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An Analysis Of The Effect Of Sixteen Academic Variables On Completion And Noncompletion Of An Associate Degree Nursing Program

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A Major Applied Research Project presented in
partial fulfillment of the requirements
for the degree of Doctor of Education

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The continuing decline in the number of applicants to nursing programs combined with the need to ensure that graduates are competent has made essential the development of reliable predictors that more fully assess the potential of all individuals in the restricted applicant pool. The purpose of this study was twofold: (1) to determine which admission and continuation criteria used by Broward Community College's (BCC) Nursing Program could be used as predictors for completion of the program and (2) to determine those students who are at-risk of not completing the nursing program. The independent variables for the study were five admission and six continuation criteria used by the nursing department. The dependent variables were completion and noncompletion of the nursing program.

The research questions addressed in the study asked the following: "Was there a significant difference at the 0.005 level between nursing program completors and noncompletors (1) cumulative grade point average (GPA) prior to enrolling in the first nursing course; (2) prerequisite mathematics scores; (3) prerequisite reading scores; (4) grade in Human Anatomy and Physiology I lecture; (5) grade in Human Anatomy and Physiology I laboratory; (6) grade in Human Anatomy and Physiology II lecture; (7) grade in Human Anatomy and Physiology II laboratory; (8) number of non-nursing credits needed for the ADN degree upon admission into nursing; (9) number of credits attempted in the first semester of nursing; (10) grade achieved in the first nursing lecture course (NUR1021); (11) cumulative GPA after completing the first semester of nursing?"

The population for this study included all of the nursing students enrolled in the first nursing course on the Central Campus site of BCC during the 1983-84, 1984-85, and 1985-86 academic year. Data were obtained from official transcripts, grade sheets, admission applications, and nursing records. Each student was assigned a number from one to 296. Using spreadsheets, data on the variables pertinent to each student were recorded.

There are two stages of statistical analysis of the data: Discriminant functions and t tests. The discriminant function method used a stepwise method with WILKS statistic

by SPSS-X. Discriminant analyses determined those variables that predicted completion/noncompletion of the nursing program. Means, standard deviations, and t tests were then determined. The t test scores determined statistical significance and allowed the comparison of each variable, one at a time.

Using discriminant analyses the following results were obtained for each category of variables. Three admission variables predicted program completion: grade in Human Anatomy and Physiology I, grade in Human Anatomy and Physiology I laboratory, and the cumulative GPA upon admission into the nursing program. Three continuation variables predicted program completion: grade in NUR1021, grade in Human Anatomy and Physiology II laboratory, and non-nursing credits remaining for the associate degree in nursing (ADN) upon admission into NUR1021. Three combined variables predicted program completion: (1) the grade in NUR1021, (2) non-nursing credits remaining from the ADN degree upon admission into NUR1021, and (3) grade in Human Anatomy and Physiology laboratory.

The results of analyses using t tests yielded eight variables that were significant at least at the 0.005 level: (1) cumulative GPA prior to enrolling in NUR1021, (2) grade in Human Anatomy and Physiology I lecture, (3) grade in Human Anatomy and Physiology I laboratory, (4) grade in Human Anatomy and Physiology II lecture, (5) grade in Human

Anatomy and Physiology II laboratory, (6) number of non-nursing credits needed for the ADN degree upon admission into nursing, (7) cumulative GPA after completing NUR1021, and (8) the grade in NUR1021.

Based on the results of this major applied research project the recommendations are as follows:

1. Disseminate the profile generated by this study to interested prospective candidates, the institutional recruiting staff, admission counselors, and faculty.

2. Discontinue two prerequisites: the Nelson-Denny Reading Test, Form C (1973) and the mathematics test designed by the nursing faculty as they do not appear to contribute to program completion.

3. Develop a potential risk profile. Student progress could be tracked throughout nursing with special attention given to providing guidance prior to crucial transitions.

4. Conduct further analyses of the contributions of the humanities, and the biological, physical, and social sciences to predicting completion/noncompletion of the nursing program.

5. Conduct another study which might include additional data such as: demographics, personal/personality characteristics, sociological data, grade-related and nongrade-related scholastic performance.

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Chapter 1

INTRODUCTION

The Postsecondary Education Planning Commission (PEPC) in Florida has acknowledged that enrollment into nursing programs has decreased dramatically over the past four years (Nursing Education in Florida, 1988:33). There also has been a reduction in the quality of applicants to schools of nursing (Pillar and Redman, 1986; Gothler and Rosenfeld, 1986; American Journal of Nursing, 1986; Aiken and Mullinix, 1987). PEPC (1988:iii) reported that nursing schools have had to "dig deeper into the applicant pool which resulted in students with fewer abilities and higher attrition rates."

Nursing programs are being forced to decrease enrollment or select more applicants who may be at-risk because of academic difficulty (Allen, Higgs, and Holloway, 1988:113). Faculty are faced with the impossible task of maintaining standards of "academic excellence" in the face of an underprepared student population (Allen, Higgs, and Holloway, 1988:114). The quality and quantity of applicants to nursing schools is at an all-time low and, at the same time, there is a nursing shortage worse than any ever experienced (Bross et al., 1989). Therefore, it becomes increasingly important to identify factors that discriminate between students who are likely to complete a nursing

between students who are likely to complete a nursing program and those who are at-risk for completion. One way to identify such factors is by studying whether or not the admissions and continuation criteria used by nursing schools predict completion of the program.

Since most nursing schools have selective admissions and continuation criteria (National League for Nursing [NLN], 1986), data are available to study whether or not admissions and continuation variables predict program completion. Oliver (1985:197) studies selected admission criteria in associate degree nursing (ADN) programs and found that, even though schools of nursing selectively admit students, the number of students who fail to graduate (noncompletors) is rising rapidly. This result means that some selected admissions criteria may be of little value in determining program completion. In a study aimed at determining the characteristics shared by nursing students who passed the State Board of Nursing Licensing Examination Digby (1985:3) concludes: "Selective admissions and continuation procedures must include a means to measure the applicant's potential for successful completion of the program."

The Associate Degree Nursing (ADN) Department of Broward Community College (BCC) began in 1963. Like other nursing schools, it established admission and continuation requirements. The admissions and continuation criteria were selected and based upon the opinions of the nursing faculty.

were variables that would screen out students who would not be able to complete the nursing program successfully. No method of validation was done to support the nursing faculty's belief that the requirements predicted program completion.

During the years that admission and continuation variables were established, there were always more applicants to nursing than there were places available. In the second half of the 70s, there were five applicants for every seat. Today, there is a declining applicant pool, students are less prepared than students of the 70s and early 80s (Pillar and Redman, 1986), and fewer students are enrolling in the nursing program.

Even though admission and continuation criteria have changed and have increased throughout the years, there has been no change in the number of students who fail to complete BCC's nursing program. The attrition rate has remained at thirty percent (National League for Nursing Reaccreditation Review, 1989:27). Admission and continuation variables do not predict those students who are at-risk for noncompletion of the nursing program. However, the nursing faculty persisted on maintaining present admission and continuation criteria even though it has not determined if admission and continuation variables were valid predictors of graduation from the nursing program.

The overall purpose of this study was to determine which, if any, of BCC's admission and continuation criteria

could be used as predictors for completion of the nursing program. Another purpose of the study was to determine those students who are at-risk of not completing BCC's nursing program.

Statement of the Problem

The Department of Nursing Technology at BCC has established various criteria for admission to and continuation in the nursing program. The assumption is that the admission and continuation variables are predictive criteria that will screen out students who would not be able to successfully complete the nursing program. However, the nursing faculty never conducted any formal studies to determine if these variables are predictive of graduation from the nursing program.

A comparison of attrition data at BCC showed that although criteria have been added throughout the years, there has been little change in the number of students who complete (completors) and do not complete (noncompletors) the nursing program. Theoretically, the admissions screening and continuation variable should have reduced the number of noncompletors. However, upon surveying departmental records (Brantferger et al., 1968-1981; and National League for Nursing (NLN) Accreditation, 1966; and NLN Reaccreditation, 1976, 1982, 1989), it was found that a thirty percent attrition rate has existed since 1967 even though admissions and continuation variables have increased

over the years (BCC catalogs, 1963-1989). Thomas (1988), executive director for the Center for Health Sciences at BCC, in a letter supporting this major applied research project, has acknowledged that noncompletion of the nursing program is a major issue at the college and has declared that retention must be increased for the following reasons:

1. there is a declining applicant pool;
2. there is a need to improve attrition since starting enrollments are low;
3. the criteria for admission and continuation must be validated in order to decrease attrition (see Appendix A).

In a study on the National Comprehensive Licensure Examination for Registered Nurses (NCLEX-RN) and attrition from Miami-Dade's Community College Nursing program, Millican (1986:2) indicates that "one of the program's goals must be to minimize student attrition and maximize student success by developing specific selection criteria."

Background and Significance

The study of sixteen cognitive variables and their effect on completion of a nursing program was conducted at Broward Community College, a large, suburban, multi-campus, community college in Fort Lauderdale, Florida. The population of both the college and the area has been growing rapidly. It was found that the nursing program started at the Central Campus site upon surveying BCC catalogs.

Twenty-five students were enrolled in the first nursing class (BCC Nursing Department Records, 1963). Applications to the nursing program increased every year, and by 1972 the Florida State Board of Nursing permitted expansion of the program to three sites and permitted the admission of 150 students per year to each site (Florida State Board of Nursing Correspondence, 1971). Students were admitted twice a year, usually in January and August. The three groups were generally equal in enrollment.

Since 1964, the nursing program at BCC has had admission and continuation requirements beyond those required for entrance into the college. A review of BCC catalogs (1964-65:85; 1965-66:58; 1966-67:60-61; 1967-68:82 respectively) showed the following nursing admission requirements: (1) evidence of good physical and mental health; (2) official transcript - satisfactory records in high school and college or nursing program previously attempted; (3) acceptable School and College Ability Test scores; and (4) satisfactory interview in the Department of Nursing Education.

Three additional admission requirements were added in 1968: (1) Florida Twelfth Grade Placement Test scores; (2) approval of Nursing Education Admission Committee; and (3) satisfactory medical and dental examination (BCC College Catalog, 1968-69:26; 1969-70:199; 1970-71:161; 1971-72:206). These criteria were required unit 1972-73 at which time the following additions were made to nursing prerequisites: (1)

a 2.0 cumulative grade point average (GPA) in college or nursing program previously attempted; (2) a completed student data sheet; (3) acceptable letters of reference from employers, where applicable; and (4) letters of personal recommendation (BCC Catalog, 1972-73:228; 1973-74:225).

Requests for student data sheets and approval for entry from the Nursing Admissions Committee were removed as criteria in 1974-75 (BCC Catalog, 1974-75:233). Requests to take the Florida Twelfth Grade Placement Test and to be interviewed by the Nursing Department faculty were removed as requirements for entry into nursing in 1976. Instead, the nursing faculty added the following to the requirements for admission: "Acceptable test scores or satisfactory completion of appropriate courses" (BCC Catalog, 1977-78:173). In 1978-79 the following addition was made to the prerequisites:

> Satisfactory completion of Human Anatomy and Physiology I (APB1023, later changed to APB1220, then APB1190) and Human Anatomy and Physiology I laboratory (APB1150L, later changed to APB1190L) or equivalent with a minimum grade of 'C' required" (BCC Catalog, 1978-79:86).

Continuation criteria included "a grade of 'C' or better in all nursing courses" (BCC Catalog, 1978-79:86).

Admission and continuation criteria changed again in 1980-81. Removed from the admission requirements were the following criteria: "Acceptable test scores or satisfactory completion of appropriate courses" and "letters of reference from employers." The nursing faculty added "acceptable assessment test scores in reading and arithmetic as

established by the Nursing Department," and "acceptable letters of personal recommendation" (BCC Catalog, 1980-81:86). Continuation criteria additions included the following: "The student will not be permitted to continue in the nursing program without the approval of the respective Department Head" (BCC Catalog, 1980-81:86).

