

PREDICTING FIRST TERM SUCCESS IN AN ASSOCIATES DEGREE NURSING  
PROGRAM USING COGNITIVE AND NONCOGNITIVE FACTORS

by

Richard Hilton Turner

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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## ABSTRACT

Since the late 1990s the nursing field has experienced increased demand for RN's as well as a number of internal and external factors that have worsened this problem. College admissions officers have struggled to identify those students who are most likely to persist in an associate degree nursing (ADN) program. Estimates of programmatic attrition vary, but fall somewhere between 25-50%. A great deal of research has been expended in an attempt to determine which preadmission variables are most likely to indicate programmatic success. Unfortunately, no "best set" of admissions variables has been identified. The purpose of this research was to identify cognitive and noncognitive predictors of success in an ADN program. These variables can then be used by nursing program administrators to help identify students during the admissions phase who are most likely to persist through the first term and potentially to degree completion. Bloom's theory of school learning serves as the theoretical framework for this research. The participants in this study were 188 students (summer and fall cohorts) in the Associate of Science in Nursing (ASN) program at a large state college in the southeastern region of the United States. The research design was a quantitative, non-experimental, correlational design to predict the relationship between four input predictor variables and one criterion variable. The Health Education Systems Inc A<sup>2</sup> assessment (HESI A<sup>2</sup>) and the Grit-S Scale were used to measure these input variables. Binary regression was used to analyze the resulting data. This research is critical in addressing nursing shortfalls, a pressing real world problem facing society at large, nursing in general, and college admissions departments for ADN programs in particular.

*Keywords:* ASN, ADN, nursing, success, attrition, HESI, grit

### **Dedication**

This dissertation is dedicated to my two daughters Torrie and Aarika. Pursue your dreams; chase after them with all that you have. This life is so very precious and fleeting, endeavor to waste very little.

## Acknowledgments

Soli Deo Gloria! Glory to God alone!

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### **List of Abbreviations**

Academic Self-Concept Scale (ASCS)

Accreditation Commission for Education in Nursing (ACEN)

American Association of Colleges of Nursing (AACN)

Associate Degree Nursing (ADN)

Associate of Science in Nursing (ASN)

Bachelor of Science in Nursing (BSN)

Emotional Intelligence (EI)

Eysenck Personality Questionnaire (EPQ)

Grade Point Average (GPA)

Health Education Systems Inc A<sup>2</sup> (HESI A<sup>2</sup>)

Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)

National Council Licensure Examination – Registered Nursing (NCLEX-RN)

National Council of States Boards of Nursing (NCSB)

National League for Nursing (NLN)

Nursing Entrance Test (NET)

Registered Nurse (RN)

Student Information System (SIS)

Statistical Package for the Social Sciences (SPSS)

Test of Essential Academic Skills (TEAS)

Variance Inflation Factor (VIF)

Watson-Glaser Critical Thinking Appraisal (WGCTA)

## **CHAPTER ONE: INTRODUCTION**

### **Overview**

The nursing field is experiencing labor shortages (Bureau of Labor Statistics, 2015) that are complicated by a number of internal and external factors (Olsen, 2017) including high attrition rates within nursing programs across the country (Harris, Rosenberg, & Grace-O'Rourke, 2014; Olsen, 2017). Although a great deal of research has been conducted in an attempt to identify those students most likely to persist through the first term, the first year, and ultimately to degree completion, a "best set" of admissions criteria have not been identified (Schmidt & MacWilliams, 2011; Taylor, Macduff, & Stephen, 2014). This lack of a best set of admissions criteria has led to nursing program admissions personnel using a wide range of admissions criteria, many which lack any research based support (Taylor et al., 2014). In this study, the researcher focused on academic preparedness and motivation toward long term goals in nursing education. Bloom's (1976) theory of school learning served as the theoretical framework for this research.

In Chapter One, the researcher discusses the background related to nursing shortages within the United States along with nursing program admissions challenges that institutions of higher learning face, which if not properly addressed, could further confound the nursing shortages. A brief overview of the theoretical framework that undergirds this research is presented and connected to the research. The problem statement is presented and discussed, including findings from previous research. The purpose and significance of this current study are discussed and finally, the research question is introduced, and definitions pertinent to this study are provided.

### **Background**

Throughout the history of health care in the United States, there has been a cyclical pattern of nursing shortages (Snavey, 2016). Since the 1990s the cyclical nature appears to have been replaced by a slowly increasing nursing deficit (Juraschek, Zhang, Ranganathan, & Lin, 2012; Rosseter, 2017) and since the late 1990s, the demand for Registered Nurses (RN) has continued to outpace supply (Jimenez, 2016; Juraschek et al., 2012). The Bureau of Labor Statistics reported in 2014 there were 2,751,000 RNs employed across the United States. In this same report, the Bureau reported the demand for RNs is expected to grow by 439,000 in the ten-year period between 2014 and 2024 (Bureau of Labor Statistics, 2015); this represents a (16%) increase in the labor market. There are a number of internal factors that are masking actual nursing shortfalls in the U.S. including nurses delaying retirement (Ramachandran, 2014) or returning to work after retirement (Olsen, 2017; Snavey, 2016), as well as a large number of nurses currently working in the field that are nearing retirement age (Olsen, 2017). At the same time, very high turnover and attrition rates within the nursing field are exacerbating the problem (American Association of Colleges of Nursing, 2017). Equally, the increasing numbers of citizens reaching retirement age (Harris et al., 2014; Ortman, 2014) and faculty shortfalls, that are hindering institution's ability to increase nursing program size (Chen & Voyles, 2013), are also putting pressure on the nursing field and have the potential to further threaten the long term supply of trained nurses. This nursing shortage requires immediate attention, and the potential impact to health care in the U.S. could be significant.

Institutions of higher learning have recognized the demand for RNs and have responded. Nearly every institution of higher learning (public or private, profit or not-for-profit) offers some type of nursing program. These offerings include Associate of Science in Nursing (ASN) and Bachelor of Science in Nursing (BSN), and many universities offer graduate level nursing

programs. Interest in the nursing field remains high, with applicant interest far exceeding higher education's ability to seat and train the nursing prospects (Peterson-Graziose, Bryer, & Nikolaidou, 2013; Schmidt & MacWilliams, 2011). Every year schools of nursing turn away qualified candidates due to lack of available seats (Knauss & Wilson, 2013). According to the National League for Nursing (NLN), roughly 85% of ADN programs in the U.S. denied qualified applicants due to lack of available seats (Peterson-Graziose et al., 2013). The American Association of Colleges of Nursing (AACN) report on Enrollment and Graduations in baccalaureate and graduate nursing programs reported that institutions of higher learning turned away 64,067 qualified applicants from their respective bachelor and graduate level nursing programs in 2016 (Rosseter, 2017). Due to RN shortages and this large disparity between applicants and available seats in nursing programs, institutions have a moral obligation to admit only students who they believe will be successful in their nursing program (Rosenberg, Perraud, & Willis, 2007). Equally, students who are entering nursing programs deserve a reasonable estimate that their admission into the program is confirmation of the institution's belief in their ability to be successful in the program (Crouch, 2015).

In spite of high demand for nurses, an abundance of qualified applicants, and the ability for institutions of higher education to admit only the best and most qualified applicants, nursing programs across the country are struggling to identify those students most likely to persist through the first term, first year, and program completion (Wambuguh, Eckfield, & Hofwegen, 2016; Wolkowitz & Kelly, 2010). Student attrition rates in nursing programs across the United States remain high with the greatest attrition occurring the first year of the nursing program and typically in the first term (Knauss & Wilson, 2013). Although reported attrition rates vary program-to-program, Harris et al. (2014) reported average attrition rates in baccalaureate nursing

programs are approximately 50% with ADN programs experiencing attrition rates of nearly 47%. Further compounding this problem is the majority of institutions (including most open access institutions) employ an admissions rubric in an attempt to identify those students most likely to be successful. Unfortunately there is no current agreed upon “best set” of admissions criteria (Schmidt & MacWilliams, 2011; Wambuguh et al., 2016; Wolkowitz & Kelly, 2010) or even an agreed upon best pre-nursing entrance examination (Manieri, DeLima, & Ghosal, 2015; Schmidt & MacWilliams, 2011).

This failure of research to produce a best set of admissions criteria (Wambuguh et al., 2016) has resulted in nursing departments using a wide array of admissions rubrics, many of which lack research based support (Knauss & Wilson, 2013; Schmidt & MacWilliams, 2011; Wambuguh et al., 2016). This creates a serious and systemic problem as institutions are left with little evidence to guide their development of an admissions rubric. Though there have been numerous research studies conducted in the areas of improving the academic performance of nursing students, the findings from these studies have at times been confusing and even worse, other times contradictory (Wambuguh et al., 2016). Equally concerning is that in the area of nursing admissions, very little research has been conducted using noncognitive factors (Schmidt & MacWilliams, 2011).

Although there is a dearth of research around cognitive entry variables and their relationship with success in an ADN program, the research around noncognitive variables is very sparse. Considering noncognitive factors and their relationship to academic success is supported by the literature (Ahammed, Abdullah, & Hassane, 2011; Duckworth, Peterson, Matthews, & Kelly, 2007; Komarraju & Nadler, 2013; Komarraju, Ramsey, & Rinella, 2013; Richardson, Abraham, & Bond, 2012; Vedel, 2014) as well as Bloom’s (1976) theory of school learning.



But, research involving noncognitive variables and nursing program success is very limited (Beauvais, Stewart, DeNisco, & Beauvais, 2014; Crouch, 2015; Olsen, 2017; Schmidt & MacWilliams, 2011). Recent research indicates that a combination of admissions criteria is more effective than any one single variable (Olsen, 2017; Schmidt & MacWilliams, 2011) and attention should be paid to both the cognitive and noncognitive domains (Crouch, 2015; Schmidt & MacWilliams, 2011), although the consideration of both cognitive and noncognitive factors in nursing admissions has only recently begun to garner attention (Crouch, 2015). Schmidt and MacWilliams (2011) speculated that early identification of motivational and psychological factors has the potential to decrease the number of unsuccessful students in ADN programs and should be explored further. This speculation is supported by Bloom's (1976) theory of school learning. While academic preparedness remains the most widely used and best documented predictor of academic achievement in nursing programs (Crouch, 2015; Cunningham, Manier, Anderson, & Sarnosky, 2014; Olsen, 2017), it is clearly not the only predictor, for cognitive measures alone fail to explain why there are differences in the performance of students with nearly identical cognitive admissions scores in nursing programs. More confounding is cognitive measures in isolation are unable to explain why students who are cognitively less prepared than their counterparts sometimes outperform their more cognitively (academically) prepared peers, or vice versa. Research involving both cognitive and noncognitive factors and their relationship to success of students in an ADN program is absolutely critical.

Student attrition and retention have been studied exhaustively for a number of years, and a handful of well-respected theories have emerged to explain these phenomena. Among those well respected theories are Tinto's (1975, 1988) institutional departure model, Bean and Metzner's (1985) nontraditional undergraduate student attrition model, and Astin's (1999)

student involvement theory, to name a few. In spite of a great deal of research that has been replicated across multiple institutions, student retention remains a significant issue, particularly in the nursing field (Knauss & Wilson, 2013; Olsen, 2017). Equally, despite a large and extensive body of literature surrounding retention, there are still many questions and a great deal that is not fully understood about the complexity and the interplay of forces around retention and attrition (Tinto, 1993).

This study focused on academic preparedness and motivation toward long-term goals in nursing education. Bloom's (1976) theory of school learning served as the theoretical framework for this study. Bloom's theory is comprised of three independent variables that each has a statistically significant relationship with the achievement of assigned learning outcomes. The first variable is cognitive entry behaviors. Bloom posited that students enter each new learning event with a history of previous learning experiences in that particular area; much of this prior learning will determine the success with the present learning. In explaining learning and the learner, Bloom placed a significant emphasis on the history of the learner. Bloom speculated that where there is great variation in prior learning experiences there is likely to be great variation in the achievement of the current learning outcomes.

The second variable in Bloom's theory is what he called affective entry characteristics. Bloom defined these entry characteristics as the degree to which students currently are or can be motivated to fully engage in the learning process. Although intelligence remains one of the best documented predictors of academic achievement (Duckworth et al., 2007), intelligence and prior learning in a particular area do not always lead to academic success. Intuitively, it is recognized that intelligence must be intermingled with other noncognitive attributes if a person is ever going to achieve difficult or long-term goals. Schmidt and MacWilliams (2011) speculated that early

identification of motivational and psychological factors could potentially decrease the number of unsuccessful students in nursing programs and should be explored. The final independent variable in Bloom's model was quality of instruction. Considering noncognitive factors that affect academic performance is fully supported by the literature (Beauvais et al., 2014; Crouch, 2015; Duckworth et al., 2007; Richardson et al., 2012), although the consideration of both cognitive and noncognitive factors in nursing admissions has only recently begun to garner attention (Crouch, 2015).

The impact and relevance of this research to society at large is significant and cannot be underestimated. First, the nursing field is facing critical long-term shortfalls in trained nurses (Jimenez, 2016; Juraschek et al., 2012) and these shortfalls will potentially reach "epic proportions" in the coming years (Juraschek et al., 2012, p. 248). Second, attrition from nursing programs wastes limited nursing educational and clinical resources that could otherwise help respond to the current shortfalls within the nursing industry (Ascend Learning, LLC, 2012; Chen & Voyles, 2013). Third, the majority of these programs are cohort based and when students fail to persist, seats are often left open in the program (Ascend Learning, LLC, 2012). Fourth, students who fail to complete nursing programs often acquire debt without completing the degree as the means to help pay back that debt (Manieri et al., 2015). Fifth, there is also a cost to the institutions in the form of lost tuition and fees, as well as future alumni contributions (Ascend Learning, LLC, 2012; Peterson-Graziose et al., 2013). Equally, for state supported schools, in states that have adopted performance based funding, persistence and degree completion are common components of those types of funding models and students failing to persist can cost the institution in future state funding (Florida Department of Education [FLDOE], 2017). There is also a cost to the taxpayers; it is estimated that each year \$240 million is expended in federal and

state grants and loans, to associate degree students who drop out prior to the second year (Peterson-Graziose et al., 2013). Finally, there are a number of potential costs to the individual nursing students who fail to complete the transition through the nursing pipeline. These include but are not limited to, increased stress, decrease in self-worth, and increased debt (Manieri et al., 2015; Urwin et al., 2010). The potential impact to society at large of this research cannot be overstated and could easily extend beyond nursing program admissions to include other programs that require moderate to high levels of persistence to achieve academic success.

### **Problem Statement**

In spite of a great deal of research around success in ADN programs, researchers have failed to produce a “best set” of admissions variables that identifies students likely to be successful in an ADN program (Schmidt & MacWilliams, 2011; Wambuguh et al., 2016; Wolkowitz & Kelly, 2010) or even an agreed upon best pre-nursing entrance examination (Manieri et al., 2015; Schmidt & MacWilliams, 2011). Most researchers agree that a combination of variables should be considered during the admissions process and that candidates should be ranked based on those variables (Manieri et al., 2015). However, researchers disagree as to which variables should be included in the admissions rubric (Manieri et al., 2015; Taylor et al., 2014).

In an attempt to identify students who are lacking the necessary skills to be successful in their institution’s nursing program, admissions departments have assigned point values in their admission rubrics to a number of different items, and ranked students based on their institutions admission rubric, which is an accepted best practice (Manieri et al., 2015). Beauvais et al. (2014) and Wolkowitz and Kelly (2010) reported the two most common criteria that nursing admissions committees review are standardized test scores (Chen & Voyles, 2013) and grade

point averages (Harris et al., 2014). Unfortunately, many different standardized tests scores are used by admissions committees including ACT scores (Olsen, 2017), SAT scores (Beauvais et al., 2014), Health Education Systems Inc A<sup>2</sup> (HESI A<sup>2</sup>) scores (Chen & Voyles, 2013; Manieri et al., 2015), Nursing Entrance Test (NET) scores (Chen & Voyles, 2013; Olsen, 2017), and Test of Essential Academic Skills (TEAS) scores (Luna, 2014; Manieri et al., 2015). To further complicate this particular issue, some admissions departments use one or more different component scores from one of these standardized tests, while others admissions committees use composite scores (Olsen, 2017; Wolkowitz & Kelly, 2010). The most common variable used by admissions departments is GPA (Schmidt & MacWilliams, 2011), but often programs use many different GPA calculations (Gale, Ooms, Grant, Paget, & Marks-Maran, 2016; Harris et al., 2014; Olsen, 2017; Wambuguh et al., 2016; Wolkowitz & Kelly, 2010).

While cognitive factors have historically carried much weight in admissions considerations, researchers have more recently begun to consider noncognitive and psychosocial factors and their relationship to academic success in nursing programs (Beauvais et al., 2014; Crouch, 2015). Crouch (2015) found a significant relationship between nursing grade point average in an ADN program and the Watson-Glaser Critical Thinking Appraisal (WGCTA) score. Crouch (2015) concluded that not only is critical thinking an absolute necessity for nurses and success in the nursing field; critical thinking, as measured on the WGCTA also has a significant statistical relationship with nursing program GPA. Khalaila (2015), in research involving BSN program students, found a statically significant relationship between intrinsic motivation, as measured with the Academic Self-Concept Scale (ASCS) and academic achievement. This same researcher also found a statistically significant relationship between academic self-concept and academic achievement (Khalaila, 2015). The researcher reported that

students who perceived themselves to be academically competent were more likely to be successful in the BSN program. It is important to note that this research was conducted with bachelor nursing program students who had already been admitted into the program.

Collins (2013), in research involving nurse anesthetists students and emotional intelligence (EI), as measured via the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), found several EI variables that were predictive of success on the national certificate examination (NCE). In conclusion, Collins speculated that EI could be used as an admissions criterion and had promise of being able to predict NCE scores. McLaughlin, Moutray, and Muldoon (2008), in their research involving first year nursing program students in the UK, found a statically significant relationship between occupational self-efficacy and student final grades in the nursing program using the short form revised Eysenck Personality Questionnaire (EPQ). The researchers also reported a statistically significant relationship between psychoticism scores on EPQ with those students who did not complete the nursing program (McLaughlin et al., 2008). Psychoticism is broadly defined by Eysenck as the third major dimension of personality (along with neuroticism and introversion-extraversion), and includes traits like aggression, apathy, and impulsiveness (Eysenck, 1992). This finding is noteworthy as impulsiveness is the antitheses of the pursuit of long term goals and highlights the finding that individuals who tend to be impulsive and apathetic are less likely to be successful in a nursing program.

These researchers have all acknowledged the linkage between noncognitive variables and academic success in the various nursing programs they were researching. Where they have all come up short, is where most research involving nursing program success has come up short. By focusing on a single domain, either cognitive or noncognitive, researchers are ignoring what is potentially a significant portion of the equation. These researchers focused their research in a

single domain (in their case noncognitive) while ignoring the other domain. Bloom (1976) outlined both the importance, and even the interaction of these two domains and research that ignores either domain is likely to produce confusing or even conflicting results.

Currently there is a substantial gap in the literature involving cognitive and noncognitive variables that indicate the likelihood of success in an ADN program. This lack of a “best set” of admissions variables (Schmidt & MacWilliams, 2011; Taylor et al., 2014) has resulted in institutions using wide variety of different models, most of which lack research based support (Schmidt & MacWilliams, 2011). In spite of a great deal of research involving success in an ADN program, no “best set” of variables have been developed that could endure under repeated research. The problem is prior research in this area has failed to consider both cognitive and noncognitive input variables, and their combined relationship, upon predicting success in an ADN program and has also failed to produce a “best set” of admissions criteria that may be applied at the point of admissions in ADN programs.

### **Purpose Statement**

The purpose of this nonexperimental, quantitative, ex post facto, correlational study was to identify both cognitive and noncognitive predictors of success in the first term of an ADN program. The researcher considered the following predictor variables; English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort. English language comprehension was measured by the HESI A<sup>2</sup> English language composite score, science comprehension was measured by the HESI A<sup>2</sup> science composite score, math comprehension was measured by the HESI A<sup>2</sup> mathematics score, and consistency of interests and perseverance of effort was measured by the Grit-S Scale composite score. The criterion variable is success in the first term of an ADN program

(successfully completing both first term classes with a grade of C or above). Jeffreys (2007) referred to this in the negative sense as first semester failure attrition. First term success or first term failure attrition is a common measurement of success used by a number of different researchers in the area of success in an ADN program (Bodman, 2012; Chen & Voyles, 2013; Hilke-Lampe, 2014; Knauss & Wilson, 2013; Luna, 2014). The participants in this research were the summer and fall 2017 ASN cohort students at a large state college in the southeastern region of the United States.

