

Predictors of Academic Success in Baccalaureate Nursing Students: Is ATI TEAS Predictive

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Abstract

The population of the U.S. is aging, and the prevalence of chronic diseases is increasing. By 2030 the elderly population of the United States will be twice that of the current senior population, and the national demand for Registered Nurses (RNs) is expected to grow by approximately 21%. Nurses make up the single largest health profession in the United States. The nursing workforce is also aging. The average age of a registered nurse is 48.8 years old. Fifty percent of RNs are age 50 or older, and 12.4% are age 65 or older [1]. The problem is clear; unless more registered nurses enter the field, a critical nursing shortage will exist. The most distressing factor related to the predicted nursing shortage is the number of students who choose a career in nursing, enroll in a program, and fail to graduate, or graduate and fail to pass the NCLEX-RN on the first attempt. The purpose of this study was to determine whether there is a predictive relationship between academic success in baccalaureate nursing students and essential academic skills of reading, English, math, and science. Using a retrospective, correlational study design, the research revealed that there are indeed predictors of academic success.

INTRODUCTION

The population of the United States (U.S.) is aging, and the prevalence of chronic diseases is increasing. By 2030 the elderly population of the U.S. will be twice that of the current senior population, and the national demand for Registered Nurses (RNs) is expected to grow by approximately 21%. Every year through the end of the 21st century two to three million people will age into Medicare [2]. Nurses make up the single largest health profession in the United States. As of June 2015, in the U.S. and its territories, 3.8 million individuals held an active Registered Nurse (RN) license [1]. However, only 81% are actively employed in nursing, and only 62.9% work full time. The problem is clear, unless more registered nurses enter the field, a critical nursing shortage will exist. What are the factors that contribute to the nursing shortage? Is there a way to mitigate these factors and train, graduate, recruit, and retain the nurses that will be needed?

In addition to an increasing elderly population other factors are influencing the nursing shortage. They include an aging nursing workforce, limited numbers of nursing faculty, limited clinical sites for training, and graduates failing to successfully pass the National Council Licensure Examination for Registered Nurses

(NCLEX-RN). Each of these factors presents a bleak outlook on the nursing shortage [3].

The average age of a registered nurse is 48.8 years old. Fifty percent of RNs are age 50 or older, and 12.4% are age 65 or older [1]. The average age of doctoral-prepared faculty holding the ranks of professor, associate professor, and assistant professor were 62.2, 57.6, and 51.1 years respectively [3]. Compounding the challenges related to an aging professorate, colleges of nursing are not able to attract new faculty to the ranks because higher compensation in the clinical and private sectors is luring current and potential nurse educators away from teaching. The shortage of nursing faculty means that qualified applicants are being turned away from colleges of nursing. In 2016, 64,067 qualified applicants were turned away from baccalaureate nursing programs due to insufficient numbers of faculty members, clinical sites, preceptors, and budgetary constraints [4]. In 2016, the AACN found that nearly 10,000 qualified applicants were turned away from master's programs and approximately 2,000 qualified applicants were turned away from doctoral programs due to a shortage of faculty and clinical education sites [4].

Faculty shortages and an aging professorate are concerning,

but perhaps the most distressing factor related to the predicted nursing shortage is the number of students who choose a career in nursing, enroll in a program, and fail to graduate, or graduate and fail to pass the NCLEX-RN on the first attempt. According to the National Council of State Boards of Nursing (NCSBN), in 2016, 72,637 baccalaureate nursing students passed the NCLEX-RN on the first attempt. This represents an 87.8% pass rate. However, 12.2 percent, or 8,862 graduates failed to achieve a passing score on the first attempt. A twelve percent failure rate may seem a small number when compared to an 87% pass rate, however, failure is devastating for graduates and further compounds the nursing shortage.