Admission requirements in 1981-82 remained the same as 1980-81, but the continuation criteria changed to "no grade lower than a 'C' in any course will be acceptable for the Nursing Degree" (BCC Catalog, 1981-82:54). During the 1982-83 year several other continuation criteria were added (BCC Catalog, 1982-83:48). They included the following stipulations:

> Any student receiving a "W" or grade of less than "C" in any nursing course will not be permitted to continue in the program without approval of the Nursing Department chair; any student who receives a "D" or "F" in a nursing module must receive departmental approval to continue in the Nursing Program which will be determined by the Department Committee; and any student who receives a second "D" or "F" in a nursing module will not be permitted to continue the Nursing Program (BCC Catalog, 1982-83:49).

It was required that students complete Human Anatomy and Physiology II lecture and laboratory courses before or during the first nursing courses. The college catalog describes Human Anatomy and Physiology II as "corequisites" of the first nursing course (NUR1021) and the associate laboratory (NUR1021L).

The college catalog in 1983-84 included a separate section for allied health (presently called the Center for Health Sciences). Listed in this section were nine

requirements for admission to all allied health programs (BCC Catalog, 1983-84:43) and, in addition, the aforementioned requirements which dated back to 1980-81. Newly included for nursing was a section regarding withdrawals, college level examination program (CLEP), and convictions.

The following prerequisites in 1984-85 were listed for admission into the nursing program: (1) Chemistry for the Health Sciences (CHM1030) with a "C" or better; (2) Human Anatomy and Physiology I (APB1190L) with a "C" or better; (3) Human Anatomy and Physiology I LAB (APB1190L) with a "C" or better; (4) passage of the Reading Assessment Test at eleventh grade or above; (5) passage of the Math Assessment Test at eighty percent or above. More information also was included about continuation criteria, readmission requirements, withdrawal information, and complaint/grievance procedure data (BCC Catalog, 1984-85:53).

All requirements for entry into nursing remained the same as those of 1984-85 in 1985-86 (BCC Catalog, 1985-86:51). In 1986-87, the nursing program added a Licensed Practical Nurse-RN Transition (LPN to RN) track and a special track for Emergency Medical Technicians (EMT) and paramedics who worked a twenty-four hours-on and forty-eight hours-off schedule. The additional tracks did not affect the generic program and for 1986-87 through 1988-89, requirements remained the same as those required in 1984-85

(BCC Catalog, 1986-87:52; 1987-88:49-50, 57-58; 1988-89:55-56, 63-64).

Research Questions

The population used in this study consisted of 296 Central Campus nursing students who were enrolled in their first nursing courses during the academic years 1983-84, 1984-85, and 1985-86. Students from North Campus and South Campus sites were not included in the study. However, the population on all three campuses is similar regarding the number of completors/noncompletors and demographics (Jackson, 1987).

All students in this study met the following admission requirements:

1. general college requirements;
2. general requirements for entry into the Center for Health Sciences;
3. a cumulative grade point average (GPA) of 2.0 (4.0 = "A") or better;
4. at least an eleventh grade reading score using the Nelson-Denny Reading Test, Form C (1973);
5. a score of forty or better (50 = 100%) on a nursing mathematics test; and
6. a grade of "C" or better in Chemistry for the Health Sciences, Human Anatomy and Physiology I, and Human Anatomy and Physiology I laboratory courses.

Students were permitted to repeat all courses and tests until the minimum criteria for admission were met.

This study consisted of an ex post facto research project in which sixteen cognitive criteria related to entry and progression in BCC's nursing program were examined. Data concerning the independent variables associated with student preparation prior to admission to the program and performance in the first semester of the nursing curriculum were obtained from official student records which included transcripts, grade sheets, reading score sheets, and student folders.

The admission variables included in this study were the following:

1. cumulative grade point average prior to starting nursing courses
2. score on a prerequisite nursing mathematics examination designed by the nursing faculty;
3. score on a reading test (Nelson-Denny, Form C, 1973);
4. grade in a required anatomy and physiology courses, Human Anatomy and Physiology I;
5. grade in a required anatomy and physiology course, Human Anatomy and Physiology I laboratory;
6. grade in a required chemistry course, Chemistry for the Health Sciences;
7. final recorded grade in Human Anatomy and Physiology I, if the course was repeated; and

8. final recorded grade in Chemistry for the Health Sciences if the course was repeated.

Continuation variables included the following:

1. grade in a required anatomy and physiology course, Human Anatomy and Physiology II;
2. grade in a required anatomy and physiology laboratory, Human Anatomy and Physiology II laboratory;
3. number of non-nursing credits needed for the ADN degree upon entering the nursing program;
4. number of credits attempted in the first semester of the nursing curriculum;
5. grade in the first nursing lecture course;
6. grade in the associated nursing clinical course; and
7. cumulative grade point average after completion of the first nursing course.

Five of the independent variables were excluded from the study for the following reasons.

1. Grade in the First Nursing Clinical was excluded from the study because students either withdrew from or satisfactorily completed the course. There were no unsatisfactory grades for NUR1021L.

2. Chemistry for the Health Sciences, Human Anatomy and Physiology I Repeat, Human Anatomy and Physiology II Repeat, and Chemistry for the Health Sciences Repeat were

excluded because there were not enough subjects to conduct meaningful statistical analyses.

The research questions that were addressed in this study were as follows: Was there a significant difference, at least, at the 0.005 level between completors and noncompletors with regards to:

1. cumulative grade point average prior to enrolling in the first nursing course;
2. prerequisite math scores;
3. prerequisite reading levels;
4. grade in Human Anatomy and Physiology I;
5. grade in Human Anatomy and Physiology I lab;
6. grade in Human Anatomy and Physiology II;
7. grade in Human Anatomy and Physiology II lab;
8. number of non-nursing credits needed for the ADN degree upon admission into nursing;
9. number of credits attempted in the first semester of nursing;
10. grade achieved in the first nursing lecture course;
11. cumulative grade point average after completing the first semester of nursing?

Hypotheses

For each research question it was hypothesized that there was no significant difference between students who completed the program (completors) and those who did not (noncompletors) based on a set of eleven independent

variables. The null hypotheses used throughout this study was:

> There was no significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to admission variables.
>
> There was no significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to continuation variables.
>
> There was no significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to combined admission and continuation variables.

The alternate hypotheses was:

> There was a significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to admission variables.
>
> There was a significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to continuation variables.
>
> There was a significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to continuation variables.

The null hypothesis were rejected if the level of significance was 0.005 or higher.

Definition of Terms

Definitions used in this study were as follows:

ADN degree. An associate of science degree in nursing offered by Broward Community College to students who graduate from the nursing program.

ADN generic program. A two-year community college based nursing program for students with no previous nursing background that leads to an associate of science degree in nursing (ADN degree).

CLEP. College level examination programs.

Clinical nursing laboratory (NUR1021L). The first nursing practice course that takes place in a health care facility and involves "hands on" patient care.

Completors. BCC nursing students who graduated with an associate of science degree in nursing.

Cumulative grade point average (GPA). The numerical average on a 4.00 scale, where 4.00 = "A," 3.00 = "B," 2.00 = "C," 1.00 = "D," and 0.00 = "F."

General education courses. Courses required by the college for the ADN degree other than related or support courses. The following were the general education courses for the years under study: two English composition courses, general psychology, developmental or child psychology, physical education, sociology; and a social science elective.

National Comprehensive Licensure Examination for Registered Nurses (NCLEX-RN). The examination required of all prospective registered nurses in order to be licensed to practice as registered nurses.

Noncompletors. BCC nursing students who did not graduate from the nursing program.

PRIORS Command. The command that specifies the proportion of individuals in the sample that should be included in each group based on existing data. Otherwise, the analysis assumes that the group is split in half.

Related courses, support courses. Courses in the sciences required for the associate of science degree in nursing. During the years under study, the courses were Human Anatomy and Physiology I; Human Anatomy and Physiology I laboratory; Human Anatomy and Physiology II; Human Anatomy and Physiology II laboratory; Chemistry for the Health Sciences (Chemistry); Essentials of Nutrition and Diet Therapy; and Pharmacology I. Nursing students may enroll in Essentials of Nutrition and Diet Therapy and Pharmacology I any time after they begin nursing courses. Many of the related courses were identified by an everchanging statewide common course numbering system. The following are the science courses and the various numbers used to identify them throughout the years:

1. Human Anatomy and Physiology I - BIO111/112, APB1150, APB1220, APB1190.
2. Human Anatomy and Physiology I Laboratory - B10105, APB1150L, APB1190L.
3. Human Anatomy and Physiology II - BIO113/114, APB1151, APB1221, APB1191.
4. Human Anatomy and Physiology II Laboratory- B10117, APB1151L, APB1191L.
5. Chemistry for the Health Sciences - CHM1030.

When referring to the sciences, the numbers used throughout this paper are the numbers currently used.

Stepwise. A method of discriminant analysis called WILKS by SPSS-X. This method entered variables one at a time using the WILKS Lambda value as the criterion (Nie, 1983:627). The advantage of using the stepwise method was that variables could be removed from the equation as others were entered, resulting in a discriminant function that contained fewer variables since redundancies were eliminated. This equation was efficient for classification purposes.

WILKS Lambda. The criterion most commonly used for testing whether or not the equation accounts for a significant proportion of the variance.

Limitations

Just as there are basic assumption underlying any research project, there are also recognized limitations to research that may have an impact on the conclusions to be drawn from an investigation. Limitations associated with this investigation included the following:

1. The interpretations of the results of this study were limited to the classes enrolled in the Generic ADN program in 1984, 1985, and 1986 at BCC, Central Campus. No reference was made to the LPN-RN track, EMT/Paramedic track or the ADN programs at other institutions.

2. The analysis of student performance was limited to the first semester of the program. Review of student evaluations obtained from 1983-1986 resulted in the observation that at least thirty percent of the nursing students demonstrated academic difficulties during the first nursing courses and exited the program during or immediately after the first semester. Thus, it was considered appropriate to concentrate on the factors associated with early performance in order to maximize the use of available data.

Assumptions

As with any research investigation, there were inherent assumptions associated with this study that required identification. The assumption in this study included the following:

1. The data from the population were representative of typical nursing students.

2. Academic performance criteria would differentiate completors from noncompletors.

Chapter 2

REVIEW OF RELATED LITERATURE

The purpose of this study was to determine the factors that predicted program completion by comparing completors of the nursing program and noncompletors based on sixteen cognitive criteria (independent variables). A review of literature written during the past twenty years was completed. The major focus of the literature search was on nursing student attrition, predictor variables, and nursing program completion.

The literature review revealed a vast amount of data related to predictive studies in nursing schools. Very few studies considered "program completion" as the outcome variable. The indicator of success or outcome variables used in most studies was "passing the nursing licensure examination." For the purposes of this study, literature that dealt with both measures of success was reviewed.

Studies of Cognitive and Noncognitive Variables

A review of literature related to variables predicting successful completion (graduation) from a nursing program revealed most researchers disagreed. Dell and Halpin (1984) find cognitive variables to be the only significant factors in predicting program completion. Felts (1986:372) finds

that the "predictive power of the traditional cognitive measures such as grades, college admission scores, nursing achievement tests, and college GPA was generally supported in the literature." Two cognitive variables that were almost universally accepted as predictors of program completion were GPA and science grades. Millican (1986) and Boyle (1986) suggest that noncognitive attributes added little to successful performance prediction. However, other authors including Yocom and Scherubel (1985); Melcolm, Venn, and Bausell (1981); and Rose (1983) find noncognitive attributes to be significant factors in predicting program completion and NCLEX-RN scores.

Most authors agreed that noncognitive variables had little predictive power regarding completion/noncompletion of a nursing program. As a result of a study on predictor variables and program completion and NCLEX-RN scores, Millican (1986:18, 23) states that "noncognitive attributes added little to successful performance prediction" and "personality and interest tests have been of little predictive value." In studies investigating noncognitive variables, Baker (1975), Jones (1975), and Montgomery and Palmer (1976), characterize the successful student as more mature, older, married, and more achievement oriented. Safian-Rush and Belock (1988) and Rose (1983) confirm that age was positively correlated with NCLEX-RN scores. Balint (1988:24), however, finds no relationship between age and NCLEX-RN scores. Safian-Rush and Belock (1988) finds

ethnicity and sex did not reveal any correlations with program success. Yocom and Scherubel (1985) finds race to be a factor in predictive studies.