### **Significance of the Study**

There has been a great deal of research conducted around variables that are related to nursing program success (Schmidt & MacWilliams, 2011). Unfortunately, most of this research has been focused on BSN programs, even though the ASN pipeline remains the primary provider of prelicensure nursing graduates in the United States (Olsen, 2017). In the research that has focused on the ASN pipeline, disparities exist between how success was defined and the independent variables under study (Schmidt & MacWilliams, 2011). Also, in spite of numerous research studies that have been conducted in the areas of improving academic performance of nursing students, the findings from these studies have at times been confusing, and even worse, contradictory (Wambuguh et al., 2016) and have failed to produce a “best set” of admissions variables (Manieri et al., 2015; Schmidt & MacWilliams, 2011). This is possibly due to researcher’s reluctance to consider noncognitive factors, along with cognitive factors, when consider nursing program success (Beauvais et al., 2014). It is also possible that this reluctance has resulted in a lack of research based support for many admissions models that are being utilized at institutions of higher learning for admissions decisions (Schmidt & MacWilliams, 2011).



This study is significant in that it has added to the empirical knowledge related to predictors of success in an ADN program. In this research a statically significant admissions model is developed and presented that was able to predict those who were likely to be successful in the first term of an ADN program with a 94.1% degree of accuracy. This admissions model also accounts for 40% of the variance of success in the first term of an ADN program. There are few, if any, studies focused on cognitive and noncognitive predictors of success in the first term of an ADN program. This research helps illuminate this gap in research and provides clear recommendations for future research. This admissions model has the potential to decrease attrition in nursing programs and the associated benefits that reductions in attrition rates would bring to students, institutions, the nursing field, and local communities.

With double-digit nursing shortfalls predicted over the next decade (Bureau of Labor Statistics, 2015), the increasing number of citizens reaching retirement age (Harris et al., 2014), and faculty shortfalls that are hindering institution's ability to increase nursing program size (Chen & Voyles, 2013), the chance to reduce attrition in the ADN pipeline from its current level of approximately 47% (Harris et al., 2014) is critical for the medical industry, the nursing profession, and local communities. Also, when students attrite from nursing programs, finite institutional resources are wasted including faculty and support staff, tutoring and mentoring services, and limited clinical training sites (Wambuguh et al., 2016). There is also a cost to the institutions in the form of lost tuition and fees as well as future alumni contributions (Peterson-Graziose et al., 2013). Equally, for state supported schools, in states that have adopted performance based funding, persistence and degree completion are common components of those types of funding models and students failing to persist can cost the institution in future state funding. There is also a cost to the taxpayers; it is estimated that each year \$240 million is

expended in federal and state grants and loans, to associate degree students who drop out prior to the second year (Peterson-Graziose et al., 2013). Finally, there are a number of potential costs to the individual nursing students who fail to complete the transition through the nursing pipeline, these include but are not limited to, increased stress, decrease in self-worth, increased debt, and accumulation of courses that may not transfer to other academic programs (Ascend Learning, LLC, 2012).

The high attrition rates in our ASN pipelines and the associated costs to the nursing industry, communities, institutions, taxpayers, and most importantly individual students, demands researchers continue to focus their attention on determining a “best set” of admissions variables that can be applied at the point of program acceptance to determine those students who possess both the cognitive and noncognitive factors that indicate they are most likely to be successful in the nursing program. This research provides the first steps and a clear path to developing this best set of admissions variables.

### **Research Question**

**RQ1:** Can first-term success in an ADN program be predicted from a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first term nursing students?

### **Definitions**

1. *Attrition* - “Attrition refers to students dropping out of the nursing program” (Jeffreys, 2007, p. 408).
2. *Continuous program retention* - This “is the continuous enrollment in a nursing program (part- or full-time) by taking the required courses sequentially until meeting the program’s graduation requirements” (Jeffreys, 2007, p. 408).

3. *First semester failure attrition* – This refers “to attrition resulting from students failing the first nursing course who either do not apply for readmission or who apply for readmission but are not accepted” (Jeffreys, 2007, p. 408).
4. *Stopout* - This “refers to a break in continuous enrollment for one or more semesters (excluding summer sessions and intercessions)” (Jeffreys, 2007, p. 408).
5. *Withdrawal* - This “is when students officially withdraw from a college course or courses due to personal and/or academic reasons” (Jeffreys, 2007, p. 408).

## **CHAPTER TWO: LITERATURE REVIEW**

### **Overview**

The purpose of this study was to identify cognitive and noncognitive predictors of success in an ADN program. Once identified, these variables can then be used by nursing program administrators to help identify students, during the admissions phase, who are most likely to be successful during the first term of the program. This literature review first presents and outlines the theoretical framework that underpins this research. The literature review then presents the major theories and models in the areas of student retention, persistence, and attrition. The review then presents and synthesizes the literature regarding the current nursing shortages both from a workforce perspective and from a higher education perspective. This literature review then outlines current nursing admissions practices. It moves next to outline the research that has already been conducted in the area of identifying cognitive and noncognitive factors that are likely to indicate that a student will be successful in a nursing program. This literature review then moves on to highlight inconsistent, confusing, and even in some cases contradictory conclusions that have been reached and finally, it outlines and synthesizes research conducted around a noncognitive survey entitled the Grit-S Scale; describing how the Grit-S Scale may help better understand a component that is currently missing in most nursing program admissions variables.

### **Theoretical Framework**

This research focused on academic preparedness and motivation toward long term goals in nursing education. Bloom's (1976) theory of school learning served as the theoretical framework for this study. Bloom's theory is comprised of three independent variables that each have a statistically significant relationship with the achievement of assigned learning outcomes.

The first variable is what Bloom called cognitive entry behaviors. Bloom posited that students enter each new learning event with a history of previous learning experiences in that particular area; much of this prior learning will determine the nature of the student's interaction with the learning tasks at hand as well as the success with the present learning outcomes (Bloom, 1976). In explaining learning and the learner, Bloom placed a significant emphasis on the history of the learner. Bloom speculated that where there is great variation in prior learning there is likely to be great variation in the outcomes of the current instruction. Bloom concluded that cognitive entry behaviors account for roughly 50% of the variation in the achievement of any learning outcome or task (Bloom, 1976). The second variable in Bloom's theory is what he called affective entry characteristics. Bloom recognized that this variable is a complex mixture of interests, attitudes, and self-views. He defined these entry characteristics as the degree to which students currently are or can be motivated to fully engage in the learning process (Bloom, 1976). Bloom posited that affective entry characteristics are important in either determining or influencing the student's achievement with the assigned learning tasks or outcomes. He estimated that effective entry characteristics could account for up to one-fourth of the variance in the achievement of any learning outcome or task (Bloom, 1976).

The final independent variable in Bloom's model is quality of instruction. Bloom estimated that quality of instruction could account for up to 25% of the variance of achievement of learning outcomes or tasks. Although Bloom recognized the importance of quality of instruction, he was clear on the associated limitations. For example, Bloom did not believe that quality of instruction could overcome a lack in prerequisite cognitive entry behaviors, unless the instruction was directly related to remedying the underlying deficiencies. Bloom did believe that quality of instruction could improve affective entry characteristics although he noted that this

overcoming effect was inversely related to the number of past frustrating or negative experiences that the student had previously experienced with the particular learning task or learning outcome. Finally, Bloom's theory of school learning deals very briefly with intelligence; specifically, Bloom concluded that general intelligence may be used as a crude predictor of a variety of academic pursuits, but rarely does it account for more than 25% of the variance of acquisition of learning tasks or outcomes. Equally, when prior learning (cognitive entry behavior) is held constant the correlation between general intelligence and academic achievement is significantly reduced (Bloom, 1976). Bloom also understood the interaction of cognitive entry behaviors and their effect over time on affective entry characteristics, describing how both quantitative marks (grades) and qualitative appraisals affect how the student approaches the next learning task in that particular subject area (Bloom, 1977). As positive performance evaluations and perceptions in a particular area begin to accumulate, the student becomes more confident in their adequacy in that particular subject area and may even begin to develop a desire for additional tasks (Bloom, 1977). Inversely, as negative performance evaluations and perceptions accumulate, the student begins to develop a deepening sense of inadequacy in that particular topic. At this point, the student can begin to approach additional learning with a deep sense of insufficiency and even diminishing patience, perseverance, and interests in that particular topic (Bloom, 1977). Although Bloom described these input variables in isolation, he was well aware of the interaction between the three.

Bloom's (1976) theory of school learning provides a possible explanation as to why research around nursing admissions has failed to produce a best set of variables to help identify students who are most likely to persist through the first term and ultimately to degree completion in an ADN program, specifically most have failed to consider what Bloom (1976) referred to as

affective entry characteristics. Most nursing program admissions criteria focus only on the cognitive or academic domain and fail to account for those motivational and psychological factors that could account for the observed variance in academic success.

## **Related Literature**

### **Student Retention and Attrition**

Retention and attrition of college students has been studied extensively for the last fifty to sixty years; in fact, it is one of the most widely studied areas in higher education (Tinto, 2006-2007). Over this time period the research has developed and matured. As one would expect, simple theories have evolved and developed, while in other cases researchers have combined theories in an attempt to better explain retention and attrition, and in still other cases simple models have given way to much more complex, multi-dimensional theories and models. But more than just an extensive body of research, there are numerous books, an entire journal, and numerous conferences dedicated solely to the topic of student retention (Tinto, 2006-2007). Over the last fifty to sixty years researchers have put forth many different theoretical models in attempts to replicate the real world complexities that comprise student retention, and we now have a number of different models. In spite of the volumes of research and expended effort, real substantial nationwide gains in persistence and retention have been hard to come by.

Recent data from the National Student Clearinghouse Research Center illuminates the reality that over the past decade there has been very little change in first year retention and persistence. In their most recent Retention and Attrition Report, the National Student Clearinghouse reported on the fall 2015 cohort; in this report they reported that only 73.4% of students in the 2015 cohort persisted to the fall 2016. This is down .2% compared against the fall 2014 cohort (National Student Clearinghouse [NSC], 2017). It is important to note that

persistence rates vary sharply by ethnicity, age, and enrollment intensity. In spite of a great deal of research and effort being expended in the area of retention and attrition additional research in this area remains critical for a number of reasons including loss of revenue to the colleges or universities (Ascend Learning, LLC, 2012; Peterson-Graziose et al., 2013; Raisman, 2013), the inability to fill the vacant seat due to cohort based models (Ascend Learning, LLC, 2012), the potential for loss of performance based funding for state supported institutions (FLDOE, 2017), and the waste of limited educational resources when students attrite (Chen & Voyles, 2013). Equally, college graduates have higher earning potential than those who have completed only high school. Among those between the ages 25 to 32, the median annual earnings for college graduates is \$17,500 greater than for those who possess a high school diploma (Kurtzleben, 2014). Recent Census Bureau data reported workers 18 and older who had earned a bachelor's degree earned an average of \$51,206 a year compared to those 18 and older with only a high school diploma who earned an average of \$27,915 (Longley, 2017). Therefore retention remains extremely important to the student, institution, local community, and society at large.

Although researchers have looked at different components, it is universally agreed upon that the causes of attrition are varied and complex. There is no simple, one size fits all model to address retention and attrition. Equally, when researchers discuss retention, they are often discussing different elements of this complex construct (Hagedorn, 2006). Although colleges have been in existence since the 1600s, the first study on retention and attrition did not occur until the 1930s, with the bulk of research in this area all occurring within the last fifty to sixty years (Seidman, 2012). During this time there has been a massive amount of research conducted by a large number of researchers. In this plethora of research, there are researchers and associated research that stand out about above the rest and help us, at least in a philosophical



way, to develop a broad understanding of the issues and complexities related to student persistence and retention.

One of the first pioneers in research around student retention was Nevitt Sanford (1968). He found that college students go through considerable personal growth and development, a great deal of which is influenced by the college environment. This influence includes what goes on in the classroom as well as what occurs outside the classroom. He suggested that for growth and personal development to occur, a student needed to have a balance of challenge and support. From this research Sanford (1968) developed the challenge and support theory. According to this theory, too much support would result in the student failing to learn, grow, and develop as they should, while too much challenge would lead to a student becoming frustrated and potentially dropping out. A third element of this model was the element of readiness. Sanford also proposed that students cannot grow and mature until they are both physically and psychologically ready to grow. Although a very simplistic theory, this theory undergirds many of the modern day theories on retention and persistence.

Another pioneer in student retention research was William Spady (1970). He proposed one of the first widely recognized models for college student retention, the undergraduate dropout process. His model contained five independent variables (grade performance, normative congruence, friendship support, intellectual development, and social integration). These five variables were indirectly linked to the dependent variable: drop-out decisions through two intervening variables, satisfaction and institutional commitment (Spady, 1970). His model provided a theoretical rationale for considering both the academic and social systems of the college experience while simultaneously linking precollege experiences and attributes with later social and academic performance. Spady (1970) would later revise this model.

Vincent Tinto (1975, 1988) proposed the institutional departure model. Building on Spady's (1970) research and theoretical views of the undergraduate college student dropout process, Tinto (1975) developed the institutional departure model. This model is based primarily on Spady's views of the interaction between students with the academic and social systems at the college they are attending. In the institutional departure model Tinto argued that student's experiences are marked by stages of passage, this he found to be especially true in the first year of the student experience. He surmised that a student's persistence in or departure from an institution of higher learning was a reflection of that student's success in navigating the stages of incorporation into the community of the institution. He theorized that departure during the first year is directly correlated to how well the students navigated the passage into the new college community. Tinto (1975) also drew from Van Gennep's work in the field of social anthropology around rites of passage in tribal societies. Tinto saw in Van Gennep's research the broad outlines of a conceptual framework that could also explain the process of student departure during the student's first year at an institution of higher learning.

Tinto (1988) saw three stages of passage that student's must successfully navigate. The first was the separation stage. During the separation stage students must disassociate themselves, to varying degrees, from past memberships and communities. Tinto recognized that for some students this could be a very difficult and even stressful period. The second stage of student departure was transition into the college setting. This was the transitional period as students shifted from old associations to new associations, and from old norms and patterns of behavior to new norms and new patterns of behavior. Tinto saw this as the stage where the student needed to establish new personal bonds, while at the same time dissolving bonds that they had previously relied on. The third stage was the incorporation or integration into the college setting. In this

stage the student had dissolved bonds and left norms and rituals from an earlier life and needed to strengthen new bonds, develop new formal rights, rituals, and norms. Tinto (1988) pointed out that in most cases the students are often left to make their own way through this process and through what he referred to as the maze of institutional life. Tinto called for changes at the institutional level, for both policy and programmatic changes to aid students in navigating this complex institutional journey. He argued that these actions must be timely and far reaching to correct the key issues that lead to student departure. Tinto would make a number of revisions to this model.

Pascarella and Terenzini (1979, 1980) concurred with Spady (1970) and Tinto's (1975) models of the college dropout process. Pascarella and Terenzini (1979) recognized that persistence and withdrawal decisions are the result of a complex longitudinal process of associations between the student and both the academic and social systems at an institution of higher learning. They argued that the student arrives at the particular institution with background issues and characteristics, which can partially determine how the student is likely to relate to the individual institution's social and academic systems. What they sought to better understand was the interactive influence of the measures of social and academic integration with various student entrance characteristics in the prediction of voluntary persistence/withdrawal decisions (Pascarella & Terenzini, 1979, 1980). They also hoped to identify interactions between measures of social integration and measures of academic integration. The Pascarella and Terenzini (1979, 1980) student-faculty informal contact model statistically controlled for the following pre-enrollment student background characteristics; sex, race, initial program of enrollment, academic aptitude, high school achievement, number of high school extracurricular activities, expected number of informal contacts with faculty, parents combined annual income,

parent's combined formal education, student's highest expected academic degree, student's importance of graduating from college, rank of this university as college of choice, and pre-enrollment confidence in this institution as being the right decision. Their model was comprised of two primary dimensions; social and academic integration and goal and institutional commitment (Pascarella & Terenzini, 1980). These dimensions were measured by a 34 Likert item, five-response instrument.

Pascarella and Terenzini (1979) argued that persistence was a complex process and recognized that what happens during the freshman year appears to be more important than the commitments, background characteristics, aspirations, or attitudes which a student brings to college. Their research found that the important determinants of freshman persistence are much more related to institutional policies and programs that affect the student rather than the goals, dreams, prior academic achievement, and educational aspirations of the incoming freshman students. It is important to note that in their research the dependent variable was persistence. The researchers acknowledged that had the dependent variable been a combination of voluntary and non-voluntary (academic) withdrawal, it is likely that incoming student variables would have had a much greater influence on their final model (Pascarella & Terenzini, 1979). The researchers were involved in a great deal of research that highlighted the importance of student faculty interactions and in particular student faculty informal interactions and their positive impact on freshman student academic and social integration.

Bean and Metzner (1985) proposed the non-traditional undergraduate student attrition model, in which they proposed a completely different structure from Tinto. Rather than focusing on first time college students, they focused on non-traditional commuter students. Bean and Metzner (1985) described how prior models had placed a heavy emphasis on the role of social

integration within each academic institution as it relates to student retention and persistence; this factor had only a minimal impact on the non-traditional student. Their research indicated that the non-traditional student seemed to be affected primarily by environmental factors, like family commitments and other external responsibilities (Bean & Metzner, 1985). They argued that non-traditional (commuter) students lacked the social integration with the institution that was the central component of previous retention models and thus earlier models were unable to adequately explain attrition of students from a different theoretical perspective. Bean and Metzner's (1985) model of non-traditional undergraduate student attrition postulated that these students experienced a different environmental pressure that includes more interaction with external environmental factors and less interaction with members or activities of the academic institution. The conceptual framework of the model is based on four independent variables: academic performance, intent to leave, background, and important environmental variables like finance, working hours, outside encouragement, family responsibilities, and opportunity to transfer. According to this model, student attrition is most affected by the environmental variables (Bean & Metzner, 1985).

Cabrera, Nora, and Castaneda (1993) suggested a model that was an amalgamation of the work of Tinto (1975, 1988) and Bean and Metzner (1985) into what they called the student retention integration model. This model aimed at correcting shortcomings in both models by merging them into a single model. The student retention integration model was comprised of all the statistically established variables from both theories. The variables that were not validated in their analysis were excluded from their model and similar constructs from each model were merged into single constructs in the student retention integration model (Cabrera et al., 1993). Their research revealed that the integrated model that combined the Tinto and Bean models

provided a better explanation of the student attrition process. Cabrera et al.'s (1993) research revealed that the new model was more robust in the number of hypothesis that were validated and further it explained more of the variance in the persistence criterion. The researchers also found that the roles of organizational and environmental variables were channeled primarily through a student's intent to persist and that this finding was consistent with both theories. Their findings indicated that the integration of the two models provided a better explanation and understanding of student attrition, and statistical analysis confirmed that environmental variables have a much more complex role in the student retention equation that Tinto recognized.

Astin (1999), after more than 20 years of research, proposed the student involvement theory. In its simplest form the student involvement theory draws a clear and logical connection between various forms of student involvement and retention. Student involvement, according to Astin (1999), was composed of five postulates. The first postulate involved physical and psychological energy. Student involvement calls for the student to invest physical and psychological energy into various objects, which include both broadly general (the student experience) and highly specific (preparing for an examination) objects. Astin's (1999) second postulate was that, regardless of its object, involvement occurs along a continuum. He recognized that different students will manifest different degrees of involvement in given objects, and that involvement can vary by object, by student, and even by time with the same student. Astin's (1999) third postulate was involvement which had both quantitative and qualitative features. For example, a student's academic work can be measured quantitatively (how many hours a student spent studying for a particular examination) and qualitatively (how much of that time was spent daydreaming). His fourth postulate was that the amount of student learning and actual personal development associated with any educational program was directly

proportional to both the quality and quantity of student involvement in that program. Astin's fifth postulate was that the effectiveness of any educational policy or practice was directly related to the ability and capacity of that policy or practice to actually increase student involvement. Astin's (1999) student involvement theory called educators to pay less attention to what they do (teaching techniques, textbook selection, resource utilization) and more attention to what the student does (motivation and energy devoted to learning and the learning process).

Morrow and Ackermann (2012) conducted research to assess the importance of a student's motivation to succeed and their sense of belonging in predicting both the student's intention to persist and their actual retention from first year to second year. Their hypothesis was that both motivation and the student's sense of connectedness would positively correlate with the student's intended persistence, as well as their actual persistence, to their second year of college (Morrow & Ackermann, 2012). Four sense of belonging subscales were analyzed: peer support, faculty support, classroom comfort, and isolation. The results indicated that students who felt they were supported by faculty were more likely to indicate that they planned to continue enrolling. Five motivational subscales were studied: intrinsic value, instrumental value, personal development, external pressure, and no better option. Instrumental value (the student's perception that a college degree would assist them in obtaining a desirable job) showed a positive correlation with the student's intended persistence. Personal development (the feeling that college helped develop critical thinking skills) had a significant positive relationship with actual enrollment in the second year (Morrow & Ackermann, 2012). When all variables were analyzed together all the motivational variables remained significant predictors of the intention to persist, while none of the sense of belonging variables showed predictive value. This among

other research brought to light the possibility that motivation might be a more accurate noncognitive predictor of retention than a sense of belonging (Morrow & Ackermann, 2012).

Research involving student retention at institutions of higher learning, including the associated theoretical models has advantages, shortcomings, points of application, and limitations. One of the most well reported limitations involves applying the finding across different institutions, with different student demographics. Because most studies are conducted at a particular institution their findings are not easily generalized across multiple institutions of higher education. The research and associated models presented here have distinguished themselves by being able to be replicated at multiple higher education institutions.

