participants was required; the data were limited to existing academic records maintained by the college. Because de-identified data arising from information already present in electronic academic databases were accessed for this study, it was deemed to be of no risk to the participants. The anonymity of participants was protected by there being no collected identifiable information or characteristics, and the collected data directly transferred to the SPSS statistical software program.

Data were stored on two portable files, one for immediate access, and another as backup. Both files were kept in a locked file drawer when not in use. Both will be destroyed in accordance with recommended procedures for destruction of electronic data.
after completion of study. Data access was limited to the principal investigator and statistician responsible for data analysis.

**Instrumentation for Data Collection**

Data for the analyses included demographic, or selected framework condition data, and measurements of cognitive attributes. All data measurements were able to be accessed from the program’s academic electronic database for demographics and grades, and the Evolve Report Builder database for standardized testing scores.

**Demographic Data Collection**

Age and gender, as self-reported demographic data, were obtained from the admission application. Academic data of age, documented as whole numbers of years handwritten by applicant on application; and gender, also handwritten by applicant as either male or female, were transcribed into the campus’ electronic academic database by the program registrar upon enrollment following the faculty’s decisions made during each campus admission committees. No demographic data were missing. Similar academic studies have examined ethnicity; however, this dissertation study was unable to access ethnicity due to inconsistent terminology and varied reporting by applicants including self-created or handwritten categories. Inconsistency in ethnicity as a mandatory reportable field with same categories are warranted for this selected framework condition to be explored with the depth that it demands (Englert, 2009; Haas et al., 2004; Roat, 2008).
**Evolve Admission Assessment (A2) Exam**

In this study, two types of instruments supported the data collection. The instrument known as the Evolve Reach Admission Assessment A2 Exam provided the preprogram data. Table 3.1 describes the exams and scores in the A2 exam. This included the Science composite score, with the individual subscores from Biology, Anatomy and Physiology, and Chemistry exams; the Basic Mathematics Skills score, and the English Language composite score with individual subscores earned on the Reading Comprehension, Vocabulary and General Knowledge, and Grammar exams.

Student reports from Evolve provided a comprehensive overview of exam performances with detailed remediation tools for success in learning the material deemed foundational to future success in the baccalaureate nursing program (Evolve Admission Assessment A2 Faculty Scoring Guide, 2011). For this study, composite scores provided average scores for exams with similar content areas, such as English, Math, and Science. All exams receive documented percentage scores ranging from 0-100% benchmarked with the “school norm” and national norms. Data for this study included the subscores, composite scores, and cumulative scores due to a lack of research in the literature for this level of exploration. Nursing research has used composite scores or the overall cumulative scores for predicting various outcomes (Evolve Admission Assessment A2 Faculty Scoring Guide, 2011).
### Table 3.1

*Evolve Admission Assessment A2 Examination's Scored Test Items*

<table>
<thead>
<tr>
<th>Test Items</th>
<th>Description</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Math Skills</td>
<td>Focuses on math skills needed for health care fields, including basic addition, subtraction, multiplication, fractions, decimals, ratio and proportion, household measures, general math facts, etc.</td>
<td>50</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>Provides reading scenarios in order to measure reading comprehension, identifying the main idea, finding meaning of words in context, passage comprehension, making logical inferences, etc.</td>
<td>47</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Contains basic grammar, including parts of speech, important terms and their uses, commonly occurring grammatical errors, etc.</td>
<td>50</td>
</tr>
<tr>
<td>Grammar</td>
<td>Contains basic grammar, including parts of speech, important terms and their uses, commonly occurring grammatical errors, etc.</td>
<td>50</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Includes matter, chemical equations and reactions, and chemical bonding and atomic structure, etc.</td>
<td>25</td>
</tr>
<tr>
<td>Anatomy &amp; Physiology</td>
<td>Includes general terminology, structure, and function of the body systems, etc.</td>
<td>25</td>
</tr>
<tr>
<td>Biology</td>
<td>Includes basics of water, biological molecules, cellular metabolism, cells, etc.</td>
<td>25</td>
</tr>
</tbody>
</table>

Note. Evolve Admission Assessment A2 Faculty Scoring Guide, 2011, p. 1

**Evolve Specialty Examinations.** This research studied the Evolve Specialty Examinations administered to all students in lieu of teacher-made final exams for all
nursing clinical courses since Fall semester of 2010 (e.g., Fundamentals, Maternal Child, Community), and Health Assessment. The basic elements of the commercially-prepared standardized exams were founded in classical test theory with the observed, true, and error scores used in a relationship whereby the observed score equals true score plus error score. The reduction of systematic and random error was critically important to ensure that scores on exams closely represented students’ true scores. Therefore, all item analyses and calculations of reliability were based on interpretations of the exam analyses (Morrison, Adamson et al., 2004).

**Scoring of the Evolve Specialty Exams.** The HESI scores achieved on the Evolve Specialty Exams were selected for the statistical analysis in this study based on research in support of the HESI score rather than conversion score predictive of academic outcomes. Previous research supported a minimum HESI score of 850 as predictive of passing NCLEX-RN on first attempt (Nibert et al., 2002; Yoho, 2006), or of achievement of 850 on the Exit Exam (Zweighaft, 2013). The associated conversion score by Evolve received upon completion of the exam was used only for a final examination score has not been used in research studies to predict academic outcomes.

Each Evolve Specialty Exam consisted of 55 items although five of the items were piloted items for future use. Test security included a proctored setting for exam delivery, secured student IDs, and access codes with protected web browsers. After exam completion, scores were uploaded to Elsevier’s HESI Predictability Model software (HPM) as a proprietary mathematical model used for calculation of HESI scores applied to the raw test scores.
Calculations at the end of each exam provided by Evolve included a summary analysis with projected reliability. According to the HESI Predictability Model, test items were individually weighted “based on their difficulty level determined by the number of correct responses to that item, thereby deriving a percentage of correct responses to the item” (Morrison, Adamson, Nibert, & Hsia, 2006, p. 41S). The HESI scores were created to predict the likelihood of students to be successful on the licensure exam. The discrimination data were obtained on testing items from the calculated point biserial correlation coefficient. The item analysis also provided a Kuder-Richardson Formula 20 for every exam with recalculation done every time a HESI exam was scored. Morrison, Free, and Newman (2002) reported, “The estimated reliability coefficients ranging for HESI exams ranged from 0.86 to 0.99” (p. 42S). The analysis provided reliability estimates that were updated regularly. As of 2011, the HESI scores ranged between 0 to over 1000, with scores that approached 1500 contingent on the exam’s difficulty level. All results were stored and accessible with faculty and administrator access (Morrison, Nibert et al., 2006).

**Exam content.** The national commercially-prepared Evolve Specialty Exams cover 5 nursing process categories, 10 NCLEX-RN client needs categories, 3 categories from the League for Nursing Accrediting Commission (NLNAC), and 17 categories from the American Association of Colleges of Nursing (AACN). The exams create assessments of nursing concepts in specific courses with parallel and multiple versions if retesting is needed to negate memorization of test items (Morrison, Adamson et al., 2006). The alignment of testing content, curricular objectives, and program outcomes is
critical. Thus, nursing educators using the exams in lieu of teacher-made final exams must use the testing blueprint to align content with course content.

The Evolve Specialty Exams for Health Assessment I and II, and Adult Health I courses required customized exams. The customization process provided the general questions used in exams but administered only questions on content taught in a specific session rather than the entire semester of content. Each session had an exam with divided content between two sessions in a semester with an exam covering only that session’s content as the final exam (Elsevier, 2011).

**Reliability and validity of exams.** An aggregate summary analysis, item analysis, and regression analysis were calculated on all exams returned to Evolve for composite reporting of aggregate data (Morrison, Free et al., 2002). Reliable and valid exam items from Evolve products have been researched. Based on classical test theory and need for the Evolve Specialty Exams, the content, construct, and criterion-related validity are studied and published annually (Morrison, Nibert et al., 2006; Pamela Wilson, personal communication, Sept 18, 2008). Content validity for Admission Assessment A2 exam items and the Evolve Specialty Exams items was accomplished by nurse experts writing and evaluating the testing items based on industry standards and the relevance of content to the needs of entry-level nursing practice (Elsevier, 2011).

Construct validity of test items was found in the NCLEX-RN test blueprint defined by practice analyses and faculty as conducted by the National Council of State Boards of Nursing and present in the IOM report. Topics included nursing process, leadership, informatics, safety, clinical prevention and more. Evolve has found that at least 75% and up to 96% of a group’s score will fall between two standard deviations
below the mean and two standard deviations above the mean even if skewing of the
distribution exists (Morrison, Adamson, Nibert, & Hsia, 2006; Morrison, Free et al.,

Criterion-related validity refers to inferences made from analyses of the exam
scores for the purpose of predicting student outcomes on another criterion of interest,
such as performance on another examination (e.g., prelicensure exam or a future Evolve
Specialty Exam). Research has been limited with only prediction of A2 scores to early
program, or early and within-program HESI scores to end of program outcomes with
another HESI score or Exit Exam scores, or NCLEX-RN pass rates (Pamela Wilson,
personal communication, September 8, 2009; Zweighaft, 2013).

“As a measure of the reliability, the Kuder-Richardson Formula 20 (KR-20) was
calculated for each analyzed exam”, and was “used in the calculation of projected
reliability for each test administered” based on previous administrations of the exam
questions and on the most recently updated item analysis (Evolve Admission Assessment
A2 Faculty Scoring Guide, 2011, p. 1). Each time an Evolve Specialty Exam or
Admission Assessment A2 was scored, the reliability estimates of the HESI scores were
recalculated for all exams containing any of the same test items. The KR-20 for the A2
math exam had a reliability estimate of 0.93; whereas, the Reading Comprehension A2
KR-20 had a 0.90 based on prior calculations. Conversely, the Admission Assessment
A2 exam had a documented KR-20 of 0.90-98 (Evolve, 2011). When the high level of
internal consistency occurred, the KR-20 moved closer to +1 as opposed to -1. The
formula measured whether the high-scoring students were consistently answering items
correctly; the lower scoring students were consistently answering items incorrectly
Reliability for all Evolve Specialty Exams and Admission Assessment A2 exam included calculations with the information stored within the HESI database from over 30,000 students’ scores (Evolve, 2011). The estimated reliability coefficients for the Evolve exams with HESI scores ranged from 0.86 to 0.99 were recalculated after each exam was given (Morrison, Free et al., 2006, p. 42S). Reliability calculations for the 2011-2012 period for the examinations studied ranged between 0.92-.94.

The data were delimited to a nursing program that used Elsevier Testing and Review products. However, the use of the Evolve exams at the nursing program did not lead to any support of any means from Elsevier. Evolve Specialty Examinations were customized rather than standardized for the three courses: Health Assessment I and II, and Adult Health I. This action was due to the standardized exam having content from a session that would not have been addressed in that session. The exam content for the sessions represented the actual topical outline of the specific session and did not include content not taught being tested. The questions still represented the publisher’s questions and provided comparison of data on test items.

**Defense of analysis of the chosen dependent variable.** The Adult Health course content was inclusive of all body systems and diseases and required application of previous science, beginning didactic, and early clinical reasoning skills. The discussion of the selected independent nominal and continuous predictor variables of scores, age, gender, GPAs, and course grades supported by research addressed the prediction of the dichotomous values of pass or fail at midprogram. Success was defined as a score of ≥ 850 or grade of C or higher C in Adult Health II course as evidenced by prior research
(Allison, 1999; Englert, 2009; Polit, 2010; Yoho, 2006). Table 3.2 shows the variables of interest for this study representative of semesters four and five with a total of 16 weeks duration for each semester.

Table 3.2

*Dependent and Independent Variables per Time Period*

<table>
<thead>
<tr>
<th>Preprogram</th>
<th>Independent Variables</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Within Program</strong></td>
<td><strong>Midprogram</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Semester IV</strong></td>
<td><strong>Semester V</strong></td>
</tr>
<tr>
<td>Prior to Enrollment</td>
<td>A2 English Language Composite</td>
<td>ESE Fundamentals II</td>
</tr>
<tr>
<td></td>
<td>Reading Comprehension</td>
<td>ESE Health Assessment I</td>
</tr>
<tr>
<td></td>
<td>Grammar</td>
<td>ESE Health Assessment II</td>
</tr>
<tr>
<td></td>
<td>Vocabulary</td>
<td>Fundamentals I Grade</td>
</tr>
<tr>
<td></td>
<td>A2 Math</td>
<td>Fundamentals II Grade</td>
</tr>
<tr>
<td></td>
<td>A2 Science Composite</td>
<td>Health Assessment I Grade</td>
</tr>
<tr>
<td></td>
<td>Biology</td>
<td>Health Assessment II Grade</td>
</tr>
<tr>
<td></td>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anatomy and Physiology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A2 Cumulative Score</td>
<td><strong>Semester V</strong></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Adult Health I Grade</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>ESE Adult Health I</td>
</tr>
<tr>
<td></td>
<td>A2 “Adjusted Program” Score</td>
<td></td>
</tr>
</tbody>
</table>


The pass/fail dichotomy for midprogram HESI scores and grades in Adult Health II was justified as a multivariate technique with logistic regression to predict success and address the exhibited higher-than-expected failure rates set by national nursing academicians within organizations. For this study, a grade of a D, F, or W represented a lack of success in the course. Only A, B, or C represented success as was consistent in other academic research studies (e.g., Englert, 2009; Higgins, 2004). Prior to the end of
the seventh week of the eight-week course, the student had the option to request to withdraw, accept a “W” as the assigned grade, and re-enroll in the course rather than risk a possible D or F as a failure at the end of the eight week. Two clinical course failures resulted in academic dismissal from the nursing program. Consistent with similar research, the inability to determine the reason for the withdraw, all W’s were considered as an unsuccessful attempt in a course. Success was determined to be the dependent variable as outcome for this study.

**Procedures**

Data were screened for accuracy, missing data, and outliers. An examination for assumptions for parametric statistical analysis was performed. The sample’s descriptive statistics of frequencies, means, standard deviations, ranges, and percentages were calculated. To determine the best predictors of academic outcomes for success in the fifth semester, a stepwise logistic regression was performed on the data using SPSS v21. All de-identified data as independent variables (e.g., preprogram scores, age, gender, and within program grades, HESI scores, and GPAs) were entered into the regression equation.

**Pearson Product Moment Correlation**

The relationship between the selected independent variables and performance at the end of the fifth semester’s Adult Health course was analyzed by computing Pearson product moment correlation. The analysis was to determine the degree of relationship or association between the academic variables employed as independent variables, and to validate the independent variables used in the multivariate analysis to examine prediction
of outcomes at the end of the Adult Health II course in the fifth of nine semesters (Hinkle, Wiersma, & Jurs, 1988). The de-identified data as independent variables were entered into the Pearson correlation using SPSS v21 including preprogram A2 scores, age, gender, and within-program course grades, HESI scores from the ESEs, and cumulative GPA at the end of the fourth semester. Data analysis selected the significance level at $p = .05$ as the standard alpha value (O’Rourke et al., 2005). This was the level of significance consistently reported in previously reviewed studies of prediction of academic success.

**Logistic Regression**

A logistic regression model was chosen to determine the extent to which the categorical and continuous explanatory variables in a model predict the academic dichotomous outcome of passing or success in the Adult Health II course. To understand the effect of each category of independent variables, the preprogram variables were entered first for both regressions; the first one with the outcome of passing the Adult Health Evolve Specialty Exam with a score of 850 or greater, and the second with the outcome of passing the Adult Health II course with a grade of C or higher. No studies have analyzed prediction of success on HESI scores, yet they account for 20% of the course grade, 25% of the testing points in courses. The exams are used widely in the U.S. without prediction of success in their outcomes evaluated.

Logistic regression was chosen to produce an estimate of the probability of success or passing the chosen Adult Health II HESI scores (logistic regression #1) or passing the Adult Health II course (logistic regression #2). Because the logistic
regression made no assumption about the distribution of the independent variables, independent variables did not need to have linear relationships, normal distributions, or have equal variance (Urdan, 2005). Linear regression was assigned to answer the research question: “What predictive value did specific independent variables from preprogram and within-program periods bring to the outcome of passing Adult Health II course or Adult Health II Evolve Specialty Exam’s HESI scores?” The selected framework condition of age used as demographic data element was included as “continuous variables in the model thus having a smoothing effect on the estimates” (Roalfe, Holder, & Wilson, 2008, p. 275).