Most studies related to demographics and other noncognitive variables find little relationship between the variables and predicting program success. Felts (1986) examines the relationship between selected demographic and cognitive variables and performance on NCLEX-RN in five ADN programs and find that demographic variables does not predict success or failure on the NCLEX-RN examination.

Allen, Higgs, and Holloway (1988:115) in a study of 296 generic nursing students, test forty potentially predictive variables. The authors find age, marital status, workload during college courses, course load, transfer from other colleges, and the number of other colleges previously attended, are not significant predictors of program completion. The authors, however, did find previous nurses' aide or licensed practical nurse status result in lower GPAs. The authors conclude that no demographic preadmission variable was significant related to program completion and the only noncognitive variables related to program completion were verbal fluency, thought organization, and self-esteem/self-confidence.

Although some studies indicated that certain noncognitive variables correlated with program completion and success on NCLEX-RN, it was generally accepted by most researchers that academic variables showed more significance

than noncognitive variables when predicting completion and noncompletion of nursing programs.

Cognitive variables have consistently proven to predict program completion/noncompletion and NCLEX-RN status. Alichnie and Bellucci (1981:50) conclude that cognitive variables have been shown to be reliable predictors of successful academic performance. Course grades and grade point averages (GPA) were the variables most often used for performance predictions regarding completion and noncompletion of nursing programs. Felts (1986:372) finds that "the predictive power of the traditional cognitive measures such as grades, college admission scores, and college GPA is generally supported in the literature." Safian-Rush and Belock (1988:73) argue that cognitive criteria require the ability of a student to use abstract and deductive thinking which plays a major role in student success. Brown (1982), in a survey of fifty-one nursing schools, attempts to determine the preferred method used to handle selection of nursing applicants. Brown (1982) finds that respondents ranked grades in courses required for nursing as the most important consideration used in selection for admission to nursing programs.

Backman and Steindler (1971) studies the cognitive differences between students who withdrew voluntarily and those who were withdrawn from the collegiate nursing program. The results indicated a significant relationship between IQ and SAT scores and the dismissal of students.

However, Backman and Steindler (1971) caution against grouping all nursing "dropouts" together.

Literature Pertinent to Sixteen Cognitive Variables Used in the Study

Admission Criteria

Cumulative GPA Prior to Enrolling in Nursing. The literature most frequently cited prenursing GPA as a significant predictor of academic success in a nursing program (Alichnie and Bellucci, 1981; Backman and Steindler, 1971; Clemence and Brink, 1978; Donsky and Judge, 1982; Ramer, 1983; Whitley and Chadwick, 1986). Allen, Higgs, and Holloway (1988) find GPAs to be the only variable significantly related to program completion. Bistreich (1978) concludes that a student's grade point average at the time of entry into the nursing program was predictive of success in allied health programs at Miami-Dade Community College. In many studies (Felts, 1986:376; Krupa, Quick, and Whitley, 1988; Rose, 1983; and Sharp, 1984), college GPA proved to be indicative of completion of nursing program and success on the NCLEX-RN.

Mathematics. Most studies related to mathematics find a strong relationship between performance in mathematics and success or failure in nursing school. Digby (1985:62) determines that poor performance in a prerequisite mathematical course may be predictive of poor performance in the ADN program. Yess (1980) determines that the Scholastic Aptitude Mathematics Test Score (SAMT) was the single most

important predictor of success in an ADN program. Bello (1977) studies 358 students to develop factors that predicted success in an ADN program and recommended a pre-admission mathematics course for all students entering nursing programs. Sharp (1984) finds that standard achievement scores in mathematics predicted NCLEX-RN success.

Woodham and Taube (1986) demonstrate that mathematics scores on a college admission test were not significant predictors of success on the NCLEX-RN. Balint (1988:21) also finds no relationship between mathematics admission scores and success on the NCLEX-RN.

Reading Level. There was little disagreement among researchers regarding the significance of reading scores. Efurd (1978) and Ferguson (1979) determine that the higher the reading scores, the greater the tendency to complete the nursing program successfully. Overmeyer (1987), in an unpublished study, finds that even though BCC requires an eleventh-grade reading scores on the Nelson Denny Reading Test, Form C (1973) for entry into the nursing program, scores of thirteenth grade and above suggested successful completion of the first nursing course. Safian-Rush and Belock (1988:73) find a high correlation between reading, writing, and computation and success in the nursing program. The authors conclude that students without skills in these areas are "being set up for failure." Woodham and Taube (1986) point out that a relationship existed between the

verbal scores on a college admission test and success on the NCLEX-RN.

Balint (1988:21) finds no correlation between reading admission scores and the NCLEX-RN. Lambert and Wehrle (1981) in Millican (1986:21) find that some students who passed nursing courses were unable to pass the NCLEX-RN. The authors conclude that the problems were not in nursing but with basic skills of reading, writing, and mathematics.

Science Criteria

Most researchers agree that science grades predicted nursing grades. Alichnie and Bellucci (1981) find that grades in science and nursing courses were the best predictors of failing to complete a nursing program, but that both were unstable predictors. Several studies reported a significant correlation between science courses taken prior to entry into nursing and academic success (Alichnie and Bellucci, 1981; Clemence and Brink, 1978; Montgomery and Palmer, 1976; Weinstein, Brown, and Wahlstrom, 1980). Bello (1977:154), in a study of 358 ADN students, reports a statistically significant relationship between college science course grades and results on the NCLEX-RN. Efurd (1978) reports that college science grades predicted success or failure in ADN programs. In an unpublished study, Overmeyer (1986) determines that a positive correlation ($r = 0.836$) was found between grades in human anatomy and physiology courses and grades in the first nursing course. Ussery and Little (1979) in Digby (1985:33)

report a positive correlation (r = .35) between grades in biology and later achievement on the nursing examination. Whitley and Chadwick (1986:94) find that students who entered the nursing program with low science GPAs were at a significantly high risk of failing the NCLEX-RN. Allen, Higgs, and Holloway (1988) find that biophysical science grades correlated with GPA.

Some researchers find that sciences grades did not predict nursing program completion. Sharp (1984) and Yocom and Scherubel (1985:246) determine that science grades are not as statistically significant in predicting NCLEX-RN success as cumulative GPA and liberal arts GPA. Regarding science grades as predictive variables, Allen, Higgs, and Holloway (1988:116) determine that,

> . . . when entered into a regression equation with other cognitive variables, science grades did not replace the overall prerequisite GPA and thus separate computation and consideration of science variables did not appear to be warrant.

Final Grades in Repeated Science Courses

There were few studies in which grades in repeated science courses were studied. However, those few studies that were found drew contradictory conclusions. Research conducted in the 1970s and early 1980s revealed college students who repeat courses (for a variety of reasons), seem to be successful program completors (Oliver, 1985). In addition, Allen, Higgs, and Holloway (1988:116) show that students who demonstrated inconsistent grades from term to

term or had any combination of "D" and "F" grades and withdrawals also earned lower nursing GPAs and tended not to complete programs.

Continuation Criteria

Number of Non-Nursing Credits Needed for ADN Upon Admission into Nursing

The number of credits remaining for graduation upon admission into nursing programs is often dependent upon the number of credits taken prior to entering nursing. A review of the literature pertaining to credits taken and remaining revealed that most research dealt with credits taken prior to admission into nursing programs. Yocom and Scherubel (1985) find that the number of credits earned prior to admission to nursing were significant factors of success on the NCLEX-RN. Montgomery and Palmer (1976) also find the number of previously earned college credits was one of the best indicators of academic success in nursing.

Some researchers find that prerequisites to nursing programs predicted program completion. Allen, Higgs, and Holloway (1988) find that the greater the number of outstanding prerequisites (i.e., more credits) the higher the GPA. GPA was the only variable significantly related to program completion. Millican (1986:21) reports the following:

> In an effort to reduce attrition, Miami Dade Community College's ADN program advises students to complete as many non-nursing courses as possible prior to entering the nursing program.

Number of Credits Attempted to the First Semester of the Nursing Program

Only one study was found that related to courses taken during the first nursing course. Smith (1983) finds the number of courses taken in the first semester of nursing by community college students was predictive of student performance and persistence.

Grades in the First Nursing Lecture Course and the Associated Laboratory

Results of studies reported in the literature regarding clinical grades and program completion varied. However, grades in the first nursing lecture course did seem to be more predictive of program completion thar grades in the nursing clinical course. Ussery and Little (1979), and Melcolm, Venn, and Bausell (1981) report that grades in the introductory first course in nursing were related to completion of nursing programs and success on the nursing licensure examination. Yocom and Scherubel (1985:244) find that cumulative nursing lecture grades were more highly correlated with success on the NCLEX-RN than were cumulative nursing laboratory (clinical or practicum) grades. Krupa, Quick, and Whitely (1988:296) find the opposite. The authors concluded from their studies that grades in clinical nursing courses were poor predictors of the NCLEX-RN. Schwirian (1976:9) determine, after reviewing predictive studies: "Clinical courses grades . . . did not aid in the

identification of any reliable predictors of program performance."

Cumulative Grade Point Average at the End of the First Nursing Grade

Studies of cumulative GPAs at the end of the first nursing course consistently proved that GPAs predicted program completion. Seither (1980) finds the majority of predictive studies in nursing education have used GPA as the criterion for completion and he concludes GPA in nursing courses had the highest correlation with the cumulative GPA. Payne and Duffey (1986) determine GPA as the strongest predictor of NCLEX-RN success for students who were at-risk. Lenning (1980) concludes that GPAs at the end of the first semester of nursing courses were a valid predictor of persistence and success in ADN programs. Astin referred to in Digby (1985), reports dissatisfaction with first semester grades as a significant reason for withdrawal from college. A report from Sister St. Thomas (1982) indicates a strong relationship between first semester grades and NCLEX-RN scores. Ramer (1983) establishes that first semester GPAs were valid measures of persistence and success in ADN programs.

Summary

Review of the literature revealed that of the sixteen variables studied all indicated predictive significance regarding nursing program completion/noncompletion and/or

Chapter 3

PROCEDURES AND METHODOLOGY

This chapter presents the overall research design of the study as well as the procedures used to collect the data. Topics included are as follows:

1. selection of the population;
2. collection of the data;
3. treatment of the data; and
4. data analyses.

This study was an ex post facto study of the academic differences between students who graduated (completors) and students who did not graduate (noncompletors) from the Associate Degree Nursing program offered at Broward Community College, Central Campus during the academic years 1985, 1986, 1987, and 1988. Sixteen cognitive variables, based on admission and continuation criteria, were selected to determine whether or not they predicted program completion/noncompletion. Five of the sixteen variables were eliminated from the study for various reasons.

Selection of the Population

The population included 296 nursing students enrolled in the first nursing courses on the Central Campus of BCC during the academic years of 1984, 1985, and 1986. The

years under study were selected because they represented the most recent graduating classes for which adequate information was available. Table 1 describes the specific number of students enrolled in the first nursing lecture course (NUR1021) by year, term, and number of cases used. There were incomplete data on ten students. Except for the ten, the study included the total population of Central Campus nursing students who entered the nursing program during the years under study. No class was admitted to the nursing program during the January, 1986 semester because enrollments were too low. The determination not to enroll a class was a budgetary decision made by the department heads of nursing, the executive director of the Center for the Health Sciences, and the College (Jackson, 1989).

Collection of Data

Class rosters from the first nursing lecture course were used to identify the names of the students to be included in the study. Each student was assigned a number from one to 296. Using spreadsheets, data on the sixteen variables pertinent to each student were recorded. The data were obtained from official transcripts, grade sheets, admission applications, and nursing records. After the data were transferred to the spreadsheets, the students' name and any other identification were removed. Subsequent identification was indicated by subject number only to maintain confidentiality. Students were divided into two

Table 1

Population Included in the Study

Semester, Year	Number Enrolled	Data Available	Difference
Winter, 1984	55	55	0
Fall, 1984	58	58	0
Winter, 1985	51	48	3
Fall, 1985	70	65	5
Winter, 1986*	0	0	0
Fall, 1986	72	70	2
Total	306	296	10

* No students entered nursing in January, 1986 because of low enrollments.

groups, those who graduated from the nursing program (completors) and those who did not graduate (noncompletors).

