

A MODEL FOR PREDICTING SUCCESS OF
OKLAHOMA PRACTICAL NURSING
STUDENTS ON THE NATIONAL
TEST POOL EXAMINATION
FOR LICENSURE

by

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CHAPTER I

INTRODUCTION

Practical nursing education was first established in the United States at the Ballard School in New York in 1893. A need was recognized at that time for persons with less than professional preparation in nursing. It was felt that such persons could meet the needs of patients in more or less stable nursing situations and assist the professional nurse or physician in more complex situations. Today practical nursing comprises a major component of nurse manpower in this country. In 1975, a total of 1,337 state approved practical nursing programs produced 46,080 graduates.

The first formal education for practical nurses in Oklahoma was offered by Blackwell General Hospital and Kiowa Indian Hospital in 1949. These programs were called schools for licensed attendants. Major improvements and expansion of practical nurse programs have occurred as a result of Public Law 911 (the Health Amendments Act) passed by Congress and signed by President Eisenhower in 1956. The 1963 Vocational Education Act and the 1968 Amendments to the Vocational Education Act have provided funds which allowed for the development of many practical nursing programs in area vocational-technical schools in Oklahoma.

At the present time there are twenty-three practical nursing programs funded under the State Board of Vocational-Technical Education. Twenty of these programs are under the administrative structure of the area vocational-technical schools. Three of the practical nursing programs in Oklahoma are conducted by public school districts which are not area vocational-technical school districts.

Statement of the Problem

Limited availability of programs, high attrition rates, and increasing numbers of failures on the licensing examination are factors which contribute to the undersupply of licensed practical nurses in Oklahoma. A method of predicting scores on the State Board Test Pool Examination did not exist. There was no valid indicator of success which could be used as a selection tool and as a guidance tool during the program.

Purpose of the Study

The purpose of this study was to develop and validate three formulae for predicting SBTPE scores. The first formula was to be derived from the information which was available prior to admission of students to the practical nursing program. This formula could then be used as a tool in student selection. A second formula would be derived from preadmission information plus additional information available at the mid-point of the program. This formula could be used to determine retention and promotion of students and as a guidance tool. A third

formula would be derived from all previous data and additional information available near the completion of the program. This formula could be utilized as a guidance tool at the time of graduation.

The formulae were to be developed utilizing data from a single school over a seven-year period. The school was selected on the basis of consistent admission procedures, an attrition rate of seven percent and a 99.4 percent success rate on the State Board Test Pool Examination over the seven-year period. Data from ten practical nursing programs across Oklahoma were used to validate the formulae.

Need for the Study

The Oklahoma Health Planning Commission conducted a study reported by OTIS Division of Research, Planning and Evaluation, 1975, which indicated a shortage of 1976 licensed practical nurses for the period from March, 1975, to March, 1976. The shortage was determined through a study of projected supply and projected need. Morton et. al. (1976) reported Oklahoma's supply of licensed practical nurses for 1976 to be 494 short of the projected need.

A national attrition rate of 24 percent in practical nursing programs was reported for 1974 by the National League for Nursing (Brunclik and Thurston, 1975). Data reported by the Oklahoma Board of Nurse Registration and Nursing Education (1976b) indicated 762 students were enrolled in Oklahoma practical nursing programs as of October 15, 1975. All of those students should have completed the

program and taken the licensing examination during the ensuing year. Only 560 persons took the examination for licensure with 520 passing. These data indicate an attrition rate of 26 percent.

The American Nurses Association (1967) reported the rate of failure on the State Board Test Pool Examination (SBTPE) at fourteen percent nationally. The Oklahoma Board of Nurse Registration and Nursing Education Newsletter (1976b) reported the failure rate for Oklahoma graduates on the State Board Test Pool Examination as two percent in 1972, four percent in 1973, five percent in 1974, six percent in 1975, and seven percent in 1976.

Information gathered from many of the faculties in practical nursing programs across the state revealed that the number of applicants for practical nursing education is approximately three times the number of available student positions. Most of the practical nursing programs employ a selection procedure which includes a pre-entrance test, an application which contains pertinent personal data, and an interview with faculty or an admissions committee. Admission requirements are established by each school and therefore may vary considerably. The number of students each program will admit is determined by the resources available in terms of faculty, financial resources, classroom space, and clinical facilities.

Much concern has been expressed by practical nursing educators of Oklahoma regarding student selection procedures and the need for guidance tools throughout the program. The development and validation

of three formulae for predicting State Board Test Pool Examination Scores will meet the expressed needs of many practical nursing educators.