Using a grade of A, B, or C in the course as “passing”, or a HESI score of 850 or greater as “passing” represented success within the midprogram period as the evidence to understand students that were predicted to succeed. Although relative risk of not succeeding has been studied in the past, the research on HESI scores was associated with the prediction of success on end of program exams (e.g., Foster, Barkus, & Yavorsky, 2006; Yoho, 2006; Zweighaft, 2011). Prediction of grades on academic outcomes has included outcomes defined from early program through end of program (e.g., Chen & Voyles, 2013).

The direct method of logistic regression placed all independent variables into the regression equation without attention to importance or order. A sufficient sample size for the study of 15 predictor variables was achieved using a moderate effect size ($R^2 = 0.13$) and a power of .80 and alpha of .05. An absolute value of 3.0 was used as the cutoff for examination of multivariate outliers using standardized residuals (Foster et al., 2006; Polit, 2010). Therefore, a sample of a minimum of 350 participants’ data was needed to
detect a population $R^2$ of 0.13 with 15 predictors, with a 5% of a Type I error and a 20% chance of a Type II error (Polit & Beck, 2008). The preprogram variables and then the within-program were examined as reduced numbers of predictors; therefore, the sample size of 302 was adequate.

The logistic regression determined the percent of variance in the dependent variable explained by the independent variables with an ability to rank according to relative importance. Logistic regression included unstandardized ($B$) coefficients with their standard errors, $\chi^2$ value, significance, confidence intervals, and degrees of freedom (Burns & Grove, 1999; Polit, 2010). Logit coefficients corresponding to beta weights summarized the strength of the relationships between the preprogram Admission Assessment A2 composite and cumulative exam scores, age, gender, within-program Evolve Specialty Exam HESI™ scores, grades in the fourth semester, and grade point average at end of the fourth semester analyzed with the measurements of success at the end of the fifth semester. The beta weights identified the variance contributed by the independent variables on the dependent variables (Polit, 2010).

The independent variables were entered into the blocks for the sequential logistic regression to proceed with analysis. The procedure required the creation of the binary level or dichotomous pass/fail dependent variables of the HESI scores on the Adult Health Evolve Specialty Exam converted from a numerical score of 0-1500 to a re-coding of “1” for a score $\geq 850$ or “0” for $< 850$. In addition, the grade for the Adult Health II course was re-coded as “1” for a grade of C or higher, and “0” for a grade of a D, F, or W. The SPSS regression used a model to predict the higher numeric code; therefore, prediction of success as the desired statistical outcome was achieved. The analyses
provided prediction of Adult Health II course grade and HESI score as success measurements with Block I having only preprogram variables added into the null model, and Block II with only within-program variables. Block III provided statistical analyses of the full model on prediction of success. Prediction of students who failed will be analyzed. The outcomes provided computations of the probability that a case with a particular set of values for the selected independent variable was a member of the modeled category of predictors of midprogram success.

In summary, the Pearson Product Moment correlation provided statistical support for relationships between pairs of interval and ordinal level variables. The logistic regression was calculated as an odds ratio (e.g., a measure of the association between two variables, while controlling for other variables). The estimated odds ratio for a dependent variable in the regression equation was the exponential beta (ExpB), which was the value of beta exponentiated. ExpB was calculated using the constant $e = 2.71828$ raised to the power of the B (eB). The regression equation predicted the odds of the selected independent variables in the database of grades, preprogram and within-program scores, grade point averages, age, and gender being in one of the two groups on the dependent variable (pass or fail in Adult Health II course) (Melnyk & Overholt, 2005; Polit, 2010).

**Independent $t$-test and Chi-square Analyses**

An independent sample $t$ test was performed to compare the groups of students who succeeded or failed at the midprogram outcome variable for an understanding of the academic results of groups. As a test for the existence of a relationship between two nominal, ordinal, or scale variables, Chi-square analyses were performed. After
conducting correlations of variables with the midprogram outcomes, it was important to more fully understand the profile of the student who achieved success, or did not achieve success at midprogram. The identification of variables of gender, age, grades, cumulative GPA, and HESI scores associated with a student’s successful performance was important if strategies are to be developed to improve retention of nursing students through midprogram in baccalaureate nursing education. Independent t-test analyses were performed to compare the results of independent variables (scores and grades) with the two gender groups to better understand if males and females were significantly different in how they performed academically during the fourth and fifth semester of the nursing program.

**Summary of Methods**

This chapter discussed the design, hypotheses, setting, sampling, protection of human rights, procedures, limitations, and statistical manipulations conducted on the collected data. In Chapter IV the data analyses give evidence to support or refute the hypotheses. In Chapter V, the conclusions from the statistical outcomes analyses give insight into the future research needed for nursing education, and the wise investment of resources for making a difference in health care.
CHAPTER IV

RESULTS

Data Collection

This study examined factors predictive of academic success at midprogram in one private-sector baccalaureate nursing program. An ex-post facto correlational approach using logistic regression was used to examine the relationships between preprogram and within-program variables to predict midprogram academic success.

Sample

The records of all students enrolled in the fifth semester Adult Health II course on eight campuses of one private-sector program were included. The record was the unit of analysis and included: (a) scores on the Evolve Reach Admission Assessment A2 Exam, (b) Evolve Specialty Exam HESI scores in five courses as the final examination grades at the completion of nursing courses, (c) grade point average, and (d) course grades. Data were compiled from the electronic academic database and the Evolve Report Builder from Elsevier for the 302 students. The sample of students was those who had completed Adult Health II course in the fifth semester’s second session. A HESI score $\geq 850$ or a grade of “C” or higher constituted midprogram success.
Size of Sample

Records for all students enrolled in the second half of the semester-long Adult Health Nursing course as an eight-week course taught between January, 2012 and ending February, 2012 were used in the analysis. Students had to have a grade in the electronic database system to be a participant. A total of 307 students’ records were evaluated for the variables studied herein. Five students had missing data and therefore were excluded.

Hypotheses

The hypotheses explored strength of predictive relationships between the preprogram and within-program variables and the midprogram academic outcome variables. The null hypotheses tested included both outcomes.

Dependent Measure: Adult Health II passing course grade:

H₀ : None of the independent variables utilized are significant predictors of a passing Adult Health II course grade.

Dependent Measure: Adult Health II Evolve Specialty Exam successful score:

H₀ : None of the independent variables utilized are significant predictors of success on the Adult Health II Evolve Specialty Exam.

Selected Framework Conditions

The age and gender data were identified from 302 student records. The majority of students were less than 30 years of age (71%) and female (88%). The traditional age of students younger than 22 years accounted for 23.8%. Males represented 12% of the student enrollment and were also representative of enrollment in nursing programs across the United States (AACN, 2010). Table 4.1 further reflects the age and gender
distribution of the students in this study. The mean age of all students in the study was 25.58. This represents the trend in older students.

Table 4.1

*Distribution of Research Sample by Age Range and Gender*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (n)</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-21</td>
<td>72</td>
<td>23.8</td>
</tr>
<tr>
<td>22-30</td>
<td>143</td>
<td>47.4</td>
</tr>
<tr>
<td>31-35</td>
<td>54</td>
<td>17.9</td>
</tr>
<tr>
<td>36-42</td>
<td>21</td>
<td>7.0</td>
</tr>
<tr>
<td>43-50</td>
<td>10</td>
<td>3.3</td>
</tr>
<tr>
<td>Over 50</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>266</td>
<td>88</td>
</tr>
</tbody>
</table>

Note. *N = 302*

Beyond the age of 22 years, 70% were less than 30 years. The age group between 31 to 42 years comprised one-fourth of students. This represents a typical period when family life with stability in careers is common. Balancing care of elderly parents with growing children challenge the time consumed in academic programs such as nursing.

Student records from eight campus sites were included in the analysis. Table 4.2 represents the geographic distribution by campus and the number of students. The number of students enrolled in Adult Health II ranged from 8 to 103 students. Site numbers varied based on region and length of time in operation. The use of the variable “campus” was excluded as a predictor variable in the analysis because of the wide
variation in enrollment in the Adult Health II course on each campus location. Four of
the campuses were located in the Midwest, three campuses in the South or Southwest,
and one campus was in the East.

Table 4.2

<table>
<thead>
<tr>
<th>Campus Location (Code)</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest (A)</td>
<td>103</td>
<td>34.1</td>
</tr>
<tr>
<td>East (B)</td>
<td>35</td>
<td>11.6</td>
</tr>
<tr>
<td>Midwest (C)</td>
<td>31</td>
<td>10.3</td>
</tr>
<tr>
<td>Midwest (D)</td>
<td>29</td>
<td>9.6</td>
</tr>
<tr>
<td>South (E)</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>South (F)</td>
<td>20</td>
<td>6.6</td>
</tr>
<tr>
<td>Southwest (G)</td>
<td>35</td>
<td>11.6</td>
</tr>
<tr>
<td>Midwest (H)</td>
<td>41</td>
<td>13.6</td>
</tr>
<tr>
<td>Total</td>
<td>302</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Descriptive Statistics for the Admission Assessment A2 Examinations

The Admission Assessment A2 exam includes many individual exams with
various scores provided on student knowledge upon completion. The report gives an A2
Cumulative score (comprised of individual exam scores), a Science and English
Composite score, and individual examination scores. Table 4.3 displays students’ actual
exam score ranges and mean ± SD for all the A2 individual exams, and the Science and
English Composite exams, and the scores for the A2 Cumulative exams. Scores were
accessed from the Evolve Report Builder database. The A2 Cumulative score represents
the average score earned on all Math exams and the average of the scores earned on both the English and Science Composite exams. All exam scores ranged from 0-100.

**English content.** The mean score for all English Composite exams was 83 out of 100 possible. When the individual components of the English Composite score were examined (i.e., Reading Comprehension, Grammar, and Vocabulary), the mean scores and SD for each individual English exam ranged from 78.04-85.91 ± 7-12, respectively. The mean scores were above the exam publisher’s research-based recommendation of 75 or 75% for predicted future successful academic outcomes (e.g., passing an Exit Exam or a Fundamentals course) (e.g., Morrison, Adamson, Nibert, & Young, 2008; Underwood et al., 2013).

The skewness statistics for the English Composite exam scores (-0.911), and each of the individual exams including Reading Comprehension (-0.779), Grammar (-2.574), and Vocabulary (-1.669) represented students’ greater achieved success scoring higher than each exam’s mean score. Each skewness statistic in a 0.5 range was considered to possess approximate symmetry with more normal distributions of reported individual exam scores. However, English exam scores found negative skewness with scores well above their exams’ means. More students achieved scores higher than the mean scores reported for the individual English exams or the English Composite exam (Polit, 2010).

**Science content.** Conversely, the mean score for the Science Composite exam for all students was only 70.97%. Comprised of biology, anatomy and physiology, and chemistry content, each individual science exam had scores ranging from 69.59-71.14 ± 14%. The scores for each individual science content exam had negative skewness scores ranging from 0.484-0.773 with a more closely approximated normal distribution in the
0.5 range compared to the English exam scores and their skewness statistic. However, all exam mean scores in the normal distribution were well below the recommended score of 75 predicted for achievement of future academic success (Chen & Voyles, 2013; Underwood et al., 2013). Students’ knowledge assessed by the A2 individual science content exam had the publisher’s documented construct and convergent validity (Morrison, Adamson et al., 2006). Therefore, the knowledge of science content was less than the knowledge of English content represented solely by the A2 examination scores. The Science Composite mean score was only 70.97 compared to the English Composite score of 82.94, an approximate difference in 15% decrease in score.

**Math.** A final individual A2 exam, Math, was another component of the A2 Cumulative score. The mean ± SD score for all students’ Math exams was 83.96 ± 13.96. The highly negative skewness statistic of -3.002 was the highest of all of the A2 individual scores. The lack of a normal distribution was evident with most performing well above the mean score even if some students did poorly with scores of 10 and above. Exam scores were more commonly found above the mean score of 83.96 with a range of 10-98. Thus, while the A2 Cumulative score for all content areas was 78.39 and was above the recommended score of 75, only mean scores for the English and Math Composite and individual exams scores were above 75.

Important to understand is most nursing programs using the Admission Assessment A2 preprogram product use only the English and Math scores together as an Adjusted Cumulative or “Adjusted Program” score as in the program studied. The omission of science scores is based on the uncertainty whether students have had sufficient previous science courses for equal evaluation of knowledge (e.g., Underwood
et al., 2013; Yoho, 2007). Still, the lower science scores may represent a lack of sufficient knowledge which according to the constructivist approach may limit the student’s ability to build nursing science knowledge.

Therefore, the average scores of only English Composite and Math as the “Adjusted Program Score” omitted all science scores. The result was a high mean score (84.59), higher ranges (53-97), and a negative skewness of 0.997 with more scores above the mean score due to only English and Math included in the evaluation. Omission of Science scores (either individual or Composite scores) resulted in higher A2 scores to use for evaluation of students’ pre-nursing knowledge.

Table 4.3

<table>
<thead>
<tr>
<th>Psychometric Values of the Major Preprogram Study Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Reading Comprehension</td>
</tr>
<tr>
<td>Grammar</td>
</tr>
<tr>
<td>Vocabulary</td>
</tr>
<tr>
<td>English Composite</td>
</tr>
<tr>
<td>Biology</td>
</tr>
<tr>
<td>Anatomy &amp; Physiology</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>Science Composite</td>
</tr>
<tr>
<td>Math</td>
</tr>
<tr>
<td>A2 Cumulative</td>
</tr>
<tr>
<td>$^+$Adjusted Program Score</td>
</tr>
</tbody>
</table>

Note. Range of scores 0-100; *High negative skewness statistic with more scores closer to 100, not normal distribution; $^+$Is combined Math and English Composite Score values with Science Composite Score or Science individual exams
Descriptive Statistics for Within-Program Exams

The within-program variables were based on the academic performance during the fourth and fifth semesters. The cognitive attributes were measured by the course grades and the HESI scores earned on selected Evolve Specialty Exams (referred to as ESEs in this chapter).

Evolve Specialty Exams. When the ESE was completed as the final examination, each student received a conversion score based on the difficulty level of the correctly answered questions. The conversion score represents “a percentage that reflects the average weight of all the test items on an exam and the average weight of the test items answered correctly.” Therefore, this conversion score is a weighted percentage score that faculty can include as a part of the student's final course grade. (Morrison, Adamson et al., 2006, p 42S).

The scores were worth 10-20% of the course grade with 10% for the fourth semester exams (Fundamentals II and Health Assessment I and II), and 20% for the fifth semester exams (Adult Health I and II). In addition, students received a HESI score calculated by the Elsevier’s HESI Predictability Model (HPM). Scores ranged between 0-1500. The remainder of the 1000 points in the course was earned by completion of assignments worth 20-30% of course grade, and teacher-created course examinations worth another 40-60% of total course points. The data in Table 4.4 show a wide range of student performance measured by HESI scores for the total of five ESEs analyzed in this study. When taking into account ESE scores, the research has supported use of HESI scores $\geq 850$ predictive of or correlated with a measurement of academic outcomes.
Table 4.4

*Descriptive Statistics: Evolve Specialty Exams – Scores*

<table>
<thead>
<tr>
<th>ESE</th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
<th>% &gt; 850</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 4: Within program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Assessment I</td>
<td>491</td>
<td>1207</td>
<td>877</td>
<td>34</td>
<td>58</td>
</tr>
<tr>
<td>Health Assessment II</td>
<td>378</td>
<td>1286</td>
<td>906</td>
<td>146</td>
<td>67</td>
</tr>
<tr>
<td>Fundamentals II</td>
<td>412</td>
<td>1206</td>
<td>830</td>
<td>157</td>
<td>44</td>
</tr>
<tr>
<td>Semester 5: Midprogram</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Health I</td>
<td>493</td>
<td>1343</td>
<td>939</td>
<td>170</td>
<td>68</td>
</tr>
<tr>
<td>Adult Health II</td>
<td>498</td>
<td>1283</td>
<td>886</td>
<td>153</td>
<td>59</td>
</tr>
</tbody>
</table>

In the first half of the fourth semester, 58% of the students earned a minimum score of 850 representing “success” on their first ESE, Health Assessment I. During the second session, only 44% of students achieved success on the Fundamentals II ESE compared to 67% on the Health Assessment II ESE. Finally, in the first half of the fifth semester, 68% of students earned success on the Adult Health I ESE, but then the percentage of successful scores decreased to 59% on the Adult Health II ESE as the dependent variable in the study.