According to the most recent data published by the National League for Nursing (2007) attrition rates for nursing programs were 22% for diploma programs, 20% for ASN programs, and 15% for baccalaureate programs [5]. Research indicates that many factors contribute to academic success or failure [6]. The focus of this study was to determine if the essential academic skills of reading, mathematics, English, and science have a significant effect on academic success, defined as on-time graduation and first-time NCLEX-RN pass rates, and anytime graduation and anytime NCLEX-RN success. Essential academic skills were measured by the Assessment Technologies Institute (ATI) Test of Essential Academic Skills (TEAS). The primary research question for this study was: Is there a relationship between academic success in baccalaureate nursing students and the essential academic skills of reading, mathematics, English and science?

LITERATURE REVIEW

A variety of predictors of academic success have been identified in the literature, they include grade point average (GPA), pre-nursing GPA, science GPA, Math GPA, reading GPA, the predictive role of standardized tests, nursing theory grades and clinical nursing grades. Each has been evaluated for its ability to predict academic success in undergraduate nursing students.

Academic factors include grade point average (GPA) which includes overall GPA, pre-nursing GPA, and science, math and reading GPAs. Each of these, individually and in combination, have been used to predict both academic successes in nursing programs and success on the NCLEX-RN exam [7]. However, GPA in isolation can be a poor predictor of academic success because of grade inflation and variable grading schemes. Therefore, nursing programs need a reliable, efficient means by which to identify students who are a risk of failing the program and the NCLEX-RN exam. Strategies used by many nursing programs include evaluation of standardized, preadmission test scores. Standardized tests demonstrate methodological rigor and precision. As such they are believed to provide a more reliable indicator of a student's ability than GPA alone [8]. For the purposes of this study, essential academic skills included competency in English, Reading, Mathematics, and Science.

Many researchers have studied the relationship between reading comprehension and English to academic success and discovered strong correlations [9-11]. In addition, researchers have also studied the relationship of science, mathematics, reading and English to early academic success and found that

science and reading ability were more predictive of academic success than mathematics or English ability [12]. Studying the relationship of science scores to academic success, Yin (2003) discovered overall GPA and natural science GPA to be most predictive of success [13], while Underwood, et al. (2013) found that when compared to English, mathematics scores had the smallest correlation.

Course grades is another variable that has been studied to determine whether it is predictive of academic success and NCLEX-RN success. Barkley, Rhodes, & DuFour (1998), conducted research to determine the predictive value of specific course grades and standardized tests on NCLEX-RN pass rates [14]. The researchers investigated whether there was a relationship between specific nursing theory courses and found that nursing course grades can be predictive of first-time NCLEX-RN success. The predictive value of preadmission GPA, cumulative GPA, and course grades on predicting NCLEX-RN passage and failure rates has also been studied and found to be predictive [15].

Many, if not all, colleges and universities use standardized test to determine pre-admission eligibility and placement and to determine program progression. Some standardized test such as the SAT and the ACT are given to determine college entrance and placement, while others, such as the TEAS, HESI, NLN and the ATI, are used to determine nursing program admission and progression [16,17,18]. The ATI TEAS is a scholastic aptitude assessment for the content domains of reading, mathematics, science, and English and is used as a pre-entrance exam to determine eligibility for acceptance into clinical coursework by many universities [19]. Each of these exams measures specific content areas and all have been studied for their ability to predict academic success, and some, such as the HESI exit exam and the ATI Comprehensive Predictor have been used to predict NCLEX-RN success.

To evaluate correlations between standardized test scores and NCLEX-RN success, Barkley, Rhodes, and DuFour (1998) and Bondmass, Moonie, and Kowalski (2008) studied relationships between NLN scores and NET entrance scores and NCLEX-RN success [14,20]. No significant results were demonstrated. Newton, Smith, & Moore (2007) discovered that TEAS, because it assesses core knowledge, was a more reliable predictor of early academic success in nursing than pre-nursing GPA [21]. To determine if preadmission tests (SAT, ACT & TEAS) showed statistical significance on the first-time passage of the NCLEX-RN exam, Trofino (2013) conducted research in which scores on the ACT, SAT, and TEAS were normalized to allow comparison of all the tests [22]. Results revealed that only the normalized math sub-scores had a statistically significant effect on the probability that the student will pass the NCLEX-RN on the first attempt. Since no other recent research investigated math sub-scores as a predictor, the data is inconclusive [22]. The HESI exit exam and the ATI Comprehensive Predictor have both been used to determine end of program academic success in nursing and first-time success on the NCLEX-RN. Both the HESI exit exam and the Comprehensive Predictor have been researched for the predictive value relative to first-time NCLEX-RN passage, however no studies demonstrated that one is superior to the

other [23,24].