Treatment of the Data

The purpose of this study was to determine the factors that best predicted completion of the nursing program at BCC. The independent variables used in this study included admission criteria and continuation criteria, listed in Table 2. As mentioned in Chapter 1, five variables were excluded from the study. The first clinical course, Nursing 1021 Laboratory was deleted because all students passed the course. Also omitted were the following variables: grade in Chemistry for the Health Sciences; final grade in

Table 2

Independent Variables Used in the Study Categorized as Admission Criteria and Continuation Criteria

Independent Variables	Research Question
Admission Criteria	
Cumulative GPA prior to starting nursing courses	1
Mathematics test score	2
Grade in Human Anatomy and Physiology I lecture	3
Grade in Human Anatomy and Physiology I laboratory	5
Continuation Criteria	
Grade in Human Anatomy and Physiology II lecture	6
Grade in Human Anatomy and Physiology II laboratory	7
Number of non-nursing credits needed for ADN degree upon admission into nursing	8
Number of credits attempted by students in the first semester of the nursing program	9
Grade in the first nursing lecture course (NUR1201)	10
Cumulative GPA at the end of the first semester of nursing	11

Chemistry for the Health Sciences Repeat; final grade in Anatomy and Physiology I Repeat; and final grade for Anatomy and Physiology II Repeat because the number of cases for each course was too small to be considered for statistical analysis.

Completion of the nursing program was determined from official transcripts. All grades and the grade point

average information used in the study were obtained from student transcripts. The grades achieved in all lecture and laboratory courses were recorded on the data spreadsheets for each individual student.

Letter grades throughout the College were assigned the following numerical values in order to calculate the GPA: "A" = 4 points, "B" = 3 points, "C" = 2 points, "D" = 1 point, "F" = 0 points. Grades for all courses used in the study were entered on the basis of a 4.00 quality point system. For each variable, withdrawals were excluded from statistical calculations. The number of times a student withdrew from a course was not studied. Only the final grade achieved in a course was researched.

Statistical Treatment and Analysis of the Data

Appendix B shows the coding used for each variable. Bielen (1989) states that a constant population is necessary to conduct discriminant functions. There were two stages of statistical analysis of the data: discriminant functions and t tests. All analyses were carried out using Statistical Package for the Social Sciences-X (SPSS-X) (Nie, 1983). The discriminant function method used a stepwise method with WILKS statistic by SPSS-X. This method entered variables, one at a time, using the WILKS Lambda value as the criterion (Nie, 1983:627).

The advantage of using the stepwise method was that variables could be removed from the equation as others were

entered. This resulted in a discriminant function that contained fewer variables since redundancies were eliminated. This method was efficient for classification purposes. All parameters were left at default values except for the PRIORS subcommand (Nie, 1983:653). This command allowed the user to specify the percentage of cases in each of the dependent variable categories. The default value for two categories was fifty percent. Actual occurrence rates were used to adjust the category values.

Discriminant analyses determined those variables that predicted completion/noncompletion of the nursing program. In answer to the questions, "which students will complete/not complete the first nursing course?" cognitive admission criteria were identified and the first discriminant analysis compared criteria required for admission into BCC's nursing program. It was then decided to identify and analyze cognitive criteria necessary for continuation in the nursing program. Therefore, the second discriminant analysis compared continuation variables. The third discriminant analysis considered all variables combined. This was included in order to determine what percentage of completion/noncompletion could be obtained when all identified variables were combined.

Kerlinger (1973:650) described discriminant analysis in detail:

> A discriminant function is a regression equation with a dependent variable that represents group membership that can be used in two main ways: (1) as a classification and diagnosis method, and (2) to study

> the relationship among variables in different population and samples.

Klecka (1975:435) states, in a description of discriminant analysis within the Statistical Package for the Sócial Sciences (SPSS) program, that discriminant analysis is used to "statistically distinguish between two or more groups of cases."

Based on the results of the discriminant functions, the second stage of the analysis was implemented. Means, standard deviations, and t tests were determined. The t tests scores determined statistical significance and allowed the comparison of each variable, one at a time. It was decided that the level of significance using the t tests would be at the 0.005 level. This level of significance increased the power of the test and reduced the risk of rejecting the null hypothesis when if, in fact, it was true.

Chapter 4

PRESENTATION OF RESULTS

The purpose of this chapter is to present the results of eleven independent variables analyzed from the 296 students enrolled in BCC's nursing program at the Central Campus site during 1984, 1985, and 1986 academic years. Table 2 lists the variables that were studied.

For purpose of analyzing the data, students were divided into two groups: completors and noncompletors. Completors were assigned the code of "1" and noncompletors were assigned the code of "2." Data collected from the 296 students revealed that 203 (69%) of the students completed BCC's nursing program during the years under study and ninety-three (31%) did not complete the program. Coding of the eleven independent variables was based on data needs.

The data are presented in two segments: "discriminant analysis" and "t tests." Discriminant analysis was applied to the eleven variables to determine if any, or a combination of any, of the variables could predict who would or would not complete BCC's nursing program. The t tests were also applied to the eleven variables to determine the means, standard deviations, and significance of each variable.

The discriminant analysis used a stepwise method which removed variables from the equation as they became redundant upon the addition of others. Redundancy occurred when variables were highly correlated with each other and thus accounted for virtually the same variance. For the discriminant analysis the independent variables were divided into three categories: admission variables, continuation variables, and all admission and continuation variables. Discriminant functions were applied to each category to identify the independent variables which significantly discriminated between students who completed the nursing program and those who did not.

The null hypotheses used throughout this study, Ho: $p1-p2 = 0$, was tested at the 0.005 level of significance. The null hypotheses were as follows:

> There was no significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to the admission variables tested.
>
> There was no significance difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to the continuation variables tested.
>
> There was no significant difference between the set of students who completed the ADN program at BCC and the set of noncompletors that could be related to the combined admission and continuation variables tested.

Discriminant Analysis of Admission Variables

Discriminant analysis of the following five admission variables was done: reading score, mathematics score, grade in Human Anatomy and Physiology I, grade in Human Anatomy

and Physiology I laboratory, and cumulative GPA upon admission into the nursing program. Three variables remained in the equation after the analysis: grade in Human Anatomy and Physiology I lecture, grade in Human Anatomy and Physiology I laboratory, and cumulative GPA upon admission into the nursing program. All three variables were significant at least at the 0.005 level. Table 3 shows the levels of significance for all five variables. Reading score and mathematics score variables were excluded from the equation. Their continue presence in the equation would have decreased the chance of predicting completors or noncompletors accurately.

The highest correlation among the five variables was between cumulative GPA upon admission into the nursing program and grade in Human Anatomy and Physiology I. Other correlations between variables were not significant. Table 4 lists the correlations for all five variables.

The probability prior to using discriminant analysis that a case belonged in a particular group when no information about the case was available, yielded a sixty-nine percent chance of predicting completors and a thirty-one percent chance of predicting noncompletors. Results using discriminant analysis yielded a 96.6 percent chance of predicting completors.

Using the regression equation for the three significant admission variables, 196 of the 203 completors (96.6%) were grouped correctly. Seven completors (3.4%) were grouped

Table 3

Discriminant Function with Five Admission Variables Extended Simultaneously

Variable	Correlation	Level of Significance	F	Discriminant Function Coefficient
A and P lecture	0.873	0.0000	18.40	0.469
A and P lab	0.753	0.0000	13.69	0.375
Prior GPA	0.781	0.0000	14.72	0.394
Reading score	0.317	0.1857*	1.76	---
Math score	0.178	0.2023*	1.63	---

*Discriminant analysis removed these variables from the equation.

Table 4

Correlation Table Using Discriminant Analyses for Admission Variables

	Read	Math	APBI	APBI lab	Prior GPA
Reading	1.000				
Math	0.117	1.000			
APBI	0.336	0.172	1.000		
APBI lab	0.156	0.124	0.509	1.000	
Prior GPA	0.257	0.129	0.542	0.354	1.000

into the noncompletors category. Of the ninety-three noncompletors (88.2%), eighty-two were grouped in the completors category and eleven cases (11.8%) were correctly classified as noncompletors. Therefore, the regression equation, based on the three significant admission variables, predicted completors but not noncompletors. Table 5 shows these results.

Table 5

Classification of Completors and Noncompletors Using Discriminant Analyses for Admission Variables

	Completors Group	%	Noncompletors Group	%	Total
Completors	196	96.6	7	3.4	203
Noncompletors	82	88.2	11	11.8	93

Discriminant Analysis of Continuation Variables

Discriminant analysis of the following six continuation variables was done: grade in Human Anatomy and Physiology II lecture, grade in Human Anatomy and Physiology II laboratory, grade in first nursing lecture course (NUR1021), cumulative GPA after completing NUR1021, number of non-nursing credits needed for the ADN degree upon admission into NUR1021, number of credits taken with NUR1021.

Three variables remained in the equation after the analysis: grade in NUR1021, grade in Human Anatomy and Physiology II laboratory, and non-nursing credits remaining for the ADN degree upon admission into NUR1021. All three variables were significant at least at the 0.005 level. Table 6 shows the levels of significance for all six variables. The variables, grade in Human Anatomy and Physiology II lecture, cumulative GPA after completing NUR1021, and number of non-nursing credits taken with NUR1021 were excluded from the equation. Their continued presence in the equation would have decreased the chance of predicting completors or noncompletors accurately.

The highest correlation among variables was between grade in NUR1021 and grade in Anatomy and Physiology II laboratory (0.579). Cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology laboratory II yielded a correlation of 0.508. All other correlations between the variables were insignificant. Table 7 shows the correlation for each variable.

The probability prior to using discriminant analysis that a case belonged in a particular group when no information about the case was available yielded a sixty-nine percent chance of predicting completors and a thirty-one percent chance of predicting noncompletors. Results using discriminant analysis yielded a 93.1 percent chance of predicting completors. Noncompletors could be predicted accurately 47.9 percent of the time.

Table 6

Discriminant Function with Six Continuation Variables Extended Simultaneously

Variable	Correlation	Level of Significance	F	Discriminant Function Coefficient
A and P grade	0.407	0.000	23.31	---**
A and P lab grade	0.356	0.000	15.73	0.133
NUR1021 grade	0.950	0.000	111.97	0.852
Post GPA	0.445	0.000	27.45	---**
*Non-nursing credits remaining for ADN degree upon admission to NUR1021	-0.489	0.000	29.63	-0.293
Credit during NUR1021	0.118	0.7391	0.11	---**

*Non-nursing credits remaining for ADN degree correlated negatively because completors needed fewer non-nursing credits to graduate at the time of starting the NUR1021 than noncompletors.

**Discriminant analysis removed these variables from the equation.

Table 8 shows that the results of using the regression equation for the three significant continuation variables indicated that, 191 of the 203 completors (94.1%) were grouped correctly. Twelve completors (5.9%) were grouped into the noncompletors category. Forty-nine of the ninety-three noncompletors (52.7%) were grouped in the completors'

Table 7

Correlation Table Using Discriminant Analyses for Continuation Variables

	APBII	APBII lab	NUR1021	Post GPA	Credits Remaining for the ADN	Credits Taken with NUR1021
APBII	1.000					
APBII lab	0.579	1.000				
NUR1021	0.337	0.246	1.000			
Post GPA	0.565	0.508	0.376	1.000		
Credits Remaining for the ADN*	-0.146	-0.046	-0.222	-0.193	1.000	
Credits Taken with NUR1021	0.029	0.043	0.069	0.090	0.224	1.000

*Values are minus.

Table 8

Classification of Completors and Noncompletors Using Discriminant Analyses for Continuation Variables

	Completors Group	%	Noncompletors Group	%	Total
Completors	191	94.1	12	5.9	203
Noncompletors	49	52.7	44	47.3	93

category and forty-four cases (47.3%) were classified correctly as noncompletors. Therefore, the regression equation, based on the three significant continuation variables, predicted completors but not noncompletors.