Analysis of the percentage of successful students’ HESI scores demonstrated higher scores earned on customized ESEs covering content based on an eight-week session’s course syllabus. The mean scores on the customized Health Assessment I, II, and Adult Health I ESEs were 5-12% higher than the mean scores on the standardized Fundamentals II and Adult Health II ESEs. The mode for the Fundamentals II ESE was only 700 demonstrating the lower scores on that standardized exam as the first one given early in the program. Standardized exams tested students on the course content from the entire 16 weeks taught across the U.S., not per one program’s syllabus.
Distribution of HESI scores. Studies on use of HESI scores (e.g., Morrison, Adamson et al., 2004; Zweighaft, 2013) have identified 850 as the recommended score predictive of end of program success. This study identified 830 as the mean score on the Fundamentals II standardized examination. Only 44% of the students achieved a score ≥ 850. A minimum score of 850 identified in prior studies has been predictive of end of program success. Figure 4.1 for a distribution of scores in percentiles.

In this study, both the mean and the median are below a HESI score of 850, yet students were successful in passing the course at midprogram. This calls into question if the cutpoint is leveled too high. Findings might suggest that a program such as the one studied in this dissertation should consider a lower cut score between success and failure. The associated conversion scores based on the HESI score would be calculated as much lower than 76% which represents the lowest passing score on an examination in this nursing program’s grading scale. For example, HESI scores over 835 represent conversion scores used as passing final exam scores over 76% (i.e., 835 = 76.56; 837 = 78.27; 842 = 77). However, one student earned a HESI score of 850, but the student’s conversion score was only 75.14 which was a failing examination score. The histogram reveals a cut score of 825 (M = 830) indicating approximately 50% were below and 50% were above the score of 825. If the goal was to require a HESI score at which a minimum of 80% of students would achieve this score, then a score of approximately 706 would be advised. This score would not convert to passing exam scores on a college grading scale. For the Fundamentals II ESE, 60 of 302 (19.9%) actually scored less than 706. Whereas, only 37 of 302 (12.3%) scored less than 706 on the Adult Health II ESE.
Two histograms are presented to display the dispersion of scores with the mean below the score of 850 predictive of end of program success by prior studies. The increase in scores less than the mean can be observed in Figure 4.1 whereas Adult Health II HESI scores shown in Figure 4.2 are presented in increased numbers above the mean of 886.

Figure 4.1. Histogram of students’ HESI scores earned in Fundamentals II demonstrate normal distribution but only 44% scoring above the mean of 830.07. (See Table 4.4)
Figure 4.2. Histogram of HESI scores in Adult Health II demonstrates higher numbers of scores (58%) above the mean of 886.

**Course grades.** Table 4.5 shows the students’ earned grades for the six nursing courses in this study. Success rate, defined as an earned grade of C or above, ranged between 89.7 to 98.3% in the six courses. The endpoint for this study, Adult Health II, had a 7.9% failure rate (24/302). The highest percentage of course failure occurred in Adult Health I (17.2%), the first nursing course that required the building of knowledge applied from sciences, general education prerequisite course knowledge (i.e., Communication, Math) Fundamentals I & II and Health Assessment I & II courses.
<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>n</th>
<th>%</th>
<th>% Success/Failure in Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamentals I grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>35</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>195</td>
<td>64.6</td>
<td>94.7/5.3</td>
</tr>
<tr>
<td>C</td>
<td>56</td>
<td>18.5</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>5</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td><strong>Fundamentals II grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>50</td>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>174</td>
<td>57.6</td>
<td>89.7/10.3</td>
</tr>
<tr>
<td>C</td>
<td>47</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>11</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>17</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td><strong>Health Assessment I grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>35</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>190</td>
<td>62.9</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>48</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>21</td>
<td>7.0</td>
<td>90.4/9.6</td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>5</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td><strong>Health Assessment II grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>71</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>193</td>
<td>63.9</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>33</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1.0</td>
<td>98.3/1.7</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>1</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td><strong>Adult Health I grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>35</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>175</td>
<td>57.9</td>
<td>82.8/17.2</td>
</tr>
<tr>
<td>C</td>
<td>40</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>27</td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>24</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td><strong>Adult Health II grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>36</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>185</td>
<td>61.3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>57</td>
<td>18.9</td>
<td>92.1-7.9</td>
</tr>
<tr>
<td>D</td>
<td>17</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>5</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>
Analysis by Research Questions

The study was guided by two research questions. The first research question was: What is the predictive value of selected preprogram cognitive attributes (Evolve REACH Admission Assessment A2 individual scores), and demographic (select framework conditions of age and gender) characteristics on midprogram academic outcomes of success of students enrolled in a prelicensure baccalaureate nursing education program?

The relationships between the dependent variables (Adult Health II course grade and Evolve Specialty Exams’ HESI scores) and the independent variables (preprogram A2 individual exam scores and within-program course grades and Evolve Specialty Exam’s HESI scores for Fundamentals I and II, Health Assessment I and II, and Adult Health I) were explored using Pearson Product Moment Correlations.

Correlation coefficients comparing the A2 individual exams scores, cumulative scores, and composite scores to the HESI scores on the Adult Health II ESE are displayed in Table 4.6. A correlation below 0.20 is considered negligible or no correlation (Polit, 2010). No correlations between the A2 individual exams’ scores for Math, Reading, Chemistry, and the “Adjusted Program” score inclusive of only the combined English/Math exams’ scores, with the midprogram outcome of success measured by the HESI scores for the Adult Health II ESEs were identified. Conversely, other research studies have reported significant positive predictive relationships between Math or Reading scores and the early or end of program outcomes in Associate and Baccalaureate programs (e.g., Chen & Voyles, 2013; Underwood et al., 2013; Yoho, 2007).

Of the weak positive correlations defined as a value between 0.20 and 0.29 by Polit (2010), the strongest relationship was between the individual A2 Anatomy and
Physiology exam and the midprogram Adult Health II ESE \((r = .282)\). Although weak in this study, accounting for only 8% of the variance in explaining the passing HESI scores on the Adult Health II ESE, many previous studies have identified Anatomy and Physiology as a significant predictor of success represented by either a course grade or a standardized examination in that content area (e.g., Chen & Voyles, 2013; Underwood et al., 2013).

Table 4.6

**Preprogram Variables Correlated with Adult Health II ESE HESI Scores**

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Pearson Correlation ((r))</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2 Reading score</td>
<td>.165</td>
<td>.050</td>
</tr>
<tr>
<td>A2 Vocabulary score</td>
<td>.215</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Biology score</td>
<td>.227</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Chemistry score</td>
<td>.127</td>
<td>.050</td>
</tr>
<tr>
<td>A2 Anatomy &amp; Physiology score</td>
<td>.282</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Math score</td>
<td>.119</td>
<td>.001</td>
</tr>
<tr>
<td>A2 English/Math “Adjusted Program” score</td>
<td>.190</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Science Composite score</td>
<td>.241</td>
<td>.001</td>
</tr>
<tr>
<td>A2 English Composite score</td>
<td>.202</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Cumulative score</td>
<td>.274</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. \(N = 302\)

As shown in Table 4.7, the statistical relationship between preprogram cognitive attributes as independent variables and the second midprogram outcome variables of “success” (i.e., A, B, or C grades) in Adult Health II were analyzed. Grades of D, F, or W were reported as failure or unsuccessful in completion of the course on first attempt. Although significant, the strongest correlation \((r = 0.107)\) was in the Biology A2 score which accounted for only 1% of the variance in Adult Health II grades.
Table 4.7

Variables Correlated with Outcome: Adult Health II Grades

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Pearson Correlation (r)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>.043</td>
<td>.050</td>
</tr>
<tr>
<td>A2 Reading score</td>
<td>.036</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Grammar score</td>
<td>.044</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Vocabulary score</td>
<td>.080</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Biology score</td>
<td>.107</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Chemistry score</td>
<td>.071</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Anatomy &amp; Physiology score</td>
<td>.029</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Math score</td>
<td>-.002</td>
<td>.001</td>
</tr>
<tr>
<td>A2 English/Math “Adjusted Program” score</td>
<td>.026</td>
<td>.001</td>
</tr>
<tr>
<td>A2 English Composite score</td>
<td>.053</td>
<td>.001</td>
</tr>
<tr>
<td>A2 Cumulative score</td>
<td>.079</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. N = 302

In summary, this study’s findings on the correlations between preprogram cognitive attributes to support enrollment decision-making for optimal midprogram outcomes of success were not identified. Previous studies have only evaluated relationships between the A2 scores as preprogram measurements and early or end of program outcomes.

Research Question Two

What is the predictive value of selected within-program cognitive attributes (cumulative GPA through semesters one through four including transfer credits, semester four and first half of semester five course grades, and semester four and first half of semester five’s Evolve Specialty Exam HESI scores) on midprogram academic outcomes of success of students enrolled in a prelicensure baccalaureate nursing education program?
As shown in Table 4.8, a strong positive correlation \( (r = .40 - .69) \) as defined by Polit (2010) was found between the within-program variable of the actual earned Adult Health I ESE’s HESI scores and a midprogram outcome measured by success on the Adult Health II ESE with a score of 850 or higher \( (r = .526, p < .001) \). The Adult Health I course was immediately preceding the endpoint for this study. The HESI scores earned in the courses during the fourth semester (Fundamentals II, Health Assessment I and II) found no relationship to success on the Adult Health II ESEs’ scores.

Table 4.8

*Within-Program Variables Correlated with Adult Health II ESE HESI Scores*

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Pearson Correlation ( (r) )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE Fundamentals I score</td>
<td>.196</td>
<td>.050*</td>
</tr>
<tr>
<td>ESE Health Assessment I score</td>
<td>.199</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Health Assessment II score</td>
<td>.213</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Adult Health I score</td>
<td>.526</td>
<td>.000*</td>
</tr>
<tr>
<td>Fundamentals I grade</td>
<td>.154</td>
<td>.050*</td>
</tr>
</tbody>
</table>

Note. \( p < .05; \ N = 302; \) ESE: Evolve Specialty Exam

Table 4.9 reports the relationship between the four within-program variables of the ESEs’ HESI scores to the final Adult Health II grade. Only a weak correlation was found between the midprogram outcome variable of successful course grades and the earned HESI scores for the Adult Health II course \( (r = .271, p < .001) \). Given the Adult Health II ESEs’ HESI scores were recorded as the final examination grades and were 20% of the final course grades in Adult Health II, this variable should have been
controlled for by calculating the earned grade excluding the HESI score component.

However, for this retrospective study it was not possible.

Table 4.9

*Within-Program Variables Correlated with Adult Health II Grades*

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Pearson Correlation (r)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE Fundamentals I score</td>
<td>.068</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Health Assessment I score</td>
<td>.022</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Health Assessment II score</td>
<td>.050</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Adult Health I score</td>
<td>.093</td>
<td>.000*</td>
</tr>
<tr>
<td>ESE Adult Health II score</td>
<td>.271</td>
<td>.000*</td>
</tr>
<tr>
<td>Health Assessment I course grade</td>
<td>.156</td>
<td>.000*</td>
</tr>
<tr>
<td>Health Assessment II course grade</td>
<td>.187</td>
<td>.000*</td>
</tr>
<tr>
<td>Adult Health I course grade</td>
<td>.186</td>
<td>.000*</td>
</tr>
</tbody>
</table>

Note. N = 302; ESE: Evolve Specialty Exam; *p < .05

**Use of the HESI Scores for Final Examination Grades in Courses**

Studies of Evolve Specialty Exams have either supported use of the exams without course credit, or up to 20-25% depending on course credit rather than testing points (e.g., Zweighaft, 2013). Discussions of the correlations between the HESI scores and conversion scores have occurred, especially among students when a score of 837 may equal a conversion score of 78.27 for one student, but a score of 864 may equal a conversion score of 75.82.

As described by Adamson, Nibert, Morrison, & Hsia (2006), the HESI Predictability Model is applied to the raw data with the test items individually weighted based on their difficulty level, which is determined by dividing the number of correct responses to the item by the total number of responses to that item, thereby deriving a percentage of correct responses to the item. Each HESI specialty exam and HESI exit exam also provides a conversion
score. This score is presented as a percentage that reflects the average weight of all the test items on an exam and the average weight of the test items answered correctly. (p. 41S)

No research has used conversion scores from the exam grade report for analyses of academic outcomes. In review of the data displayed in Table 4.10, inequality in scores was noted. Lower ranges of HESI scores as unsuccessful such as 788 had its equivalent conversion score of the exam reported as only 69.0; whereas a lower HESI score of 758 had a conversion score of 71.7. Therefore, Student A had a HESI score 4.9% lower than Student B but had a conversion score 2.6% higher than Student B. In the upper range of scores, similar findings occurred. Student C had a HESI score 0.3% lower than Student D but had a conversion score 1.5% higher than Student D.

Table 4.10

<table>
<thead>
<tr>
<th>Adult Health II Student</th>
<th>HESI Score</th>
<th>Conversion Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>758</td>
<td>71.7</td>
</tr>
<tr>
<td>Student B</td>
<td>788</td>
<td>69.0</td>
</tr>
<tr>
<td>Student C</td>
<td>1078</td>
<td>94.2</td>
</tr>
<tr>
<td>Student D</td>
<td>1081</td>
<td>92.8</td>
</tr>
</tbody>
</table>

Note. $n = 4$

An analysis using a Pearson correlation was conducted using one cohort of the students ($n = 35$) to compare both outcome measurements (i.e., HESI score and conversion score) provided by the Evolve Report Builder as results from the students’ Adult Health II ESE. As shown in Table 4.11, the Pearson correlation between HESI scores and conversion scores further illustrates that there is not a one-to-one relationship between the HESI score and the conversion score. Still significant ($p < .001$), there was
not a perfect correlation. The likely cause of the lack of correlation is based on conversion scores’ use for calculation of difficulty levels and weighting of items from the HESI Predictability Model in creation of the conversion scores. This was critical to understand due to faculty and students’ questions regarding comparisons of scores after exams are taken.

Table 4.11

*Correlation Between the HESI Scores and the Conversion Scores*

<table>
<thead>
<tr>
<th>Statistical test</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.984</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. $n = 35$

**Analyses for Prediction of Success**

The logistic regressions that were conducted required the presence of independence of crossover of content between predictors (Agresti, 2005). The “Adjusted Program” scores, Composite scores, and the Cumulative scores were excluded from analyses by logistic regression because each included some or all of the individual ESE content and exams represented in the scores. The assumption was made students who did well on the individual examinations in the A2 Admission Assessment exam will be more likely to succeed at midprogram, ergo pass Adult Health II.

Prior to the logistic regression, the correlations between the variables were examined. Multicollinearity was evaluated among the independent preprogram and within-program variables prior to analysis with the logistic regression. For each predictor
variable to explain a portion of the variance for analysis with a logistic regression, the correlation between the predictor variables cannot be too strong (Urdan, 2005). The cut-score of > .70 was used per recommendations by Tabachnick (2007); however, the highest correlations found were only between the A2 Biology and the A2 Chemistry exam ($r = .618$). Moderate correlations were found between the scores on the A2 Grammar, Reading, and Vocabulary Exams ($r = .528 - .556$), between scores on the A2 Biology and the A2 Anatomy and Physiology exams ($r = .541$), and between the HESI scores for the Adult Health I and Adult Health II ESE Exams ($r = .526$).

Two individual sequential logistic regression analyses were used to evaluate a model of prediction of success using both dependent variables in Adult Health II (course grade of C or higher, and ESE HESI scores of 850 or greater) with the independent predictor variables of: (a) preprogram individual Admission Assessment A2 exam scores; (b) age and gender; (c) within-program course grades for Fundamentals I and II, Health Assessment I and II, and Adult Health I; (d) within-program ESE HESI scores for Fundamentals II, Health Assessment I and II, and Adult Health I courses; and (e) grade point average at the conclusion of the fourth semester.