There are many standardized tests and other factors used by nursing programs to determine program entrance, evaluate academic success and determine program progression. Use of a particular assessment instrument, or group of assessments is often determined at the administrative level based on the type of university setting, the program outcomes, and financial concerns. However, no single assessment tool appeared to be more predictive of academic or NCLEX-RN success than another. Thus, despite NCLEX-RN being a standardized measure of essential, entry-level nursing knowledge, universities in the U.S. have no standard by which they can predict academic and NCLEX-RN success. Clearly, the conflicting results found during the review of literature suggest the possible need for additional research into this area. This study sought to address this gap in knowledge.

PURPOSE

The purpose of this study was to determine if there is a predictive relationship between academic success in baccalaureate nursing students and essential academic skills of reading, English, math, and science as measured by the ATI TEAS. In this study, academic success was defined in two ways: one definition was sequential progression from one clinical nursing level to the next without repeating (on-time graduation) and successfully passing the National Council Licensure Examination for Registered Nurses (NCLEX-RN) on the first attempt, within six months of graduation, the other definition included students who graduated from the university (anytime graduation) and were successful on the NCLEX-RN attempt at any time after graduation (not on the first attempt). Data was gathered and evaluated for both definitions.

The study design was retrospective, correlational and attempted to discover relationships among the study variables that were predictive of academic success. Each of the independent variables was correlated with the others and with the dependent variables to determine their relative predictive value in determining academic success in undergraduate baccalaureate nursing programs.

METHODOLOGY

Academic and nonacademic predictors of NCLEX-RN success as identified in this study were tracked over a five-semester nursing program beginning with the spring 2013 cohort and concluding with the spring 2016 cohort. Data related to successful progression from one cohort to the next were obtained from student records housed at the College of Nursing. ATI TEAS scores were obtained from the ATI database related to the College of Nursing. NCLEX-RN results for the study cohorts were obtained from records kept by the College of Nursing. Anonymity for all obtained information was maintained by numerical encoding thereby eliminating unique identifying information.

Site, Population and Sampling Method

The site for this study was a mid-size public university in the southern United States. The participants consisted of a convenience sample of students, separated by cohort, who were enrolled in the baccalaureate nursing program, in their first semester of clinical courses beginning in the spring of

2013 through the fall semester of 2016 and for whom records were available. The convenience sample included 835 students enrolled on two campuses at the university. All students who met the inclusion criteria were included. Only students for whom data was unavailable were excluded from this study.

Access and Permissions/ Data Gathering Procedures

Approval to conduct the study was granted through the University's Human Subject's Institutional Review Board (IRB) and other relevant stakeholders. Secondary data obtained from the College of Nursing database and ATI records belonging to College of Nursing was analyzed. NCLEX-RN pass rates were accessed through records kept at the College of Nursing and verified through the National Council of State Boards of Nursing reports. Student scores for the individual components of the ATI TEAS were used as independent variables. Academic success, as previously defined, was the dependent variable.

Instruments

TEAS

The instrument used for this study was the ATI TEAS®. The ATI TEAS was developed by Assessment Technologies Institute. Because the components of the ATI TEAS are specific to academic success in health-related fields, this instrument, among the many available, was chosen for this study. The purpose of the ATI TEAS is to assess a student's overall academic preparedness for a health science program and consists of 170 multiple choice questions [25]. Examinees are allowed a total of 209 minutes to complete the exam. The validity and reliability for the ATI TEAS have been well documented [19].