Discriminant Analysis of Combined Admission and Continuation Variables

Discriminant analysis of the admission and continuation variables resulted in the entering of all eleven admission and continuation variables into the equation. Variables that remained in the equation were the grade in NUR1021, non-nursing credits remaining for the ADN degree upon admission into NUR1021, and the grade in Human Anatomy and Physiology I laboratory. Variables removed from the equation because their presence decreased the chances of accurately predicting completors/noncompletors included the following: (1) cumulative GPA after completing NUR1021; (2) cumulative GPA prior to enrolling in NUR1021; (3) grade in Anatomy and Physiology I lecture; (4) grade in Anatomy and

Physiology II lecture; (5) grade in Anatomy and Physiology II laboratory; (6) prerequisite math score; (7) prerequisite reading score; and (8) number of credits attempted in the first semester of nursing.

The highest correlation among variables was between cumulative GPA after completing NUR1021 and cumulative GPA upon admission into NUR1021 (0.905). This correlation would be expected as few changes would occur in a student's GPA during a one semester period. Other high correlations occurred between (1) cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology I lecture (0.627); (2) grade in Human Anatomy and Physiology II lecture and grade in Human Anatomy and Physiology II laboratory (0.579); (3) cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology II lecture (0.565).

Although all variables were entered by design, an examination of the univariate ratios for differences between completors and noncompletors revealed that, in all cases, variables were significantly different. The variables that have the highest correlation with discriminant function are listed in Table 9 by category. Variables that remained in the equation after all other were removed were the grade in NUR1021, non-nursing credits remaining for ADN degree upon admission to NUR1021, and the grade in Human Anatomy and Physiology I laboratory. Variables were removed from the equation because their presence decreased the chances of accurately predicting completors and/or noncompletors.

Physiology II lecture; (5) grade in Anatomy and Physiology II laboratory; (6) prerequisite math score; (7) prerequisite reading score; and (8) number of credits attempted in the first semester of nursing.

The highest correlation among variables was between cumulative GPA after completing NUR1021 and cumulative GPA upon admission into NUR1021 (0.905). This correlation would be expected as few changes would occur in a student's GPA during a one semester period. Other high correlations occurred between (1) cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology I lecture (0.627); (2) grade in Human Anatomy and Physiology II lecture and grade in Human Anatomy and Physiology II laboratory (0.579); (3) cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology II lecture (0.565).

Although all variables were entered by design, an examination of the univariate ratios for differences between completors and noncompletors revealed that, in all cases, variables were significantly different. The variables that have the highest correlation with discriminant function are listed in Table 9 by category. Variables that remained in the equation after all other were removed were the grade in NUR1021, non-nursing credits remaining for ADN degree upon admission to NUR1021, and the grade in Human Anatomy and Physiology I laboratory. Variables were removed from the equation because their presence decreased the chances of accurately predicting completors and/or noncompletors.

Table 9 shows the variables used for this analysis and the level of significance after discriminant analysis was completed.

The highest correlation between variables was between cumulative GPA after completing NUR1021 and cumulative GPA upon admission into NUR1021 (0.905). This correlation would be expected as few changes would occur in a student's GPA during a one semester period. Other high correlations occurred between cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology II lecture and grade in Human Anatomy and Physiology II laboratory (0.579), and cumulative GPA after completing NUR1021 and grade in Human Anatomy and Physiology II lecture (0.565). Correlations for all variables are shown in Table 9. Grade in NUR1021 had a near perfect correlation of 0.941, and the remaining variables all correlated below 0.490. Although all variables were entered by design, an examination of the univariate ratios for differences between completors and noncompletors revealed that, in all cases, variables were significantly different. For each category, the variables that have the highest correlation with discriminant function are listed in Table 9.

Table 10 shows that using all variables the functions were better at identifying completors than noncompletors. Using the regression equation, 189 the 203 completors (93.1%) were grouped correctly. Fourteen completors (6.9%) were grouped into the noncompletors category. Forty-eight

Table 9

Discriminant Function with Eleven Combined Variables Extended Simultaneously

Variable Correlation	Coefficient	Level of Significance	F	Discriminant Function Coefficient
Anatomy and Physiology I lab grade	0.329	0.0003	13.69	0.184*
NUR1021 grade	0.942	0.0000	111.00	0.646
Non-nursing credits needed for ADN degree upon admission to nursing	-0.485	0.0000	29.63	-0.245
Cumulative GPA after taking NUR1021	0.451	0.0000	29.63	---*
Anatomy and Physiology II lab grade	0.412	0.0001	23.31	---*
Anatomy and Physiology I lecture grade	0.326	0.0000*	18.40	---*
Cumulative GPA upon admission into NUR1021	0.320	0.0002	14.72	---*
Anatomy and Physiology II lecture grade	0.295	0.0000	15.73	---*
Math score	0.132	0.2023	01.63	---*
Reading score	0.128	0.1857	01.76	---*
Non-nursing credits taken with NUR1021	0.113	0.7391	00.11	---*

*Variables excluded from equation.

Table 10

Classification of Completors and Noncompletors Using Discriminant Analyses for Combined Variables

	Completors Group	%	Noncompletors Group	%	Total
Completors	189	93.1	14	6.9	203
Noncompletors	49	51.6	45	48.4	93

of the ninety-three noncompletors (51.6%) were grouped in the completors category and forty-five cases (48.4%) were correctly classified as noncompletors. Of the ninety-three cases who did not complete the nursing program, forty-eight (52%) had a completor's profile. Therefore, the regression equation, based on the admission and continuation variables, predicted completors but not noncompletors.

Analysis Using t Tests

Cumulative Grade Point Average Prior to Enrolling in the First Semester of Nursing

All students prior to admission to the nursing program at BCC must have a 2.0 or better cumulative grade point average. The cumulative GPAs of the 296 students immediately prior to enrolling in the first nursing courses are listed in Table 11. One hundred and three (35%) students enrolled in the first nursing courses had a GPA of

3.0 for higher. Eighty-five (42%) of those were completors and eighteen (19.4%) were noncompletors. As shown in Table 11, three of the completors entered the program with less than a 2.0 cumulative GPA. Careful investigation did not determine why these students were admitted into the nursing program.

Results of the t test answered research question one, "Was there a significant difference at least at the 0.005 level between completors and noncompletors' cumulative grade point averages prior to enrolling in the first nursing courses?" The means, standard deviations, and t test results are shown in Table 12. The t test resulted of 3.84 with a significance level of 0.000 indicated that there was a significant difference between completors and noncompletors in students' GPAs immediately prior to entering the nursing program.

The decision was made to reject the null hypothesis for research question one. There was a significant difference between the two groups. Completors as compared to students who did not complete the nursing program had significantly higher GPAs prior to entering the nursing program.

Prerequisite Mathematics Score

A mathematics test was administered to all prospective nursing students. The test, designed by the faculty of the nursing department, assessed whether prospective nursing students had the basic mathematics skills to solve medication dosage problems found in nursing situations.

Table 11

Number and Percent of Completors and Noncompletors' Cumulative GPAs Prior to Enrolling in the First Semester of Nursing

GPA Prior to the First Semester of Nursing	Completors		Noncompletors		Total	
	n	%	n	%	n	%
4.0	1	.5	1	1.1	2	.7
3.0 - 3.9	84	41.4	17	18.3	101	34.1
2.0 - 2.9	115	56.6	75	80.6	190	64.2
1.0 - 1.9	3	1.5	0	0.0	3	1.0
Total	203	100.0	93	100.0	296	100.0

There were fifty problems on the test and each problem was assigned the same weight. A total of fifty points could be attained. One point was deducted for each wrong answer. The minimum score for entry into the nursing program was forty. Different versions of the test were available and students could retake the test until an acceptable score was achieved.

The mathematics scores for completors and students who did not complete the nursing program are presented in Table 13. As seen in this table, four students entered the nursing program during the years under study with mathematics scores below forty. Careful investigation did not determine why these students were admitted into the program.

Table 12

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' Cumulative GPAs Prior to the First Semester of Nursing

Variable	Group	n	Mean Prior GPA	SD	t Test Score	Significance Level
Prior GPA	Completors	203	2.93	0.515	3.84	0.0000
	Noncompletors	93	2.70	0.430		

Table 13

Number and Percent of Completors and Noncompletors' Prerequisite Mathematics Scores

Math Scores	Completors n	%	Non-completors n	%	Total n	%
50	22	0.8	2	2.2	24	8.1
49	42	20.7	11	11.8	45	17.9
48	30	14.8	15	16.1	45	15.2
47	24	11.8	9	9.7	33	11.1
46	29	14.3	25	26.8	54	18.2
45	13	6.4	6	6.9	19	6.4
44	15	7.4	8	8.6	23	7.8
43	9	4.4	5	5.3	14	4.7
42	7	3.4	4	4.3	11	3.8
41	6	3.0	6	6.5	12	4.1
40	2	1.0	2	2.2	4	1.4
Unavailable	4	2.0	0	0.0	4	1.3
Total	203		93		296	100.0

Each group of students had scores ranging from forty to fifty. One hundred fifty-five students (52%) achieved a score of forty-seven or better on the test. This number represented 118 (58%) of the completors and thirty-seven (40%) of the noncompletors.

Research question two asked, "Was there a significant difference at least at the 0.005 level between completors

and noncompletors' prerequisite mathematics scores?" The t test score of 1.52 was significant at the 0.202 level. Therefore, there was no significant difference between the two groups. Completors and noncompletors mathematics test scores did not differ significantly. The decision was made to fail to reject the null hypothesis. The means, standard deviation, t value, and the two-tailed probability for these mathematics scores are listed in Table 14.

Prerequisite Reading Level

During the years under study and prior to admission into the nursing program, each student had to take the Nelson-Denny Reading Test, Form C 1973. A reading level score of at least eleventh grade was required to be admitted into the nursing program. Students who scored lower than the eleventh grade reading level were offered remediation and were permitted to retake the test until an acceptable reading level score was obtained. As shown in Table 15, seven students scored at the tenth grade reading level. The seven originally entered the nursing program under a catalog when tenth grade reading level scores were acceptable for entry into the nursing program.

The reading level scores for nursing program completors and noncompletors are listed in Table 15. One hundred fifty-seven completors (77%) and sixty-eight noncompletors (73%) had reading levels of thirteenth grade or better. The

Table 14

Means, Standard Deviations, and t Test Scores of Completors and Noncompletors' Mathematical Scores

Group	n	Mean Math Score	SD	t Test Score	Significance Level
Completors	203	46.42	4.08	1.52	0.202
Noncompletors	93	45.84	2.49		

Table 15

Number and Percent of Completors and Noncompletors' Reading Levels

Reading Level	Completors n	%	Non-completors n	%	Total n	%
15th Grade	43	21	16	17	59	20
14th Grade	55	27	20	21	75	25
13th Grade	59	29	32	34	91	31
12th Grade	28	14	10	11	38	13
11th Grade	13	6	13	14	26	9
10th Grade	5	3	2	3	7	2
Total	203	100	93	100	296	100

means, standard deviations, and t test results for the reading levels of completors and noncompletors are presented in Table 16. Research question three asked, "Was there a

Table 16

Means, Standard Deviations, and t Test Scores of Completors and Noncompletors' Reading Levels

Group	n	Mean Reading Score	SD	t Test Score	Significance Level
Completors	203	13.65	1.17	1.33	0.186
Noncompletors	93	13.45	1.22		

significant difference at least at the 0.005 level between completors and noncompletors' prerequisite reading score?" The results of the t test was 1.33 with a 0.186 significance level. There was no significant difference between the two groups. These results led to a decision to fail or reject the null hypothesis. Completors did not differ from noncompletors in terms of their scores on the reading test.