### **Nursing Shortage**

Throughout the history of health care in the United States, there has been a cyclical pattern of nursing shortages (Snively, 2016). Since the 1990s the cyclical nature appears to have been replaced by a slowly increasing nursing deficit (Juraschek et al., 2012; Rosseter, 2017), and since the late 1990s, the demand for Registered Nurses (RN) has continued to outpace supply (Jimenez, 2016; Juraschek et al., 2012). The Bureau of Labor Statistics reported in 2014 there were 2,751,000 RNs employed across the United States. In this same report, the Bureau reported that they expect the demand for RNs to grow by 439,000 in the 10-year period between 2014 and 2024 (Bureau of Labor Statistics, 2015); this represents a (16%) increase in the labor market. In their research, Juraschek et al. (2012) described a much more dire scenario; they outlined the various models that have been used to forecast future nursing supply and expected demand, and all models indicate a nursing shortage somewhere between 300,000 to as high as 1,000,000 by 2020. A RN shortage that approaches 1,000,000 has the potential to severely weaken our health care system and negatively impact those currently employed in the nursing field. In their



research they describe how this expected RN shortage is occurring in all 50 states and the number of states receiving a grade of “D” or “F” for their particular state’s RN shortage will increase from five in 2009 to a projected 30 in 2030 (Juraschek et al., 2012). The states with the largest shortage of RNs in 2030 are projected to be California (shortage 193,100), Florida (shortage 128,364), and Texas (shortage 109,799); the states with the largest RN shortage to population (ratio) are projected to be New Mexico, Arizona, and Nevada (Juraschek et al., 2012).

There are a number of factors that are exacerbating an already serious situation as it relates to nursing shortfalls in the United States. First, as the economy continues to strengthen and recover from the recent recession, many nurses who had delayed retirement or had returned to work during the recession will likely reenter retirement (Olsen, 2017; Snavelly, 2016). Second, a large number of those currently serving in the nursing field are nearing retirement age (American Association of Colleges of Nursing, 2017; Harris et al., 2014; Olsen, 2017). The National Council of States Boards of Nursing (NCSB, 2015) in their National Nursing Workforce Study reported over 50% of nurses working in the field are currently over the age of 50. Third, nursing colleges are reporting significant faculty shortfalls in classroom, laboratory, and clinical settings. These shortfalls are hampering institutions of higher learning from attempting to increase the size of their nursing programs (Chen & Voyles, 2013; Peterson-Graziose et al., 2013; Snavelly, 2016). According to the American Association of Colleges of Nursing (AACN) many of the qualified candidates who were denied admissions, were denied due to faculty shortfalls within nursing colleges (American Association of Colleges of Nursing, 2017). Fourth, the number of citizens over the age of 65 continues to increase. This increasing population of older, retired citizens is placing additional demands on the health care field in general and the nursing field in particular (American Association of Colleges of Nursing, 2017;

Harris et al., 2014; Snavely, 2016). Lastly, the nursing field suffers from very high turnover and attrition rates (American Association of Colleges of Nursing, 2017; Snavely, 2016). Nursing is a field where employees are well paid and the job is very rewarding. But, the nursing field is also known for long hours, mandatory overtime, hard work, and high stress. These work conditions often lead to fatigue and burnout. An estimated 30 - 50% of new RNs will change positions or even leave the nursing profession altogether within the first three years of entering the field (MacKusick & Minick, 2010). In a qualitative study seeking to understand why nurses left clinical practice, three major themes emerged from the interviews. The first reason named by all participants in the research was an unfriendly workplace (MacKusick & Minick, 2010). The second most often mentioned reason was the emotional distress related to caring for patients (often with no support), and the third most often mentioned reason was fatigue and exhaustion (MacKusick & Minick, 2010). The nursing shortages are real and require immediate attention. The potential impact to health care in the United States could be extremely serious.

Institutions of higher learning have recognized the high demand for RNs and have responded. Nearly every institution of higher learning (public or private, profit or non-for-profit) offers some type of nursing program. These offerings include ASN and BSN, and many universities offer graduate-level nursing programs. Although interest in the nursing field remains high, applicant interest far exceeds institutions of higher education's ability to seat and train the nursing prospects (Peterson-Graziose et al., 2013; Schmidt & MacWilliams, 2011). Schools of Nursing of every type turn away qualified candidates who do not score high enough on that particular institution's admissions rubric for that particular admissions period. According to the National League for Nursing (NLN), roughly 85% of associate degree programs in the United States denied qualified applicants due to lack of available seats (Peterson-Graziose et al.,

2013). The AACN report on Enrollment and Graduations in Baccalaureate and Graduate programs in Nursing, reported that institutions of higher learning turned away 64,067 qualified applicants from their respective bachelor and graduate level nursing programs in 2016 (Rosseter, 2017). The number of nursing students denied entry at state and community colleges is currently unknown, but it is believed that the number is significant. At the state college where this researcher is employed, annually we turn away approximately 600 ASN applicants. If you multiply even a fraction of this number across the state and community colleges located within the United States, it provides a staggering number of interested applicants who are denied admission. Due to this large disparity between applicants and available seats in nursing programs, it is imperative for institutions of higher learning to do everything within their power to ensure they select for admissions only candidates who are likely to be successful in the first term, first year, persist through the program, and successfully complete the National Council Licensure Examination – Registered Nursing (NCLEX-RN). Some believe that due to current nursing shortfalls, scarce resources, lack of available program seats, and the abundance of qualified applicants, institutions of higher learning have a moral responsibility to do all that is within their power to only admit students who they believe will be successful in their nursing program (Rosenberg et al., 2007). The current shortfall, both in the United States and across the globe, of RNs has nothing to do with supply and much more to do with admissions criteria, available seating, limited resources, persistence, and completion.

In spite of an abundance of qualified applicants, nursing programs across the country are facing many challenges involving persistence, completion, and NCLEX-RN pass rates (Chen & Voyles, 2013; Harris et al., 2014; Olsen, 2017; Wambuguh et al., 2016; Wolkowitz & Kelly, 2010). The overwhelming majority of nursing schools (even most open access institutions)

employ prescreening techniques and/or admissions selection criteria in an attempt to admit only the most academically prepared students. In spite of significant prescreening and various forms of admissions criteria, student attrition rates in nursing programs across the United States remain high with approximately 20% to 42% of nursing students in the United States leaving the program by the end of the first year (Peterson-Graziose et al., 2013). According to Harris et al. (2014), average attrition rates in baccalaureate nursing programs are approximately 50%, with ADN programs experiencing similar attrition rates of approximately 47%. Harris et al. (2014) also reported that observed attrition rates in minority nursing student programs are even higher and have been observed as high as 85%. The nursing field is undergoing a prolonged shortage that has many confounding and exacerbating components both in the market-place, in the nursing field, and within higher education. If left uncorrected these factors could create a crisis in health care in general and in the nursing field in particular.

### **Nursing Program Admissions**

Over the past few decades a great deal of research has been conducted around academic success in general and, more specifically, academic success in nursing programs. The first observation from a literature review is that success has been defined in a number of different ways (Wambuguh et al., 2016). It has been defined as passing the first term, passing the first year, passing all coursework, achieving a certain programmatic GPA, and/or attaining a passing score on the NCLEX-RN (Wambuguh et al., 2016). For the sake of this research, nursing program success will be defined as success in the first term of the program (successfully completing both first term classes with a grade of C or above). Success in the first term of a nursing program is an extremely common metric that has been utilized in a large number of research studies (Bodman, 2012; Chen & Voyles, 2013; Hilke-Lampe, 2014; Knauss & Wilson,

2013; Luna, 2014). Jeffreys (2007) referred to failure at this point as first semester failure attrition.

In an attempt to identify students who are lacking the necessary skills to be successful in their institution's nursing program, admissions departments have assigned point values in their admission rubrics to a number of different items. Wolkowitz and Kelly (2010) reported the two most common criteria that nursing admissions committees review are standardized test scores (Chen & Voyles, 2013; Harris et al., 2014) and grade point averages (Chen & Voyles, 2013; Taylor et al., 2014). Unfortunately, many different standardized tests scores are used by admissions committees including; ACT scores (Olsen, 2017), SAT scores (Schmidt & MacWilliams, 2011), HESI-A<sup>2</sup> scores (Chen & Voyles, 2013; Manieri et al., 2015), NET scores (Chen & Voyles, 2013; Olsen, 2017), and TEAS scores (Hilke-Lampe, 2014; Luna, 2014). To further confound this particular issue, in some cases admissions departments use one or more different component or area scores of one of these standardized tests, while other admissions departments use composite scores. The most common variable used by admissions departments is GPA (Schmidt & MacWilliams, 2011), but often programs use different GPAs including; cumulative GPA, science coursework GPA (Wambuguh et al., 2016), GPA in anatomy and physiology I and II (Harris et al., 2014), mathematics GPA (Olsen, 2017), various pre-selected coursework GPA (Wolkowitz & Kelly, 2010), and senior year high school GPA (Gale et al., 2016). Other items that have been included in admissions decisions include interviews (Gale et al., 2016; Taylor et al., 2014), health care work experience (Wambuguh et al., 2016), degrees previously earned (Wambuguh et al., 2016), and written essays (Chen & Voyles, 2013). Not only are colleges and universities employing a large number of methods to attempt to determine the best candidates to admit into their nursing program, there is an obvious lack of a "best set" of

academic variables for admissions consideration. Equally, and more importantly, there is a lack of research based support for most selection methods that are being utilized at institutions of higher learning for admissions decisions involving their nursing programs (Schmidt & MacWilliams, 2011; Taylor et al., 2014).

### **Nursing Admissions Cognitive Variables**

There has been a great deal of research conducted by a large number of researchers focusing on a variety of nursing program cognitive admissions variables (Schmidt & MacWilliams, 2011). Unfortunately, most of this research has been focused on BSN programs in spite of the fact that the ASN pipeline remains the primary provider of prelicensure nursing graduates in the United States (Olsen, 2017). In the research, disparities exist between how success was defined and the independent variables under study (Schmidt & MacWilliams, 2011). Unfortunately, even when the same dependent and independent variables are used conflicting results are often obtained. In spite of numerous research studies conducted in the area of improving academic performance of nursing students, the findings from these studies have at times been confusing, and even worse, contradictory (Wambugh et al., 2016). In this section of the literature review this researcher will highlight some of the confusing and even conflicting research that has occurred in the area of cognitive admissions variables.

The second most common variable used in the admissions decisions are standardized examinations and there is a great deal of research to support the use of one of these instruments in the admissions process. Many institutions utilize the HESI A<sup>2</sup> as a variable of choice in nursing admissions decisions (Bodman, 2012; Chen & Voyles, 2013; Hilke-Lampe, 2014; Manieri et al., 2015). In recent research, HESI A2 scores were found to show statistical significance at predicting first term success in an ADN program, with the HESI A<sup>2</sup> score

explaining 15.9% of the variance of success in the program (Manieri et al., 2015). This research involving the HESI A<sup>2</sup> was based on a single cohort of students ( $n = 171$ ) (Manieri et al., 2015). Unfortunately, the researchers did not specifically mention which HESI A2 score was used in the research; although, it can be assumed that it was the composite score, it is not specifically stated, and there is no mention of the individual content area scores. Bodman (2012) found that HESI A<sup>2</sup> composite score, biology score, and chemistry score were positively correlated with passing Nursing-1 and Nursing-2 (the first term of coursework in the nursing program). HESI A2 reading comprehension and mathematics scores were found to be inconsistently significant across multiple cohorts. This research was based on three nursing cohorts ( $n = 253$ ). Knauss and Wilson (2013) reported similar findings in their research in which they were using four HESI component scores (mathematics, reading comprehension, vocabulary/general knowledge, and grammar) along with the HESI composite score. Their findings indicated a positive and highly significant correlation between HESI A<sup>2</sup> composite score and final course grades in Nursing-1 and Nursing-2 (the first two semesters in the nursing program). Specifically their research found as the HESI A<sup>2</sup> composite score increased, so did the final course grades for Nursing-1 and Nursing-2. Knauss and Wilson (2013) also found moderate, but still significant correlations between all HESI A<sup>2</sup> component scores under review and final grades in Nursing-1 and Nursing-2, this research was based on four nursing cohorts ( $n = 157$ ). Hilke-Lampe (2014) came to the exact opposite conclusion during her research involving the use of the HESI A<sup>2</sup>. Her research involved a single cohort of nursing students ( $n = 133$ ) where she concluded that there was no predictive value between the HESI A<sup>2</sup> composite score, reading comprehension score, mathematics score, language score, or vocabulary/general knowledge score with success in the first term of an ASN program. Hilke-Lampe's opening sentence of the results section of her

research summed up the findings: “The results from the logistic regression analysis conducted in this study did not support the importance of the Health Education Systems Incorporated (HESI A<sup>2</sup>) scores in determining nursing student success in passing the first semester classes” (Hilke-Lampe, 2014, p. 48). Although there is strong evidence to support the use of HESI A<sup>2</sup> as part of an admissions criteria, it is important to note that even this evidence has its detractors.

Many institutions use the TEAS as a variable in nursing admissions decisions. Luna (2014), in research using TEAS composite scores, preadmit anatomy and physiology grades, and prerequisite coursework GPA as independent variables and success in first-term nursing coursework as the dependent variable, found that none of the independent variables had a strong correlation with success in the first term while TEAS composite score and TEAS science score had moderate levels of correlation. Using multiple linear regression, the TEAS composite score proved to be the only statistically significant predictor of final course grades in the first term (Luna, 2014). This finding is in stark contrast to Newton and Moore (2009) who found that neither TEAS scores nor pre-nursing scholastic aptitude were predictive of nursing program attrition. In Manieri et al.’s (2015) research, they found that TEAS entrance examination scores did have a statistically significant relationship with predicting success in an associated degree nursing program; unfortunately, they also reported that final TEAS scores explained only 5.9% of the variance of success in the nursing program, while HESI A<sup>2</sup> scores explained 15.9% of the variance of success in the ADN program.

Some institutions are using NET scores as a variable in nursing admissions decisions. Research involving the use of the NET is not as common as the HESI A<sup>2</sup> or TEAS (Schmidt & MacWilliams, 2011). Sayles, Shelton, and Powell (2003) reported a statistically significant relationship between the NET composite score and success on the NCLEX-RN examination.



Czubatyj (2010) in her research reported that there was no statistically significant difference in graduation rates pre-NET when compared to graduation rates post-NET at the institution where she was conducted her research.

GPA in one form or another is the most common admissions variable, yet even with this variable the research is splintered and at times leads to different conclusions. To further confound this problem, programs often use different GPAs including; cumulative GPA, science coursework GPA (Wambuguh et al., 2016), GPA in anatomy and physiology I and II (Harris et al., 2014), mathematics GPA (Olsen, 2017), various pre-selected coursework GPA (Wolkowitz & Kelly, 2010), and even senior year high school GPA (Gale et al., 2016).

Beery (2014) in her research focused on identifying the relationship that exists between grades in preadmit anatomy and physiology I and II and the grades earned in beginning and advanced medical/surgical nursing courses as well as the relationship between preadmit anatomy and physiology I and II grades and overall grades in the nursing program. First, she found a statistically significant relationship between grades earned in anatomy and physiology I and II and grades earned in the advanced medical surgical nursing courses in the nursing program. Second, she found no statistically significant relationship between anatomy and physiology I and II grades when compared to final nursing program GPA or preadmit biology grades and nursing program GPA. Luna's (2014) research involved the TEAS, nursing preadmit GPA, and preadmit grades in anatomy and physiology I and II and she came to some slightly different conclusions. First, she found that preadmit GPA had no predictive value related to final course grades for the first semester in the nursing program. She also found that neither preadmit GPA nor preadmit anatomy and physiology I and II grades had a statically significant relationship to final course grades for the first semester nursing program. These findings are in line with Newton and

Moore's (2009) research where they reported pre-nursing scholastic aptitude was not predictive of nursing program attrition.

What continues to confound this issue is different researchers arriving at different conclusions. In spite of confusing and even conflicting data, researchers agree that there is strong evidence that supports the association between academic aptitude and success in a nursing program (Olsen, 2017). Research, as well as Bloom's (1976) theory of school learning, highlight the importance of cognitive measures that seek to measure prior learning experiences in the same areas as the expected learning outcomes in the nursing program. This is why entrance examination like the HESI, TEAS, and NET have become so popular. Research also acknowledges that items like standardized test scores, higher GPAs, and higher science grades should be given priority over other non-evidence supported options (Schmidt & MacWilliams, 2011). Finally, it is important to note that no cognitive instrument is currently recognized as the exclusive predictor of successful nursing program completion (Crouch, 2015).

Researchers believe that this confounding and often confusing evidence is suggesting that a combination of admissions criteria should be used in the admissions process and will ultimately be more effective than a single variable (Olsen, 2017; Schmidt & MacWilliams, 2011). Schmidt and MacWilliams (2011) provide two important recommendations. First, they recommend that researchers pay attention to both academic and nonacademic factors. This is an important recommendation, as the bulk of research in this area has been cognitive. Second, they note the early identification of motivational and psychological factors could possibly decrease the number of students who are unsuccessful and requires further exploration and research (Schmidt & MacWilliams, 2011).

### **Nursing Admissions Noncognitive Variables**

Although there is a dearth of research around cognitive entry variables for success in an ADN program, the research around noncognitive variables is very sparse. Considering noncognitive factors and their relationship to academic success is supported by the literature (Ahammed et al., 2011; Duckworth et al., 2007; Richardson et al., 2012) as well as Bloom's (1976) theory of school learning, but research involving noncognitive variables and nursing program success is very limited (Beauvais et al., 2014; Crouch, 2015; Olsen, 2017; Schmidt & MacWilliams, 2011). Recent research indicates that a combination of admissions criteria is more effective than any one single variable (Olsen, 2017; Schmidt & MacWilliams, 2011) and attention should be paid to both the cognitive and noncognitive domains (Schmidt & MacWilliams, 2011), although the consideration of both cognitive and noncognitive factors in nursing admissions has only recently begun to garner attention (Crouch, 2015). Schmidt and MacWilliams (2011) speculated that early identification of motivation and psychological factors has the potential to decrease the number of unsuccessful students in ADN programs and should be explored further. This speculation is supported by Bloom's (1976) theory of school learning. The limited amount of research conducted in the area of nursing program success and noncognitive variables appears to support this speculation, although not conclusively.

Beauvais et al. (2014) found that emotional intelligence was related to academic success in the graduate nursing program under review. These research findings were in line with Collins (2013) research around emotional intelligence and graduate nurse anesthetist students, where he found that emotional intelligence variables were predictive of academic success. Yet, Beauvais et al. (2014) found that emotional intelligence was not related to academic success in the ADN program-this was in spite of the exact opposite finding in graduate nursing program students. Crouch (2015) found a significant relationship between nursing grade point average in an ADN

program and the Watson-Glaser Critical Thinking Appraisal (WGCTA) score. Crouch concluded that not only is critical thinking an absolute necessity for nurses and success in the nursing field; critical thinking, as measured on the WGCTA also has a significant statistical relationship with nursing program GPA. Khalaila (2015), in research involving BSN students, found a statically significant relationship between intrinsic motivation, as measured with the Academic Self-Concept Scale (ASCS), and academic achievement. This same researcher also found a statistically significant relationship between academic self-concept and academic achievement (Khalaila, 2015). Students who perceived themselves to be academically competent were more likely to be successful in the program. It is important to note that this research was conducted with BSN students who had already been admitted into the program.

Collins (2013) conducted research involving nurse anesthetist students and emotional intelligence (EI) as measured via the MSCEIT and found several EI variables that were predictive of success on the national certificate examination scores. Collins speculated that EI could be used as an admissions criterion and had promise of being able to predict national certification examination scores. McLaughlin et al. (2008) in their research involving first year nursing program students in the UK found a statically significant relationship between occupational self-efficacy and student final grades in the nursing program. Using the short form revised EPQ they also found a statically significant relationship between psychoticism scores on EPQ with those students who did not complete the nursing program (McLaughlin et al., 2008). Psychoticism is broadly defined by Eysenck as the third major dimension of personality (along with neuroticism and introversion-extraversion), and high order psychoticism includes traits like aggression, apathy, and impulsiveness (Eysenck, 1992). This finding is noteworthy as impulsiveness is the antitheses of the consistent pursuit of long term goals and highlights the

finding that individuals who tend to be impulsive and apathetic are less likely to be successful in a nursing program.

While academic preparedness remains the most widely used and best documented predictor of academic achievement in nursing programs (Crouch, 2015; Cunningham et al., 2014; Olsen, 2017), it is clearly not the only predictor, for cognitive measures alone fail to explain why there is deviation in performance of students with nearly identical cognitive admissions scores in nursing programs. More confounding is cognitive measures in isolation are unable to explain why students who are cognitively less prepared than their counterparts sometimes outperform their more cognitively (academically) prepared peers.