Assumptions Basic to the Study

A major assumption is that faculties across the state will provide accurate information on characteristics of students admitted to the program.

A second assumption is that a series of validated prediction formulae will provide practical nursing programs with a selection formula and two additional formulae which can be used as guidance tools to increase the program completion rate and success rate on the licensing examination.

A third assumption is that future applicants will not differ substantially from past applicants.

Limitations of the Study

This study is limited to the students enrolled during 1976-1977 in the twenty-three practical nursing programs in Oklahoma. Further limitations are implied by the fact that all subjects of the study were enrolled in practical nursing programs. Available data on subjects was determined by the information required on admission forms and the pre-admission instruments used by the participating schools.

Definition of Terms

Practical Nursing Program - This term describes a twelve-month program established as a part of vocational education in a public school system or in the area vocational-technical school. The curriculum as prescribed by the Oklahoma Board of Nurse Registration and Nursing Education consists of Fundamentals of Practical Nursing and Nursing Care of Patients of all ages.

State Board Test Pool Examination (SBTPE or SBE) - the State Board Test Pool Examination for registered nurse licensure or practical nurse licensure is utilized as the licensing examination in Oklahoma. This is a national standardized examination for licensure and is used by all the U. S. Jurisdictions. Oklahoma is a member of the Test Pool through its participation in the Council of State Boards of Nursing of the American Nurses' Association. The policies and procedures for the examination are established by the Council and implemented through committees authorized by the Council according to the Oklahoma Board of Nurse Registration and Nursing Education (1975).

Oklahoma Board of Nurse Registration and Nursing Education (OBNRNE) - The Oklahoma Legislature enacted the Oklahoma Nursing Practice Act in 1953 which provided for legal control of nursing by the Oklahoma Board of Nurse Registration and Nursing Education. The Oklahoma Board of Nurse Registration and Nursing Education is responsible for licensing of registered and practical nurses, prescribing minimum standards for educational programs preparing nurses for

licensure, and taking necessary and appropriate action relating to the violation of the law according to the Oklahoma Board of Nurse Registration and Nursing Education (1971).

National League for Nursing (NLN) - A national voluntary organization that is comprised of nurses and other individuals who are concerned with the improvement of nursing care and nursing education and with meeting the nursing needs of the people. The National League for Nursing is the recognized national accrediting agency for all types of nursing education programs.

Previous Nursing Employment is defined as paid employment for service in a nursing capacity, with a title such as nurse assistant, nurse aide, orderly, or military medic.

Licensed Practical Nurse (LPN) - A licensed practical nurse is an individual who has successfully completed a course of study as prescribed by the Oklahoma Board of Nurse Registration and Nursing Education and the State Department of Vocational and Technical Education, and who, upon completion of the prescribed curriculum, has successfully passed a state board licensing examination, or an individual who was licensed under a waiver of the educational requirements on the basis of work experience prior to 1956.

Prediction School - The Central Oklahoma Area Vocational-Technical School, Division of Practical Nursing, was utilized as the Prediction School for the purposes of this study on the basis of their 98 percent completion rate compared to a statewide average of 76

percent and their 99.4 percent success rate on the State Board Test Pool Examination compared to a statewide average of 94 percent.

Area Vocational-Technical School (AVTS) - A school which involves a large geographic area usually including several local administrative units and offering specialized vocational-technical training to high school students and persons who have completed or left high school and are available for full-time study.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The concern regarding attrition in schools of nursing is due at least in part to research studies conducted over the past several years. The American Nurses Association (1958) reported that a nursing shortage, first recognized in the 1940's was widening throughout the 1950's. Cohen (1963) reported that President John F. Kennedy recognized the nursing shortage as an area of concern to the nation in 1963. During that same year the Surgeon General's Consultant Group on Nursing (1963) reported the nursing shortage as a "critical national problem." The group also reported that one-third of the students who enter nursing programs do not complete the program.

In addition to the problem of attrition, many of the candidates who write the SBTPE do not pass the examination and are never licensed to practice. Fourteen percent of the first-time writers and thirty-seven percent of the repeat writers failed the SBTPE in 1965 according to the American Nurses Association (1967).

Johnson (1976) reported that nursing programs at all levels have reached a zero point in terms of expansion. Admissions to professional

nursing programs and practical nursing programs reflect a growth rate of only 1.02 percent. Nationally, a zero growth rate in programs as well as admissions is predicted for the next few years. The total number of programs preparing registered nurses was 1,375 in 1975 compared with 1,363 in 1971. Practical nursing programs numbered 1,337 in 1975 compared with 1,291 in 1971. Graduates of basic registered nurse programs numbered 74,536 in 1975 compared to 47,001 graduates in 1971. Practical nursing programs produced 38,556 graduates in 1975.