**Logistic Regression to Predict Adult Health II HESI Scores**

Logistic regression identified the significance levels, coefficients, and standard errors of a formula that predicted a logit transformation of the probability of the student possessing the characteristic of “passing” (Urdan, 2005). The likelihood of observing the dependent variable was chosen by the parameters most likely to occur, unlike other regressions. The model was created by the select framework conditions (demographic
variables of age and gender), preprogram, and within-program independent variables predictive of either of the two academic midprogram outcomes. Based on Urdan (2005), the model was expressed as:

\[
\text{Logit (p) = } b_0 + b_1x_{1\text{age}} + b_2x_{2\text{A2gender}} + b_3x_{3\text{A2reading}} + b_4x_{4\text{A2grammar}} + b_5x_{5\text{A2vocab}} + b_6x_{6\text{A2Biology}} + b_7x_{7\text{A2Chemistry}} + b_8x_{8\text{A&P}} + b_9x_{9\text{Math}} + b_{10}x_{10\text{FundIIHESI}} + b_{11}x_{11\text{H. AssessIHESI}} + b_{12}x_{12\text{H. AssessIIHESI}} + b_{13}x_{13\text{FundIgrade}} + b_{14}x_{14\text{FundIIgrade}} + b_{15}x_{15\text{H. AssessIgrade}} + b_{16}x_{16\text{H. AssessIIgrade}} + b_{17}x_{17\text{AHIgrade}} + b_{18}x_{18\text{AHIHESI}} + b_{19}x_{19\text{SemIVGPA}}.
\]

This formula existed for each of the two logistic regressions run separately where \( p \) was the probability of passing either midprogram outcome representative of success: (a) Adult Health II Evolve Specialty Exams’ HESI scores of 850 or greater, or (b) an earned course grade in Adult Health II as a C or higher.

**Organization of blocks for the first logistic regression.** Three blocks were used in this first sequential logistic regression. The direct sequential method was used to enter all predictor variables into the first regression equation to predict the outcome of passing the ESE with HESI scores of 850 or greater. Each block was a level of outcome data based on semester of coursework. The null model had no predictor variables. The sequential logistic blocks are represented in Figure 4.3.
Results of the Logistic Regression: Success on Adult Health II HESI Scores

The variables were entered as preprogram variables entered into block one. The null model found 58.9% \((n = 178)\) of students would be predicted to achieve success on the Adult Health II Evolve Specialty exam with HESI scores \(\geq 850\). The model predicting successful HESI scores found the model to be a reasonable fit for the data with the Hosmer & Lemeshow test \(\chi^2 = 9.491, \text{df} = 8, p = .303\) for preprogram variables. The Nagelkerke’s \(R^2\) of .147 explained 14.7% of the variance in the null model which increased to 21.2% with preprogram variables added. This increase in explanatory power by the preprogram variables was slight, although statistically significant.

The presence of a relationship between the preprogram dependent variables and combination of independent variables based on the statistical significance of the model.
chi-square found the probability of the model Chi-square \( (x^2 = 34.969) \) was less than or equal to the level of significance of \( p < .001 \) (\( df = 9 \)). The null hypothesis that there was no difference between the null model with only a constant and the full model with the preprogram variables was rejected, therefore, a relationship existed between at least some of the selected predictors (Anatomy and Physiology A2 score \([p < .001]\)). The A&P score at preprogram, and Adult Health II HESI scores as dependent variable of success on the Adult Health II ESE as measured by achieved HESI scores \( \geq 850 \) was supported and displayed in Table 4.12. The model correctly predicted 66.6% of the students’ outcome using preprogram variables. Of the 124 students who failed to achieve a HESI score of 850 or greater, 54 were correctly predicted to fail (43.5%). There were 217 students who were predicted to succeed, but 70 of them actually failed. Success planning for the students admitted with low A&P A2 scores may have benefitted students. However, inconsistencies in knowing additional information would have assisted in the analysis. Examples include knowing if the students had completed an A&P course prior to taking the A&P A2 exam, and knowing if the student had studied for the A2 exam or even how many times it was taken prior to this scored attempt. Students may take the A2 exam at multiple schools to improve their scores. This information may have accounted for the percent of variance explained by the A2 score.
Table 4.12

*Preprogram Variables to Predict Adult Health II ESE Success (HESI score ≥ 850)*

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted Failure</th>
<th>Predicted Success</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure</td>
<td>54</td>
<td>70.0</td>
<td>43.5</td>
</tr>
<tr>
<td>Success</td>
<td>32</td>
<td>147.0</td>
<td>82.1</td>
</tr>
<tr>
<td>Percent Correct (%)</td>
<td>62.8</td>
<td>67.7</td>
<td>6.3</td>
</tr>
</tbody>
</table>

The cut value is .500

The significant correlations between preprogram and midprogram ESE outcome is shown in Table 4.13.

Table 4.13

Logistic Regression: Preprogram and the Outcome Variable: Adult Health II Grades

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>p</th>
<th>Exp(B)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.030</td>
<td>0.020</td>
<td>2.272</td>
<td>.132</td>
<td>.971</td>
<td>.966</td>
</tr>
<tr>
<td>Gender</td>
<td>0.578</td>
<td>0.671</td>
<td>0.330</td>
<td>.856</td>
<td>.929</td>
<td>.471</td>
</tr>
<tr>
<td>A2Read</td>
<td>-0.057</td>
<td>0.041</td>
<td>1.424</td>
<td>.233</td>
<td>1.027</td>
<td>.871</td>
</tr>
<tr>
<td>A2Gram</td>
<td>0.043</td>
<td>0.036</td>
<td>0.169</td>
<td>.681</td>
<td>.992</td>
<td>.973</td>
</tr>
<tr>
<td>A2Vocab</td>
<td>0.018</td>
<td>0.031</td>
<td>0.364</td>
<td>.546</td>
<td>1.010</td>
<td>.959</td>
</tr>
<tr>
<td>A2Bio</td>
<td>-0.020</td>
<td>0.028</td>
<td>1.450</td>
<td>.229</td>
<td>1.016</td>
<td>.928</td>
</tr>
<tr>
<td>A2Chem</td>
<td>0.030</td>
<td>0.024</td>
<td>1.831</td>
<td>.176</td>
<td>.984</td>
<td>.983</td>
</tr>
<tr>
<td>A2A&amp;P</td>
<td>0.041</td>
<td>0.022</td>
<td>12.639</td>
<td>.001</td>
<td>1.042</td>
<td>1.019</td>
</tr>
<tr>
<td>A2Math</td>
<td>0.026</td>
<td>0.023</td>
<td>0.023</td>
<td>.880</td>
<td>1.002</td>
<td>.980</td>
</tr>
</tbody>
</table>

Note. *p < .05 Note: N = 302; df = 1; A2: Admission Assessment; A.H.: Adult Health; ESE: Evolve Specialty Exam; Bio: Biology; Chem: Chemistry; Gram: Grammar; Vocab: Vocabulary; Read: Reading comprehension;*

The within-program variables were entered into the regression as the next semester of courses creating the full model. The Adult Health I ESE remained a significant predictor of performance of success in the Adult Health II ESE.
As shown in Table 4.15, the overall prediction for achieved success as the outcome measured by HESI scores of $> 850$ achieved on the Adult II ESE was 74.8%, an increase from 58.9% found in the null model. The full model correctly classified 82 of the 124 cases, or 66.1% of those who failed the Adult Health II ESE with $\leq 850$ score, but 144 or 80.9% of those who achieved success. Previous research has supported the use of standardized exams (e.g., Evolve Specialty Exams; NCLEX-RN) to predict successful outcomes rather than failure as an outcome (Spurlock & Hanks, 2004). This statistically significant full model ($p = .03$) predicted 82 student outcomes of failure when they actually failed. However, there were 42 students predicted to fail based on the model but instead the students passed Adult Health II ESE with a HESI score $\geq 850$. 

As shown in Table 4.14, the overall prediction for achieved success as the outcome measured by HESI scores of $> 850$ achieved on the Adult II ESE was 74.8%, an increase from 58.9% found in the null model. The full model correctly classified 82 of the 124 cases, or 66.1% of those who failed the Adult Health II ESE with $\leq 850$ score, but 144 or 80.9% of those who achieved success. Previous research has supported the use of standardized exams (e.g., Evolve Specialty Exams; NCLEX-RN) to predict successful outcomes rather than failure as an outcome (Spurlock & Hanks, 2004). This statistically significant full model ($p = .03$) predicted 82 student outcomes of failure when they actually failed. However, there were 42 students predicted to fail based on the model but instead the students passed Adult Health II ESE with a HESI score $\geq 850$. 

Table 4.14

<table>
<thead>
<tr>
<th>Step</th>
<th>$B$</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig</th>
<th>Exp ($B$)</th>
<th>95% C.I. Lower</th>
<th>95% C.I. Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESE Fund II</td>
<td>.001</td>
<td>.001</td>
<td>.001</td>
<td>.988</td>
<td>1.000</td>
<td>.998</td>
<td>1.002</td>
</tr>
<tr>
<td>ESE HAI</td>
<td>.002</td>
<td>.001</td>
<td>2.034</td>
<td>.154</td>
<td>1.002</td>
<td>.999</td>
<td>1.004</td>
</tr>
<tr>
<td>ESE HAI</td>
<td>.000</td>
<td>.001</td>
<td>.027</td>
<td>.868</td>
<td>1.000</td>
<td>.997</td>
<td>1.002</td>
</tr>
<tr>
<td>SEMIV GPA</td>
<td>.488</td>
<td>.438</td>
<td>1.241</td>
<td>.265</td>
<td>1.629</td>
<td>.690</td>
<td>3.845</td>
</tr>
<tr>
<td>Fund I Grade</td>
<td>.151</td>
<td>.189</td>
<td>.634</td>
<td>.426</td>
<td>1.162</td>
<td>.802</td>
<td>1.684</td>
</tr>
<tr>
<td>Fund II Grade</td>
<td>.164</td>
<td>.209</td>
<td>.613</td>
<td>.434</td>
<td>1.178</td>
<td>.782</td>
<td>1.776</td>
</tr>
<tr>
<td>H. Assess Gr I</td>
<td>-.336</td>
<td>.180</td>
<td>3.491</td>
<td>.062</td>
<td>.715</td>
<td>.502</td>
<td>1.017</td>
</tr>
<tr>
<td>H. Assess Gr II</td>
<td>.183</td>
<td>.252</td>
<td>.527</td>
<td>.468</td>
<td>1.201</td>
<td>.732</td>
<td>1.969</td>
</tr>
<tr>
<td>A. H. Gr I</td>
<td>.066</td>
<td>.155</td>
<td>.178</td>
<td>.673</td>
<td>1.068</td>
<td>.787</td>
<td>1.009</td>
</tr>
<tr>
<td>ESE A. H I</td>
<td>.007</td>
<td>.001</td>
<td>31.569</td>
<td>.000*</td>
<td>1.007</td>
<td>1.004</td>
<td>1.448</td>
</tr>
<tr>
<td>Constant</td>
<td>-11.261</td>
<td>2.553</td>
<td>19.460</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 4.15

*Full Model for Prediction of Adult Health II HESI Scores (Pass/Fail)*

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failed</td>
<td>Passed</td>
<td>% Correct</td>
</tr>
<tr>
<td>Fail</td>
<td>82</td>
<td>42</td>
<td>66.1</td>
</tr>
<tr>
<td>Pass</td>
<td>34</td>
<td>144</td>
<td>80.9</td>
</tr>
<tr>
<td>Percent Correct (%)</td>
<td>70.7</td>
<td>77.4</td>
<td>74.8</td>
</tr>
</tbody>
</table>

The cut value is .500

The Nagelkerke’s $R^2$ of .384 identified a moderate relationship between prediction and grouping with the full model explaining 38.4% of the variance in the prediction of success, an increase from the 14.7% with the null model.

As shown in Table 4.16, two significant predictors for success on Adult Health II exam’s HESI scores were the A2 Anatomy and Physiology score at preprogram and the Adult Health I ESE’s HESI scores in the within-program period. The predicted odds ratio of students with an A&P A2 score of 56 or more is 1.043 times as great as students whose score is less than 56, while holding the other variables constant. At 95% C.I., we predict that the odds ratio of students with an A2 score of 56 or more is 1.016 to 1.070 times as great as students whose A&P score is less than 56. Increases in the A&P A2 score were predicted to result in increased odds of earning successful HESI scores in the Adult Health II midprogram outcome.

The predicted odds ratio of students with a HESI score on the Adult Health I ESE is 1.007 times greater than students whose scores were less than 767 while holding the other variables constant. At 95% C.I., we predict that the odds ratio of students with an Adult Health HESI score of 767 is 1.004 to 1.448 times as great as students whose HESI
score is less than 767, while holding other variables constant. Increases in the Adult Health I HESI were predicted to result in increased odds of earning a successful HESI score in Adult Health II; that is more likely to achieve midprogram success. Although significant, the findings are not supportive of policy changes or academic programmatic actions due to the low correlation between the scores.

Table 4.16

**Significant Predictors of Success for Success on Adult Health II ESE**

<table>
<thead>
<tr>
<th>Step 1</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>p</th>
<th>Exp (B)</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2 A&amp;P</td>
<td>.042</td>
<td>.013</td>
<td>10.194</td>
<td>.001*</td>
<td>1.043</td>
<td>1.016, 1.070</td>
</tr>
<tr>
<td>ESE A.H I</td>
<td>.007</td>
<td>.001</td>
<td>31.569</td>
<td>.000*</td>
<td>1.007</td>
<td>1.004, 1.448</td>
</tr>
</tbody>
</table>

Note. 1df; *p < .05; A.H.: Adult Health; A&P: Anatomy and Physiology

**Logistic Regression to Predict Passing Grade in Adult Health II Course**

A Hosmer and Lemeshow test showed overall goodness of fit for the model and rejected the null that there was no difference between the full and null models (H-L test: \(x^2 = 13.293, df = 8, p = .102\)). The increased variance explained by the null model at 6% increased to 23.7% in the full model (Nagelkerke \(R^2 = .237\)). In Table 4.17, significant correlations were observed between preprogram, within-program variables and midprogram grades. Only significant correlations between the within-program variables of Fundamentals II and Health Assessment II courses existed between the variables in the full model.
## Table 4.17

### Significant Correlations with Outcome Variable: Adult Health II

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>p</th>
<th>Exp (B)</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.047</td>
<td>0.042</td>
<td>1.283</td>
<td>.257</td>
<td>1.049</td>
<td>0.966</td>
</tr>
<tr>
<td>Gender</td>
<td>0.578</td>
<td>0.671</td>
<td>0.743</td>
<td>.389</td>
<td>1.782</td>
<td>0.479</td>
</tr>
<tr>
<td>A2Read</td>
<td>-0.057</td>
<td>0.041</td>
<td>1.875</td>
<td>.171</td>
<td>.945</td>
<td>0.871</td>
</tr>
<tr>
<td>A2Gram</td>
<td>0.043</td>
<td>0.036</td>
<td>1.417</td>
<td>.234</td>
<td>1.044</td>
<td>0.973</td>
</tr>
<tr>
<td>A2Vocab</td>
<td>0.018</td>
<td>0.031</td>
<td>0.339</td>
<td>.560</td>
<td>1.018</td>
<td>0.959</td>
</tr>
<tr>
<td>A2Math</td>
<td>-0.020</td>
<td>0.028</td>
<td>0.53</td>
<td>.467</td>
<td>.980</td>
<td>0.928</td>
</tr>
<tr>
<td>A2Bio</td>
<td>0.030</td>
<td>0.024</td>
<td>1.551</td>
<td>.213</td>
<td>1.031</td>
<td>0.983</td>
</tr>
<tr>
<td>A2A&amp;P</td>
<td>0.041</td>
<td>0.022</td>
<td>5.21</td>
<td>.061</td>
<td>.960</td>
<td>0.919</td>
</tr>
<tr>
<td>A2Chem</td>
<td>0.026</td>
<td>0.023</td>
<td>1.211</td>
<td>.271</td>
<td>1.026</td>
<td>0.980</td>
</tr>
<tr>
<td>ESE HAI</td>
<td>-0.003</td>
<td>0.002</td>
<td>0.934</td>
<td>.335</td>
<td>.998</td>
<td>0.994</td>
</tr>
<tr>
<td>ESE HAI</td>
<td>-0.002</td>
<td>0.002</td>
<td>0.934</td>
<td>.335</td>
<td>.998</td>
<td>0.994</td>
</tr>
<tr>
<td>SEMIV GPA</td>
<td>-0.313</td>
<td>0.755</td>
<td>0.172</td>
<td>.678</td>
<td>.731</td>
<td>0.166</td>
</tr>
<tr>
<td>FundIGrade</td>
<td>0.377</td>
<td>0.319</td>
<td>1.395</td>
<td>.238</td>
<td>1.458</td>
<td>0.780</td>
</tr>
<tr>
<td>FundIIGrade</td>
<td>0.637</td>
<td>0.295</td>
<td>4.658</td>
<td>.031*</td>
<td>1.891</td>
<td>1.060</td>
</tr>
<tr>
<td>H.AssessGrI</td>
<td>0.157</td>
<td>0.257</td>
<td>0.372</td>
<td>.542</td>
<td>1.169</td>
<td>0.707</td>
</tr>
<tr>
<td>H.AssessGrII</td>
<td>0.780</td>
<td>0.362</td>
<td>4.635</td>
<td>.031*</td>
<td>2.182</td>
<td>1.072</td>
</tr>
<tr>
<td>ESE A.H. I</td>
<td>0.001</td>
<td>0.002</td>
<td>0.284</td>
<td>.594</td>
<td>1.001</td>
<td>0.998</td>
</tr>
<tr>
<td>A.H. GR I</td>
<td>0.453</td>
<td>0.233</td>
<td>3.779</td>
<td>.052</td>
<td>1.573</td>
<td>0.996</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.562</td>
<td>4.247</td>
<td>0.135</td>
<td>.713</td>
<td>.210</td>
<td></td>
</tr>
</tbody>
</table>

Note. *p < .05; A2: Admission Assessment; A.H.: Adult Health; ESE: Evolve Specialty Exam; Bio: Biology; Chem: Chemistry; Gram: Grammar; Vocab: Vocabulary; Read: Reading comprehension; SEMIV: Semester four grade point average; H.A.: Health Assessment; FUND: Fundamentals; GR: grade.