### **The Grit Scale**

Intuitively, it is recognized that academic preparedness must be mingled with other noncognitive attributes if a person is ever going to achieve difficult or long-term goals. The Grit Scale is used to measure what the designers have entitled “grit.” The designers of the survey defined grit as “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087). The original Grit Scale was developed out of research by Duckworth et al. (2007) as they sought to answer the question: Why do some individuals, of similar intelligence, accomplish or achieve more than their peers? In their research they acknowledged the importance of intelligence in academic pursuits, but their interest was rooted in why individuals of similar intellectual make-up vary in their attainment of personal and professional goals. Their research attempted to link talent and achievement with practice evidence; this linkage was supported by Ericsson and Charness’s (1994) research into expert performers, where they concluded that the main thing that separates experts is both talent and sustained practice over long periods of time. With this research based concept of perseverance towards long term goals, the researchers attempted to

find an instrument that would be able to measure this perseverance. They reviewed several instruments, but failed to find one that met their criteria. In the absence of a valid instrument Duckworth et al. (2007) developed and subsequently validated the self-report questionnaire which they entitled the Grit Scale. The researchers began by developing a pool consisting of 27 items that they believed tapped into their overall construct of grit. They developed items that would be face valid for adults as well as adolescents. The researchers included items in the pool that drew on the capacity of an individual to sustain effort in the face of adversity. The researchers also recognized that some people sustain effort because they are afraid of change, compliance with the desires of others, or they are unaware of alternative possibilities, so the researchers also included several Grit Scale items about the consistency of interests over time. The researchers expected the Grit Scale to be associated with both conscientiousness and self-control from the Big Five traits theoretical model (Duckworth et al., 2007).

During the initial research and development phase, the Grit Scale was utilized in six different studies that honed and refined the items as well as verified validity and reliability across multiple groups with different attributes. In the first study the researchers conducted a cross sectional study designed to both develop and validate the instrument. This initial study consisted of a large number of adults aged 25 years and older. The broad range of participants also allowed the researchers to analyze if grit (perseverance towards long term goals) changed with age (Duckworth et al., 2007). In April of 2014 the researchers deployed a link to the Grit Scale on [www.authentic happiness.org](http://www.authentic happiness.org), inviting visitors to the site to participate in validating the Grit Scale. By October 2005, 1545 adults had completed the survey ( $M = 45$  years old; 73% women, 27% men). Following the collection of data the researchers considered item-total correlation redundancy, internal reliability measurements, and simplicity of language and eliminated 10

items. Of the remaining 17 items the researchers conducted an exploratory factor analysis on half of the observations, these were chosen at random ( $n = 772$ ). Following the analysis, the researchers retained 12 items. This resulted in six items aligning with consistency of interests and six items aligning with perseverance of effort. This finalized Grit Scale demonstrated a high internal consistency for the overall scale ( $\alpha = .85$ ). The internal consistency was also high both for consistency of interests, ( $\alpha = .84$ ) and perseverance of effort ( $\alpha = .78$ ) (Duckworth et al., 2007).

The second study was designed to determine if the relationships would hold when conscientiousness and other Big Five traits were controlled for. In this research 706 participants aged 25 years and older completed the survey that had been finalized in the first study (Duckworth et al., 2007). In this study the researchers found what they expected in relationship to the Big Five traits. The researchers observed that grit related to conscientiousness ( $r = .77, p < .001$ ) more than any other Big Five traits (Duckworth et al., 2007). The researchers also verified the incremental predictive validity of grit scale for education and age with all Big Five traits. Post hoc comparisons also indicated that those individuals who had completed only “some college” were lower in grit than individuals who had earned an associate’s or higher. They also determined that grit had an incremental predictive validity in relationship to the number of career changes a person had made over and beyond age, or any Big Five traits. They found that individuals whose score was one standard deviation or higher than the average in grit were 35% less likely to make frequent career changes (Duckworth et al., 2007).

Duckworth et al. (2007) developed their third study to test if grit was associated with cumulative GPA among students at an elite university. In this third study there were 139 participants (69% women, 31% men). The findings revealed that more gritty students

outperformed their less gritty counterparts with Grit Scale scores being associated with higher GPAs ( $r = .25, p < .01$ ); this relationship was found to be even stronger when SAT scores were held constant. An interesting and somewhat surprising finding was that grit scores were associated with lower SAT scores ( $r = -.20, p < .001$ ). This seems to suggest, at least at this elite level of undergraduates, that smarter students appear to be less gritty than their peers (Duckworth et al., 2007).

Study number four consisted of 1,218 of the 1,223 freshman cadets who entered West Point (Army Military Academy) in July 2014. West Point calculates a candidate score that is a weighted composite of high school rank: SAT score, Leadership Potential Scores, and a Physical Aptitude Examination. The Grit Scale score predicted completion of the difficult summer training program better than any other predictor (Duckworth et al., 2007). Incoming cadets who scored higher in grit than the average, by one standard deviation or more, were 60% more likely to complete the summer training program ( $\beta = .48, OR = 1.62, p < .001$ ) (Duckworth et al., 2007). It is worth noting that grit was not the best predictor of cumulative first-year GPA for those cadets who remained at West Point. These findings suggest that there is a difference between major and minor accomplishments and seems to indicate that grit may be the best predictor for successful completion of major accomplishments (Duckworth et al., 2007). The fifth study replicated study four and produced very similar results with the Grit Scale being the best predictor of success in the arduous summer training program (sometimes referred to as Beast Barracks) (Duckworth et al., 2007).

The sixth study was a longitudinal study that involved the finalists in the 2005 Scripps National Spelling Bee. This annual spelling bee involves thousands of students from many different countries. This research focused on the 273 finalists, of which 175 (64%) elected to



participate in the research by returning the signed child and parent consent forms along with a self-report questionnaire (Duckworth et al., 2007). In predicting advancement to the higher rounds, grit was the best predictor, with finalists with a grit scores one standard deviation above the mean being 41% more likely to advance to later rounds. When grit, self-control, and age were entered as predictors of final round achievement, only grit and age were significant predictors of attainment (Duckworth et al., 2007).

Across six studies, differences in an individual's grit accounted for significant variance in success outcomes beyond what was accounted for by IQ (Duckworth et al., 2007). Also, grit accounted for more variance in outcomes than any of the Big Five traits. In studies one and two it was found that attainment of higher degrees related to the student's grittiness. In studies four and five grit was a better predictor of summer term retention than any other measure available to the West Point admissions committee (Duckworth et al., 2007). In the sixth and final study, grittier spelling bee competitors of the same age ranked higher than their less gritty peers.

Subsequently, Duckworth and Quinn (2009) reexamined the validity of the original Grit Scale by performing item-level correlations from studies three through six in the original research. Duckworth and Quinn (2009) then eliminated two items (most frequently below the median in prediction) from each subscale, thereby reducing the Grit Scale instrument from 12 items to eight, but maintaining the two factor areas with four questions per factor. The researchers also established test-retest stability during their research as they administered the Grit-S to a subset of high achieving middle and high school students. Grit-S scores predicted GPA and remained stable year-over-year (Duckworth & Quinn, 2009).

Rojas, Reser, Usher, and Toland (2012) conducted research with 2,426 fourth through eight graders (50.1% male and 49.9% female) at four middle and three elementary schools in the

Southeastern region of the United States to determine if grit had any correlation with self-efficacy and self-regulation in mathematics and reading. The researchers concluded grit scores were positively related to self-efficacy and self-regulation in both mathematics and reading. The researchers also found grit scores correlated with other motivational measures, and that overall girls (at this age) scored higher in grit than their male peers (Rojas et al., 2012). Their research is significant in that it extended the predictive nature of grit to elementary and middle school students (Rojas et al., 2012).

Strayhorn (2014) conducted research to test the role that grit plays in explaining the academic success of Black male college students at four year, primarily white institutions. He found that participant's grades in college were moderately related to Grit-S scores in the positive direction. Strayhorn (2014) also found that Grit-S scores were positively related to high school grades and ACT scores of the participants. He concluded that grittier Black males earned higher grades in high school, higher scores on the ACT, and higher grades in college than their less gritty, same race, male peers. Strayhorn's (2014) research is significant in that it extended grit into both pre-collegiate assessments and collegiate grades.

The Grit-S Scale has been used in a number of other studies that have, to varying degrees, validated the original findings of the usefulness of the Grit-S Scale (Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014; Maddi, Matthews, Kelly, Villarreal, & White, 2012; Singh & Jha, 2008).

### **Summary**

In this literature review, the researcher has outlined the theoretical framework that underpins this research, Bloom's (1976) theory of school learning. This theory is comprised of three independent variables that each has a statistically significant relationship with the

achievement of assigned learning outcomes. The first variable is what Bloom called cognitive entry behaviors. Bloom posited that students enter each new learning event with a history of previous learning experiences in that particular area; much of this prior learning will determine the nature of the student's interaction with the learning tasks at hand as well as the success with the present learning outcomes (Bloom, 1976). The second variable in Bloom's theory is what he called affective entry characteristics. Bloom recognized that this variable is a complex mixture of interests, attitudes, and self-views. He defined these entry characteristics as the degree to which students currently are or can be motivated to fully engage in the learning process. Bloom posited affective entry characteristics are important in either determining or influencing the student's achievement with the assigned learning tasks or outcomes. The final independent variable in Bloom's model is quality of instruction. Bloom's (1976) theory of school learning provides a possible explanation as to why research around nursing admissions has failed to produce a best set of variables to help identify students who are most likely to persist through the first term and ultimately to degree completion in an ADN program, specifically most have failed to consider what Bloom called affective entry characteristics (1976). Most nursing program admissions criteria focus only on the cognitive or academic domain and fail to account for motivational and psychological factors that could account for the observed variance in success in the program.

Although there has been a great deal of research conducted by a large number of researchers focusing on a variety of nursing program cognitive admissions variables (Schmidt & MacWilliams, 2011), this research has failed to produce a "best set" of admissions criteria and, unfortunately, conflicting, confusing, and even contradictory results have been reported (Wambugh et al., 2016). This failure of researchers to produce a best set of admissions criteria

has resulted in colleges and universities employing a variety of different methods to determine the candidates that will be admitted; unfortunately, there is a lack of research-based support for most selection methods that are being utilized (Knauss & Wilson, 2013; Taylor et al., 2014) and the majority of these admissions models are based solely on the cognitive domain (Crouch, 2015).

This research pulled together into one admissions model a proven cognitive (academic) instrument and a proven noncognitive instrument (in this case, an instrument that measures consistency of interests and perseverance of effort). These instruments represent the areas that Bloom's (1976) theory of school learning indicates represent up to 75% of the variance in academic success of any learning outcome. It is quite possible that the failure of previous research to consider both cognitive entry behaviors and affective entry characteristics has resulted in the observed confusing, conflicting, and even contradictory findings (Wambuguh et al., 2016). Synthesizing these lines of research may help better understand what we have observed within nursing program admissions across the country involving student success and persistence. The applicability of this research could also go well beyond nursing admissions to all types of academic programs, in particular those that require medium to long term persistence and high levels of motivation for success.

Finally, the high attrition rates in our ASN pipelines and the associated costs to the nursing industry, communities, institutions, taxpayers, and, most importantly, individual students, demands researchers focus their attention on determining a best set of admissions variables that can be applied at the point of program acceptance to determine those students who possess both the cognitive and noncognitive factors that indicate they are most likely to be successful in an ADN program.

## CHAPTER THREE: METHODS

### Overview

Nursing admissions departments are struggling to identify students who are most likely to persist through the first term, first year, degree completion, and successfully complete the National Council Licensure Examination for Registered Nurses (NCLEX-RN). Although a great deal of research has been conducted in an attempt to identify these students, a “best set” of admissions criteria have not been identified (Schmidt & MacWilliams, 2011; Taylor et al., 2014). Most researchers agree that a combination of variables should be considered and candidates should be ranked based on those variables (Manieri et al., 2015) although researchers disagree as to which variables should be included in that calculation (Manieri et al., 2015; Taylor et al., 2014). Equally, very little research has been conducted in nursing admissions that takes into account noncognitive variables (Schmidt & MacWilliams, 2011). This lack of a best set of admissions criteria has led to nursing program admissions officers using a wide range of admissions criteria, many which lack any research based support (Taylor et al., 2014). The purpose of this non-experimental, correlational study was to examine the relationship between the predictor variables: English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort with the criterion variable (first term success in an ADN program). The Health Education Systems Inc A<sup>2</sup> (HESI A<sup>2</sup>) English language composite score was used to measure English language comprehension, the HESI A<sup>2</sup> science composite score was used to measure science comprehension, the HESI A<sup>2</sup> basic mathematics score was used to measure math comprehension, and the Grit-S Scale composite score was used to measure consistency of interests and perseverance of effort. In Chapter Three, this researcher will present a discussion on this study’s

design, the research question and null hypothesis, participants, setting for the research, the instruments that were used in the research, procedures for administration of both instruments, and research procedures. In the final section of Chapter Three, the researcher will outline data analysis including a discussion on the predictor variables and the criterion variable.

### **Design**

The research design that was utilized in this study was a quantitative, non-experimental, correlational design to examine the relationship between four input predictor variables and one criterion variable. Correlational research designs are used for two reasons, to explore the relationship between multiple variables and to predict scores on one output variable based on scores on other input variables (Gall, Gall, & Borg, 2007). In this study, a correlational design was used to examine the predictive relationship between three cognitive input predictor values: HESI A<sup>2</sup> English language composite score, science composite score, mathematics score: and one noncognitive predictor input variable, Grit-S Scale composite score with the criterion variable (first term success in an ADN program). The design for this study is appropriate, as this study explored the causal relationship between four predictor variables and one criterion variable (Gall et al., 2007; Warner, 2013). Because the outcome variable is dichotomous, binary logistic regression was the appropriate analysis to be performed (Warner, 2013, p. 340). Binary logistic regression was also appropriate in this research as it provides an overall model fit as well as the nature of the relationship between predictors (Warner, 2013, p. 1007). Binary logistic regression also requires less restrictive assumptions than linear regression, resulting in binary logistic regression being widely viewed as the most appropriate method of analysis in many research situations where the outcome variables are truly dichotomous (Warner, 2013, p. 1008); the linear regression model is simply inadequate when the outcome variable is dichotomous (Warner,

2013, p. 1010). Finally, this methodology has been utilized in previous studies involving nursing success (Knauss & Wilson, 2013; Manieri et al., 2015; Schmidt & MacWilliams, 2011).

The outcome (criterion) variable was success in the first term of an ADN program (passing all first term coursework with a grade of C or above). This is a very common variable in research involving nursing program success used by a number of different researchers (Bodman, 2012; Chen & Voyles, 2013; Hilke-Lampe, 2014; Knauss & Wilson, 2013; Luna, 2014). Jeffreys (2007) referred to failure at this point as first semester failure attrition.

The first predictor variable under consideration was English language comprehension which was measured by the HESI A<sup>2</sup> English language composite score. The HESI A<sup>2</sup> English language composite score is a composite of the reading comprehension, vocabulary and general knowledge, and grammar usage and mechanics scores (HESI Admissions Assessment, 2017). The second predictor variable that was under consideration was science comprehension which was measured by the HESI A<sup>2</sup> science composite score. The science composite score is a composite of the biology, anatomy and physiology, and chemistry scores (HESI Admissions Assessment, 2017). The third predictor variable under consideration was math comprehension which was measured by the HESI A<sup>2</sup> mathematics score. The fourth predictor variable was a combination of consistency of interests and perseverance of effort and was measured by the Grit-S Scale composite score (Duckworth & Quinn, 2009).

The HESI A<sup>2</sup> English language composite score is comprised of reading comprehension, vocabulary and general knowledge, and grammar scores (HESI Admissions Assessment, 2017). The reading comprehension section is designed to test reading comprehension, passage comprehension, identification of the main idea, as well as the meaning of words in context. The vocabulary and general knowledge section is designed to test the student's level of knowledge

with commonly used terms in the health career field and the grammar section is designed to test basic grammar, parts of speech, as well as common grammatical errors (HESI Exam Guide, 2017). The HESI A<sup>2</sup> science composite score is comprised of biology, chemistry, and anatomy and physiology (HESI Exam Guide, 2017). The biology section covers molecules, cells, cellular respiration, and metabolism; the anatomy and physiology section covers general terminology as well as anatomical structures and systems; and the chemistry section covers matter, chemical equations, reactions, periodical table and nuclear chemistry (HESI Exam Guide, 2017). The basic mathematics section covers addition, subtraction, multiplication, fractions, decimals, ratios and proportions (HESI Exam Guide, 2017).

### **Research Question**

**RQ1:** Can first term success in an ADN program be predicted from a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first term nursing students?

### **Null Hypothesis**

**H<sub>01</sub>:** There is no predictive relationship between first term success and a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first term nursing students.

### **Participants and Setting**

The participants in this archival study were the summer and fall 2017 ASN cohort students. The summer nursing cohort commenced coursework in May 2017 and the fall nursing cohort commenced coursework in August 2017. All students included in this research were new nursing students; no transfer or reinstated students (students who had previously failed the first



term and were reentering) were included in the sample population. This research methodology provided 188 participants. These participants were obtained via convenience sampling since the data is archived and readily available (Gall et al., 2007). An appropriate sample size as outlined by Warner (2013) is determined by the formula  $104 + k$  where  $k$  is the number of predictor variables. Tabachnick and Fidell (2013) asserted that the appropriate number of cases for testing multiple correlations is determined by the formula  $50 + 8m$  where  $m$  is the number of predictor variables. Gall et al. (2007) outlined the minimum population required for correlational studies for a medium effect size with statistical power of .7 at the .05 alpha level as 66. Therefore, a sample size of 188 students ( $N = 188$ ) was a sufficient sample size for binary logistic regression with four input variables.

The setting for this research was a public, not-for-profit, state college located in the southeastern region of the United States. This institution offers services through five campuses, two centers, and online. The institution is accredited through the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) and the ASN program is also accredited by the Accreditation Commission for Education in Nursing (ACEN). The unduplicated institutional headcount is approximately 50,600 students annually, 59.9% female, 40.1% male. Student ethnicity is self-reported during the admissions process at the institution and is currently as follows: African American 25.4%, Caucasian 48.9%, Hispanic 6.8%, two or more 2.2%, other minorities 4.4%, non-resident alien .8%, and not reported 11.5%. The nursing program at this institution is comprised of coursework, labs, and clinical rotations all of which are administered fully on-ground.

A demographic inspection of the sample revealed that the participants were 81.38% ( $n = 153$ ) female and 18.62% ( $n = 35$ ) male. The National League for Nursing (National League of

Nursing National Statistics, 2017) reported the demographic breakdown nationally for ADN students was 85% female and 15% male for the calendar year 2014. This sample is very similar to national statistics as it relates to the gender of students in an ADN program. An inspection of the ethnic breakdown of the sample revealed; African American 13.8% (n = 26), Caucasian 53.2% (n = 100), Hispanic 6.4% (n = 12), two or more 6.9% (n = 13), Asian 8.6% (n = 16), and not reported 11.2% (n = 21). The National League for Nursing (National League of Nursing National Statistics, 2017) reported the ethnic breakdown nationally for ADN students in the calendar year 2014 was; African American 12.2%, Caucasian 64.8%, Hispanic 8.1%, Asian or Pacific Islander 5.9%, American Indian 1.5%, other 7.5%. The demographic breakdown is similar, with the largest variance in Caucasian students. In the sample only 53.2% of students self-reported as Caucasian compared to the national average for Caucasian students of 64.8%. In the sample 11.2% did not identify ethnicity during the application phase; assuming that ethnically these break-down percentage wise, like the sample, then it can be estimated that an additional 10 students who did not self-identify are Caucasian. That would bring the sample to 58.3% Caucasian, still 6.5% below the national average for students in an ADN program.

## **Instrumentation**

### **Noncognitive Grit-S Scale**

Archival data was used for this research; included within the archival data were scores on two different instruments that were used in this study, one noncognitive (non-academic) instrument and the second a cognitive (academic) instrument. The noncognitive instrument that was used for this research was the Grit- S Scale. This instrument contains eight items, each rated on a five-point Likert scale from 1 (*not at all like me*) to 5 (*very much like me*). Questions 2, 3, and 7 are reversed scored. The maximum score attainable is 40 the minimum score attainable is

8. That score is then shifted to a 4.0 scale with a minimum score of 1.0 and maximum score of 4.0. The Grit-S Scale is untimed and takes approximately three to four minutes to complete.

The purpose of the Grit-S Scale is to measure two factors (*consistency of interests* and *perseverance of effort*), with four questions aligned to each factor. In this research only the Grit-S Scale composite score was used. See Appendix for the Grit-S Scale.

The designers of the survey defined grit as “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087). The original Grit Scale was developed out of research by Duckworth et al. as they sought to answer the question: Why do some individuals, of similar intelligence, accomplish or achieve more than their peers? In their research they acknowledged the importance of intelligence in academic pursuits, but their interest was rooted in why individuals of similar intellectual make-up, vary in their attainment of personal and professional goals. Their research was attempting to link talent and achievement with practice evidence, this linkage was supported by Ericsson and Charness’s (1994) research into expert performers, where they concluded that the main thing that separates experts is talent and sustained practice over long periods of time. With this research based concept of perseverance towards long term goals, the researchers attempted to find an instrument to measure this perseverance. They reviewed several instruments, but failed to find one that met their criteria. It was at that point that they decided to create an instrument. They expected the Grit Scale to be associated with both conscientiousness and self-control from the Big Five traits theoretical model (Duckworth et al., 2007).