Analysis of Data

For the purposes of this study, both descriptive and inferential statistics were used. Descriptive statistics were used to describe the characteristics of the sample population, while inferential statistics allowed the researcher to determine if essential academic skills, as defined in the study, were significant predictors of academic success in baccalaureate nursing students. The data evaluation plan involved a two-step process. In the initial step, academic success was used as the independent variable in a One-way Analysis of Variance (ANOVA) to determine if successful students had significantly different test scores than students who were not successful. Based on the results of these initial tests, variables having different means among successful students were used as independent variables in multivariate step-wise logistic regression analyses in an attempt to better explain the relationship between these independent variables and academic success. Data analysis was accomplished using the Statistical Package for Social Sciences (SPSS) and SAS version 9.4. All statistical tests were two-tailed and were conducted at the 0.05 level of statistical significance.

RESULTS

The sample for this study consisted of 843 baccalaureate nursing students enrolled in a mid-sized public university in the southern United States and entering first-level clinical courses during the period between the spring of 2013 and the fall of 2016. Of the original sample of 843 student records analyzed and evaluated for inclusion in this study, eight student records were eliminated

due to missing data or not meeting inclusion criteria (did not start first clinical course at study university, was an LPN, or missing data), leaving a final sample size of 835 student records.

The participant demographics of gender and ethnicity were collected for this study. The study sample was 83.85% female (n = 618), and 16.15% male (n = 119). Gender information was incomplete on 98 student records.

Students records regarding ethnicity reflected that most of the sample population identified as Caucasian (n = 533, 72.71%), with the second largest population identifying as Black or African American (n = 142, 19.37%). Hispanic or Latino, Asian and students with two or more ethnicities, collectively, represented 6.28% of the population (n = 46). American Indian,

Hawaiian Other, Non-Resident Aliens and unknown ethnicities represented less than 2% of the population in total (n = 12). Ethnicity data was not reported on 102 student records.

Using the previously defined definitions of academic success, of the sample population (n = 835), 65.91% (n = 549) graduated on time and were successful on the first NCLEX-RN attempt (for 2 students NCLEX data was unavailable), and 34.09% (n = 284) did not graduate on time, thus were not considered successful using the strict definition of academic success. Using anytime graduation from the BSN program and anytime NCLEX-RN success as the outcome criteria for academic success, 88.21% (n = 718) were successful and 11.79% (n = 96) were not successful (data was missing from 21 student records) (Tables 1 & 2).

Table 1: TEAS Score One Way ANOVA Results On-time Graduation; first-time NCLEX-RN Success

Dependent Variable	Independent Variable On-time Graduation Status; first-time NCLEX-RN Success	n	Mean	Std. Dev	F Statistic	p- value
TEAS Composite	Failure	282	0.69	0.09	46.51	<.0001
	Success	547	0.74	0.09		
TEAS English	Failure	282	0.72	0.12	12.94	0.0003
	Success	547	0.75	0.11		
TEAS Mathematics	Failure	282	0.70	0.14	57.59	<.0001
	Success	547	0.77	0.13		
TEAS Reading	Failure	282	0.77	0.12	17.63	<.0001
	Success	547	0.80	0.10		
TEAS Science	Failure	282	0.60	0.12	40.07	<.0001
	Success	547	0.66	0.12		

Table 2: TEAS Score One Way ANOVA Results Anytime Graduation; Anytime NCLEX-RN Success

Dependent Variable	Independent Variable: Anytime Graduation Status; anytime NCLEX- RN Success	n	Mean	Std. Dev	F Statistic	p- value
TEAS Composite	Failure	95	0.69	0.10	18.19	<.0001
	Success	715	0.73	0.09		
TEAS English	Failure	95	0.72	0.12	5.71	0.0171
	Success	715	0.75	0.11		
TEAS Mathematics	Failure	95	0.70	0.15	16.99	<.0001
	Success	715	0.76	0.13		
TEAS Reading	Failure	95	0.76	0.13	10.30	0.0014
	Success	715	0.80	0.10		
TEAS Science	Failure	95	0.60	0.12	12.65	0.0004
	Success	715	0.65	0.12		