Grade in Human Anatomy and Physiology I

All students, prior to admission into the nursing program, must complete the prerequisite courses Human Anatomy and Physiology I and the associated laboratory with a grade of "C" or better. The following coding was used for all Human Anatomy and Physiology grades which students achieved: 4 = "A," 3 = "B," 2 = "C," 1 = "D," 0 = "F." All 296 students completed Human Anatomy and Physiology I and the associated laboratory. The distribution of Human

Anatomy and Physiology I lecture grades for completors and noncompletors is shown in Table 17. One hundred and sixteen completors (57%) received a grade of "B" or higher while only thirty-four noncompletors (37%) received similar grades. In the associated laboratory, 159 completors (78%) and fifty-seven noncompletors (61%) achieved grades of "B" or higher (see Table 18).

Research questions four and five asked, "Was there a significant difference at least at the 0.005 level between completors and noncompletors' grades in prerequisite Human Anatomy and Physiology I lecture and the associated laboratory?" Results of the t tests were as follows: Human Anatomy and Physiology I had a t score of 4.29 with a level of significance at 0.000 and Human Anatomy and Physiology I laboratory had a t score of 3.71 with a level of significance of 0.0000. There was a significant difference between the two groups for the Human Anatomy and Physiology I lecture and the associated laboratory course. Therefore, the null hypotheses were rejected at the 0.005 level of significance. Completors significantly differed from noncompletors in terms of their grades in Human Anatomy and Physiology and the associated laboratory. The means, standard deviations, t values, and significance levels for Human Anatomy and Physiology I and the associated laboratory are found in Table 19.

Table 17

Number and Percent of Completors and Noncompletors' Human Anatomy and Physiology I Grades

Grade	Completors n	%	Non-completors n	%	Total n	%
A	48	23.7	9	10.0	57	19.3
B	68	33.5	25	26.7	89	30.1
C	70	34.4	45	48.3	117	39.5
D/F	17	8.4	14	15.0	33	11.1
Total	203	100.0	93	100.0	296	100.0

Table 18

Number and Percent of Completors and Noncompletors' Human Anatomy and Physiology I Laboratory Grades

Grade	Completors n	%	Non-completors n	%	Total n	%
A	83	40.9	22	24.0	105	19.3
B	76	37.4	35	38.0	111	30.1
C	41	20.4	30	32.0	71	39.5
D/F	3	1.5	6	6.0	9	11.1
Total	203	100.0	93	100.0	296	100.0

Grade in Human Anatomy and Physiology II

Human Anatomy and Physiology II (APB1191) and the Associated Laboratory (APB1191L) are corequisite courses for NUR1021 and NUR1021L. However, most nursing students take APB1191 and APB1191L prior to entering nursing. The distribution of Human Anatomy and Physiology II lecture grades for completors and noncompletors is shown in Table 20. Ninety-nine completors (43.8%) received a grade of "B" or higher while only thirty noncompletors (32.2%) received similar grades. In the Associated Laboratory, 113 completors (55.6%) and thirty-four noncompletors (36.4%) achieved grades of "B" or higher (see Table 21).

Research questions six and seven asked, "Was there a significant difference at the 0.005 level between completors and noncompletors' grades in prerequisite Anatomy and Physiology II lecture and the Associate Laboratory?" Results of the t tests showed that Human Anatomy and Physiology II had a t score of 4.83 with a level of significance at 0.000 and Human Anatomy and Physiology II laboratory had a t score of 3.97 with a level of significance of 0.000. There was a significant difference between the two groups for the Human Anatomy and Physiology II lecture and the associated laboratory course. Therefore, the null hypotheses could not be accepted at the 0.005 level of significance. Completors differed significantly from noncompletors in terms or their grades on Human Anatomy and

Table 19

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' Grades for Human Anatomy and Physiology I and the Associated Laboratory

Variable	Group	n	Mean	SD	t Test Scores	Significance Level
A and P I	Completors	203	2.82	0.89	4.29	0.000
	Noncompletors	93	2.33	0.95		
A and P I Laboratory	Completors	203	3.11	0.91	3.70	0.000
	Noncompletors	93	2.14	1.10		

Table 20

Number and Percent of Completors and Noncompletors' Human Anatomy and Physiology Grades

Grade	Completors n	Completors %	Non-completors n	Non-completors %	Total n	Total %
A	33	11.3	7	7.5	40	10.1
B	66	32.5	23	24.7	89	30.1
C	97	47.8	49	52.7	146	49.3
D/F	17	8.4	14	15.1	31	10.5
Total	203	100.0	93	100.0	296	100.0

Physiology II and the Associate Laboratory. The means, standard deviations, t values, and significance levels for Human Anatomy and Physiology II and the Associated laboratory are found in Table 22.

Number of Non-Nursing Credits Needed for the ADN Degree Upon Admission into Nursing

Various numbers of credits were required to complete the Associate Degree in Nursing (ADN) during the years under study. Students who entered in 1983-84 needed eighty-four credits; in 1984-85, seventy-three credits; and in 1985-86, eighty-eight credits to complete the program. The various credit changes were not considered upon admission into the nursing program when determining the number of credits remaining for the ADN degree.

Table 21

Number and Percent of Completors and Noncompletors' Human Anatomy and Physiology II Laboratory Grades

Grade	Completors n	Completors %	Non-completors n	Non-completors %	Total n	Total %
A	35	17.2	9	9.5	44	14.9
B	78	38.4	25	26.7	103	34.8
C	84	41.4	40	43.0	115	41.9
D/F	6	3.0	19	20.6	25	8.4
Total	203	100.0	93	100.0	296	100.0

These increases were partly due to an increase in the number of credits required in nursing courses during the years under study. During the 1983-84 academic year the number of credits in nursing courses was thirty-six credits. The nursing credits increased to forty-six in the 1984-85 academic year and further increased to forty-six for the 1985-86 academic year.

The number of credits in science courses changed during the years under study. The number of credits assigned to Human Anatomy and Physiology I lecture and Human Anatomy and Physiology II and the associated laboratories changed from a total of ten in 1983-84, to eleven in 1984-85, to fifteen in 1985-86. Chemistry for the Health Sciences was introduced into the curriculum as a three-credit course in 1985-86. Chemistry for the Health Sciences was not included in the

Table 22

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' Grades for Human Anatomy and Physiology II and the Associated Laboratory

Variable	Group	n	Mean	SD	t Test Scores	Significance Level
A and P II	Completors	203	2.64	0.87	4.83	0.000
	Noncompletors	93	2.07	1.07		
A and P Laboratory	Completors	203	2.63	0.92	3.97	0.000
	Noncompletors	93	2.14	1.10		

statistical analyses because there were too few cases available for computation. However, Chemistry for the Health Sciences, Human Anatomy and Physiology I lecture, and Anatomy and Physiology laboratory were prerequisites for entry into first nursing course and would have been completed prior to the student's entrance therein. Human Anatomy lecture and Physiology II and Human Anatomy and Physiology II laboratory were listed as corequisites to the first nursing course.

Except for Physical Education courses, which changed from four credits with age exemptions in 1983-84 to two credits with no age exemptions in 1984-85, the number of credits in general education courses remained the same throughout the years under study. The following general education credits were required for the ADN degree: six credits in English, three credits of social science elective, three credits in general sociology, three credits in general psychology, and three credits in developmental psychology.

Essentials of Nutrition and Diet Therapy and Pharmacology I were related courses required for the ADN degree that students could not enroll in until nursing courses were begun. Essentials of Nutrition and Diet Therapy was a three credit course during the years under study. Pharmacology I was a one-credit course in 1983-84 academic year and a two credit course in the 1984-85 and 1985-86 academic years.

The number and percentage of credits which completors and noncompletors needed for the ADN degree upon admission into the nursing program are listed in Table 23. Ninety-one students (31%) of the 296 students had completed all of the credits for the Associate Degree in Nursing except for credits in Pharmacology I and Essentials of Nutrition and Diet Therapy upon admission into the nursing program. Seventy-one (78%) of the students were program completors and twenty (22%) were noncompletors. One hundred and five (53%) of the completors and twenty-seven (29%) of the noncompletors had three of fewer general education credits remaining for their ADN degree. One hundred fifty-five (76%) of the completors and forty-six (49%) of the noncompletors had seven or less credits remaining for the ADN degree.

Research question eight asked the following: "Was there a significant difference at least at the 0.005 level between completors and noncompletors' number of credits remaining for the ADN degree upon admission into the nursing program?" As presented in Table 24, the t test results of 5.44 and a 0.000 significance level indicated a significant difference between the two groups. The null hypothesis could not be accepted.

Credits Attempted in the First Semester of Nursing

The number of credits taken in the first semester of nursing was studied. The first semester nursing courses

Table 23

Number and Percent of Completors and Noncompletors' Number of Non-nursing Credits Needed for the ADN Degree Upon Admission Into Nursing

Non-nursing Credits Needed	Completors n	%	Non-completors n	%	Total n	%
0	71	35.0	20	21.4	91	30.8
1	7	3.4	1	1.1	8	2.7
2	6	3.0	1	1.1	7	2.4
3	21	10.3	5	5.3	26	8.8
4	13	6.3	5	5.3	18	6.1
5	6	3.0	1	1.1	7	2.4
6	17	8.3	6	6.5	23	7.8
7	14	6.8	7	7.5	21	7.1
8	5	2.5	1	1.1	6	2.0
9	5	2.5	1	1.1	6	2.0
10	6	3.0	4	4.4	10	3.4
11	5	2.5	1	1.1	6	2.0
12	6	3.0	14	15.1	20	6.8
13	2	1.0	2	2.2	4	1.4
14	5	2.5	0	0.0	5	1.6
15	3	1.5	3	3.2	6	2.0
16	0	0.0	1	1.1	1	0.3
17	1	0.5	0	0.0	1	0.3
18	2	1.0	0	0.0	2	0.6
19	0	0.0	1	1.1	1	0.3
20 +	8	3.9	19	20.4	27	9.2
Total	203		93		296	

were assigned ten credits in the 1983-84 academic year and twelve credits during the 1984-85, 1985-86 years. Coding

Table 24

Means, Standard Deviations, and t Test Scores of Completors and Noncompletors' Number of Non-nursing Credits Needed for ADN Degree Upon Admission Into Nursing

Group	n	Mean	SD	t Test Scores	Significance Level
Completors	203	4.86	5.45	5.44	0.0000
Noncompletors	93	9.01	7.31		

consisting of listing the actual number of credits taken during the first semester of nursing. Coding did not account for variations regarding the number of credits assigned to the first nursing courses during the years under study.

As shown in Table 25, 255 of the students (36%) attempted thirteen or fewer credits during the first semester of nursing. One hundred seventy-seven of the 203 completors (87%) attempted ten to thirteen credits during the semester they were enrolled in the first nursing courses. The remaining twenty-six completors (13%) registered for fourteen or more credits. Seventy-eight of the ninety-three noncompletors (84%) registered for ten to thirteen during the first semester in the nursing program. The remaining fifteen noncompletors (16%) registered for fourteen or more credits. From these data, one can infer that there is little difference between the two groups'

Table 25

Number and Percent of Completors and Noncompletors' Credits Attempted in the First Semester of Nursing

Number of Credits	Completors n	%	Non-completors n	%	Total n	%
10	80	40.0	39	42.0	119	40.0
11	36	18.0	13	14.0	49	17.0
12	17	8.0	13	14.0	30	10.0
13	44	22.0	13	14.0	57	19.0
14	20	10.0	8	9.0	28	9.0
15	4	1.0	3	3.0	7	2.0
16	1	.5	2	2.0	3	1.3
17	1	.5	0	0.0	1	0.4
18	0	0.0	2	2.0	3	1.3
Total	203	100.0	93	100.0	296	100.0

attempted number of credits during the first semester of nursing.

Research question nine asked, "Was there a significant difference at least at the 0.005 level between completors and noncompletors' number of credits attempted during the first semester of nursing?" As shown in Table 26, the t test result of 0.33 with a 0.739 level of significance, indicated no significant difference between the two groups. Thus, the null hypothesis could not be rejected.

Grade in the First Nursing Courses

The first nursing courses were Nursing Process lecture (NUR1021) and the associated laboratory, Nursing Process Clinical (NUR1021L). NUR1021 was a lecture course which provided an introduction to basic principles of nursing. NUR1021L was a "hand-on" hospital course where students practiced nursing principles learned in the Nursing Process lecture. Both courses provided the foundation for further learning in nursing.