Significant relationships were displayed in Table 4.18. The presence of a relationship between the dependent variable and combination of independent variables based on the statistical significance of the model Chi-square found the probability of the model Chi-square ($\chi^2 = 31.597$) was less than or equal to the level of significance of .05 ($df = 18$). The null hypothesis that there was no difference between the null model with only a constant and the full model with the addition of the predictor variables was rejected. Therefore, the relationship between two of the selected predictor variables
(Fundamentals II grade and Health Assessment II grade) and achievement of success with an earned grade of C or higher in Adult Health II course was supported.

The full model identified two statistically significant variables predicting achieved success measured by course grades of C or higher in Adult Health II course ($p \leq .05$). According to the Wald Chi-square statistics with associated $p$ values, the variables that contributed significantly to the model were the grades in the courses of Fundamentals II ($x^2 = 4.658, p = .031$), and Health Assessment II ($x^2 = 4.635, p = .031$).

The O.R. for the Fundamentals II course grade was 1.891 with a 95% confidence interval (C.I.) of 1.060-3.372. The odds ratio for students with a grade of 2.79 or more in Fundamentals II was 1.891 times as great as students whose Fundamentals grade was less than 2.79. At 95% C.I., the odds ratio for students with a grade of 2.79 or more in Fundamentals II was 1.060 to 3.372 times as great as students whose grade is less than 2.79, while holding other variables constant.

The results demonstrated a grade of 2.34 or more (mean grade of 2.79 minus 0.45 or 1 S.D) was 1.89 times as likely to pass the Adult Health II course with a C or higher than students who achieved a grade lower than 2.34 equivalent to a C in the course. This finding was observed when students who earned less than a C in the Fundamentals II course either failed or knew of potential for failure so withdrew by the end of the sixth week of the course. Students who failed and repeated the course were aware that inability to pass the course on second attempt, or having a future clinical nursing course failure, or a combination of any three failed required courses would result in academic dismissal.
Significant predictors are shown in Table 4.18. The odds ratio of students with a grade of 3.052 or more in Health Assessment grade II was 2.182 times as likely as students whose grade was less than 3.052, while holding the other variables constant. At 95% CI, the odds ratio of students with a grade of 3.052 or more in Health Assessment grade II is 1.072 to 4.439 times as great as students whose grade is less than 3.052, while holding the other variables constant. Increases in the Health Assessment II grade were predicted to result in increased odds of earning a successful grade in Adult Health II, that is, were more likely to achieve midprogram success.

The analysis revealed that students with an increase in the Health Assessment II grade from a C to a B found that the odds of achieving a passing course grade in the Adult Health II course was increased 2.182 or two-fold. Students with a grade of an A earned in Health Assessment II found the odds of achieving a grade ≥ C in Adult Health II increased by 2.182 x 2.182 or 4 ¾ fold. Similarly, the increase in Fundamentals II grade of an A, rather than a C, found the increase in odds of earning a passing grade ≥ C in the Adult Health II course was 1.89 x 1.89 or a 3 ½ fold increase.

Table 4.18

<table>
<thead>
<tr>
<th>Step 1</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig</th>
<th>Exp (B)</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental II Grade</td>
<td>.637</td>
<td>.295</td>
<td>4.658</td>
<td>.031*</td>
<td>1.891</td>
<td>1.060</td>
</tr>
<tr>
<td>Health Assessment II Grade</td>
<td>.780</td>
<td>.362</td>
<td>4.635</td>
<td>.031*</td>
<td>2.182</td>
<td>1.072</td>
</tr>
</tbody>
</table>

Note. p < .05; 1 df
As shown in Table 4.19, the overall correct classification with all predictors added to the full model was 92.4%, only a minimal increase from 92.1% shown in the null model. This statistically significant full model ($p = .03$) correctly classified 2 of the 24 cases, or 8.3% of those who failed, but 278 or 100% of those who achieved success. The 22 students who were predicted to fail but actually achieved success with HESI scores $\geq 850$ would have used resources that were not necessary if they had been correctly identified as success. Only two students were predicted to have success, but then failed which would have negatively affected the student’s outcomes. The results support previous research on the ability to predict success is greater than the accuracy in prediction of failure (Spurlock & Hanks, 2004).

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted Failure</th>
<th>Predicted Success</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure</td>
<td>2</td>
<td>22</td>
<td>8.3</td>
</tr>
<tr>
<td>Success</td>
<td>1</td>
<td>278</td>
<td>100.0</td>
</tr>
<tr>
<td>Percent Correct (%)</td>
<td>0.6</td>
<td>99.4</td>
<td>92.4</td>
</tr>
</tbody>
</table>

The cut value is .500

To summarize, logistic regression predicted success in Adult Health II using variables studied in this dissertation. The preprogram variable of the A2 Anatomy and Physiology exam score predicted success with success in Adult Health II measured by an earned HESI score $\geq 850$; however when the preprogram variables were entered into the regression model alone followed by within-program variables, no statistically significant
relationships were found. The preprogram variables accounted for 56% of the variation in the model as shown in Table 4.20.

Table 4.20

*Model Summary from Preprogram Variables to Predict Adult Health II Grade*

<table>
<thead>
<tr>
<th>-2 Log likelihood</th>
<th>Cox &amp; Snell R square</th>
<th>Nagelkerke R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>160.262&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.024</td>
</tr>
</tbody>
</table>

Note. a Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

In Table 4.21, the preprogram variables were added with no variable statistically significant in predicting grade in Adult Health II.

Table 4.21

*Logistic Regression: Preprogram Prediction on Adult Health II Course Grades*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>p</th>
<th>Exp(B)</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>A2Read</td>
<td>-0.019</td>
<td>0.036</td>
<td>0.277</td>
<td>0.599</td>
<td>0.981</td>
<td>0.913 - 1.054</td>
</tr>
<tr>
<td>A2Bio</td>
<td>0.035</td>
<td>0.022</td>
<td>2.518</td>
<td>0.113</td>
<td>1.036</td>
<td>0.992 - 1.082</td>
</tr>
<tr>
<td>A2Chem</td>
<td>0.008</td>
<td>0.020</td>
<td>0.146</td>
<td>0.702</td>
<td>1.008</td>
<td>0.969 - 1.048</td>
</tr>
<tr>
<td>A2A&amp;P</td>
<td>-0.017</td>
<td>0.019</td>
<td>0.850</td>
<td>0.357</td>
<td>0.983</td>
<td>0.947 - 1.020</td>
</tr>
<tr>
<td>A2Gram</td>
<td>0.005</td>
<td>0.033</td>
<td>0.022</td>
<td>0.882</td>
<td>1.005</td>
<td>0.943 - 1.071</td>
</tr>
<tr>
<td>A2Vocab</td>
<td>0.018</td>
<td>0.026</td>
<td>0.473</td>
<td>0.491</td>
<td>1.018</td>
<td>0.967 - 1.072</td>
</tr>
<tr>
<td>Age</td>
<td>0.046</td>
<td>0.038</td>
<td>1.450</td>
<td>0.229</td>
<td>1.047</td>
<td>0.971 - 1.129</td>
</tr>
<tr>
<td>Gender</td>
<td>0.658</td>
<td>0.601</td>
<td>1.197</td>
<td>0.274</td>
<td>1.931</td>
<td>0.594 - 6.276</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.290</td>
<td>2.944</td>
<td>0.192</td>
<td>0.661</td>
<td>0.275</td>
<td></td>
</tr>
</tbody>
</table>

Note. \( N = 302; \ 1 \ df \)
The within-program variable of Adult Health I ESE’s HESI score demonstrated a predictive relationship with success on the Adult Health II ESEs’ HESI scores ≥ 850 in the full model using within-program variables as entered into block two. Further analysis was conducted with entering all ESE scores into a logistic regression with the Adult Health II HESI scores as the outcome. As shown in Table 4.22, the model correctly predicted 92% of the students with the addition of the HESI scores to the null model.

Table 4.22

*Full Model for Prediction of Success on Adult Health II HESI Scores ≥ 850*

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure</td>
<td>Success</td>
</tr>
<tr>
<td>Failure</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Success</td>
<td>0</td>
<td>278</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td>0</td>
<td>92.1</td>
</tr>
</tbody>
</table>

The cut value is .500

In Table 4.23, the prediction of success on the Adult Health II ESE using the HESI scores as the independent variable found no significance.

Table 4.23

*Logistic Regression: Within-Program Grades with Successful Adult Health II Grades*

<table>
<thead>
<tr>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>p</th>
<th>Exp(B)</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE226</td>
<td>.001</td>
<td>.002</td>
<td>.714</td>
<td>.398</td>
<td>1.001</td>
</tr>
<tr>
<td>ESE302</td>
<td>-.001</td>
<td>.002</td>
<td>.120</td>
<td>.729</td>
<td>.999</td>
</tr>
<tr>
<td>ESE304</td>
<td>.000</td>
<td>.002</td>
<td>.012</td>
<td>.912</td>
<td>1.000</td>
</tr>
<tr>
<td>ESE324</td>
<td>.002</td>
<td>.001</td>
<td>1.757</td>
<td>.185</td>
<td>.999</td>
</tr>
<tr>
<td>Constant</td>
<td>.084</td>
<td>1.727</td>
<td>.002</td>
<td>.961</td>
<td>1.088</td>
</tr>
</tbody>
</table>

Note. a. Variables entered on step 1: ESE226, ESE302, ESE304, ESE324.
Predicting success in earning a course grade of a C or higher in Adult Health II nursing was determined by the within-program variables of Health Assessment II and Fundamentals II course grades. However, the correlations between the predictive variables and the outcomes were minimal that warrants further benefit ratio and impact on educational policies and actions. The recommendations and conclusions for the statistical analyses provided in this chapter are presented in Chapter V.

**Understanding Academic Success and Failures in Adult Health II Course**

Further analyses were needed to understand differences between the groups of students who failed and those who succeeded academically at midprogram. The groups were further delineated by students who failed or passed with Adult Health II grades as the outcome and those who failed or passed Adult Health II ESE using the HESI scores to determine the profile of each group of students.

**Adult Health II course grade.** Analysis of the data using an independent-samples $t$ test with comparison of student groups who earned a passing course grade and the group who earned a failing course grade in Adult Health II was performed. There were only two interval / ratio variables in this study in which there were statistically significant differences between students who had a positive outcome with a passing course grade (i.e., A, B, or C) in Adult Health II on their first attempt compared to students who had a negative outcome of course grade of a D, F, or W earned on their first attempt in completion of the Adult Health II course. They included the cumulative GPA at the end of the fourth semester, and the HESI score earned on the Adult Health II ESE.
An independent-samples *t*-test was conducted to compare the preprogram and within-program variables for the 302 students with the midprogram academic outcome of Adult Health II course grade. As shown in Table 4.24, there was a significant difference in the HESI scores earned on the Adult Health II ESE and the earned Adult Health II passing course grade (*M* = 899.12, SD = 149.69) and the negative course grade (*M* = 746.38, SD = 114.43); *t* (1) = -4.88, *p* < 0.001. This result suggests that the Adult Health II ESE scores have an effect on success or failure in course grade earned in the Adult Health II. Multicollinearity existed with the analysis because the inclusion of the HESI score earned on the Adult Health II ESE accounted for 20% of the course grade as it was the Adult Health II final exam. A low HESI score affected the outcome of total points earned, thus it resulted in a lower course grade.

The second statistically significant variable with an effect on the Adult Health II course grade outcome was the cumulative grade point average at the end of the fourth semester prior to the start of the session of Adult Health II. As shown in Table 4.24, there was a significant difference in the cumulative grade point average and the earned Adult Health II passing course grade (*M* = 3.43, SD = .40) as success, and the failing or unsuccessful completion of the course due to earned course grade of D, F, or W (*M* = 3.19, SD = .44); *t* (1) = -2.82, *p* = .005). This result suggests that the cumulative grade point average at the end of the fourth semester has an effect on the midprogram success or failure in the Adult Health II course based on course grade. Previous successful academic performance may lead to future successful performances as students apply knowledge, learning experiences, and effective study strategies.
The A2 scores in preprogram did not discriminate between students who passed or failed the midprogram Adult Health II course grade. The HESI score on Adult Health II ESE identified the mean score for those who failed was 746.38, whereas the score for students who received a successful passing grade in the course was 899.12. The recommended score for future achieved success with HESI scores during or at end of program based on previous research was 850; this score is 5% higher (Zweighaft, 2013). Increased percentages of success using the Exit Exam to predict RN licensure success suggested an earned score of 900 (e.g., Morrison, Nibert et al., 2006). These findings are not supported by past research; however, the outcome of the Adult Health II course grade as an outcome has not been studied either. Results of studies would be impacted by the variability of the validity and reliability of the teacher-created examinations and the percentage of the grade based on other graded course activities.
### Table 4.24

**T test of Independent Variables and Students’ Adult Health II Earned Course Grades**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Students Passed</th>
<th></th>
<th>Students Failed</th>
<th></th>
<th>t-value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>26.68</td>
<td>6.7</td>
<td>25.25</td>
<td>6.2</td>
<td>-1.01</td>
<td>.314</td>
</tr>
<tr>
<td>A2 Reading Score</td>
<td>85.65</td>
<td>7.3</td>
<td>84.67</td>
<td>8.6</td>
<td>-0.62</td>
<td>.534</td>
</tr>
<tr>
<td>A2 Grammar</td>
<td>86.33</td>
<td>8.1</td>
<td>85.00</td>
<td>8.6</td>
<td>-0.77</td>
<td>.443</td>
</tr>
<tr>
<td>A2 Vocabulary Score</td>
<td>78.94</td>
<td>10.8</td>
<td>75.76</td>
<td>9.4</td>
<td>-1.39</td>
<td>.164</td>
</tr>
<tr>
<td>A2 Biology score</td>
<td>72.08</td>
<td>13.5</td>
<td>66.67</td>
<td>15.1</td>
<td>-1.87</td>
<td>.062</td>
</tr>
<tr>
<td>A2 Chemistry score</td>
<td>71.87</td>
<td>13.5</td>
<td>68.33</td>
<td>13.6</td>
<td>-1.23</td>
<td>.219</td>
</tr>
<tr>
<td>A2 A &amp; P score</td>
<td>69.67</td>
<td>13.7</td>
<td>68.17</td>
<td>17.8</td>
<td>-.51</td>
<td>.613</td>
</tr>
<tr>
<td>A2 Science Composite score</td>
<td>71.55</td>
<td>11.1</td>
<td>67.79</td>
<td>13.1</td>
<td>-1.59</td>
<td>.112</td>
</tr>
<tr>
<td>A2 Cumulative score</td>
<td>78.56</td>
<td>7.3</td>
<td>76.40</td>
<td>8.3</td>
<td>-1.38</td>
<td>.170</td>
</tr>
<tr>
<td>A2 English Composite score</td>
<td>83.61</td>
<td>7.4</td>
<td>82.17</td>
<td>7.2</td>
<td>-.91</td>
<td>.363</td>
</tr>
<tr>
<td>A2 Math score</td>
<td>85.43</td>
<td>10.1</td>
<td>85.50</td>
<td>7.0</td>
<td>.03</td>
<td>.973</td>
</tr>
<tr>
<td>A2 “Adjusted Program Score; English &amp; Math score average</td>
<td>84.52</td>
<td>7.1</td>
<td>83.83</td>
<td>5.96</td>
<td>-.46</td>
<td>.649</td>
</tr>
<tr>
<td>Fundamentals II HESI score</td>
<td>833</td>
<td>161.0</td>
<td>794</td>
<td>82.9</td>
<td>-1.18</td>
<td>.240</td>
</tr>
<tr>
<td>Health Assessment I HESI score</td>
<td>878</td>
<td>136.1</td>
<td>868</td>
<td>104.0</td>
<td>-.38</td>
<td>.705</td>
</tr>
<tr>
<td>Health Assessment II HESI score</td>
<td>908</td>
<td>147.9</td>
<td>881</td>
<td>122.6</td>
<td>-.87</td>
<td>.387</td>
</tr>
<tr>
<td>Adult Health I HESI score</td>
<td>993</td>
<td>170.3</td>
<td>881</td>
<td>117.0</td>
<td>-1.62</td>
<td>.106</td>
</tr>
<tr>
<td>Adult Health II HESI score</td>
<td>899</td>
<td>149.7</td>
<td>746</td>
<td>114.4</td>
<td>-4.88</td>
<td>.001 *</td>
</tr>
<tr>
<td>Cumulative GPA at end of Semester IV</td>
<td>3.4</td>
<td>0.40</td>
<td>3.2</td>
<td>0.4</td>
<td>-2.82</td>
<td>.005 *</td>
</tr>
</tbody>
</table>

Note. *p < .05; A2 scores reported in hundredths; HESI scores reported in whole numbers.