During the initial research and development phase the Grit Scale was utilized in six different studies that honed and refined the items as well as verified validity and reliability across multiple groups with different attributes. The first study involving the Grit Scale commenced in

April of 2004 and involved administering the survey to 1,545 random participants aged 25 years and older ( $M = 45$  years: 73% women, 27% men) who participated in the survey located at [www.authentic happiness.org](http://www.authentic happiness.org), this study focused on educational attainment (Duckworth et al., 2007). This research resulted in a two factor solution for the survey (*consistency of interests* and *perseverance of effort*). The 12-item scale demonstrated high internal consistency ( $\alpha = .85$ ) for the overall score. In follow-on analysis, neither factor was consistently more predictive of outcomes than the two factors together (Duckworth et al., 2007). In the second study grit was associated with educational attainment and participant's age. The goal of this study was to determine if these relationships would hold when big five traits (neuroticism, extroversion, agreeableness, conscientiousness, and openness to experience) were controlled for (Duckworth et al., 2007). As expected, grit related the closest to the big five trait conscientiousness ( $r = .77, p < .001$ ). This research supported the incremental predictive validity of grit for education and age over conscientiousness.

Study three looked for an association with cumulative GPA among undergraduate level students at one of the top universities in the U.S., participants for this research were 139 students (69% women, 31% men) majoring in psychology with an average SAT score of 1415. In this study, students who exhibited grit outperformed their less gritty contemporaries. Grit scores were associated with higher GPAs ( $r = .25, p < .01$ ); when SAT scores were held constant, the relationship was even stronger ( $r = .34, p < .001$ ). The overall scale again demonstrated high internal consistency ( $\alpha = .82$ ) for the overall score (Duckworth et al., 2007). Study four involved new cadets in the United States Military Academy, West Point and their retention through the difficult summer training program. In spite of a very rigorous screening mechanism approximately one in 20 candidates attrite during this training program. To examine the

individual effects of grit, the big five (self-control), and other retention predictors, separate binary logistic regressions were conducted on each variable. Grit predicted completion of the difficult summer training program better than any other predictor including the whole student composite score that West Point uses for admissions criteria. Cadets who were a standard deviation or higher than average in grit were over 60% more likely to complete the summer training program ( $\beta = .48$ , OR = 1.62,  $p < .001$ ) (Duckworth et al., 2007).

Study five was very similar to study four and once again summer retention was predicted better by the Grit Scale than any other predictor variable. Using binary logistic regression, the Grit Scale was the best predictor of summer retention ( $\beta = .39$ , OR = 1.47,  $p < .03$ ). The 12 item scale demonstrated an internal consistency ( $\alpha = .79$ ) (Duckworth et al., 2007). Study six involved students participating in the 2005 Scripps National Spelling Bee. This competition normally draws thousands of children. Participants ranged in age from seven to 15 years old. An ordinal regression was conducted with attainment to the final round as the dependent variable; grit and age were found to be significant predictors. This indicated that same-aged finalists with grit scores one standard deviation higher than same-aged finalist were 41% more likely to advance to future rounds. Also when holding age constant, grit was the leading predictor of final round attainment. The 12 items scale demonstrated an internal consistency ( $\alpha = .80$ ) for the overall score (Duckworth et al., 2007).

Subsequently, Duckworth and Quinn (2009) reexamined the validity of the original Grit Scale, by performing item-level correlations from studies three through six in the original research. Duckworth and Quinn (2009) then eliminated two items (most frequently below the median in prediction) from each subscale, thereby reducing the Grit Scale instrument from 12 items to eight, but maintaining the two factor areas with four questions per factor. The

researchers also established test-retest stability during their research as they administered the Grit-S to a subset of high achieving middle and high school students. Grit-S scores predicted GPA and remained stable year-over-year (Duckworth & Quinn, 2009). The Grit-S Scale has been used in numerous studies that have, to varying degrees, validated the original findings of the usefulness of the Grit-S Scale (Eskreis-Winkler et al., 2014; Maddi et al., 2012; Strayhorn, 2014).

### **Cognitive Instrument HESI A<sup>2</sup>**

The cognitive instrument that was utilized in this study was the HESI A<sup>2</sup>. The HESI A<sup>2</sup> is an entrance assessment that is used at a number of different institutions for admissions into a variety of medical programs. The methodology used in the development of the critical thinking test items contained within the HESI A<sup>2</sup> is grounded in the Paul's critical thinking theory and Bloom's cognitive taxonomy (Morrison, Adamson, Nibert, & Hsia, 2008). The HESI A<sup>2</sup> is a computer-based examination that is comprised of seven sections; reading comprehension, vocabulary and general knowledge, grammar usage and mechanics, basic mathematics, biology, anatomy and physiology, and chemistry. The reading comprehension section contains 55 questions and is designed to test reading comprehension, passage comprehension, identification of the main idea, as well as the meaning of words in context. The vocabulary and general knowledge section contains 55 questions and is designed to test the student's level of knowledge with commonly used terms in the health career field. The grammar usage and mechanics section contains 55 questions and contains grammar, parts of speech, as well as common grammatical errors.

The basic mathematics section of the HESI A<sup>2</sup> contains 55 questions and tests addition, subtraction, multiplication, fractions, decimals, ratios and proportions. The biology section

contains 30 questions and covers molecules, cells, cellular respiration, and metabolism. The anatomy and physiology section contains 30 questions and covers general terminology as well as anatomical structures and systems. The chemistry section contains 30 questions and covers matter, chemical equations, reactions, periodical table and nuclear chemistry (HESI Admissions Assessment, 2017). Each of these seven sections contains five questions that are being piloted and are not scored, although it is impossible for the student to know which questions in each section are being piloted (HESI Admissions Assessment, 2017). There are also two additional surveys contained within the HESI A<sup>2</sup> assessment, a learning style survey comprised of 14 questions and a personality style survey comprised of 15 questions (HESI Exam Guide, 2017). The HESI scoring algorithm also produces three composite scores; an overall composite comprised of all subarea examinations, an English language composite score (comprised of reading comprehension, vocabulary and general knowledge, and grammar), and a science composite score (comprised of biology, chemistry, and anatomy and physiology) (HESI Admissions Assessment, 2017). The HESI has been used in a large number of peer reviewed studies involving both ASN and BSN admissions (Chen & Voyles, 2013; Knauss & Wilson, 2013; Manieri et al., 2015).

Elsevier, the company that owns the HESI A<sup>2</sup> offers a number of different examinations; the two most popular are the HESI A<sup>2</sup> used as an entrance assessment device for a number of different medical programs and the HESI E<sup>2</sup> used as an end-of-program exit examination for RN programs. Because the HESI E<sup>2</sup> is directly aligned with the RN certification examination, Elsevier has produced a number of content and validity reports for the E<sup>2</sup> examinations (Langford, 2013; Young & Wilson, 2012; Zweighaft, 2013). The HESI E<sup>2</sup> exit examinations have consistently exhibited an estimated reliability coefficient using the Kuder Richardson

Formula 20 (KR 20) with a range from 0.84 to 0.98 and a predictive accuracy of success on the NCLEX-RN that has consistently been greater than 90% (Langford, 2013; Young & Wilson, 2012; Zweighaft, 2013). Although Elsevier does not publish reliability or validity studies in relationship to the HESI A<sup>2</sup>, there have been a number of research studies that investigated the predictive validity of the A<sup>2</sup> examination. Manieri et al. (2015) and Chen and Voyles (2013) found that HESI A<sup>2</sup> scores correlated with final course grades in the first term nursing courses. Manieri et al. (2015) reported that the HESI A<sup>2</sup> score explained 15.9% of the variance of success in an ADN program. Knauss and Wilson (2013) conducted a retrospective study of ASN students, and found a positive, moderate, and highly significant correlation between the HESI A<sup>2</sup> overall composite score and grades in Nursing I and Nursing II (the first two semesters in the nursing program under review). Literature supported the use of the HESI A2 examination as a predictor of success in the first term of an ADN program.

## **Procedures**

### **Instrument Administration Procedures**

The HESI A<sup>2</sup> is administered in a secure testing environment at one of the college's Assessment and Certification Centers. The HESI A<sup>2</sup> is scored at the completion of the examination by a completely automated scoring algorithm and candidates leave the assessment environment with a complete breakdown of their examination, including scores on all composite examinations (overall, English language, and science) as well as all content area scores (reading comprehension, vocabulary and general knowledge, grammar usage and mechanics, basic math skills, biology, chemistry, and anatomy and physiology) (HESI Admissions Assessment, 2017). The student is also provided with their learning style as well as their personality style (both from the HESI A<sup>2</sup> examination score report). Upon completion of the examination the candidate's



scores are entered into the college's student information system (SIS) by Assessment and Certification Center staff. Students are provided two copies of their score report at the completion of the HESI A<sup>2</sup> administration. Prior to assessment administration, students are provided with detailed information about the assessment as well as the college's retest policy. The college currently allows two attempts of the HESI A<sup>2</sup> examination in a twelve month period and these attempts must be separated by 90 days or more. For admissions, the college uses the attempt with the highest score on the admissions rubric, but does not combine scores from different examination administrations. The total cost to take the HESI A<sup>2</sup> at the college is \$97.

The Grit-S Scale is administered during the nursing program orientation to students who have already been admitted into the program. These scores are entered into the college's admissions SharePoint site where all student admissions data for limited and selective admissions programs are maintained. Because the Grit-S Scale is a low stakes, face value survey, examination security protocols are not necessary. During ASN Orientation (which occurs following admissions) nursing students are provided with basic instructions for completing the self-report survey and subsequently complete the survey. The Grit-S Scale contains 8 items, each rated on a 5-point Likert scale from 1 (*not at all like me*) to 5 (*very much like me*). Questions 2, 3, and 7 are reversed scored. The maximum score attainable is 40 the minimum score attainable is eight. That score is then shifted to a 4.0 scale with a minimum score of 1.0 and maximum score of 4.0. The Grit-S Scale is untimed and takes approximately three to four minutes to complete.

### **Research Procedures**

Permission to collect data on nursing students was originally informally requested from the school of nursing. An email was sent to the Dean of Nursing outlining some of the concerns

that this researcher had observed in our institution's nursing program, particularly related to attrition and persistence. This researcher outlined how many of the challenges our institution is facing in this area are common to many institutions of higher learning. This email requested her support in moving forward to put together a research plan that would involve new nursing program students at our institution. The Dean of Nursing immediately emailed this researcher expressing similar concerns involving our program's retention and attrition, expressed her support in the research, and indicated she would be interested in reviewing the research once completed. Subsequently, permission was obtained from the college's Institutional Review Board (IRB) process (see Appendix C) with a modification made later to the initial request (see Appendix D). IRB approval was then sought and acquired from Liberty University (see Appendix E).

Following approval from Liberty University this researcher worked with the academic institution to collect the appropriate data. The data set provided by the institution included the ASN cohort that each student was a member of, student demographic data (gender and ethnicity), HESI A<sup>2</sup> scores, the Grit-S Scale score, and academic performance in the first term of the ASN program. Student confidentiality was maintained throughout the study as this researcher was provided with de-identified data from the participating institution. The data was pulled from the participating institution's SIS. All admissions, demographic, and academic data was provided in a Microsoft® Excel file and downloaded to a portable USB thumb drive. The data provided included 188 individual rows of de-identified student data. This data was then loaded from the USB thumb drive to this researcher's personal password protected Dell laptop. At no time was student identifiable data transferred to this researcher or this researcher's personal Dell laptop. The portable USB thumb drive was maintained in a locked file cabinet in this researcher's office

in the event that this initial raw data was ever required by the dissertation committee or chair. Data analysis, screening, random number assignment, and assignment of variable codes all occurred in Microsoft® Excel prior to loading data into the Statistical Package for the Social Sciences (SPSS) Version 23.0. This random number corresponding to the specific was maintained and used as the method of student identification when conducting analysis. This researcher will not disclose or publish actual personal or identifiable student data to ensure complete confidentiality and anonymity is maintained. These records do contain demographic data (gender and ethnicity), HESI A<sup>2</sup> English language composite score, science composite score, mathematics score, and Grit-S composite score, as well as all first term grades for students in the two nursing cohorts under review.

The data that had previously been transcribed into Microsoft Excel® format was imported into SPSS (Version 23.0). All digital data was maintained on the researcher's personal password-protected Dell laptop computer. When the data was discussed, no names or identifying components were divulged. Again, any personal or identifying factors were not published to maintain anonymity. At the completion of the research the digital data was maintained on the same portable USB memory thumb drive. At the end of a three-year period, following the completion of the research, the digital data will be deleted from the portable USB memory thumb drive and the USB memory thumb drive will be destroyed and disposed of in an appropriate manner. The statistical analysis that was used in this research is discussed in the next section.

### **Data Analysis**

The research method that this researcher employed in this research was binary logistic regression. There are assumptions that must be met for binary logistic regression to be an

appropriate research method. The first assumption is that the outcome variables are dichotomous; second, the outcome variables are statistically independent from each other; third, the model should not include any irrelevant predictors, and; fourth, the categories of the outcome variable are assumed to be exhaustive and mutually exclusive (Warner, 2013). These assumptions are all tenable. First, the outcome variable is truly dichotomous as a student cannot be in both groups at the same time; each student will either be scored as “1” successful in the first term or “0” not successful in the first term. Second, these scores are statistically independent of each other. Third, the model only includes relevant predictors. The HESI scores have been found (to varying degrees) to be valid predictors of nursing program success (Bodman, 2012; Chen & Voyles, 2013; Knauss & Wilson, 2013; Manieri et al., 2015). The Grit-S has not been used in nursing research, but has been used in other academic research where it proved to be a relevant predictor of success (Duckworth et al., 2007; Eskreis-Winkler et al., 2014; Maddi et al., 2012; Strayhorn, 2014). Fourth, the outcome variables are exhaustive and mutually exclusive, which is the case for success or failure in the first term, with success in the first term being defined as successfully completing both first term classes with a grade of C or above. The data was analyzed for normal distribution using the Kolmogorov-Smirnov, which is a test of normality of the null hypothesis to ensure that the sample distribution is not dissimilar to a normal distribution (Warner, 2013, p. 153). Descriptive statistics were calculated for gender and ethnicity using SPSS 23.0. The descriptive statistics include the frequency count for gender and ethnicity. Both gender and ethnicity were collected at the time the student applied to the college, were self-reported, and neither were required fields in the application process. Neither gender nor ethnicity were used in the logistic regression model.

### **Predictor Variables**

The first three predictor variables were all cognitive (academic) and were taken from the HESI A<sup>2</sup> examination and include the English language composite score (comprised of reading comprehension, vocabulary and general knowledge, and grammar usage and mechanics), the science composite score (comprised of biology, chemistry, and anatomy and physiology), and the basic mathematics score. The fourth and final predictor variable was the Grit-S Scale composite score (comprised of consistency of interests score and perseverance of effort score).

The HESI A<sup>2</sup> scoring algorithm also produces three composite scores: an overall composite score (comprised of all subareas), an English language composite score (comprised of reading comprehension, grammar, and vocabulary & knowledge), and a science composite score (comprised of biology, chemistry, and anatomy and physiology). All HESI A2 scores fall within a range of 0-100. The score for each subject area as well as the three composite scores are automatically calculated by Elsevier's proprietary software whenever an examinee completes the HESI A<sup>2</sup> examination. The fourth predictor variable is the Grit-S Scale score. The Grit-S Scale score is a combination of two factors: consistency of interests and perseverance of effort; this variable is on a 4.0 scale and falls between 1.0 to 4.0. This score was determined by taking the overall score and dividing that number by eight (the number of questions in the Grit-S Scale).

### **Criterion Variable**

The criterion variable was success in the first term of an associates degree nursing program; success was defined as successfully completing both first term classes with a grade of C or above. A dichotomous variable was coded as either a "0" for not successful during the first term of the program or a "1" indicating the student was successful in all coursework assigned during the first term of the program.

This researcher used binary logistic regression analysis to test the null hypothesis. Binary logistic regression is similar to linear regression in that the regression model may include several predictor variables, but it is different in that with binary logistic regression the output variable is dichotomous (Gall et al., 2007; Warner, 2013). Although binary logistic regression requires less restrictive assumptions than multiple linear regression or discriminant analysis (Warner, 2013) scatter plots were utilized to compare for outliers in predictor variables (Warner, 2013). The Wald statistic (null hypothesis) and estimated change in odds are reported along with a 95% confidence interval (Warner, 2013). For overall model fit, Nagelkerke's  $R^2$  was examined and reported to assess the percent of variance in the outcome variable that is explained by the input variables (Warner, 2013). The Hosmer and Lemeshow Test was reported which provides a goodness-of-fit measure (Warner, 2013). The overall model significance was reported using the  $\chi^2$  omnibus test of model coefficients, a significance of less than 0.05 indicates the overall model is statistically significant (Warner, 2013). Beta coefficients are also reported to facilitate the conversion of the model into a workable admissions formula. Odds ratios were calculated and reported to determine the chance that each of the predictor variables had on predicting the outcome methodology (Warner, 2013).

## CHAPTER FOUR: FINDINGS

### Overview

The purpose of this nonexperimental, quantitative, ex post facto, correlational study was to identify both cognitive and noncognitive predictors of success in the first term of an ADN program. The analysis examined 188 students who were assigned to two different ASN cohorts at a large state college in the southeastern region of the United States. The researcher considered the following predictor variables: English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort. The criterion variable used in this research was success in the first term of an ADN program (successfully completing both first term classes with a grade of C or above).

In Chapter Four, the researcher presents descriptive statistics to supplement the broader narrative. The researcher outlines the data screening procedures that were utilized in this research. The assumptions for logistic regression analysis are outlined and discussed. This researcher then presents the null hypothesis, including logistic regression results as well as Cox and Snell and Nagelkerke's pseudo  $R^2$  values. Hosmer and Lemeshow's goodness of model fit were also calculated and reported. The researcher examined the Wald statistic to assess the unique statistical significance of each predictor value. Odds ratios were used to interpret the outcome of each variable in the model. Lastly, the researcher reports a regression model based on the findings of the binary logistic regression.

### Research Question

**RQ1:** Can first term success in an ADN program be predicted from a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first term nursing students?

### Null Hypothesis

**H<sub>01</sub>:** There is no predictive relationship between first term success and a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first term nursing students.

### Descriptive Statistics

The sample included 188 participants; the break-down of participants by gender and ethnicity is outlined in Table 1.

Table 1

*Descriptive Statistics for Participants (N = 188) in Research*

	<i>n</i>	%
ASN Cohort		
Summer 2017	90	47.78
Fall 2017	98	52.13
Gender		
Female	153	81.38
Male	35	18.62
Ethnicity		
Caucasian	100	53.19
African American	26	13.83
Asian	16	8.61
Multi-racial	13	6.91
Hispanic	12	6.38
No reported	21	11.17

The sample included 188 students; 90 students were assigned to the ASN cohort that commenced coursework in the summer of 2017 and 98 students were assigned to the ASN cohort that commenced coursework in the fall of 2017. There were 153 female students in the sample and 35 male students. There were 100 students who self identified as Caucasian, 26 students



who self identified as African American, 16 students who self identified as Asian, 13 students who self identified as multi-racial, 12 students who self identified as Hispanic, and 21 students who did not disclose ethnicity at the time of application.

Data were analyzed for the outcome (criterion) variable, success in the first term of an ADN program (passing all coursework with a grade of C or above), and the results can be viewed in Table 2.

Table 2

*Descriptive Statistics for Criterion and Predictor Variables*

Variable		
Success in first term	<i>n</i>	%
Passed	173	92.0
Failed	15	8.0
Scores	M	SD
English	86.54	6.574
Science	77.78	10.129
Mathematics	87.12	10.005
Grit	4.18	.419

*Notes.* English = HESI A<sup>2</sup> English Composite Score, Science = HESI A<sup>2</sup> Science Composite Score, Mathematics = HESI A<sup>2</sup> Basic Mathematics Score, Grit = Grit-S Scale Score.

There were 15 students who were not successful in their first term coursework. Five of the 15 students were unsuccessful in the first (seven-week) first-term course NUR1020C, nine were not successful in the second (7 week) first-term course NUR1023C, and one was unsuccessful in both courses. The mean HESI A<sup>2</sup> English language composite score was 86.54 with a standard deviation of 6.574. There were 101 students who scored at or above the mean and 87 students who scored below the mean. The mean HESI A<sup>2</sup> science composite score was 77.78 with a standard deviation of 10.129. There were 100 students who scored at or above the

mean and 88 students who scored below the mean. The mean HESI A<sup>2</sup> mathematics score was 87.12 with a standard deviation of 10.005. There were 116 students who scored at or above the mean and 72 students who scored below the mean. There were 56 students in the sample who scored at or above the mean in all three cognitive areas: HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, and HESI A<sup>2</sup> mathematics score, while there were 37 students who scored below the mean on all three cognitive areas. The mean Grit-S Scale score was 4.18 with a standard deviation of .419. There were 98 students scoring at or above the mean and 90 students scoring below the mean. There were 36 students who scored greater than one standard deviation above the mean Grit-S Scale score.