Students received conventional grades of "A," "B," "C," "D," or "F" for the first nursing lecture course. For this study, grades were coded: 4 = "A," 3 = "B," 2 = "C," 1 = "D," 0 = "F." Grades of "W" (withdrawal) were eliminated from the statistical computations and analysis. Of the 296 students who enrolled in the first nursing lecture course, twenty-two withdrew. Students received either an "S" (satisfactory) or "F" (failure) grade in the associated laboratory course NUR1021L. Since thirty-three students withdrew from the Nursing Process laboratory and there were no falling grades for the remaining students, this variable was eliminated. See Table 27.

As presented in Table 27, 274 students completed the first nursing lecture course. None of the program completors failed the course. As shown in Table 28, two completors (1%) and twenty noncompletors (22%) withdrew from the first nursing lecture course. The two completors who withdrew reenrolled in nursing at later dates. One hundred

Table 26

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' Credits Attempted During the First Semester of Nursing

Group	n	Mean Credits	SD	t Test Scores	Significance Level
Completors	203	11.49	1.68	0.33	0.739
Noncompletors	93	11.56	1.79		

Table 27

Number, Standard Deviations, and t Test Scores for Completors and Noncompletors' Credits Attempted During the First Semester of Nursing

Grade	Completors n	Completors %	Non-completors n	Non-completors %	Total n	Total %
A	31	15.4	3	4.1	34	12.4
B	133	66.4	30	41.1	163	59.5
C	37	18.4	29	39.7	66	24.1
D/F	0	0.0	11	15.1	11	4.0
Total	201	100.0	73	100.0	274	100.0

ninety-seven (71.9%) of the students received grades of "B" or better in the lecture course. One hundred sixty-four (83%) of the 197 were completors and thirty-three (17%) were noncompletors.

Table 28

Number and Percent of Students Who Withdrew vs Completed the First Nursing Lecture Course

First Course	Completors n	%	Non-completors n	%	Total n	%
Completed	201	99.0	73	78.0	274	93.4
Withdrew	2	1.0	20	22.0	22	7.6
Total	203	100.0	93	100.0	296	100.0

Research question ten asked the following: "Was there a significant difference at least at the 0.005 level between completors and noncompletors' grades achieved in the first nursing lecture course?" As shown in Table 29, for grades achieved in Nursing Process lecture, the t test results of 8.47 with a significance level of 0.001 indicated a significant difference between the two groups. The decision was made to reject the null hypothesis. As previously stated none of the students failed the nursing process laboratory; therefore, this variable was eliminated.

Cumulative Grade Point Average After Completing the First Semester of Nursing

Cumulative GPAs of students upon completion of the first semester of nursing are listed in Table 30. Eighty-seven of 203 completors (42%) had a cumulative GPA higher

Table 29

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' Grades in the First Nursing Lecture Course

Group	n	Mean	SD	t Test Scores	Significance Level
Completors	201	2.94	0.63	8.47	0.001
Noncompletors	73	1.80	1.24		

than 3.0 while only nineteen of 73 noncompletors (20%) had a cumulative GPA over 3.0.

Research question eleven asked, "Was there a significant difference at least at the 0.005 level between completors and noncompletors' cumulative grade point averages after completing of the first semester of nursing?" The t test results of 5.24 with a significance level of 0.000 indicated that there was a significant difference in the cumulative GPAs of completors and noncompletors after completing the first semester of nursing. The means, standard deviations, and t test results are presented in Table 31. The decision was made to reject the null hypothesis.

Summary of Analysis Using t Test

The research question formulated and tested for each variable was, "Was there a significant difference at least at the 0.005 level among students who completed and did not

Table 30

Number and Percent of Completors and Noncompletors' Cumulative GPAs After Completing the First Semester of Nursing

GPAs	Completors n	Completors %	Non-completors n	Non-completors %	Total n	Total %
4.0	0	0.0	1	1.0	1	0.3
3.0 - 3.9	87	41.9	17	18.0	104	35.1
2.0 - 2.9	115	56.6	72	77.4	187	63.2
1.0 - 1.9	1	0.5	3	3.2	4	1.4
Total	203	100.0	93	100.0	296	100.0

Table 31

Means, Standard Deviations, and t Test Scores for Completors and Noncompletors' for Cumulative GPAs After Completing the First Semester of Nursing

Group	n	Mean	SD	t Test Scores	Significance Level
Completors	203	2.94	0.44	5.24	0.000
Noncompletors	93	2.65	0.46		

complete BCC's ADN program as related to the eleven independent variables under consideration?" The results of the two-tailed t tests applied to the remaining eleven variables revealed that eight variables were significant at least at the 0.005 level. The significant independent

variables in order of their level of significance are as follows:

1. Cumulative GPA prior tc enrolling in NUR1021- 0.000;
2. Human Anatomy and Physiology I lecture - 0.000;
3. Human Anatomy and Physiology I laboratory - 0.000;
4. Human Anatomy and Physiology II lecture - 0.000;
5. Human Anatomy and Physiology II laboratory - 0.000;
6. Number of non-nursing credits needed for ADN degree upon admission into nursing - 0.000;
7. Cumulative GPA after completing NUR1021 - 0.000;
8. Grade in NUR1021 lecture - 0.001.

Chapter 5

INTERPRETATION, CONCLUSIONS, AND RECOMMENDATIONS

Interpretation

This major applied research project was conducted to determine which, if any, of eleven cognitive variables used in the Associate Degree Nursing program at Broward Community College, Central Campus, predicted who will complete the program. Also studied were students who are "at-risk" for not completing the nursing program. Data were collected for all 296 Central Campus nursing students (203 completors and ninety-three noncompletors) who completed the first nursing course during 1983, 1984, and 1985 academic years. Most of the students graduated in 1985, 1986, 1987, and 1988.

The data were subject to discriminant analysis and two-tailed independent t tests. The level of significance was 0.005. The eleven cognitive variables which represented five admission criteria and six continuation criteria were subjected to discriminant analysis separately and combined. Discriminant analysis was used to compare the variables and remove the effect from overlapping and a prediction equation was obtained for each analysis performed using the varying combination of the eleven variables. Based on significant results from the discriminant analysis the variables were

then subjected to t tests designed to compare each variable, one at a time.

The variables were categorized three ways and the following questions were asked:

1. Do the admission variables used by BCC's nursing program predict nursing program completors and noncompletors?
2. Do the continuation variables used by BCC's nursing program predict program completors and noncompletors?
3. Do combined admission and continuation variables predict program completors and noncompletors?

Variables used in the study included the following:

Admission Variables

1. Cumulative GPA prior to starting nursing courses.
2. Prerequisite mathematics score.
3. Prerequisite reading level.
4. Grade in Human Anatomy and Physiology I lecture.
5. Grade in Human Anatomy and Physiology I laboratory.

Continuation Variables

6. Grade in Human Anatomy and Physiology II lecture.
7. Grade in Human Anatomy and Physiology II laboratory.
8. Number of non-nursing credits needed for ADN degree upon admission into nursing.

9. Number of credits attempted in the first semester of the nursing program.
10. Grade in the first nursing lecture course (NUR1021).
11. Cumulative GPA at the end of the first semester of nursing.

Four other variables were originally included in the study but were excluded from statistical analyses for the following reasons: the variable, grade in the first nursing clinical (NUR1021L) was omitted because all students enrolled in the course during the period under study passed the course. The remaining three variables, the final grade in repeated Human Anatomy and Physiology I lecture, the final grade in repeated Human Anatomy and Physiology II lecture, and the final grade in repeated Chemistry for the Health Sciences were excluded because the number of students who repeated the courses was not large enough to provide reliable data.

Results of Discriminant Analyses

Discriminant Analysis with Admission Variables. Three of the five admissions variables were significant in discriminating between completors and noncompletors. These variables were grade in Human Anatomy and Physiology I lecture, cumulative college GPA prior to starting nursing courses, and the grade in Human Anatomy and Physiology I laboratory.

One can predict a student's chances of completing the nursing program at BCC, Central Campus, given the individual's grades from the above mentioned classes and the cumulative GPA earned at BCC. The classification results indicate that the prediction equation was not one hundred percent accurate. An administrative decision would need to be made as to whether additional variables for admission should be included, such as high school GPA or a higher cutoff, thus eliminating potential noncompletors.

Based on the results of the above discriminant analysis one can reject the null hypothesis and accept the alternate to determine the significance of each variable in distinguishing between completors and noncompletors under the alpha level (0.005) used for the discriminant analysis. This procedure is analogous to running Scheffe's after a significant ANOVA is determined. Due to the significant discriminant analysis, each variable can be analyzed against completors, one at a time. Research questions were derived from the null hypotheses.

Discriminant Analysis with Continuation Variables. Three variables remained in the equation for continuation variables: grades in NUR1021, non-nursing credits remaining for ADN degree upon admission into NUR1021, and grade in Human Anatomy and Physiology II laboratory.

Although the prediction equation is not one hundred percent accurate, it is sufficiently accurate that one can predict, most of the time, a student's chances of completing

the nursing program at BCC, Central Campus. Based on the results of the above discriminant analysis, one can reject the null hypothesis and accept the alternate to determine the significance of each variable in distinguishing between completors and noncompletors under the alpha level (0.005) used for the discriminant analysis. This procedure is analogous to running Scheffe's after a significant ANOVA is determined. Due to the significant discriminant analysis, each variable can be analyzed against completors, one at a time. Research questions were derived from the null hypotneses.

Discriminant Analysis with Admission and Continuation Variables Combined. Three variables remained in the equation when admission and continuation variables were combined: grades in NUR1021, non-nursing credits needed for the ADN degree upon admission into nursing, and the grade in Human Anatomy and Physiology I laboratory. This analysis, although it was significant, cannot be used at the time of admissions to the nursing program due to the unavailable data for non-nursing credits. The first discriminant function is operational for admissions. The choice between using continuation variables or the combination should be based on availability, reliability of data as well as effective and efficient use of staff time, in the determination of a student's status.

Results of Discriminant Analyses

Discriminant analyses predicted completors but were not predictive of noncompletors. The following are results of these discriminant analyses:

1. Regarding the admission criteria of the 203 completors, 196 were classified as completors, while eleven were classified in the noncompletors group. Of the ninety-three noncompletors, eighty-two were classified in the completors group, while eleven were classified correctly as noncompletors.

2. Regarding continuation criteria, of the 203 completors, 191 were classified as completors and twelve were classified as noncompletors. Of the ninety-three noncompletors, forty-nine were classified in the completors group and forty-four were classified as noncompletors.

3. When all the variables were used, of the 203 completors, 189 were classified correctly as completors and, fourteen were classified incorrectly as noncompletors. Of the ninety-three noncompletors, forty-eight were classified in the completors group and forty-five were classified correctly as noncompletors.

Results of t Tests

Grade point average proved to be a significant predictor of program completion using discriminant analyses and the two-tailed t test. The null hypothesis could not be accepted at the 0.005 level of significance. The predictive power of the GPA was consistent with the findings of most

researchers (Allen, Higgs, and Holloway, 1988; Alichnie and Bellucci, 1981; Backman and Steindler, 1971; Bistreich, 1978; Clemence and Brink, 1978; Donsky and Judge, 1982; Ramer, 1983; Whitely and Chadwick, 1986). The results of analysis of the data regarding cumulative GPA prior to entering the first semester of nursing showed that the higher the cumulative GPA the greater the likelihood that the student would complete the program.

Math admission scores, with a significance level of 0.186, failed to predict completion of the nursing program. Results of studies conducted on math admission scores demonstrated contradictory results. Woodham and Taube (1986) and Balint (1988) found no relationship between mathematics admissions scores and NCLEX-RN success. However, Yess (1980), Bello (1977), Sharp (1984), and Digby (1985) determined that math scores were important predictors of nursing program completion and/or NCLEX-RN success. It is important to note that in this study that there was no data to compare students who might have scored below the required passing score.