The Oklahoma nurse shortage was reflected by the Oklahoma Health Manpower 1975-1980, a report of a study conducted by the Oklahoma Health Planning Commission and reported by the OTIS Division of Research, Planning and Evaluation, State Department of Vocational and Technical Education (1975). The study reflects a net demand of 408 registered nurses and 176 licensed practical nurses for 1976. Consideration was given to current job vacancies, expansion, replacement, and projected supply in determining this data. According to Morton et. al. (1976) in the OTIS Cycle Eight report, Oklahoma has a deficit of 359 registered nurses and 494 licensed practical nurses for 1975-1976. Statistical data reported by the Oklahoma Board of Nurse Registration and Nursing Education (1976) in February of 1976, revealed that 7,063 of the 9,702 professional nurses registered in Oklahoma were employed during 1975 and 5,686 of 7,509 practical nurses licensed in Oklahoma were employed during 1975.

During fiscal 1975, 567 registered nurse candidates wrote the SBTPE as first-time writers. Four hundred ninety-two or 84 percent were successful. Six hundred and forty-four first-time practical nurse candidates wrote the SBTPE during the same time period and 608 or 94 percent were successful. The percentage of candidates who have been successful on the first writing on the SBTPE from 1970 to 1975 has ranged from 80 percent to 91 percent for registered nurse candidates and from 94 percent to 98 percent for practical nurse candidates according to the February, 1976, Oklahoma Board of Nurse Registration and Nursing Education Newsletter (1976).

An excerpt from the Oklahoma Board of Nurse Registration and Nursing Education Newsletter (1974) identifies yet another factor which relates to the nurse shortage.

The Federal Energy Office recently announced that the term "shortage" of energy products was somewhat incorrect. . . the more correct term would be 'regional dislocation'. . . Editor's Comments: wonder if this same rationale applies to the 'nursing shortage'. . . perhaps the term 'regional dislocation of nursing personnel' might be more appropriate. A recent report says that the registered nurse supply continues to increase but that there is still a wide range in the nurse per 100,000 population ratio in various areas of the country (p. 2).

Admission Criteria

In view of the data previously presented, it seems imperative that schools of nursing use extreme care in selecting only those candidates who are likely to complete the program and pass the licensing

examination. Brunclik and Thurston (1956) addressed the problem of student attrition in an article for Nursing Outlook. They summarized the situation thusly:

To get the number of students needed to meet the national goal in a highly competitive recruitment situation nursing will probably have to tap sources of students less capable, less interested, or less well informed than students currently being admitted to nursing schools. The increasing difficulty of the nursing curriculum coupled with students who may be less capable of succeeding could lead to an attrition rate in excess of 60 percent; a ratio frightening to contemplate in terms of financial expense to the school, demoralizing effect on faculty, and trauma to the many students involved (p. 57).

Gleser (1960) advised nursing educators that the primary goal of student selection is to identify those individuals who have a higher than average probability of success. She further gave nursing educators reassurance against being overly concerned about rejecting some students who might have been successful as long as adequate candidates are available who meet the admission criteria.

Criteria currently utilized in the selection of students vary widely among training agencies. Clearly, the selection of an instrument and the establishment of a cut-off score is the responsibility of the administrators and educators in a given program. Kovacs (1970) suggested that a major concern should be in the area of counseling and guidance for all nursing applicants. Consistency in adhering to established standards also is considered essential by Kovacs regardless of what instrument is utilized.

Weber, King, and Pitts (1973) evaluated the use of the GATB and PACE as admissions devices. The general result of their study was a realization that many schools of practical nursing use several tests in combination as a screening technique. This was discounted by their study as being invalid and very expensive, not to mention time consuming. The major objective of the Weber, King, and Pitts study was to identify variables related to success in schools of practical nursing. Procedures included a questionnaire sent to each of the 34 schools of practical nursing in Virginia. Information regarding age, sex, educational level, I.Q. scores, General Aptitude Test Battery (GATB) scores, Preassessment and Classification Examination (PACE) scores, and Virginia State Board Examination scores were requested. Coefficients of correlation were computed on each variable and on several combinations of variables.

Initial results indicated that Age, GATB-G, and GATB-V scores were significant. Significant improvement was noted when Age and GATB-V scores were combined. Specific correlations are identified here between each of the variables and the criterion, State Board Examination results.