To answer the research question, a one-way analysis of variance (ANOVA) test was performed to determine whether

there were any statistically significant differences between student’s scores in reading, mathematics, English and science for students who were academically successful and those who were not. The dependent variables for the ANOVA were the

TEAS mathematics, reading, English and science scores. The independent variables for the analysis were graduation status, success or failure, in both on-time graduation and first-time

NCLEX-RN success and anytime graduation and anytime NCLEX-RN success. The significance level (α) for the ANOVA test was set at 0.05. Tables 3 and 4 list the sample sizes (n), mean scores,

Table 3: Summary of Variable Significance for On-time Graduation and First-time NCLEX-RN Success

Variable	Test Used	Test Significance Level	Variable Results	Significant?
TEAS Composite	ANOVA	0.05	<.0001	Yes
TEAS English	ANOVA	0.05	0.0003	Yes
TEAS Math	ANOVA	0.05	<.0001	Yes
TEAS Reading	ANOVA	0.05	<.0001	Yes
TEAS Science	ANOVA	0.05	<.0001	Yes

Table 4: Summary of Variable Significance for Anytime Graduation and Anytime NCLEX-RN Success

Variable	Test Used	Test Significance Level	Variable Results	Significant?
TEAS Composite	ANOVA	0.05	<.0001	Yes
TEAS English	ANOVA	0.05	0.0171	Yes
TEAS Math	ANOVA	0.05	<.0001	Yes
TEAS Reading	ANOVA	0.05	0.0014	Yes
TEAS Science	ANOVA	0.05	0.0004	Yes

standard deviation, F statistic, and p values of the ANOVA tests which were performed.

A comparison of the mean scores, standard deviation and p values reveals that for both groups of students (on-time, and anytime graduation), both composite and individual components of the TEAS scores were significant predictors of academic success. Students successfully graduating had higher mean scores than those who did not graduate, in both on-time graduation and anytime graduation. However, for students in the on-time graduation and first-time NCLEX success sample, TEAS composite, mathematics, reading, and science scores were all significant at a p-value of <0.001. For students in the anytime graduation, and anytime NCLEX success sample, all

TEAS elements were statistically significant at the p-value of 0.05. In addition, the TEAS composite and mathematics scores reached the <0.001 level of significance.

The results of the research question are summarized below in tables 3 and 4. The results for the single variable analysis testing revealed that all components of the TEAS exam were statistically significant for both success definitions. Successful students, also defined as those who graduated on-time and passed the NCLEX-RN on the first attempt, had significantly higher TEAS scores than unsuccessful students, who were defined as students who did not graduate on-time but passed the NCLEX-RN at any time after graduation (graduated late and more than one NCLEX-RN attempt).

Table 5: Pearson Correlation Coefficient and P-values

Measure	1	2	3	4	5
1. TEASComp TEAS Composite Score	1.00000	0.69196 <.0001	0.72685 <.0001	0.75161 <.0001	0.81407 <.0001
2. TEASEng TEAS English Score	0.69196 <.0001	1.00000	0.33795 <.0001	0.45732 <.0001	0.42772 <.0001
3. TEASMath TEAS Math Score	0.72685 <.0001	0.33795 <.0001	1.00000	0.36708 <.0001	0.49861 <.0001
4. TEASRead TEAS Reading Score	0.75161 <.0001	0.45732 <.0001	0.36708 <.0001	1.00000	0.47363 <.0001
5. TEASSci TEAS Science Score	0.81407 <.0001	0.42772 <.0001	0.49861 <.0001	0.47363 <.0001	1.00000

As shown in table 5, ANOVA testing revealed that when on-time graduation; first-time NCLEX-RN Success, were used as the independent variable, the results demonstrated that all components of the TEAS were statistically significant. Likewise, when anytime graduation; anytime NCLEX-RN Success were used as the independent variable, the results demonstrated that all components of the TEAS were statistically significant.