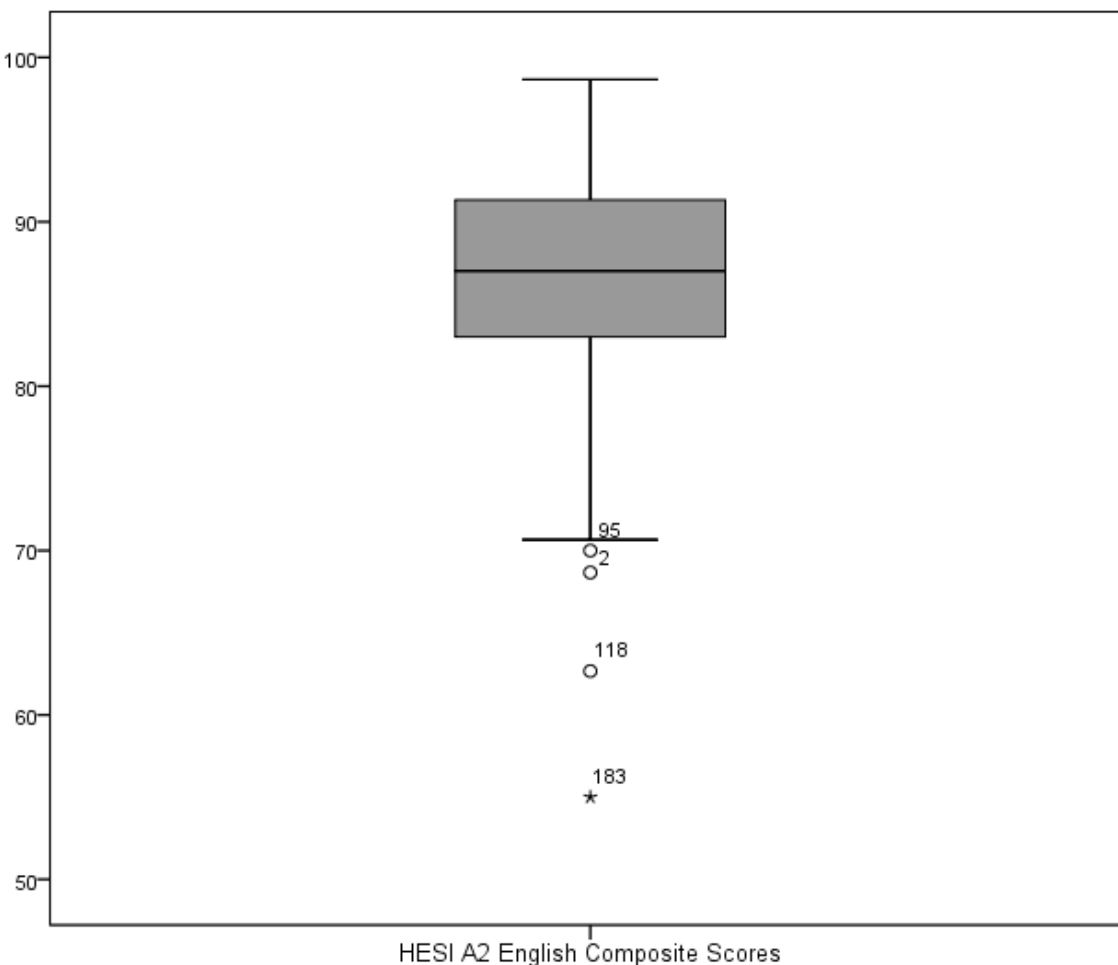
## **Results**

### **Data Screening**

This researcher conducted data screening on each of the predictor variables (HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, HESI A<sup>2</sup> mathematics score, and Grit-S Scale score) to review for any data inconsistencies. This was accomplished by sorting the data by each variable and examining for inconsistencies including missing, excessively high or excessively low scores. A few missing scores were identified and this researcher worked with the state college to retrieve those missing scores. After the missing scores were retrieved, all scores were found to fit within the expected ranges.

All categorical variables had been previously coded in Excel for use in SPSS. Pass or fail for the first term was coded as 0 – fail, 1 – pass. The ASN cohort start term was coded 0 = summer 2017, 1 = fall 2017. The student gender variable was coded as 0 – male, 1 – female. The student ethnicity variable was coded as 0 – Caucasian, 1 – African American, 2 – Asian, 3 – multi-racial, 4 – Hispanic, 5 – not reported.

Next, the researcher conducted scatterplots for all four input variables to analyze for extreme outliers in any one of the four input variables. Visually, there were outliers in each of the scatterplots, although visually none of the outliers appeared to be extreme. Because the evidence that no extreme outliers existed was inconclusive, the researcher conducted box plots for each of the input variables using SPSS. Analysis of the box plot for English language composite scores indicated there were three outlier scores and one extreme outlier (student number 183). See Figure 1.



*Figure 1.* Box plot of HESI A<sup>2</sup> English language composite scores. The circles with the case numbers indicate the student record where the HESI A<sup>2</sup> English language composite score was an outlier. The star with the case number indicates that the HESI A<sup>2</sup> English language composite score was an extreme outlier for student 183. In all cases these were low outliers.

Next this researcher analyzed the box plot for HESI A<sup>2</sup> science composite scores, this analysis indicated there were two outlier scores and no extreme outliers. See Figure 2.

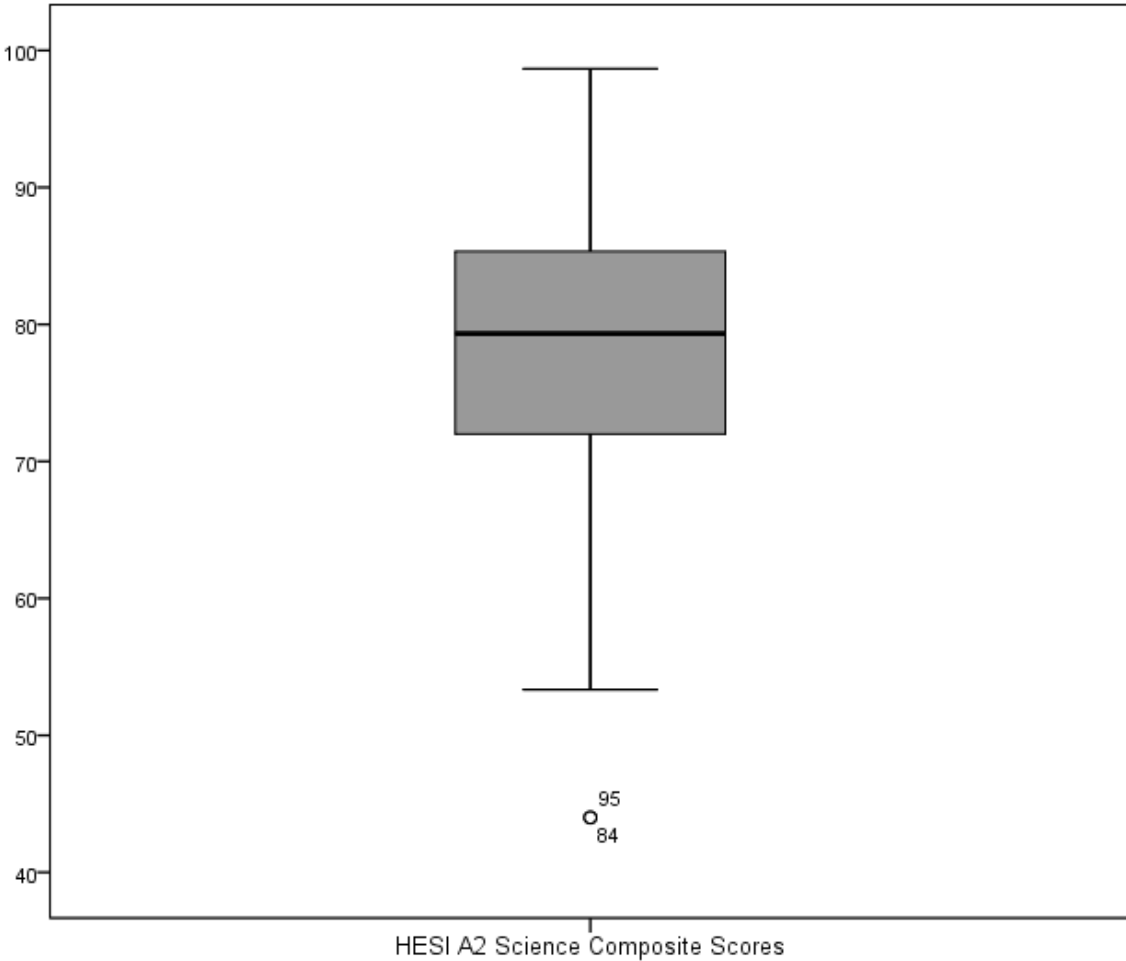


Figure 2. Box plot for of HESI A<sup>2</sup> science composite scores. The circles with the case numbers indicate the student record where the HESI A<sup>2</sup> science composite score was an outlier. In both cases these were low outliers.

Next this researcher analyzed the box plot of the HESI A2 basic mathematics scores.

This analysis indicated that there were nine outlier scores and no extreme outliers. See Figure 3.

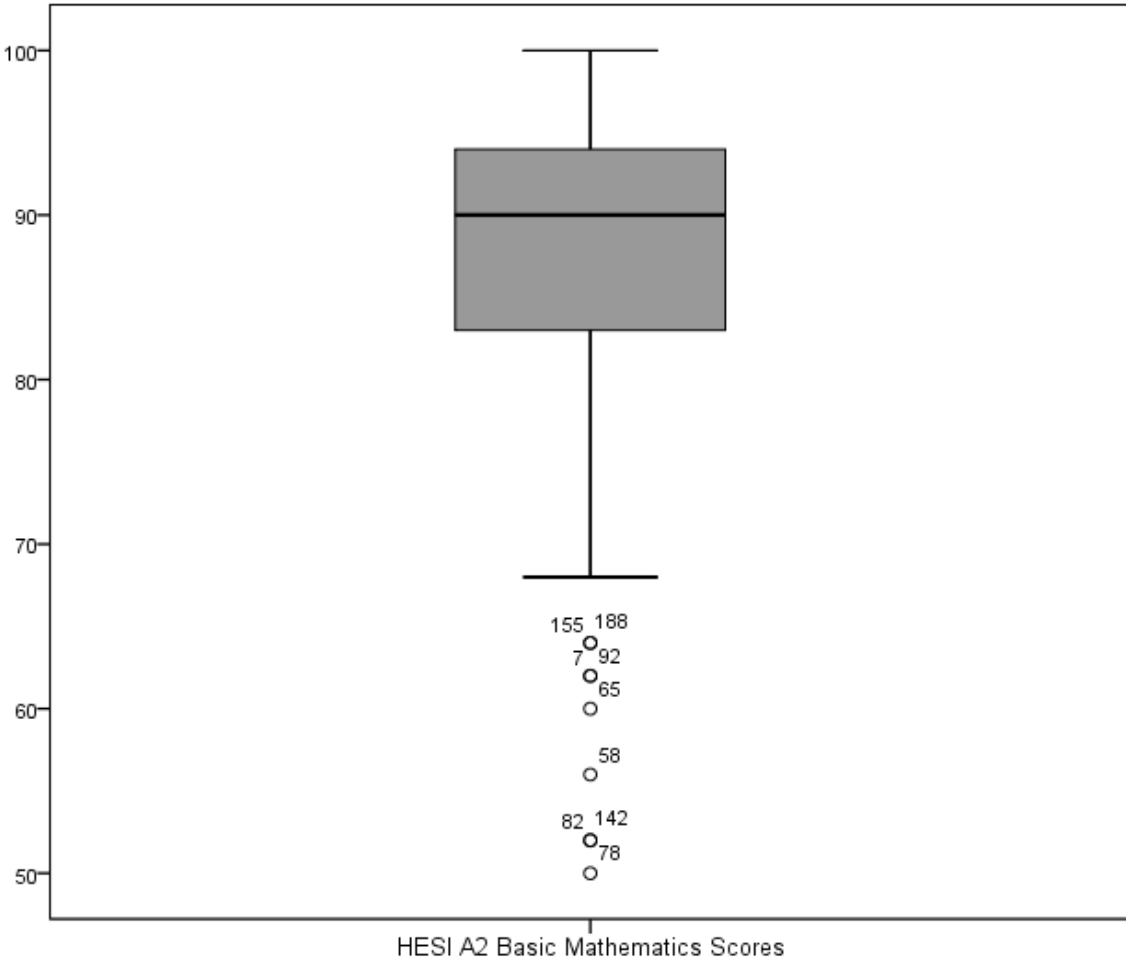
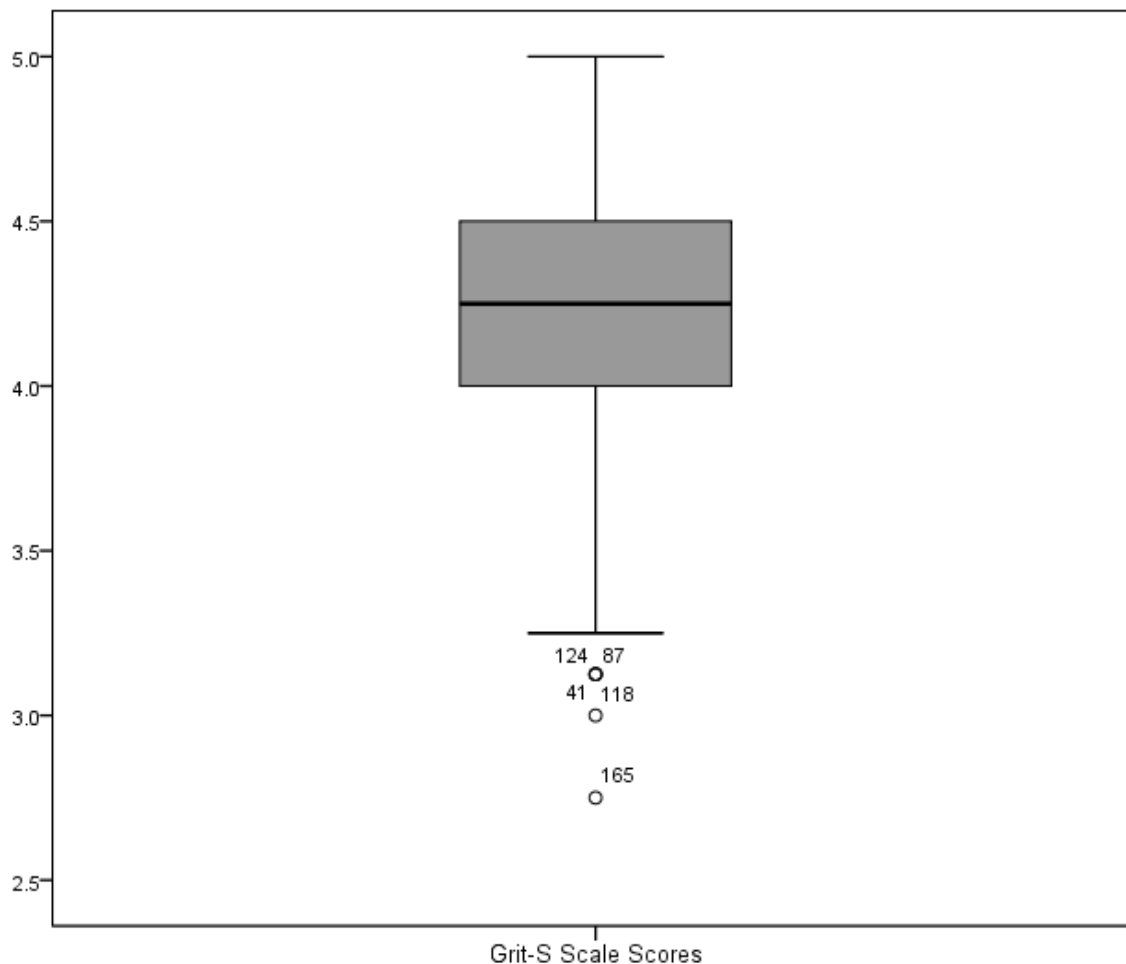


Figure 3. Box plot of HESI A2 basic mathematics scores. The circles with the case numbers indicate the student record where the HESI A2 basic mathematics scores was an outlier. In all nine cases these were low outliers.

Next, this researcher analyzed the box plot of the Grit-S Scale Scores. The analysis of the Grit-S Scale scores indicated that there were five scores that were outliers and no scores that were extreme outliers. See Figure 4.



*Figure 4.* Box plot of Grit-S Scale Scores. The circles with the case numbers indicate the student record where the Grit-S Scale score was an outlier. In all five cases these were low outliers.

After verifying the data was correct from the initial dataset for all outliers and the single extreme outlier, the researcher decided to maintain student #183 in the sample. The rationale for this decision is discussed in the prior chapter explaining assumption testing and data screening for binary logistic regression.

### **Data Analysis**

Data was analyzed for normal distribution using the Kolmogorov-Smirnov, which is a test of normality of the null hypothesis to verify that the sample distribution is not dissimilar to a normal distribution. The expected result is greater than .05 for all four input variables indicating that the null hypothesis should be rejected and that the values are normally distributed. This

researcher analyzed each of the predictor variables for normal distribution utilizing the Kolmogorov-Smirnov, and the results for all four input variables are outlined in Table 3. First, this investigator analyzed the predictor variable HESI A<sup>2</sup> English language composite score using the Kolmogorov-Smirnov which was found to be statistically significant  $D(188) = .108, p < .05$ . Next, this researcher analyzed the predictor variable HESI A<sup>2</sup> science composite score using the Kolmogorov-Smirnov which was found to be statistically significant  $D(188) = .089, p < .05$ . This researcher also analyzed the predictor variable HESI A<sup>2</sup> math score using the Kolmogorov-Smirnov which was also found to be statistically significant  $D(188) = .156, p < .05$ . Finally, this researcher analyzed the predictor variable Grit-S Scale score using the Kolmogorov-Smirnov which was also found to be statistically significant  $D(188) = .117, p < .05$ . The null hypothesis was rejected for all four distribution curves indicating that none of the distribution curves for the input variables were normally distributed.

Table 3

*Kolmogorov-Smirnov Tests of Normality of Predictor Variables*

Variables	D	df	p
English Comp	.108	188	.000
Science Comp	.089	188	.001
Mathematics	.156	188	.000
Grit	.117	188	.000

This researcher then conducted additional analysis on the distribution of the input variables. This researcher analyzed skewness, kurtosis, and the histograms for all four input variables. The statistical results of skewness and kurtosis are outlined in Table 4.