Reading admission scores, with a significance level of 0.202, failed to predict program completion. Contradictory information was presented in the literature regarding the predictability of reading scores and program completion and/or noncompletion although authors agreed that unless students could read, they could not function in college (Efurd, 1978; Ferguson, 1979; Safian-Rush and Belock, 1988;

and Woodham and Taube, 1986. Balint (1988) found no correlation between reading admission scores and passing the NCLEX-RN. There were little data to compare students without the reading prerequisite or reading scores lower than the eleventh grade cutoff point in this study. It is not possible to predict whether students with lower reading scores would complete the nursing program.

Science grades were found to predict completion of the nursing program. The results of the study showed completors to have received higher grades inn Anatomy and Physiology courses than noncompletors. This was in agreement with other studies that found grades in science courses were among the best predictors of nursing program completion (Alichnie and Bellucci, 1981; Bello, 1977; Efurd, 1978). All science variables used in the study (Human Anatomy and Physiology I lecture, Human Anatomy and Physiology I lecture, Human Anatomy and Physiology I laboratory, and Human and Physiology II laboratory) had levels of significance of 0.000 using both discriminant analysis and t tests. Human Anatomy and Physiology II lecture was removed from the prediction equation. The null hypotheses could not be accepted at the 0.005 level of significance for the science variables used in the study.

The number of non-nursing credits needed for the ADN degree upon admission into nursing was found to predict completors with a significance level of 0.000. Completors earned significanTly more credits than noncompletors prior

to enrolling in the first nursing course. The null hypothesis failed to be accepted at the 0.005 level. This variable had a negative correlation indicating that the fewer the credits needed, the greater the likelihood of completing the nursing program. Researchers are consistently in agreement regarding the relationship between credits completed prior to entering the first nursing course and future success on NCLEX-RN and program completion (Montgomery and Palmer, 1976; Allen, Higgs, and Holloway, 1988; and Millican, 1986).

The number of credits attempted in the first semester of the nursing curriculum was not an accurate indicator of program completors or noncompletors. This is contrary to the results of the only study found regarding credits attempted during the first semester of nursing. Smith (1983) found that the number of courses taken during the first semester of nursing by community college students was predictive of student performance and persistence. The mean number of credits for both completors and noncompletors was nearly the same (completors = 11.49, noncompletors = 11.56).

Further study regarding this variable may be necessary for the following reasons. At the time of this study there was "waiting list" for entry into nursing. Most prospective nursing students completed the non-nursing courses required for the degree; therefore, few additional courses beyond nursing were needed. On the other hand, since current students do not have to wait to begin nursing courses, some

may have to enroll in more than eleven to twelve credits during their first semester of nursing.

The grades in the first nursing lecture course was found to predict completors with a significance level of 0.000. Completors consistently achieved higher grades than noncompletors in the first nursing lecture course. This finding was consistent with results found in the literature (Oliver, 1985). This variable proved to also have the highest correlation with both discriminant analyses (Stepwise = .849).

Cumulative GPA at the end of the first nursing course had a significance level of 0.000. There was a significant difference between the GPAs of completors and noncompletors at the end of the first nursing course. Even though the level of significance was less than 0.005 using discriminant analysis, this variable was excluded early from the prediction equation. The reason for this was that whatever variability it may contribute to the equation that variability is being done through another variable or combination of variables that are in the equation already. The results of studies found in the literature consistently showed that GPAs at the end of the first nursing course predicted program completion and NCLEX/RN status (Lenning, 1980; Payne and Duffy, 1986; Ramer, 1983; Seither, 1980).

There is little likelihood that the cumulative GPA would change significantly from the time of entering the first nursing courses to the end of the first semester of

nursing. One reason is that most students enrolled in fewer than thirteen credits during that semester might have included only the first nursing courses. Another reason is that both completors and noncompletors took approximately the same number of credits during the first semester of nursing. In addition, the cumulative GPA of these students upon entering the program was based on the comparison of at least twelve credits. Accordingly many additional credits would have to be accumulated before significant changes would occur in the cumulative GPA.

The review of the literature contained many references to most of the variables used in the study and other variables as predictors of nursing program completion and/or noncompletion. The literature also supported the need for continued evaluation of programs of nursing, since

> the primary concern of nursing education is the implementation of knowledge in such a manner that the nursing student can become a competent, accountable and effective professional (Woodham and Taube, 1986:113).

Competence is measured, in part, by graduation from the nursing program.

Conclusions

Based on results of the study the conclusions are the following: among the admission variables tested, the grade in Human Anatomy and Physiology I lecture, the grade in Human Anatomy and Physiology I laboratory, and the cumulative GPA are the best admission criteria predictors

for completion of the nursing program. Among the continuation variables tested, the grade in the first nursing lecture course (NUR1021), the completion of non-nursing credits needed for the ADN degree before admission into the nursing program, and the grade in Human Anatomy and Physiology II laboratory are the best continuation criteria predictors for completion of the grade in NUR1021. The completion of non-nursing credits needed for the ADN degree upon admission into the nursing program, and the grade in Human Anatomy and Physiology I laboratory are the best combined criteria predictors for completion of the nursing program.

The grades in Human Anatomy and Physiology courses predict which students will complete the nursing program and those who will not. One reason for this might be that nursing behaviors derived from the nursing process are assessed throughout the nursing program and the integration of the problem-solving process and the relevance of this content to the nursing courses may be a contributing factor to the discrimination effectiveness of these courses.

None of the variables were as good at predicting noncompletors as completors. Hence the overall conclusion for the nursing program at BCC Central Campus is that the criteria used were valid predictors for admitting but other variables need to be determined to predict who would become a program noncompletor.

Retention of students has been a problem for all programs at community colleges, four-year institutions, and universities (Bielen, 1989). Is the cause age related, financial, personal, motivational, or is it all of the above or only some of the above? Does it vary on marital status, number of children, personal experiences? For the most part, these kinds of data are not found in student records. Whether they can predict program completion in BCC's nursing program is something that may warrant additional research. For the time being, given readily available data the admission criteria predict program completion and that a degree of attrition is bound to occur despite having all the right data on the admission criteria and criteria for the first semester of nursing.

Recommendations

The recommendations based on the findings and conclusions of this study are as follows:

1. The major purpose of this study was to attempt to determine which, if any, of eleven cognitive variables predicted completion or noncompletion in the Associate Degree Nursing program at BCC. The results of the study proved to predict only program completors. A profile of program completors was developed. It is recommended that the profile be disseminated to interested prospective candidates, the institutional recruiting staff, admission counselors, and faculty

The factors which best indicated the potential for program completion were as follows:

A. Admission Variables
   1. Grade in Human Anatomy and Physiology I lecture;
   2. grade in Human Anatomy and Physiology I laboratory and;
   3. cumulative GPA prior to entering nursing.

B. Continuation Variables
   1. Grade in the first nursing lecture course;
   2. non-nursing credits remaining for the ADN degree upon admission into nursing; and
   3. grade in Human Anatomy and Physiology II laboratory.

C. When admission and continuation variables were combined, the following variables were significant:
   1. grade in the first nursing lecture course;
   2. non-nursing credits needed for the ADN degree upon admission into nursing; and
   3. grade in Human Anatomy and Physiology I laboratory.

All of these measures should be useful in appraising the potential for success of the individual candidates for the program. Prospective nursing students will be able to use the admission variables to better inform themselves concerning the program requirements and assess their own

potential for success. The comparative profile provides admission personnel, student counselors and recruiters with information to appraise objectively the educational preparation of potential candidates for the program.

2. Two of the admission prerequisites should be revised or dropped as they do not appear to contribute to program completion. First, the reading level requirement should be excluded. There is no evidence of improved performance as a result of this requirement. Some students appear to be penalized by the additional time required to increase their reading level to the eleventh grade.

The second recommendation concerns the mathematics prerequisite. The results of the study indicated that although the mathematics score may act as an informal screen by students considering the program, the variable in no way predicts program completion.

3. The third recommendation involves using information regarding these predictive variables to develop a potential risk profile. This profile could be weighted based upon the strength of the predictiveness of selected variables in the student's background, thus providing an "early warning" system. An initial assessment of potential academic problems followed by referral to appropriate resources for assistance could be part of the anticipatory guidance provided the newly admitted student by an academic advisor. Student progress could be tracked throughout the major with special attention given to providing guidance prior to

crucial transitions or points in the curriculum where complexity of content or emphasis on synthesis increases and weaker students ware known to have difficulty.

Identification and consistent application of predictive variables and utilization of the data to assist students to succeed will enable programs to reduce the costs and increase the benefits of accepting students who are at-risk for noncompletion of the nursing program. Considering the current nursing shortage, this approach will also directly benefit the community by promoting retention of students.

4. A fourth recommendation is that nurse educators should conduct further analyses of the contributions of the humanities, the biological, physical and social sciences to nursing.

A correlative recommendation concerns this study. Since the study examined only a limited number of the factors that my be related to program completion and has generated areas for further study, it is recommended that a similar research project should be undertaken in the near future. The project might include demographics; personal/ personality; sociologic; scholastic performance, nongrade-related; further scholastic performance, grade-related. It can also be expected that some of the characteristics pertain to students will change as the results of the recommendations of the study, and the most current information available should be used in admission decisions and student counseling.

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APPENDIX A

LETTER FROM THOMAS, EXECUTIVE DIRECTOR

CENTER FOR HEALTH SCIENCES,

BROWARD COMMUNITY COLLEGE

BROWARD COMMUNITY COLLEGE

Office of the Executive Director • Center for Health Science Education
A. Hugh Adams Central Campus • (305) 475-6767

September 5, 1989

Major Applied Project Committee
Nova University
3301 College Avenue
Davie, Fl. 33314

Dear Committee Members:

I am writing this letter on behalf of Karon Overmeyer. Ms. Overmeyer is a doctoral student who is proposing to study criteria which may be predictive of the student's ability to complete the Nursing program at Broward Community College.

Over the past few years the enrollment in the nursing program has steadily dropped while the demand for nurses continues to increase nationally. There is a critical need to assure that both admission criteria and criteria for continuation in the program enable retention in the program. Ms. Overmeyer's study will provide invaluable data to the nursing faculty and department heads. The results will assist in determining if the standards for admission should be changed, and assist in the advisement of students who are at risk of failing or being a non-completer.

I am looking forward to the results of this study.

Sincerely,

Wanda Thomas
Executive Director

WT:dk

APPENDIX B

CODING OF DATA

CODING OF DATA

INDEPENDENT VARIABLE	CODING
Cumulative GPA Obtained to the First Nursing Course Cumulative GPA Upon Completion of First Nursing Course	Actual GPA (e.g., 2.02, 3.57, etc.)
Score on Prerequisite Mathematics Test	Actual Score (Range 40-50)
Score on Prerequisite Reading Test	Score Computed by Reading Department (e.g., 14.3, 09.6, etc.)
Grades in Courses	From Transcript (e.g., 4.5, 2.0, etc.)
Number of Non-nursing Credits Remaining for the ADN Degree After Enrolling in the First Nursing Course	From Transcript. Counted Number of Non-nursing Courses Taken Between Enrollment in the First Nursing Course and Graduation (e.g., 06, 30, etc.)
Number of Credits Taken in the First Semester of Nursing	From Transcript. Counted All Credits Taken During First Nursing Course

BIOGRAPHICAL SKETCH OF AUTHOR

Karon Overmeyer-Titus was born on June 6, 1939 in Pearl River, New York. Her childhood and adolescent years were spent roaming the woods of the Hudson Valley drawing landscapes. She is presently an accomplished free-lance artist. Karon's original career choice was in the arts: thus she worked as a window decorator for a number of years in New York City. The combination of financial hardship and New England pragmatism dictated a change of career to tone with more security.

Karon decided to attend nursing school. She completed an associate in applied science degree in 1963 from Rockland Community College. She gave birth to her son and best friend George in 1964. She attended Columbia University in New York City from 1964 through 1968 where she received a bachelor's degree in nursing and a master's degree in nursing education.

Karon taught nursing at the University of Hawaii and Bronx Community College. She came to Florida in 1976 and has taught at Broward Community College for the past fourteen years. She presently lives in Plantation, Florida with her two Scottish terriers, Anguish and Chaos.