**Analysis of relationships with midprogram outcomes of grades.** Independent variables were analyzed for significance in determining success or failure in Adult Health II using Chi-square statistics. The success or lack of success was based on students’ first attempts in courses. Students may have repeated the course after an initial first attempt that was unsuccessful as in failure or withdrawal with an earned grade of D, F, or W. If they repeated and failed the same course, academic dismissal occurred. The second attempt must have achieved success for continued progress in the program. A passing
grade of A, B, or C in the course represented successful completion of the course and success in this study.

**Age.** As shown in Table 4.24, the t test for differences in age for success and failure with midprogram outcomes found the mean ages for both groups were similar. There was no statistical difference between ages of those who were successful in completion of the Adult Health II course with a grade of A, B, or C, and those who were unsuccessful with a grade of D, F, or W ($t = -1.01; p = .314$).

**Gender.** The variable gender was analyzed to understand the association between gender and the earned passing or failing grade in Adult Health II. As shown in Table 4.25, the distribution of gender found a higher percentage of males (11.1%) than females (7.5%) earned a failing grade; however, the actual numbers were 4 males and 20 females due to only 11% of the 302 students being male. There was no statistical difference found between the males and females in earning a passing or failing grade in Adult Health II course ($x^2 (1) = .559, p < .455$). As shown in Table 4.26, the Fisher’s Exact test performed due to the small size of males in the sample also found no statistical significance between gender and grade as success/fail in Adult Health II ($p = .507$).

Table 4.25

*Distribution of Adult Health II Grades per Gender*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Failing grade</td>
<td>7.5</td>
<td>20</td>
</tr>
<tr>
<td>Passing grade</td>
<td>92.5</td>
<td>246</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>266</td>
</tr>
</tbody>
</table>

Note. $N = 302$
Table 4.26

Chi-Square Test for Relationship Between Gender and Adult Health II Course Grades

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>Asymp. p (2 sided)</th>
<th>Exact p (2 sided)</th>
<th>Exact p (1 sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>.559</td>
<td>a  .455</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>.176</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td>.507</td>
<td>.317</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear-by-linear Association</td>
<td>.557</td>
<td>.455</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. a. 1 cell (25.0%) has expected count less than 5. The minimum expected count is 2.86.
b. Computed only for a 2x2 table

Fundamentals I grade. As shown in Table 4.27, the Pearson Chi-square test was used to analyze the relationship between the students’ grades in Fundamentals I representative of a passing or failing grade with the ability to then achieve a passing grade (A, B, or C) rather than a failing grade (D, F, or W) in Adult Health II. The results were not significant ($p = .052$). There were 24 students with failures in Fundamentals I with five subsequently failing Adult Health II; whereas 19 students passed Fundamentals I followed by failure in Adult Health II. A total of 273 students had success with grades of A, B, or C as earned grades in Fundamentals I, but only 254 students then had earned passing grades as successful completion of the Adult Health II course on first attempt. With one cell of 5 or less, the Fisher’s Exact test was performed. The results found asymptotic relationship with $p = .066$. There was no relationship between an earned grade in Fundamentals I and an earned grade in Adult Health II.
Table 4.27

**Distribution of Fundamentals I Course Grades per Adult Health II Course Grades**

<table>
<thead>
<tr>
<th>Outcome in Adult Health II Course Grade</th>
<th>Fundamentals I Course Grade on First Attempt</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failed</td>
<td>Passed</td>
<td>Significance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Failed</td>
<td>17.2</td>
<td>5</td>
<td>7.0</td>
<td>19</td>
</tr>
<tr>
<td>Passed</td>
<td>82.8</td>
<td>24</td>
<td>93.0</td>
<td>254</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>29</td>
<td>100</td>
<td>273</td>
</tr>
</tbody>
</table>

Note. Pearson Chi-Square = 3.788; 1 cell (25%) has an expected count < 5.

As shown in Table 4.28, the results of Pearson Chi-Square analysis was performed and no relationship was found between the Fundamentals of Nursing course grade and the outcome of either a passing or failing course grade earned in Adult Health II course, \(X^2(1, N = 302) = 3.778, p = .052.\)

Table 4.28

**Relationship Between Fundamental I and Adult Health II Course Grades**

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. (p) (2-sided)</th>
<th>Exact (p) (2-sided)</th>
<th>Exact (p) (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>3.788(^a)</td>
<td>.052</td>
<td></td>
</tr>
<tr>
<td>Continuity Correction(^b)</td>
<td>2.513</td>
<td>.113</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>3.015</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td>.066</td>
<td>.066</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>3.776</td>
<td>.052</td>
<td></td>
</tr>
</tbody>
</table>

Note. \(N = 302; 1 df; \(^a\)1 cell (25.0%) has expected count less than 5. The minimum expected count is 2.86; \(^b\) Computed only for a 2x2 table
**Fundamentals II grade.** As shown in Table 4.29, a Pearson Chi-square analysis was used to determine the relationship between the students’ passing or failure outcomes of course grades in Fundamentals II and the outcome achieved for the Adult Health II course. The analysis found a statistically significant relationship between grades earned in both courses ($\chi^2 (1, N = 302) = 12.541$, $p = <.001$). As shown in Table 4.29, students with a passing grade in the Fundamentals II course (A, B, or C) were found to have earned a passing grade in Adult Health II (course grade of A, B, or C).

Five students (6.6%) with a failing grade in Fundamentals II proceeded to unsuccessfully complete Adult Health II. Failure with a D or F in both courses led to academic dismissal and inability to be included in end of program outcome studies, i.e. NCLEX-RN success. Nineteen students had a positive outcome in Fundamentals II followed by failure in the Adult Health II course. Of the 16 who had earned a failing (i.e., D, F, or W) grade in Fundamentals II, only 5 failed and were unsuccessful in completion of the Adult Health II course upon first attempt. If a grade of D or F was earned in both, academic dismissal would have occurred. Eleven students then achieved success in passing the Adult Health II course. Opportunities for early success planning could be provided based on the grade outcome in the Fundamentals II course prior to risk of an earned failure again in Adult Health II.
Table 4.29

Distribution of Fundamentals II Course Grades per Adult Health II Course Grades

<table>
<thead>
<tr>
<th>Outcome in Adult Health II Course Grade</th>
<th>Fundamentals II Course Grade on First Attempt</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failed</td>
<td>%</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td>31.3</td>
<td>5</td>
<td>11.6</td>
<td>19</td>
</tr>
<tr>
<td>Passed</td>
<td>68.7</td>
<td>11</td>
<td>88.4</td>
<td>267</td>
</tr>
<tr>
<td>Total</td>
<td>100.</td>
<td>16</td>
<td>100.</td>
<td>286</td>
</tr>
</tbody>
</table>

Note. Pearson Chi-Square = 12.541; 1 cell (25%) has an expected count ≤ 5

The Pearson Chi-square analysis had one cell with five data elements; therefore, a Fisher’s Exact test was performed. Both analyses demonstrated that a significantly higher percentage of students who successfully completed the Fundamentals II course with a passing grade of A, B, or C proceeded to earn a passing grade in the Adult Health II course. Table 4.30 displays the significant results of the Fisher’s Exact Test and the Pearson Chi-square.

Table 4.30

Relationship Between Fundamentals II and Adult Health II Course Grade

<table>
<thead>
<tr>
<th>Value</th>
<th>Asymp. p (2-sided)</th>
<th>Exact p (2-sided)</th>
<th>Exact p (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>12.541(^a)</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Continuity Correction(^b)</td>
<td>9.403</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>7.917</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td>.005(^*)</td>
<td>.005</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>12.500</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

Note. \(p < .05\); 1 df; \(^a\) 1 cell (25.0%) has an expected count less than 5. The minimum expected count is 1.27; \(^b\) Computed only for a 2 x 2 table
**Health Assessment I and II.** A Pearson Chi-square analysis was used to understand the relationship between students’ Health Assessment I and II course grades as success or failures in relation to earned success measured by course grade in the Adult Health II course grade on first attempt. In Table 4.31 and 4.32, no statistically significant relationship was found between the Health Assessment I and II grades and Adult Health II grades.

Table 4.31

*Distribution of Health Assessment I Course Grades per Adult Health II Course Grades*

<table>
<thead>
<tr>
<th>Adult Health II grade as outcome</th>
<th>Health Assessment I Course Grade</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failed</td>
<td>%</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
<td>12.9</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td></td>
<td>87.1</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Passed</td>
<td>%</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
<td>7.4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td></td>
<td>92.6</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0%</td>
<td>271</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 302; Pearson Chi-Square = 1.16; 1 cell (25%) has an expected count of less than 5.

Table 4.32

*Distribution of Health Assessment II Course Grades per Adult Health II Grades*

<table>
<thead>
<tr>
<th>Adult Health II grade as outcome</th>
<th>Health Assessment II Course Grade</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failed</td>
<td>%</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
<td>20.0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td></td>
<td>80.0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>5</td>
<td>297</td>
</tr>
<tr>
<td></td>
<td>Passed</td>
<td>%</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td></td>
<td>7.7</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td></td>
<td>92.3</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>297</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 302; Pearson Chi-Square = 1.16; 1 cell (25%) has an expected count < 5.
The Pearson Chi-square analyses documented the need for Fisher’s Exact test to be completed. No statistical significance was found between the grade performance on either Health Assessment course and earning a passing grade as successful completion of the Adult Health II course as shown in Table 4.33.

Table 4.33

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>1.160(^a)</td>
<td>.281</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction(^b)</td>
<td>.528</td>
<td>.468</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>1.011</td>
<td>.315</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td></td>
<td>.289</td>
<td>.222</td>
</tr>
<tr>
<td>Linear-by-Linear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Association</td>
<td>1.156</td>
<td>.282</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Valid cases: \(N = 302\); 1 \(df\); \(^a\) 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27; \(^b\) Computed only for a 2x2 table

The relationship between the Health Assessment II course grade and Adult Health II course grade is shown in Table 4.34. The relationship \(\chi^2 (1) (N = 302) = 1.010, p = .341\) remained not significant when the Fisher’s Exact test was performed due to less than five in a cell.
Table 4.34

*Relationship Between Health Assessment II and Adult Health II Course Grades*

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Asymp. $p$ (2-sided)</th>
<th>Exact $p$ (2-sided)</th>
<th>Exact $p$ (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>1.010a</td>
<td>.315</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correctionb</td>
<td>.029</td>
<td>.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>.740</td>
<td>.390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td>.341</td>
<td></td>
<td>.341</td>
</tr>
<tr>
<td>Linear-by-Linear</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Association</td>
<td>1.006</td>
<td>.316</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. 1 df; a. 2 cells (50.0%) have expected count < 5. The minimum expected count is .40; b. Computed only for a 2x2 table.

*Adult Health I.* Displayed in Table 4.35 the Pearson Chi-square analysis compared the success and failure in the Adult Health I course with the same outcomes in the Adult Health II midprogram period. The results were found to be statistically significant ($\chi^2 (1, N = 302) = 7.254, p = .006$). Of the 52 students who failed Adult Health I, 17% ($n = 9$) of students failed both courses. The 15 students who had success with a passing Adult Health I course grade could have benefitted from success planning to not proceed to a failing grade in Adult Health II. A failure could increase the risk of academic dismissal.
Table 4.35

Distribution of Adult Health I Course Grades per Adult Health II Course Grades

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Adult Health II Course Grade</th>
<th>Failed</th>
<th>Passed</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent</td>
<td>n</td>
<td>Percent</td>
<td>n</td>
</tr>
<tr>
<td>Failed</td>
<td>17.3</td>
<td>9</td>
<td>6.0</td>
<td>15</td>
</tr>
<tr>
<td>Passed</td>
<td>82.7</td>
<td>43</td>
<td>94.0</td>
<td>235</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>52</td>
<td>100.0</td>
<td>250</td>
</tr>
</tbody>
</table>

Note. \( X^2 = 7.524; \) 1 cell (25%) has an expected count of less than 5.

As shown in Table 4.36, a Fisher’s Exact test found a significant relationship between the Adult Health I and II grade outcomes \( (p = .011) \). The identification of high risk students with a failing grade (D, F, or W) as unsuccessful completion of the Adult Health I course would prompt a plan for increasing the chance for future success in the second session of Adult Health.

Table 4.36

Relationship Between Adult Health I and Adult Health II Course Grades

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Asymp. ( p ) (2-sided)</th>
<th>Exact ( p ) (2-sided)</th>
<th>Exact ( p ) (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>7.524(^a)</td>
<td>.006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction(^b)</td>
<td>6.058</td>
<td>.014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>6.194</td>
<td>.013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher's Exact Test</td>
<td></td>
<td></td>
<td>.011*</td>
<td>.011</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>7.499</td>
<td>.006</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N of valid cases = 302; \(^a\)\(X^2; \) 1 cell (25.0%) has expected count less than 5. The minimum expected count is .40; \(^b\) Computed only for a 2x2 table; \(*p < .05\)
In summary, in review of the Chi-square analyses provided, only two categorical variables in this study had a significant relationship with the outcome of Adult Health II as a categorical variable (success or failure on first attempt). The two significant variables included the success or failure measured as passing or failing course grades in Fundamentals II and Adult Health I.

In terms of these two variables, the Fundamentals II course grade represents the better point at which to provide students with additional assistance because it occurs earlier in the curriculum than Adult Health I at the institution where these students were enrolled. The impact would provide a longer horizon in which to reinforce these students with additional assistance to prepare them for Adult Health II. At this institution Adult Health I is a pre-requisite for Adult Health II. Students must pass Adult Health I course successfully with a passing grade (A, B, or C) prior to enrollment in the second session. A failing grade or withdrawal representing lack of success in the course may require a student to wait for a later session to retake the course. Academic dismissal occurred if previous failures in both courses occurred, or a second attempt in same course resulted in failure.