Once ANOVA testing revealed that meaningful correlations existed between the independent and dependent variables multivariate analysis testing was performed. These tests determined that for both groups of students, on-time graduation; first time NCELEX-RN success, and anytime graduation; anytime-time NCLEX-RN success, all elements of the TEAS exam were statistically significant in predicting academic success. Once a relationship was established between the variables (TEAS composite, reading, mathematics, English, science), the Pearson Correlation Coefficient (PCC) was computed for the independent variables to check for possible multicollinearity between these variables. The PCC between the TEAS composite scores and the TEAS English, reading, mathematics, and science scores were; 0.692, 0.727, 0.752, and 0.814, respectively demonstrating a strong positive correlational association. PCC values above 0.70 indicated that multicollinearity could be an issue if the TEAS composite and the TEAS component scores were in the logistic regression model at the same time [26]. Table 5 represents the results of the Pearson Correlation Coefficient.

In summary, the essential academic skills of reading, mathematics, English and science, as measured by the ATI TEAS exam, were found to be significantly higher for students who graduated on-time and were successful on the first NCLEX-RN attempt and were also higher for students who graduated anytime and were successful on the NCLEX-RN exam any time after graduation. ANOVA testing was performed analyzing all elements of the TEAS test (composite, reading, mathematics, English, and science) and all scores were found to be significantly higher in both on-time and anytime graduates.

DISCUSSION

Research suggests that success in nursing programs is impacted by a variety of factors. The purpose of this study was to evaluate the essential academic skills of English, reading, mathematics, and science in relation to academic success. Two definitions of academic success were used: Academic success was defined as on-time graduation and passing the NCLEX-RN on the first attempt, and anytime graduation and anytime NCLEX-RN Success. To determine if any of the essential academic skills could be correlated to academic success the following study question was posed:

Is there a relationship between academic success in baccalaureate nursing students and the essential academic skills of reading, mathematics, English, and science?

This quantitative, retrospective, study utilized One-way Analysis of Variance (ANOVA), Pearson Product Correlation and Multiple Linear Stepwise Regression Analysis to investigate the relationship between ATI TEAS scores and academic success in undergraduate baccalaureate nursing students. The study sam-

ple consisted of 835 baccalaureate nursing students enrolled in first-level clinical courses between the spring of 2013 and the fall of 2016. The study site was a mid-sized public university in the south-central United States. The study instrument used was the Assessment Technologies Institute (ATI) Test of Essential Academic Skills® developed by Assessment Technologies Institute.

The results of this research revealed that all components of the TEAS exam (English, reading, mathematics and science) were correlated to academic success regardless of success definition. The results of this research demonstrate that using a standardized assessment tool, such as the ATI TEAS as a component in the admission criteria for entrance into nursing programs can increase the probability of student success and identify students who may be at risk, academically, based on TEAS scores. Even though other researchers have used components of the ATI TEAS exam in conjunction with other variables, no study reviewed exclusively used all components of the TEAS as a correlative factor. This may shed light on the fact that no other studies yielded similar conclusions.

STUDY LIMITATIONS

The primary limitations of this study were that the results may not be generalizable to other universities which may be different from the study university regarding student population demographics, geographic location, or other unique factors. Because the data utilized was gathered from only one university nursing program in the southern United States, the results may only be generalizable to a limited geographic area. An additional limitation of this study was that only the ATI TEAS product was used as an assessment instrument. Universities that use other assessment tools may find the results of this study of limited value.

CONCLUSION/IMPLICATIONS FOR PRACTICE

The intent of this study was to determine which, if any, essential academic skills were predictive of academic success in baccalaureate nursing students. The goal of the research was, in part, to devise a way to identify high-risk students before they were in academic jeopardy so that they could be offered remediation. The research results revealed that there were, indeed, predictors of academic success for both on-time and anytime graduates. This knowledge may allow the researcher and others the opportunity to identify at-risk students and offer remediation. When determining admission criteria, many universities, including the research study site, use only the TEAS composite to determine clinical admission. Perhaps the knowledge that all TEAS elements are predictive will encourage universities to use the TEAS composite and the individual components of the TEAS as an admission measure.

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