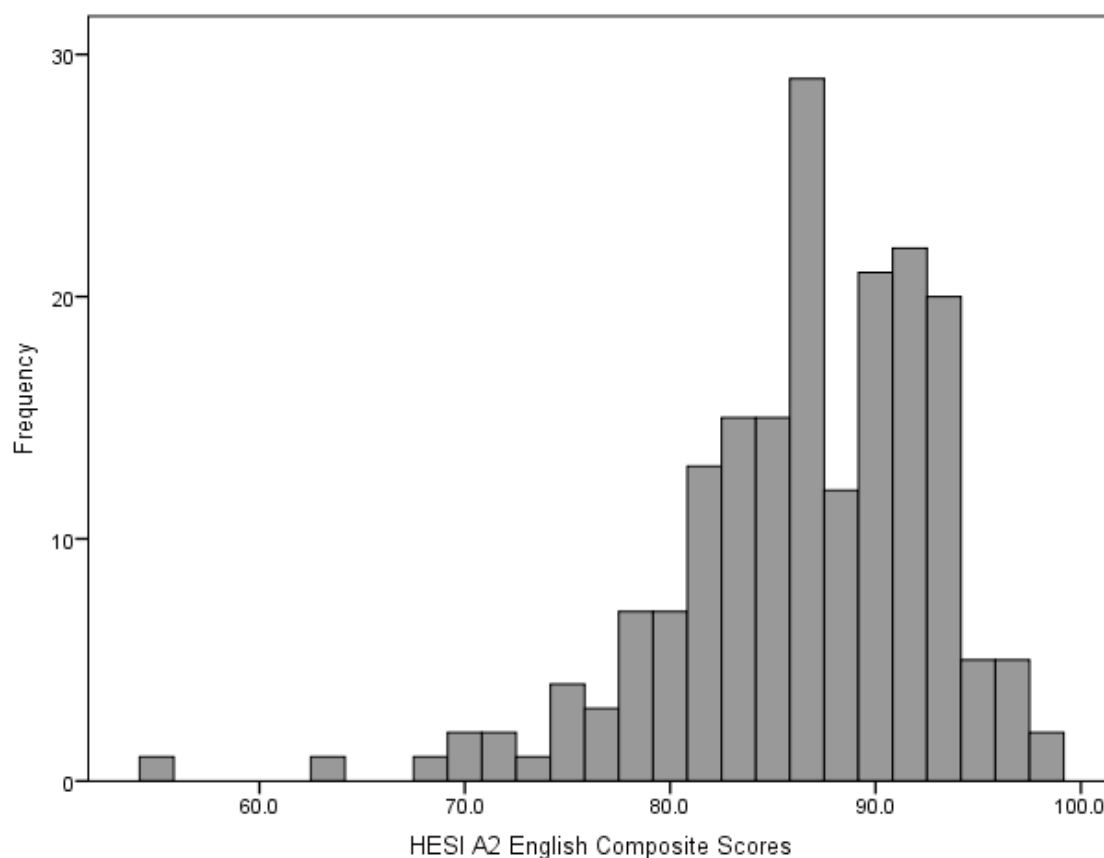
Table 4

*Analysis for Normal Distribution of Predictor Variables*

Variable	Skewness	Kurtosis
English Comp	-1.216	2.941
Science Comp	-.644	.440
Mathematics	-1.403	2.121
Grit	-.720	.356

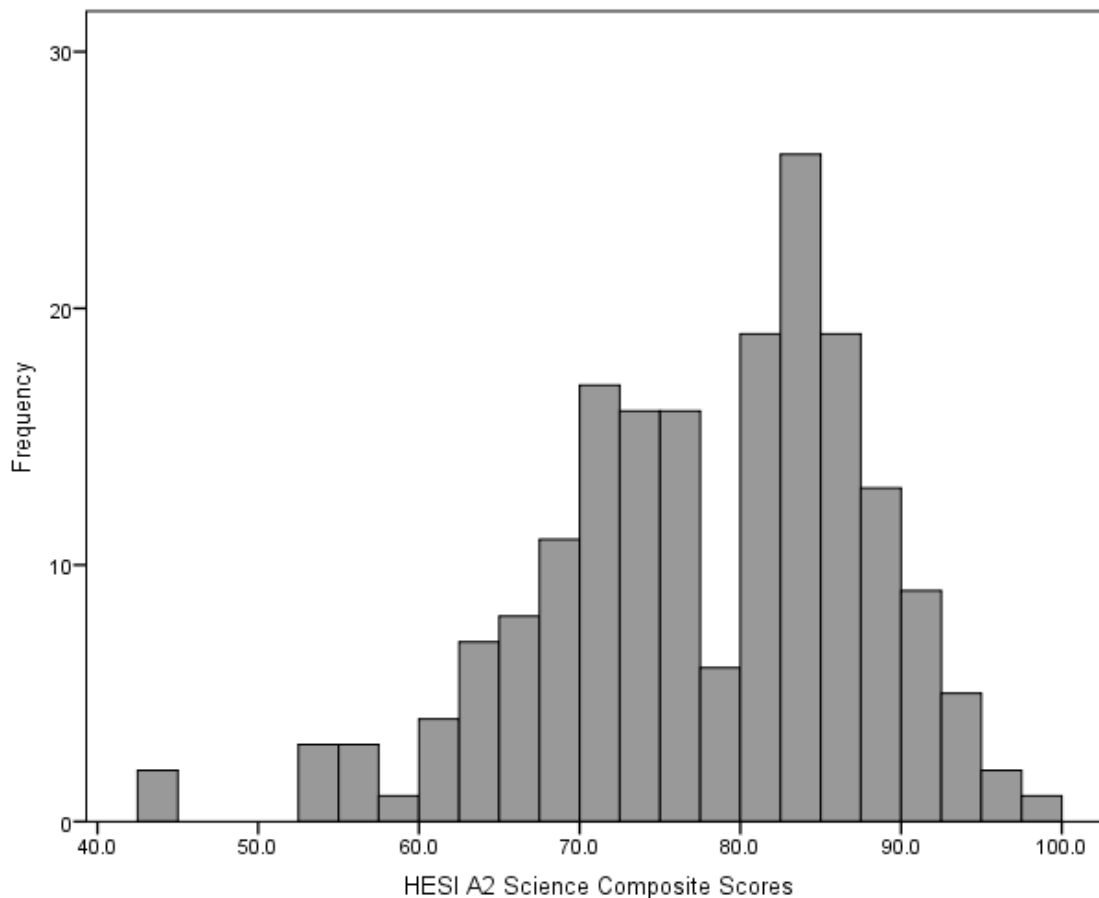
First, this investigator analyzed the predictor variable HESI A<sup>2</sup> English language composite score; skewness was negative indicating a pileup of cases to the right and a left tail that is too long (Tabachnick & Fidell, 2013, p. 79). The Kurtosis was positive indicating that the curve is too peaked (Tabachnick & Fidell, 2013, p. 79). Visual analysis of the histogram for HESI A<sup>2</sup> English language composite score indicated a distribution curve that favored the right with a longer tail to the left although visually kurtosis appeared to be normal. See Figure 5.





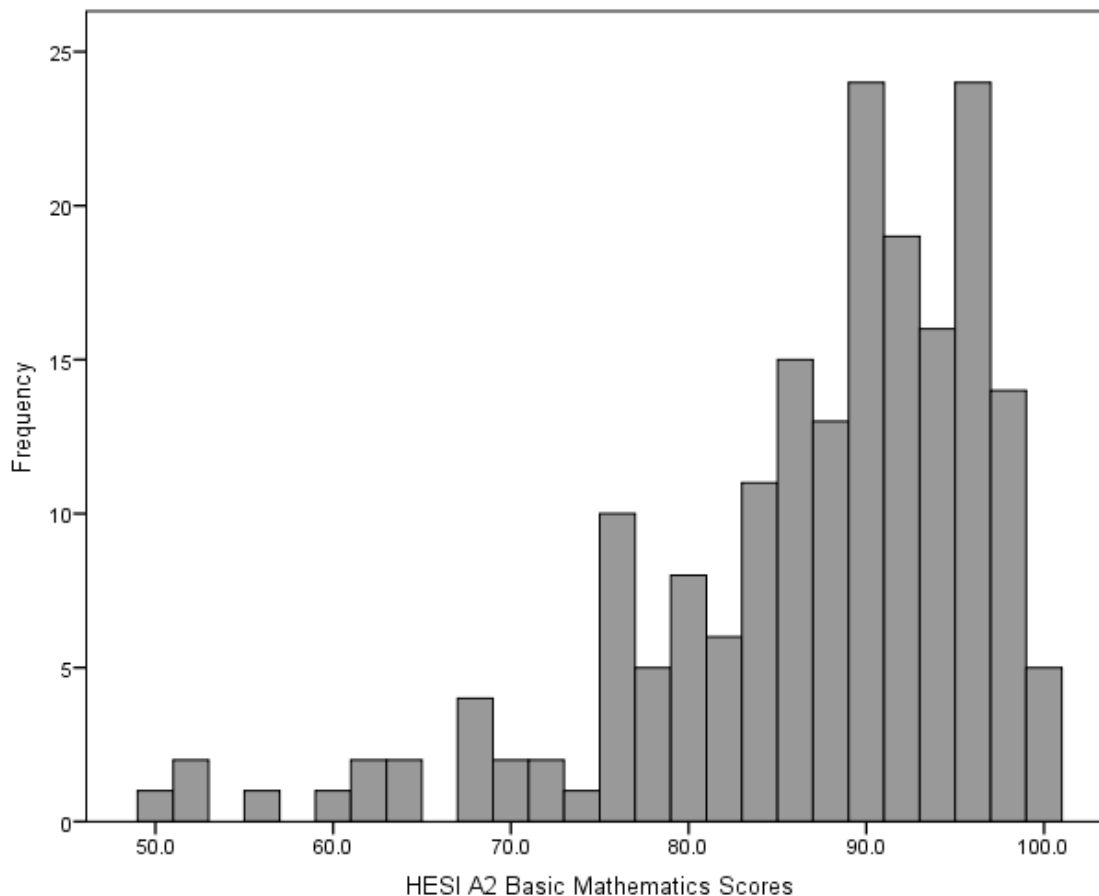
*Figure 5.* Histogram of HESI A2 English language composite scores. Each bar is a frequency count of the HESI A2 English language composite scores that fell within the score range across the bottom of the figure.

Next, this investigator analyzed the predictor variable HESI A<sup>2</sup> science composite score; skewness was also negative indicating a pileup of cases to the right and a left tail that is too long and once again Kurtosis was positive indicating a distribution curve that was too peaked (Tabachnick & Fidell, 2013, p. 79). Visual analysis of the histogram for HESI A<sup>2</sup> science composite scores indicated a distribution curve that slightly favored the right with a longer tail to the left although visually kurtosis appeared to be normal. See Figure 6.



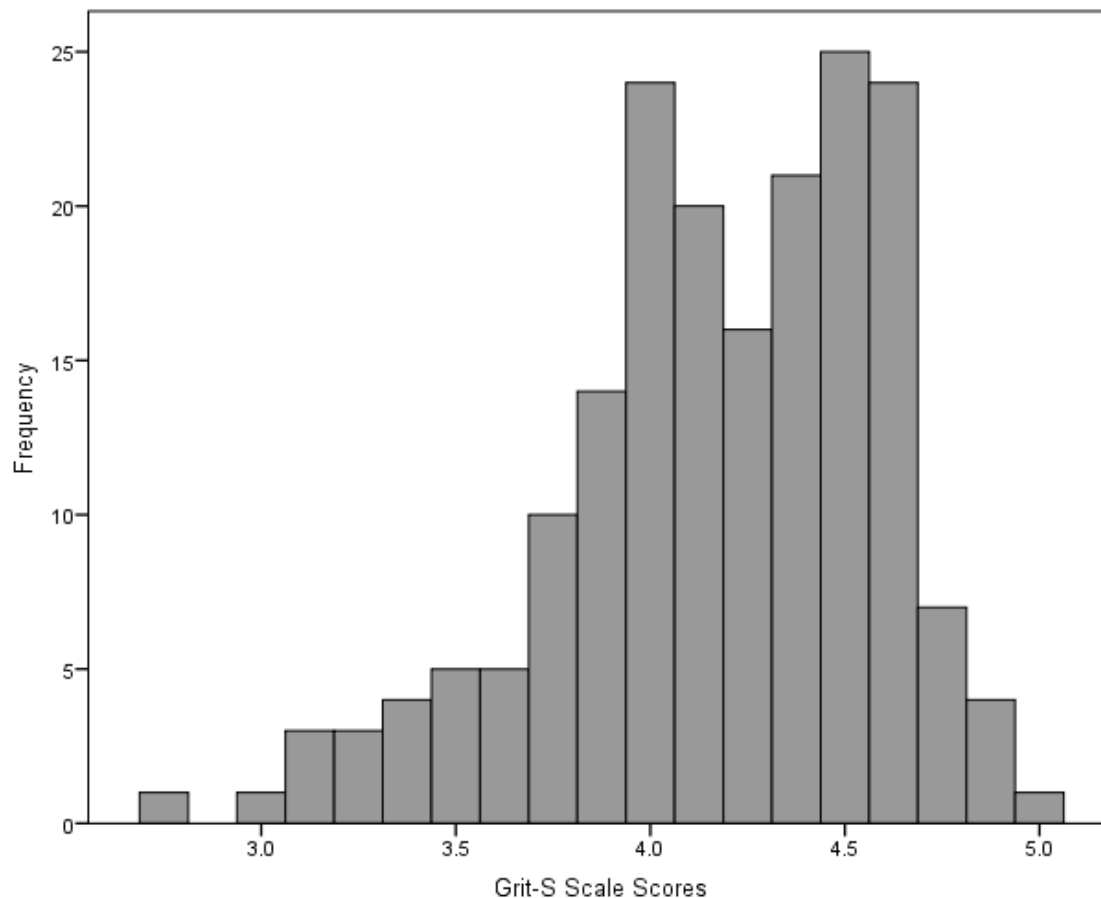
*Figure 6.* Histogram of HESI A2 science composite scores. Each bar is a frequency count of the HESI A2 science composite scores that fell within the score range across the bottom of the figure.

Next, this investigator analyzed the predictor variable HESI A<sup>2</sup> basic mathematics score; once again skewness was negative indicating a pileup of cases to the right and a left tail that is too long and once again Kurtosis was positive indicating a distribution curve that was too peaked (Tabachnick & Fidell, 2013, p. 79). Visual analysis of the histogram for HESI A<sup>2</sup> basic mathematics scores indicated a distribution curve that highly favored the right side with a very long left tail; visually the curve appeared to be too peaked and did not resemble a normal distribution curve. See Figure 7.



*Figure 7.* Histogram of HESI A2 basic mathematics scores. Each vertical bar is a frequency count of the HESI A2 basic mathematics scores that fell within the score range across the bottom of the figure.

Finally, the investigator analyzed the predictor variable Grit-S Scale score; once again skewness was negative indicating a pileup of cases to the right and a left tail that is too long and once again Kurtosis was positive indicating a distribution curve that was too peaked (Tabachnick & Fidell, 2013, p. 79). Visual analysis of the histogram for Grit-S Scale scores revealed a distribution curve that favored the right side with a long left tail; visually kurtosis appeared to be normal. See Figure 8.



*Figure 8.* Histogram of Grit-S Scale scores. Each vertical bar is a frequency count of the Grit-S Scale scores that fell within the score range across the bottom of the figure.

Because the ADN program under review is highly competitive, it is reasonable that the majority of the students accepted into the program would have scores in the upper score range for each of the predictor variables with a smaller percentage of scores in the lower range. This researcher speculated that if the Kolmogorov-Smirnov test was conducted on all students who applied to the ADN at this state college, the results would not be statistically significant for any of the input variables (HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, HESI A<sup>2</sup> mathematics score, and Grit-S Scale score). Although normal distribution curves for each of the input variables is a required assumption for multiple linear regression, it is not a required assumption for binary logistic regression (Warner, 2013, p. 1008). However, this

researcher felt that understanding the distribution of input variables was an important component of the research.

### **Assumptions**

An appropriate minimum sample size for logistic regression as outlined by Warner (2013) is determined by the formula  $104 + k$  where  $k$  is the number of predictor variables. The minimum appropriate sample size as described by Tabachnick and Fidell (2013) is determined by the formula  $50 + 8m$  where  $m$  is the number of predictor variables. Gall et al. (2007) recommended the minimum population required for correlational studies for a medium effect size with statistical power of .7 at the .05 alpha level as 66. Therefore, a sample size of 188 participants ( $N = 188$ ) exceeded the calculated minimum recommended requirements for binary logistic regression with four input variables. Warner (2013) also noted that a binary logistic regression does not perform well when groups have frequencies less than five. In this study, there were no groups with a frequency count less than five.

Warner (2013) outlined four assumptions that are required for logistic regression to be an appropriate research method. First, the criterion variable must be dichotomous; the criterion variable in this study is success in the first term, this variable is dichotomous with the two options of pass or fail. Second, that the predictor variables are statistically independent from each other, in theory this is true as each of the three cognitive variables are measuring a different cognitive (academic) domain, while the Grit-S Scale is statistically independent of any academic area as it seeks to measure consistency of interests and perseverance of effort. To ensure the absence of multicollinearity this researcher examined tolerance values and variance inflation factors (VIF) of the predictor variables utilizing SPSS. Tolerance values can range from 0 to 1. A variable with a tolerance value of 0 represents perfect multicollinearity indicating that no

further predictive value can be added by this variable. A variable with a tolerance value of 1 is a value that represents no correlation with other input variables (Warner, 2013). The VIF is the inverse of the tolerance value. To demonstrate absence of multicollinearity the VIFs should each be less than 10 (Tabachnick & Fidell, 2013). All VIFs were found to be less than 1.4 as outlined in Table 5.

Third, Warner (2013) noted the model must not include any irrelevant predictor variables. After an exhaustive literature review, the researcher chose the cognitive predictor variables HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, and HESI A<sup>2</sup> mathematics score. The HESI A<sup>2</sup> has been found (to varying degrees) to be a valid predictor of nursing program success (Bodman, 2012; Chen & Voyles, 2013; Knauss & Wilson, 2013; Manieri et al., 2015). Although this researcher could not find where the Grit-S had been previously used in determining nursing program success, it has been found (to varying degrees) extremely useful in predicting success towards long-term goals that require both consistency of interests and perseverance of effort. Based on a comprehensive literature review all four of these variables are relevant and appropriate. Fourth, Warner (2013) stated that the “categories on the outcome variable are assumed to be exhaustive and mutually exclusive” (p. 932). Each participant in the research either passed or failed the course work in the first term. A grade of C or better in both first term courses (NUR1020C and NUR1023C) was considered successfully passing, while any other grade combination (D, F, or W in the first term were considered unsuccessful). All participants were either successful or not successful in the first term as described above. In this research, all assumptions required by Warner (2013) for logistic regression to be an appropriate research method were met.

Table 5

*Analysis of Multicollinearity of Predictor Variables*

Variable	Tolerance	VIF
English Comp	.816	1.225
Science Comp	.726	1.377
Mathematics	.816	1.226
Grit	.989	1.011

**Results for Null Hypothesis**

A binary logistic regression analysis was used to analyze the relationship between the predictor variables (HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, and HESI A<sup>2</sup> mathematics score, and the Grit-S Scale score) at a 95% confidence level. The categorical variables were all dummy-coded. Gender was coded “0” for male and “1” for female. Admissions term was coded “0” for the summer 2017 ASN cohort and “1” for the fall 2018 ASN cohort. Success in the first term of coursework was coded “0” for unsuccessful and “1” for successful (success being defined as a grade of C or above on both courses in the first term of the ADN program).

The results of the binary logistic regression were statistically significant using the omnibus model of coefficients,  $\chi^2(4) = 35.08, p = .000$ . The overall model strength of association was determined using Cox and Snell’s ( $R^2 = .17$ ) and Nagelkerke’s ( $R^2 = .402$ ) (see Table 6). The results of Nagelkerke’s  $R^2$  indicate that 40% of the variance in the outcome variable was predicted by the predictor variables under consideration. The results of the Hosmer Lemeshow test was not statistically significant,  $\chi^2(4) = 13.537, p = .095$ , indicating a reasonable goodness of fit for the model. The model indicated predictive relationship between success in the first term of an ADN program and the predictor variables (HESI A<sup>2</sup> English language

composite score, HESI A<sup>2</sup> science composite score, HESI A<sup>2</sup> mathematics score, and the Grit-S Scale). Thus, this researcher rejected the null hypothesis. The model correctly classified 94.1% of all cases; correctly classifying 99.4% (172 of 173) of students who were successful in the first term coursework and 33.3% (5 of 15) of students who were not successful in this first term. The overall model outperformed the null model by 2.1%. The null model correctly classified 92.0% of all cases. The null model is based on the assumption that all students would be successful (pass with a grade of C or above both first term classes).

Table 6

*Logistic Regression Model Analysis*

$\chi^2$	$p$	Cox & Snell $R^2$	Nagelkerke's $R^2$
35.08	.000	.17	.403

This researcher also investigated each of the predictor variables under consideration (see Table 7). The predictor variable HESI A<sup>2</sup> English language composite score was found to be statistically significant,  $\chi^2(1) = 34.848, p = .000$ . In addition the Wald statistic for the HESI A<sup>2</sup> English language composite score was found to be statistically significant  $\chi^2(1) = 15.211, p = .000$ . The odds ratio for the HESI A<sup>2</sup> English language composite score was 1.219 indicating for each 1-point increase in the HESI A<sup>2</sup> English language composite score the odds of successfully completing the first term in the ADN program increased by 1.219.

The researcher also investigated the predictor variable of HESI A<sup>2</sup> science composite score. The predictor variable HESI A<sup>2</sup> science composite score was also found to be statistically significant,  $\chi^2(1) = 13.123, p = .000$ . In addition the Wald statistic for the HESI A<sup>2</sup> science composite score was found to be statistically significant  $\chi^2(1) = 4.328, p = .037$ . The odds ratio for the HESI A<sup>2</sup> English language composite score was 1.017 indicating for each 1point increase



in the HESI A<sup>2</sup> science composite score the odds of successfully completing the first term in the ADN program increased by 1.017.

The researcher also investigated the predictor variable HESI A<sup>2</sup> mathematics score. Overall, the predictor variable of the HESI A<sup>2</sup> mathematics score was not statistically significant,  $\chi^2(1) = .019, p = .889$ . In addition the Wald statistic for the HESI A<sup>2</sup> mathematics score was found to be not statistically significant  $\chi^2(1) = 2.547, p = .111$ .

This researcher also investigated the predictor variable of Grit-S Scale score. Overall, the predictor variable of Grit-S Scale score was not statistically significant,  $\chi^2(1) = .595, p = .440$ . In addition, the Wald statistic for the Grit-S Scale score was found to be not statistically significant  $\chi^2(1) = 1.239, p = .266$ .