Evolve Specialty Examinations

**Fundamentals II ESE.** Displayed in Table 4.37 the Pearson Chi-square analysis compared the HESI score success (≥ 850) and failure (< 850) on the ESE for the Fundamentals II course with the HESI scores on the Adult Health II ESE at midprogram. The results were found to be statistically significant ($\chi^2 (1, N = 302) = 11.211, p = .001$).
Of the 170 students who failed the Fundamentals II ESE, 84 (49.4%) achieved HESI scores < 850 in both courses.

Table 4.37

*Distribution of Fundamentals II HESI Scores per Adult Health II HESI Scores*

<table>
<thead>
<tr>
<th>Outcome in Adult Health II ESE HESI scores</th>
<th>Fundamentals II ESE Scores</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure (HESI Scores &lt; 850)</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Failure of A.H. ESE</td>
<td>49.4</td>
<td>84</td>
<td>30.3</td>
<td>40</td>
<td>.001*</td>
</tr>
<tr>
<td>Success with A.H. ESE</td>
<td>50.6</td>
<td>86</td>
<td>69.7</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>170</td>
<td>100.0</td>
<td>132</td>
<td></td>
</tr>
</tbody>
</table>

Note. * p < .05; Pearson Chi-Square = 11.211; 0 cells have an expected count < 5

**Health Assessment I ESE.** The Pearson Chi-square analysis demonstrated 68 of the 128 students who failed Health Assessment I’s ESE proceeded to achieve HESI scores on the Adult Health II ESE < 850. The results in Table 4.38 were found to be statistically significant ($\chi^2 (1, N = 302) = 13.364, p = <.001$). Similar to Fundamentals II, almost one-third of students who passed the Health Assessment I ESE, failed the Adult Health II ESE without any notification of at-risk status to receive success planning. Almost half of those who had Health Assessment I ESE scores < 850 proceeded to also have Adult Health II ESE scores < 850.
Table 4.38

Distribution of Health Assessment I HESI Scores per Adult Health II HESI Scores

<table>
<thead>
<tr>
<th>Health Assessment I ESE Scores</th>
<th>Failure (HESI Scores &lt; 850)</th>
<th>Success (HESI Scores &gt; 850)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Failure of A.H.ESE</td>
<td>53.1</td>
<td>32.2</td>
<td>56</td>
</tr>
<tr>
<td>Success with A.H.ESE</td>
<td>46.9</td>
<td>67.8</td>
<td>118</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>128</td>
</tr>
</tbody>
</table>

Note. Pearson Chi-Square = 13.364; 0 cells have an expected count < 5

**Health Assessment II ESE.** As shown in Table 4.39, the Health Assessment II ESE was found to have a significant association with the midprogram Adult Health II ESE outcome scores. The Pearson Chi-square analysis demonstrated 51.5 % (n = 51) students who failed to achieve a passing score of at least 850 on their final exam using the Health Assessment II ESE also failed to achieve a passing score on the Adult Health II ESE given as the final exam. The results were found to be statistically significant ($\chi^2$ (1, $N = 302) = 6.653, p = <.010$). Similar to other ESE’s results, approximately one-third (36%) of those who passed the Health Assessment II ESE, proceeded to fail the Adult Health II ESE.
Table 4.39

*Distribution of Health Assessment II HESI Scores per Adult Health II HESI Scores*

<table>
<thead>
<tr>
<th>Outcome in Adult Health II ESE HESI scores</th>
<th>Health Assessment II ESE Scores</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure (HESI Scores &lt; 850)</td>
<td>Success (HESI Scores &gt; 850)</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Failure of A.H.II ESE</td>
<td>51.5</td>
<td>51</td>
<td>36.0</td>
<td>73</td>
</tr>
<tr>
<td>Success with A.H. II ESE</td>
<td>48.5</td>
<td>48</td>
<td>64.0</td>
<td>130</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>99</td>
<td>100.0</td>
<td>203</td>
</tr>
</tbody>
</table>

Note. Pearson Chi-Square = 6.653; 0 cells have an expected count < 5

**Adult Health I ESE.** The Adult Health I ESE was found to have a significant association with the midprogram Adult Health II ESE outcome scores. The Pearson Chi-square analysis demonstrated 66.3 % (n = 63) of students who failed to achieve a passing score of at least 850 HESI score on their Adult Health I final exam also failed to achieve a passing score on the Adult Health II ESE (see Table 4.40). The results were found to be statistically significant ($\chi^2 (1, N = 302) = 36.532, p = .001$). Less than one-third (29.5%) of the students achieved success on the Adult Health I ESE, but later scored less than 850 on the Adult Health II ESE.
Table 4.40

*Distribution of Adult Health I Scores per Adult Health II HESI Scores*

<table>
<thead>
<tr>
<th>Outcome in Adult Health II ESE HESI scores</th>
<th>Adult Health I ESE Scores</th>
<th></th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure (HESI Scores &lt; 850)</td>
<td>Success (HESI Scores &gt; 850)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Failure of A.H.II ESE</td>
<td>66.3</td>
<td>63</td>
<td>29.5</td>
<td>61</td>
</tr>
<tr>
<td>Success with A.H.II ESE</td>
<td>33.7</td>
<td>32</td>
<td>70.5</td>
<td>146</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>95</td>
<td>100.0</td>
<td>207</td>
</tr>
</tbody>
</table>

Note. *p<.05; Pearson Chi-Square = 36.532; 0 cells have an expected count < 5.

**Summary of Results**

Statistical analyses to answer the research questions were performed with Pearson correlations, logistic regression, *t* tests, Pearson Chi-squared analyses, and Fisher Exact tests. Using the Fundamentals I grade, students would benefit from individualized remediation and success planning to address educational needs. The results from this study support decisions for nursing programs to pay attention to students who achieve failing grades in Fundamentals courses. Knowing the constructivist theory acknowledging the building of domain-specific (e.g., basic nursing skills, nursing process, pathophysiology) content for future successful achievement of learned content, it would be critical to enforce early course material. Without strength in understanding Fundamentals and Health Assessment content, students struggle with material in Adult Health course content. Approximately one-third of students who completed each ESE as their final failed the exam and later proceeded to not achieve 850 on the Adult Health II ESE also. Individualized remediation and success planning may affect a change in the outcome to reduce risk of failure and academic dismissal.
Although correlations and predictions using the Admission Assessment examination were performed, only weak correlations were found. This is critical when nursing programs seek to enroll students who will successfully progress academically through passing the RN licensure exam. Where research has used the findings to predict end of program outcomes, this study addressed outcomes at midprogram for the early identification of academically at-risk students prior to failure.
CHAPTER V

CONCLUSIONS

The predictive value of cognitive attribute variables evaluated by using standardized testing, course grades, and overall grade point average was of limited value in predicting midprogram academic success in a sample of baccalaureate nursing students in a multiple campus, private-sector program in the U.S. The A2 test taken prior to admission did not predict student success either within or at midprogram. Standardized tests administered within program were successful in predicting student success within program and at midprogram but were not predictive of midprogram failure. The prescribed score of 850 based on prior studies had been predictive of end of program success. The score of 850 to indicate successful mastery of core content on each Evolve Specialty Examination may be inflated and therefore requires further consideration in order to provide a more accurate appraisal of the potential for failure when used to predict subsequent progression in this baccalaureate nursing program.

Age and Gender

Age. Of interest, the majority of students in this program were beyond the “traditional” age of 22 years. While this study was not powered to analyze differences in the distribution of HESI scores within and between age cohorts, different life cycle events
may impact cognitive variables. Establishing normative data on standardized testing by age may be important to contribute insight into student success. This beginning examination of contributors to success at midprogram highlights the need to expand Tinto’s work. Tinto’s work focused on traditional younger (≤ 22 years) student success using variables of students with pre-college characteristics, goals and student commitments, and institutional experiences typical of the younger student.

The age of the traditional high school student entering college is 18 to 22 years. The term “nontraditional student” has taken on many interpretations, notably as an individual older than 22 years old. Currently, unemployment is rising for all age groups and people are returning to school to find new career opportunities. Nursing programs have seen an influx of nontraditional students who seek to improve their career and economic opportunities. Students enrolled in this dissertation study were from a private-sector institution. Both age and other characteristics of students may vary from public sector institutions’ nursing programs, although mean age in this study and reported by AACN are nearly the same.

In this study, traditional students younger than 22 years old represented less than 25% of this sample (23.8%). The majority of the student population (47.4%) was between the ages of 22-30 years old. The supporting literature on the predictor of age has identified inconsistencies and lack of replication with age ranges, definitions, and research outcomes (e.g., Beeson & Keesling, 2002; Campbell & Dickson, 1996; Sabwarhal, 2005). Summative conclusions have been nonexistent. For this study, age was not found to be a preprogram predictor for midprogram success, as analyzed with logistic regression with the dichotomous outcome measurement of success on Adult
Health II grades or HESI scores. When comparing the student age of those who achieved success in Adult Health II, the average age was not significantly different, 26.7 ± 6.68 years versus 25.3 ± 6.24 years respectively. Further consideration of this age cohorts’ cognitive and noncognitive needs may reveal different teaching/learning strategies to achieve outcomes of success.

The IOM and AACN documents note the need to explore technology and social media in nursing education with age as a variable (Schmitt, Sims-Giddens, & Booth, 2012). Teaching strategies for nursing using simulation, podcasts, “flipped classrooms” and other techniques require evaluation, using age as one variable to evaluate effective ways to present nursing information in educational settings. Research on success specific to ages of nursing students will require large multisite studies to gather sufficient cohort numbers to make generalizable comparisons.

A sociological perspective may be useful to examine the impact of age on success in nursing programs. The Model of Institutional Departure proposed by Tinto defined factors that influenced student integration into undergraduate education based on the traditional student. Tinto’s model can be used as a beginning model to be tested and modified on pre-entry attributes, goals and intentions, institutional commitments, and integration to determine variables specific to the life experience for nursing students (Tinto, 1993). This has implications for intergenerational program development and remediation.

Qualitative research studies to understand the educational experience of cohorts of varied ages while in a nursing program may reveal both socio-cultural issues as well as stress points within the nursing curriculum. Understanding these stress points may allow
for individual and group mediation to reduce distress while in the nursing program and build on academic success.

**Gender.** The gender distribution of males in this study, 11.9% male, was representative of national averages of males enrolled in nursing programs (12%) (AACN, 2011). This study found the percentage of failure in Adult Health II was higher for males (11.1%) than for females (7.5%) ($p = .46$), but not statistically significant. Understanding why more males failed could not be determined by the quantitative data collected in this study. Additional research is needed to understand the impact of gender on cognitive and noncognitive, and sociocultural issues as they impact learning and progression in nursing.

Examining traditional and nontraditional student success in nursing programs may have important implications for curriculum development, student assignments, and the creation of intergenerational programs to enhance student success at midprogram and beyond. Evaluation of the influences of cognitive, socio-cultural, and environmental variables with the study of the diverse student populations, e.g., gender, race, and other social variables is needed to better understand nursing education. The remaining sections of this dissertation review findings in light of the current literature related to standardized testing, course grades, and GPA as measures of student success. Strengths and limitations will be identified as well as suggestions for further study.

Multiple strengths of this study design addressed concerns in the literature related to the generalizability of findings. For example, study limitations, identified by Harding (2010) and Newton and colleagues (2007), related to single site studies, addressed particular concern for limited geographic and ethnic variability. This study addressed this concern by using multiple sites at different geographic locations and with diverse
student bodies. Although cohort size at each institution varied and did not allow for analysis by geographic location or diversity, this study does provide a broader investigation with greater generalizability because of the consistency of admission and progression policies and identical curriculum plans at each site as well as diversity of student populations.

Another strength of this study was the examination of student profile who had reached the program at midpoint as defined by enrollment into Adult Health II. A prior study by Peterson (2009) reported the dropout rate in the first semester of nursing to be as high as 30%. By using enrollment in Adult Health II as the midpoint, this study captured all students who were able to progress to this point. This design allowed the researcher to examine using the Constructivist theory how the learner’s knowledge is built on preceding and subsequent course content. It was not the intent of this study to identify the percent of course failures that resulted in student dismissal from the program but rather to predict how success in subsequent courses both on standardized tests, course grade, and cumulative GPA would predict success at midpoint and to identify points for remediation to promote student progression. By using this approach, this study was able to identify the percent of course failure for those students who were still in program.

Robinson and Niemer (2010) reported students earning a grade of C in a course were at high risk for failure in subsequent courses. While this study did not track the individual student, it was interesting to note the percent of students with a grade of C or below were highest in Adult Health I (17.1%) and Fundamentals II course (10.3%). The number of students with unsuccessful HESI scores < 850 was highest in the standardized Fundamentals II ESE (54%), the first exam given which was in Health Assessment I
(42%), and in the standardized Adult Health II ESE (41%) compared to the fewer students scoring low HESI scores in Health Assessment II (33%) ad Adult Health I (32%). A question still remains, where is the best point for academic intervention, and what intervention would most successfully build knowledge. Using the Constructivist Theory, the learner explores the content from all learning environments, individual social experiences, and interactions, and carries forth prior knowledge to construct the new. Further study is needed to provide evidence to support this idea as it is used in nursing education.

**Student Failures**

The primary focus of this study was on student success at midprogram. Descriptive data on students who failed at midpoint are presented to understand student characteristics. While data may be limited in generalizability of findings pertaining to students who failed at midpoint, this study presents a beginning that addresses the call by the National Council of State Boards of Nursing (2010) for data to evaluate program attrition. This study’s findings identified relationships between the Adult Health I ESE predictive of HESI scores ≥ 850 on the ESE for Adult Health II, and the course grades for Fundamentals II and Adult Health I predictive of successful completion of Adult Health II measured by a grade of A, B, or C.

As was expected, students with a higher midprogram GPA (fourth semester of total of nine) achieved a higher HESI score on the Adult Health II ESE than those with a lower GPA. While the course grade was inclusive of the standardized exam scores as final exam points, the ESE in Fundamentals and Health Assessment courses accounted
for only 10% of the grade. Students in the 4th semester had additional courses figured into this calculation, i.e. Pathophysiology. These exams predicted student success but not failure at midprogram.

Alexander and Brophy (1997) examined the predictive ability of nursing courses on success in passing NCLEX post-graduation (end of program outcome). Their Adult Health course was one of three courses which contributed to 80.6% predictive accuracy. Consistent with the findings in this study, focusing on this course for predictive value of standardized testing on passing courses beyond midpoint may be important.

Importantly, the Admission Assessment Examination (A2) administered prior to admission did not significantly add to the predictive model in this sample for student success/failure. Weak to moderate correlations (.28-.53) were noted between the individual A2 Anatomy and Physiology A2 exam scores and Adult Health I ESE outcomes as scores with the Adult Health II ESE HESI scores; and between the Fundamentals II and Adult Health I grades with Adult Health II grades. Results from this study extend the findings of Wong and Wong (1999) in which the A2 score was weakly correlated with early program course outcome. In other subcategories of the A2 because of the weak correlations, there was no enhanced value of looking at individual exam scores to predict midprogram success. The multiple studies with relationships with various A2 scores and various outcome measurements have supported that statement (e.g., Underwood et al., 2013). Similar findings with other preprogram testing products have been reported. What is unknown in this study and similar research is the length of time between completion of the A2 Anatomy and Physiology examination and taking core courses in Anatomy and Physiology prior to entry into the nursing program.
Furthermore, some students applying to nursing programs taking the A2 have yet to take their Anatomy and Physiology course. Their scores may be based on a high school or GED foundation. Likewise, students may have taken the A2 exam multiple times compared to the first attempt’s score submitted from another applicant. Therefore, these factors must be controlled in future studies using the initial scores to predict students’ outcomes. The variability in this study of when students may have taken the A2 multiple times may limit the generalizability of the statement that the individual exam scores on the A2, e.g. Anatomy and Physiology provide no predictive ability for student success.

Using the Constructivist theory, knowledge building and mastery of domain-specific prior content is essential to build student success. Theoretically, from an advising standpoint, when low scores on individual A2 exam are linked to courses within the nursing curriculum, monitoring students with lower scores is an important remedial point for intervention to ensure the successful acquisition of knowledge to progress. At present, however, the findings in this study suggest the individual A2 exam scores are of limited predictive value for basing enrollment decisions. The issue at hand is the use of A2 scores, and the need to have further research which supports or not, the results of this study.