Table 7

*Summary of Binary Logistic Regression Predicting Successful Program Completion*

Variables	B	SE	Wald	df	p	Exp(B)	95% CI for Odds Ratio	
							Lower	Upper
English	.198	.051	15.211	1	.000	1.219	1.103	1.346
Science	.069	.033	4.328	1	.037	1.071	1.004	1.143
Mathematics	-.071	.044	2.547	1	.111	.932	.854	1.016
Grit	-.803	.722	1.239	1	.266	.448	.109	1.843
Constant	-12.711	4.881	6.782	1	.009	.000		

The prediction equation generated with the coefficients from Table 7 is  $\log\left(\frac{Y}{1-Y}\right) = -12.711 + .198x_1 + .069x_2 - .071x_3 - .803x_4$ , where Y is the probability of successfully completing both first term courses in the ADN program. This can be expressed in terms of the variables from the analysis, the logistic equation is  $\log\left(\frac{Y}{1-Y}\right) = -12.711 + .198*\text{English} + .069*\text{science} - .071*\text{mathematics} - .803*\text{grit}$ .

### **Additional Analysis**

Due to the single extreme outlier representing a student who was not successful in the first term (defined as a grade of C or above on both classes in the first term) this researcher decided to rerun all statistical analysis with the student removed from the sample (N = 187). With student 183 failing the first term and having a very low score on the English language composite score, this researcher wanted to verify that this single record did not have a significant impact on the research findings. The results were not significantly impacted with the extreme outlier removed.

### **Summary**

In Chapter Four, the researcher provided a summary of the data collected and the procedures that were used for analyzing the data. The data consisted of the HESI A<sup>2</sup> English language composite score, HESI A<sup>2</sup> science composite score, HESI A<sup>2</sup> mathematics score, Grit-S Scale score, grades in both classes in the first term of coursework in the ADN program. ADN cohort each student was assigned to, gender and ethnicity. The descriptive statistics and logistic regression analysis were reported for the entire sample. The statistical analysis indicated that the predictor variables of HESI A<sup>2</sup> English language composite score and HESI A<sup>2</sup> science composite score were both statistically significant predictors of success in the first term of an ADN program (grade of C or above on both first term classes), and the researcher rejected the null hypothesis. The statistical analysis also indicated that the predictor variables of HESI A<sup>2</sup> mathematics score and Grit-S Scale score were not statistically significant predictors of success in the first term of an ADN program (defined as a grade of C or above on both first term classes).

In Chapter Five this researcher will discuss these statistical findings in relation to the related research as well as the implications of these results.

## **CHAPTER FIVE: CONCLUSIONS**

### **Overview**

In Chapter Five this researcher will discuss the results of the statistical analysis and the implications of those results. Related research will be reviewed and highlighted. Finally, the limitations of this research will be examined as well as suggestions for future research will be recommended.

### **Discussion**

The purpose of this nonexperimental, quantitative, ex post facto, correlational study was to identify both cognitive and noncognitive predictors of success in the first term of an ADN program. The criterion variable for this research was first term success in an ADN program (successfully completing both first term classes with a grade of C or above).

This study focused on academic preparedness and motivation toward long-term goals in nursing education. Bloom's (1976) theory of school learning was tested in this study. Bloom's theory is comprised of three independent variables that each has a statistically significant relationship with the achievement of assigned learning outcomes. The first variable is cognitive entry behaviors. Bloom posited that students enter each new learning event with a history of previous learning experiences in that particular area; much of this prior learning will determine the success with the present learning. The second variable in Bloom's theory is what he called affective entry characteristics. Bloom defined these entry characteristics as the degree to which students currently are or can be motivated to fully engage in the learning process. The final independent variable in Bloom's model was quality of instruction. Bloom's final component (quality of instruction) was not under consideration in this study. Considering cognitive and noncognitive factors that affect academic performance is fully supported by the literature

(Beauvais et al., 2014; Chen & Voyles, 2013; Crouch, 2015; Duckworth et al., 2007; Manieri et al., 2015; Richardson et al., 2012), although the consideration of both cognitive and noncognitive factors in nursing admissions has only recently begun to garner attention (Crouch, 2015).

This researcher considered the following predictor variables: English language comprehension, science comprehension, math comprehension (cognitive factors), and a combination of consistency of interests and perseverance of effort (noncognitive factors). English language comprehension was measured by the HESI A<sup>2</sup> English language composite score, science comprehension was measured by the HESI A<sup>2</sup> science composite score, math comprehension was measured by the HESI A<sup>2</sup> basic mathematics score, and consistency of interests and perseverance of effort was measured by the Grit-S Scale composite score. The criterion variable used in this research was success in the first term of an ADN program (successfully completing both first term classes with a grade of C or above). Jeffreys (2007) referred to this in the negative sense as first semester failure attrition. First term success or first term failure attrition is a common measurement of success used by a number of different researchers in the area of success in an ADN program (Bodman, 2012; Chen & Voyles, 2013; Hilke-Lampe, 2014; Knauss & Wilson, 2013; Luna, 2014).

The research question was whether first term success in an ADN program could be predicted from a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first-term nursing students. Findings suggesting the affirmative would support Bloom's (1976) theory of school learning, as well as possibly support his findings that up to 75% of the variation in the achievement of any learning outcome or task can be predicted by a combination of cognitive entry behaviors and affective entry characteristics. Three

cognitive variables (Bloom's cognitive entry behaviors) and one noncognitive variable (Bloom's affective entry characteristics) were reviewed in this study.

### **The Overall Model**

This research was based on the theoretical constructs in Bloom's theory of school learning and intensive research to identify the best assessments for measuring what Bloom called cognitive entry behaviors and affective entry characteristics. Bloom posited that cognitive entry behaviors could account for up to 50% of the success in any learning outcome, while affective entry characteristics could account for up to 25% of the success in any learning outcome.

In this the overall model, English language comprehension, science comprehension, math comprehension, and consistency of interest and perseverance of effort were found to be statistically significant predictors of success and accounted for 40% of the variance in the outcome variable (success in both first term classes of an ADN program). This finding caused this researcher to reject the null hypothesis, concluding that first-term success in an ADN program can be predicted from a linear combination of English language comprehension, science comprehension, math comprehension, and a combination of consistency of interests and perseverance of effort for first-term nursing students. This finding (at least in part) supports Bloom's (1976) theory of school learning where he posited that up to 50% of the success in any learning outcome can be predicted by cognitive entry behaviors.

### **English Language Comprehension**

In this study English language comprehension, as measured by the HESI A<sup>2</sup> English language composite score (comprised of reading comprehension, vocabulary and general knowledge, and grammar usage and mechanics scores) was found to be a statistically significant predictor of success in the first term of the ADN program under review. This finding is similar

to Chen and Voyles' (2013) research where they found that reading comprehension, vocabulary and general knowledge, and grammar usage and mechanics scores (all components of English language composite score) were correlated to first term grades in an ADN program. They also found vocabulary and general knowledge and grammar usage and mechanics scores to be significantly correlated to first term grades in an ADN program. This finding is also in line with Knauss and Wilson's (2013) research where they found positive and significant correlations between grades in Nursing-1 and Nursing-2 (first term classes in the ADN program) and reading comprehension, vocabulary and general knowledge, and grammar usage and mechanics scores.

### **Science Comprehension**

In this study science comprehension, as measured by the HESI A<sup>2</sup> science composite score (comprised of biology, anatomy and physiology, and chemistry scores), was found to be a statistically significant predictor of success in the first term of the ADN program under review. This finding is similar to Chen and Voyles' (2013) research where they found that anatomy and physiology scores were significantly correlated to first term grades in an ADN program. This finding is also supported by Bodman (2012) where the researcher found statistically significant correlations between HESI A2 biology and chemistry scores and grades in Nursing-1 and Nursing-2 (the first term classes in the ADN program).

### **Math Comprehension**

In this study math comprehension, as measured by the HESI A<sup>2</sup> basic mathematics score, was not found to be a statistically significant predictor of success in the first term of the ADN program under review. This finding is very similar to Hilke-Lampe's (2014) study, where the researcher concluded that the HESI A<sup>2</sup> basic mathematics score was not a reliable predictor of success in the first term classes of an ADN program. Bodman (2012) reported inconsistent

correlations across multiple cohorts between the HESI A2 mathematics scores and grades in Nursing-1 and Nursing-2 (the first term classes in the ADN program). These findings stand in contrast to Chen and Voyles' (2013) research where they found that the HESI A2 basic mathematics score significantly correlated to first term grades in an ADN program.

The first two classes in the ADN program under review are both nursing concepts classes focused around health and wellness. It is possible that the courses containing more complex mathematics concepts do not come up until later in the course sequencing. If this is the case, this might explain the lack of statistical significance in the finding around the HESI A<sup>2</sup> basic mathematics score.

### **Consistency of Interests and Perseverance of Effort**

In this study consistency of interest and perseverance of effort were measured using the Grit-S Scale and were found not to be statistically significant predictors of success in the first term of an ADN program. Although this researcher is unaware of any ADN program research that has utilized the Grit or the Grit-S Scale scores, this finding does stand in contrast to findings from a number of different researchers and research involving a number of academic pursuits where the Grit or Grit-S Scale have previously shown high levels of reliability (Duckworth et al., 2007; Eskreis-Winkler et al., 2014; Rojas et al., 2012; Strayhorn, 2014).

It is possible that the real benefits of possessing consistency of interest and perseverance of effort do not materialize until further progression in the program. Duckworth et al. (2007) reported similar phenomena in their research involving West Point Cadets. In that research they concluded that there appears to be a difference between major and minor accomplishments and this seems to indicate that the Grit Scale may be best at predicting successful completion of major accomplishments (Duckworth et al., 2007). This might explain why the Grit-S indicated

no predictability to success in the first term of an ADN program. It may be the major accomplishment that researchers should focus on in reference to the Grit-S Scale is ADN program completion. Equally, because the ADN is a competitive program at the college where this research is occurring, it is possible that all of the students who scored high enough on the admissions rubric to be accepted into the program possess a high level of consistency of interest and perseverance of effort as measured by the Grit-S when they are compared to the entire population who applied to the program, rather than comparing them only to those accepted into the program. This conclusion is supported by skewness in the distribution curve for Grit-S Scale scores (see Table 4). This finding not only stands in contrast to previous research involving the Grit and Grit-S Scale scores but also brings into question Bloom's (1976) theory of school learning (the theoretical framework underpinning this research).

### **Implications**

This research contributes to the empirical knowledge base related to first term success in an ADN program and highlights the importance of both English language comprehension as well as science comprehension to be successful in the first term of an ADN program. Further, this research contributes to and further refines previous ADN program research that has been conducted utilizing the HESI A<sup>2</sup> entrance examination. This research (at least in part) supports the prior findings of multiple researchers (Bodman, 2012; Chen & Voyles, 2013; Knauss & Wilson, 2013; Manieri et al., 2015) who found that the HESI A2 has value in predicting first term success in an ADN program. Further, this research has additional implications involving successful completion of an ADN program, as success in the first term is absolutely necessary to be successful in the program. This research also contributes to the knowledge base related to first term success in an ADN as it is the first study that this researcher is aware of that sought to



combine cognitive and noncognitive predictor variables in an attempt to predict first term success in an ADN program. Although a great deal of research has been conducted using cognitive variables, only limited research has been conducted using noncognitive variables.

Bloom's (1976) theory of school learning is only partially supported by this research. The finding that English language comprehension and science comprehension significantly predicted success in the first term of an ADN program and that together the input variables predicted 40% of the variance in the outcome variable (first term success in an ADN program) seems to fully support Bloom's theory. In his theory Bloom posited that up to 50% of the success in any learning outcome can be predicted by cognitive entry behaviors. The inability of the Grit-S Scale to measure what Bloom referred to as affective entry characteristics, brings into doubt the use of the Grit-S for this purpose and/or the possible advantages of consistency of interests and perseverance of effort not manifesting themselves until later in the ADN pipeline. It is also possible that Bloom's theory of school learning is simply incorrect and noncognitive factors do not contribute to the acquisition of academic endeavors to the extent that Bloom predicted.

The lack of statistical significance of mathematics comprehension highlights a number of possibilities. First, it is possible that the mathematics comprehension is not adequately tested in the first two courses of the ADN program under review. Second it is possible that the basic mathematics section of the HESI A<sup>2</sup> does not adequately test the mathematics skills needed to be successful in an ADN program. It is also important to note that findings involving the HESI A2 basic mathematics section are splintered and its real predictive value is currently unclear. If mathematics comprehension (as measured by the HESI A2 mathematics composite score) is not

a significant predictor of success, researchers must continue to search for the best mathematics predictor of success in ADN as well as BSN programs.

### **Limitations**

A notable limitation discussed in the section is focused entirely on the Grit-S Scale score and its noncognitive predictive value, especially in a highly competitive program like the ADN. A second limitation is that this research focused entirely on the HESI A2 Admissions Assessment Examination (English language composite score, science composite score, and basic mathematics score) as the cognitive tool to predict success in the first term of an ADN program. Although both the Grit-S and the HESI A<sup>2</sup> were selected only after careful research, there may be other cognitive and/or noncognitive tools that may better predict first term success in an ADN program. All of the participants in this research were from a single state college located in the southeastern region of the United States. It is widely acknowledged that institutions often have a certain type of student and this can be vastly different than the average student across a given region or across the United States. This researcher suggests caution should be exercised in generalizing beyond the target population in this study. This research involved first term success and it is quite possible that the difficulty level of the first term is different (substantially easier or harder) than subsequent terms. Thus, the results of this study may not be generalizable to other ADN programs. This research involved a modest sample (N = 188) and findings may be hampered by the sample size. This research focused on an ADN program and may not be generalizable to BSN programs.

### **Recommendations for Future Research**

Some suggestions for future research resulted from the limitations associated with this study. Future studies that will replicate the methods and analysis used in this research are

evident for a number of reasons. While the sample size was adequate, multi-institute research could further generalize or provide refutation of the findings in this study considering that this study utilized only one institution. This research focused on first term success, the research methods and associated analysis should be replicated looking across entire ADN programs, shifting from researching first term success to researching program success. This could potentially further validate the findings in English and science and could validate or provide further clarification on the findings in both mathematics and consistency of interest and perseverance of effort. Further research studies involving noncognitive instruments in general and the Grit and Grit-S specifically are absolutely critical as researchers continue the important work of building a robust admissions model for predicting success in the first term and ultimately the entire ADN program. This study examined only a traditional ADN program. With the increased demand for BSN prepared nurses, future research should examine ADN to BSN and traditional BSN programs in an attempt to identify predictors of first term success as well as successful program completion.

### **Summary**

Chapter Five discussed the findings of the study in regards to the research question and null hypothesis. The null hypothesis was rejected, as there was significant statistical relationships between the predictor variables English language comprehension (as measured by the HESI A<sup>2</sup> English language composite score) and science comprehension (as measured by the HESI A2 science composite score) and the outcome variable first term success in an ADN program (success being defined as a grade of C or higher on both first term classes). These results only partially supported Bloom's theory of school learning, failing to find statistical significance in what Bloom referred to as affective entry characteristics. The findings involving

math comprehension and the Grit-S Scale were overviewed and discussed. Limitations of the current study were outlined and discussed. Finally, recommendations involving future research were suggested. These recommendations included both the expansion of the current research to success through the entire ADN program, possible research involving other noncognitive instruments, as well as the expansion of the current research into BSN programs.

These study findings are significant in that they have added to the empirical knowledge base related to predictors of success in an ADN program. In this research a statistical significant admissions model was developed and presented that was able to predict those students who were likely to be successful in the first term of an ADN program with a 94.1% degree of accuracy. This admissions model also accounts for 40% of the variance of success in the first term of an ADN program. There are few, if any, studies focused on cognitive and noncognitive predictors of success in the first term of an ADN program. This research helps illuminate this gap in research and provides clear recommendations for future research. Finally, the use of this admissions model has the potential to decrease attrition in nursing programs and the associated benefits that reductions in attrition rates would bring to students, institutions, the nursing field, and local communities.

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## APPENDICES

### Appendix A: Grit-S Scale

Grit-S (Short Grit Scale) – Angela Duckworth available at:  
<https://www.dropbox.com/s/8opex6ezi7jzisi/8-item%20Grit%204.pdf?dl=0>



## Appendix B: Permission to Use Grit-S Scale

**From:** Duckworth Team [mailto:info@angeladuckworth.com]  
**Sent:** Friday, October 27, 2017 11:00 AM  
**To:** Turner, Rich [redacted]@edu>  
**Subject:** Re: AngelaDuckworth.Com: Other

Dear Rich,

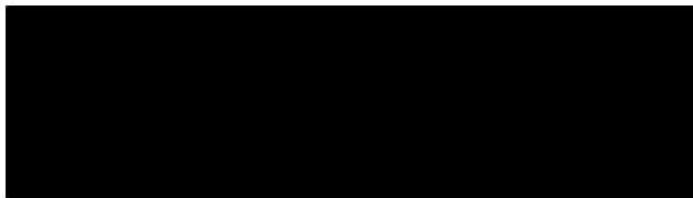
Thanks for reaching out.

As detailed here, <http://AngelaDuckworth.com/research/>, the Grit Scale is copyrighted and can only be used for education or research purposes. For example, PhD students and professors are welcome to use the Grit Scale in their projects. The Grit Scale cannot be used for any commercial purpose, nor can it be reproduced in any publication.

We also discourage using the Grit Scale to evaluate students or employees. As Angela discusses in this [paper](#), this [Q&A](#), and this [op-ed](#), the scale is not appropriate for high-stakes assessment and, in addition, may not be the ideal instrument for evaluating programs (e.g., seeing whether a particular program increases grit).

Best,  
Duckworth Team

## Appendix C: Request to Conduct Research



April 4, 2017

Rich Turner



Subject: Permission to Conduct Study at [REDACTED] Tracking  
Number 0108)

This letter is to grant permission for Rich Turner, a doctoral student at Liberty University, to collect data for his dissertation entitled *Cognitive and Noncognitive Predictors of Success in an Associate Degree Nursing Program*.

As explained in the initial request, the researcher will identify cognitive and noncognitive predictors of success in the associate degree nursing program using surveys, document analysis and statistical analysis. The study participants in this research will be the 20173 ASN cohort. All data used in the research will be de-identified student data.

The research activities do not appear to present more than minimal risk to the human subjects. The probability and magnitude of physical or psychological harm or discomfort anticipated in the research do not appear to be greater, in and of themselves, than those normally encountered in daily life or during the performance of routine examination or tests.

Please contact me at [REDACTED] with questions. Good luck with your project.

Sincerely,



Acting Vice President for Institutional Advancement  
IRB Chair

## Appendix D: Revision to Conduct Research



### IRB Review of Approved Project Form: Procedural Revisions or Yearly Periodic Reviews

#### Applicant Information

**Date Submitted:** 2/28/2018

**Title:** Predicting First Term Success in an Associate Degree Nursing Program Using Cognitive and Noncognitive

**Applicant Name:** Rich Turner

**Applicant Phone:**

**Applicant Email:**

**Applicant Address:**

**Organization:** Liberty University

#### Study Background

**Start Date for Research:** 4/1/2018

**Duration of Research (in months):** 12 Months

**Total Number of Human Subjects:** Summer 20173 and Fall 20181 ASN cohorts, approximately 200-240 students

#### Status

**Type of Project (Select one):**

Exempt  Expedited  Full IRB Committee Review

**Project Status (Select one):**

Procedural revision to previously approved project (Date previously approved: N/A)

Yearly periodic review of continuing project (Date previously approved: N/A)

**Other organizations involved in project, if applicable:** N/A

#### Changes

**Changes to Project (Select one):**

No  Yes

### Appendix D: (continued)



#### Summary of Changes

While working with my research consultant and developing my prospectus a few changes were recommended:

- 1) To better align with current research in the field, the outcome variable was shifted from success in the first year of the program to success in the first term of the program
- 2) To ensure adequate sample size the number of participants was increased from one ASN cohort to two ASN cohorts (200-240 students).
- 3) The predictor variables changed to the HESI A2 English language composite score, HESI A2 science composite score, HESI A2 mathematics composite score and Gris Scale score.



Will these changes increase the level of risk for the human subjects?

No  Yes

#### Summary of Risks

#### Submission

Applicants should submit completed IRB Initial Routing Form along with necessary attachments via email to

 Questions about the IRB process can be addressed to 

#### IRB Decision (to be completed by IRB Chair)

- Approved
- Changes must be made before approval will be granted
- Referred for Full IRB Committee Review due to significant changes in the project's protocol (not required for Exempt or Expedited projects)
- Not approved

College Administrator for Applicant:

IRB Tracking Number: 0108

Signature of IRB Chair: 

Date: 3/6/18

**Appendix E: IRB Approval****LIBERTY UNIVERSITY.**  
INSTITUTIONAL REVIEW BOARD

April 19, 2018

Richard H Turner

IRB Exemption 3244.041918: Predicting First Term Success in an Associate's Degree Nursing Program Using Cognitive and Noncognitive Factors

Dear Richard H Turner,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.


Your study falls under exemption category 46.101(b)(4), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:101(b):

(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

Please note that this exemption only applies to your current research application, and any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at [irb@liberty.edu](mailto:irb@liberty.edu).

Sincerely,

  
G. Michele Baker, MA, CIP  
*Administrative Chair of Institutional Research*  
The Graduate School

**LIBERTY**  
UNIVERSITY.  
*Liberty University | Training Champions for Christ since 1971*