**Evolve Specialty Exams (ESEs)**

Of the five Evolve Specialty Examinations that were studied, the lowest scores were found on the Fundamentals II ESE with the mean below the recommended score of 850. Although previous studies using HESI scores for prediction of end of program outcomes have reported 850 as the minimum score to achieve success on the NCLEX-RN
(Nibert et al., 2002; Zweighaft, 2013), the HESI score of 850 in this study is overly conservative and was not predictive of student success at midprogram.

In this study, 44% of students achieved a minimum score of 850 on the Fundamentals II ESE. Students had prior experience taking the standardized examinations at this point in the curriculum. A student earning a minimum HESI score of 830 or more achieved a passing score on the final examination. Using a conversion score, a HESI score of 830 was equivalent to a 76% in many cases. The final exam was worth 10% of the 1000 points or 76% of the 600-800 testing points used to achieve success as a passing grade in the course. If the goal of the final examination was to have a score whereby 80% of the students would score above it, then a score of only 700 was required. This is a critical finding, because it impacts the numbers of students failing this program that otherwise might have passed as well as the number of student slots that could be filled in subsequent semesters.

Recall that a conversion score was created based on the difficulty of the ESE question and exam completed by the student as the final exam grade rather than a HESI score. No studies of convergent validity to examine HESI scores and their relationship to conversion scores with the course grades were found. A compelling question is whether to use the conversion score as part of the final examination or to use the raw score and assign a grade based on earned points. The inclusion of ESE test scores into the grade is known as high stakes testing. High-stakes testing impacts academic outcome and has been a topic challenged by national education leaders and researchers at the National League for Nursing (e.g., Spurlock & Hanks, 2004). These examination scores affect
academic progression particularly where up to 25% of the course grade is based on the HESI scores.

The role of standardized testing is to demonstrate summative knowledge. In this study several exams were customized based on the division of an entire course’s content delivered in two sessions rather than a standardized exam covering the entire semester’s content. Without customization of examinations based on content delivered during the semester, students are at risk for earning a conversion based on the exam and related to the HESI score less than 850 which may impact passing their course and ultimately impact progression due to program policies related to repeating courses and dismissal.

Further research is needed to evaluate the benefit of using the ESE scores as part of the course grade or their use for assessment purposes to allow for prediction of end of program outcomes and important points for remediation of course content. Generalizability of research findings from HESI examinations is limited based on how individual schools are using the examinations within their curriculum. Some schools are controlling for the exams by calculating their earned grade excluding the HESI component (Zweightaft, 2013). This study could not evaluate this as the level of data was not accessible. While benchmarked average scores for Associate, Diploma, and Baccalaureate educational programs are included in the summative report for each specialty exam, how to use these data to predict students at risk for failure remains undetermined. Finally, all consideration for using these examinations should be balanced against the cost:benefit ratio.

Other programs have devised several methods to use ESE results to calculate a grade used in the total course grade. Programs may use conversion scores without credit
as a grade in the course. Some programs require mandatory remediation if the earned conversion score is less than the national average score for the program’s degree level. It would be unclear if the first test score or the remediated test score is used in the data.

One nursing program reported using scales with intervals to meet the needs of assigned letter grades and assessment of prediction of success for administered ESEs. For example, a score of > 950 or conversion score of > 95 may coincide with an A or “outstanding”. For a HESI score of 700-750, or a conversion score of 75-79, it is noted as “additional study needed” for likelihood of passing the NCLEX-RN.

The NLN cited in their *High-Stakes Testing* document the need for faculty to be mindful when using tests and evaluative measures to assess student achievement, to support student learning, and to evaluate and improve teaching and program effectiveness” (NLN, 2010, paragraph 10). In this study ESEs were not adequate to predict student failure. Students with HESI scores at the 700 level continued to pass courses and progress.

When high-stakes testing is involved, Mills et al. (2001) identified another intervening factor, test anxiety. Further research is needed to study the impact of anxiety when traditional testing versus standardized tests are used as an evaluation component for courses. The use of these computerized tests is arguably important as practice testing for end of program particularly when students take the NCLEX examination. It may be efficacious to use standardized testing in senior level courses only but not in early courses where they can be perceived as punitive and affect progression. Faculty in early courses may be better served to create tests using NCLEX format to address specific content information in the course. This may lower anxiety and avoid the notion of “teaching to
the test”. A balance between faculty-generated tests and quizzes and use of ESE HESI scores in the final grade may be supportive of student success. From a college/school perspective, anxiety occurs when students have multiple course failures early in the program. Poor NCLEX-RN pass-rates may mar the school’s reputation and threaten the sustainability of the program with the State Board of Nursing. While benchmarked average scores for Associate, Diploma, and Baccalaureate educational programs are included in the summative report for each specialty exam, how to use these data to predict students at risk for failure remains undetermined. Finally, all consideration for using these examinations should be balanced against the cost-benefit ratio.

Several researchers have weighed in on the use of the examinations and their validity with diverse student populations. Issues of cultural and language barriers with the exams have presented challenges for future research and considerations. For example, a question on the ESE with the term “superior” to define cardiac landmarks was interpreted by the nursing student with English as a second language as a “higher being”, not the physical relationship to location.

Morrison, Adamson et al. (2006) contended the use of standardized examinations to predict future success at the end of a program warrants a comparison of faculty teaching strategies to support students’ success on the exams, and the presenting curriculum. Using the Evolve Specialty Exam scores to predict within-program outcomes has not been studied (Pamela Wilson, personal communication, September 8, 2009). Forty-nine percent of students who failed to achieve a score of at least 850 on their final exam in Fundamentals II also failed to achieve at least 850 on the Adult Health
II ESE. The relationship between these two courses was not supported when analysis was conducted using logistic regression ($p = .998$).

In most curricula, a fundamentals or foundations course is prerequisite to higher level courses as Adult Health II which focuses on concepts of medical-surgical nursing. Building on prior learning, it would seem logical that a student who does not pass a foundations course will need remedial work prior to entering the next level course. In one study, early failure in a foundation level course accounted for a 30% attrition rate (Peterson, 2009). Because nursing programs are structured for rapid progression to degree attainment, there is often limited time for remediation before the next course begins. For example, a course failure on Friday in an accelerated program often means repeating the failed course on Monday. Besides not having the time to identify what went wrong to cause the failure, a student may feel a mixture of complex feelings surrounding the failure. There is no time for reflection on the consequences of failure and there is pressure to perform satisfactorily or be dismissed from the program. Thus, a time out may be important to identify issues with plans to remediate not only the academic component of the failure but to consider other noncognitive factors affecting both short term progression and long term success and completion of the program. Noncognitive factors may be social, emotional, financial, or work related. From the perspective of the academic nursing program, the logistics of altering already-arranged clinical placements adding students to repeat the class, increasing class size for teaching, all impact faculty workload and satisfaction. As faculty resources become further constrained by the faculty shortage, new ideas on how to remediate students to enhance success is needed. The creation of a campus Center for Academic Success is one
alternative to provide intense support to both the student and faculty. Success planning requires infrastructure support at the university/college level with sufficient resources, e.g., faculty, tutors, counseling, and other supportive services to achieve future success.

It was anticipated that the core courses Health Assessment I and II would have an association with the Adult Health II course grade and ESE HESI scores. This postulated relationship only held for the customized exam in Adult Health I and Adult Health II ESE \((p < .001)\) but was unrelated to the grade. The Pearson Chi-square analysis demonstrated that 53.1\% of students who failed to achieve success as a score of at least 850 on their Adult Health I ESE as the final exam in the course also failed to achieve a minimum of 850 on the ESE for Adult Health II.

Recalling the Constructivist Theory of the building of knowledge, 58\% of students taking the Health Assessment I ESE achieved scores greater than 850, which increased to 67\% in the second session of Health Assessment II. Both courses’ scores on the ESE had a mean of 877 and 906 respectively. This increase may have been related to the differences between the use of customized ESE exams in Health Assessment I and II, and the standardized ESE in the Fundamentals II course. With standardized examinations, students must assimilate and apply knowledge from nationally-based course content for both sessions in the semester, rather than solely on the session’s school syllabus for the course just previously covered.

The HESI scores earned on the Health Assessment II I ESE and the Adult Health II ESE were related \((p = .01)\). Approximately 52\% of students who failed to achieve a score of 850 or higher on their Health Assessment II ESE also failed to achieve a score of 850 on the ESE for Adult Health II. The percent of students who unsuccessfully
completed the Adult Health I course was 17.2%, while the percent who did not complete the Adult Health II course was only 7.9%. Study findings suggest further research is needed to identify the HESI scores most predictive of within-program success, which in this study is below the 850 point.

Nibert and colleagues (2002) found when remediation was focused on missed content, student scores improved. The Constructivist approach supports the building of baseline knowledge for use in future courses. The HESI scores earned on the Adult Health I ESE were positively associated with the HESI scores earned on the Adult Health II ESE ($p < .001$). Sixty-eight percent of the students achieved a HESI score $\geq 850$ on the customized Adult Health I ESE HESI (939, 170), the highest pass rate for all five ESEs in this study. This exam was customized compared to Adult Health II as a standardized exam given across the U.S. In both courses, the ESE’s HESI scores accounted for 20% of earned course points to determine the course grade. The remaining 32% of students who received HESI scores below 850 had conversion scores which may or may not have provided a final exam score of 76 or higher but these students passed the course based on other components of their grade, e.g., course exams, quizzes, and assignments. As defined by school policy, the negative outcome of failing to successfully complete both courses with a grade of A, B, or C would result in academic dismissal.

When comparisons are made with research reported in the literature, it is difficult to control for variations in the type of testing, particularly whether standardized or customized examinations were used. Additionally, information is not provided as to the other course components which went into the final course grade or how the HESI scores
were used in the final computation. As previously stated, 850 may be an inflated value for evaluating midprogram success. For this study, in calculating the HESI score whereby 80% of students passed, a score of 700-750 may be an acceptable range to determine midprogram success. Additional studies examining cohorts of students are necessary to define the best predictive values for midprogram success as well as end of program success. Also, further study is needed to make recommendations on whether to use customized or standardized exams based on defining the material to be tested and the purpose of testing, e.g., remediation, practice for NCLEX, as part of a course grade, or within a particular program.

This study found the course grades in two early program courses, Fundamentals II and Adult Health I were predictive of midprogram success in grades. While program consistency is maintained across campuses, the mix of teacher-created exams and assignments were not compared across the sites studied. One way to control for this variability may be to create standardized test-banks with well-written, NCLEX-type items from which reliability and validity statistics can be developed. The relationships between early program grades and midprogram outcomes allow administrative leaders and faculty to better create programs, teaching strategies, and policies to retain students, while simultaneously constructing a knowledge base that applies across a curriculum for safe client care and the wise use of resources.

**Future Research**

Given resource constraints in today’s nursing programs, selecting students with the best chance for successful completion of a fast paced curriculum is critical to meeting
the nursing shortage and limiting student debt. Evaluating programs with multiple campuses is one way to identify the impact of a consistent curriculum on outcomes. Control using standardization of teacher-created exams, determining point allocation for testing and assignments, and using consistent academic policies, including grading scales, will allow for comparisons for determining how best to evaluate student progress. These strategies will enhance generalizability of findings.

**Summary**

The value of standardized testing within nursing programs remains an important means to evaluate knowledge acquisition and to provide testing opportunities to prepare for the NCLEX-RN examination and the computerized testing environment. The use of preprogram testing to aide in enrollment decisions, while not predictive of success at midprogram, remains important for identifying deficits in knowledge which may suggest remediation prior to program entry.

Identifying academically-ready and at-risk students is essential for enrollment decisions and early and supportive program intervention. Increased rates of unemployment and underemployment, particularly among younger adults have resulted in the influx of students into nursing programs with the goal of seeking career opportunities in an expanding work field. National trends for nursing programs indicate seats within nursing programs are limited, yet the call for an increased BSN workforce to meet the needs of the aging population is imminent (AACN, 2011; Campbell & Dickson, 1996). Students with the highest chance for successful completion of the BSN program are needed to fill workforce needs. The effective use of testing resources able to predict
program success and identify early intervention points is critical to prevent shortages in the nursing workforce. Examining preprogram and within-program cognitive variables alone was insufficient to predict midprogram success/failure using the current testing model. Developing expanded models which take into account the intergenerational needs of the student population in addition to standardized testing may enhance midprogram academic success for nursing students.
REFERENCES


Bondmass, M. D., Moonie, S., & Kowalski, S. (2008, April 1). Comparing NET and ERI standardized exam scores between graduates who pass or fail the NCLEX-RN. *International Journal of Nursing Education Scholarship, 5*(1), Article 16.


APPENDICES
APPENDIX A

CHAMBERLAIN COLLEGE OF NURSING IRB PERMISSION

Chamberlain College of Nursing
Institutional Review Board (IRB)
333 E. Butterfield Road, Suite 500
Lombard, IL 60148

December 10, 2012

Patricia Fedorka, PhD, RNC-OB, C-EFM
Chamberlain College of Nursing
MSN Online Nursing Program

Dear Patricia Bishop

This letter is to inform you that the Chamberlain College of Nursing (CCN) Institutional Review Board (IRB) for the Protection of Human Subjects has received and processed your proposal titled “Use of Pre-Program and Within Program Cognitive Attributes to Predict Mid-Program Academic Success at Multiple Campuses of a Baccalaureate Nursing Program”. Your proposal was assigned IRB # 2012-12-10-Ex which should be referenced in future communications.

It is the Board’s opinion that you have provided adequate safeguards to protect the rights and welfare of the participants in this study. The Board also feels that your proposal is in compliance with the DHHS Regulations for the Protection of Human Subjects (45 CFR 46) and has been classified as exempt.

You are authorized to implement this study as of the date appearing at the top of this letter. This approval is valid until 12/10/13. This project must be conducted in full accordance with all applicable sections of the approved proposal and you must notify the IRB immediately of any proposed changes. You must report any unanticipated problems involving risks to the participants or others to the Board immediately. For projects which continue beyond one year from the starting date, the IRB will require continuing review and update of the research project. Your study will be due for continuing review as stated above. The primary investigator must also advise the Board when this study is completed or discontinued by
completing the Final Report form that may be obtained from the eCollege IRB Resource Center, located within Doc Sharing. The primary investigator will also ensure that CITI IRB Training for Faculty and Staff Researchers is current throughout the project for all involved researchers.

If you have any questions, do not hesitate to contact one of the co-chairs of the IRB. Congratulations on obtaining IRB approval and best of luck with your scholarly inquiry!

Sincerely,

Martha A. Spies Patricia Fedorka
Martha A. Spies, Co-Chair Patricia Fedorka, Co-Chair
APPENDIX B

THE UNIVERSITY OF AKRON IRB PERMISSION

Office of Research Services and Sponsored Programs
Akron, OH 44325-2102
330-972-7699 Office

January 8, 2013

Patricia J. Bishop
5331 West Village Drive
Glendale, Arizona 85308

From: Sharon McWhorter, IRB Administrator

Re: IRB Number 20130102 "Use of Pre-Program and Within-Program Cognitive Attributes to Predict Mid-Program Academic Success in Multiple Campuses of a Bachelor's Nursing Program"

Thank you for submitting your Exemption Request for the referenced study. Your request was approved on January 7, 2013. The protocol represents minimal risk to subjects and matches the following federal category for exemption:

☐ Exemption 1 - Research conducted in established or commonly accepted educational settings, involving normal educational practices.

☐ Exemption 2 - Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior.

☐ Exemption 3 - Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior not exempt under category 2, but subjects are elected or appointed public officials or candidates for public office.

☐ Exemption 4 - Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens.

☐ Exemption 5 - Research and demonstration projects conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine public programs or benefits.

☐ Exemption 6 - Taste and food quality evaluation and consumer acceptance studies.

Annual continuation applications are not required for exempt projects. If you make changes to the study's design or procedures that increase the risk to subjects or include activities that do not fall within the approved exemptor category, please contact me to discuss whether or not a new application must be submitted. Any such changes or modifications must be reviewed and approved by the IRB prior to implementation.

Please retain this letter for your files. This office will hold your exemption application for a period of three years from the approval date. If you wish to continue this protocol beyond this period, you will need to submit another Exemption Request. If the research is being conducted for a master's thesis or doctoral dissertation, the student must file a copy of this letter with the thesis or dissertation.

Cc: Elaine Fisher - Advisor
Cc: Valerie Cotlar - IRB Chair

The University of Akron is an Equal Education and Employment Institution

☐ Approved consent form/s enclosed

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