1. Age: .43
2. Highest Grade Completed: .03
3. GATB-G, Intelligence: .32
4. GATB-V, Verbal Ability: .32
5. GATB-Q, Clerical Perception: .11

6. GATB-K, Motor Coordination: .10
7. I.Q.: .32
8. PACE, General Information: .47
9. PACE, Science and Health: .62
10. PACE, Arithmetic: .30
11. PACE, Total I: .60
12. PACE, Vocabulary: .49
13. PACE, Reading: .42
14. PACE, Total II: .51

The researchers suggested that the administration of the PACE as the single test for screening applicants would be equally efficient and much less expensive than using multiple tests. The study was very thorough and included more than adequate data on each student. It covered a total of 922 students on which six variables were studied. PACE scores were studied on 219 students. From the data gathered it would be difficult to deny the significance of the correlation between the PACE scores and the State Board Examination scores. A further study of the correlation between other predictive tests and State Board Examination scores might prove other tests to be equally significant.

A study by Rubin and Cohen (1974) was initiated as a result of the authors' belief that underachievement is a major factor in attrition in nursing programs rather than limited ability. The researchers conducted the study to demonstrate the effects of group therapy for

underachievers and remediation for those with basic skill deficiency on the attrition rate in nursing programs.

The authors sought to prove that attrition rates can be reduced through the use of counseling, remediation, or a combination of counseling and remediation. Sixty-nine students were identified as having academic problems. Approximately one-third of the group was selected at random to serve as a control group and received no treatment. The remaining subjects were placed into three groups. Thirty-two students participated in twenty one-hour psychotherapy sessions, eight participated in twenty one-hour remediation sessions, and eight participated in ten one-hour psychotherapy sessions and ten one-hour remediation sessions. Grade Point Average (GPA) was used as a measure of effects as well as a retest using the California Test of Achievement (CAT). Analysis of variance was carried out.

Significant reduction in attrition rate resulted from the program (from 44-50 percent to 21 percent). Fifty percent of those who left were in the control group. Rubin and Cohen (1974) questioned the reliability of the CAT based upon the lack of correlation between improved GPA and the CAT scores. Rubin and Cohen concluded that remediation and/or counseling can have a significant effect on the attrition rate in schools of nursing.

Lavin (1965) reviewed over 300 studies on prediction of academic success in an attempt to identify predictors. He classified predictors into three categories--intellective factors, personality factors, and

sociological factors. Lavin concluded that three factors may be identified as basic correlates of academic success. Those three factors were ability, sex, and socio-economic status. Lavin stressed the consistency with which these factors were related to performance rather than their being more significant than other variables. He further stated that students of higher socio-economic status perform at higher levels than students of lower socio-economic status; females have higher levels of academic achievement than males; and ability is directly related to school performance.

Oklahoma Studies

A study by McCormick (1966) reported an investigation of the variables used in the selection of practical nursing students. McCormick concentrated his efforts on the OTIS Quick-Scoring Mental Ability Test: GAMMA, the Nelson-Denny Reading Test, and the Minnesota Multiphasic Personality Inventory. The population was selected from nine practical nursing programs in Oklahoma. Correlations were computed between reading scores, general mental ability scores, personality assessment scores and the practical nurse basic achievement test, the practical nurse achievement test, and the state board licensing examination. Significant positive relationships were identified between general mental ability and achievement, and between reading skills and achievement, and between elevated personality scales and the attrition group.

The study suggested caution in generalizing the results of the study to a single individual. Geographical limitations were also cited due to the area represented by the students. Cross-validation of the results with a different population of student practical nurses was recommended as an area for additional research.

Significant factors related to completing a nursing program were identified by Pittman (1974) in her doctoral dissertation as Age, Marital Status, Parental Status, Social Studies and Composite ACT Scores, High School GPA, Number of Units of High School Math, and Number of Years of Previous Nursing Employment. Insignificant factors indicated by the study included Number of Units of High School Science, Natural Science, Math and English ACT Scores, and Sex.

Standardized Test Data

Standardized tests used in this study include the General Aptitude Test Battery (GATB) and the National League for Nursing - Three Units of Content (TUC) and Nursing Including Pharmacology (NIP). The GATB is used as a guidance tool in counseling students with regard to entering the practical nursing program. It is a nationally standardized test with established norms recommended by the Employment Security Commission for entering practical nursing.

The General Aptitude Test Battery (GATB) is used by many of the practical nursing programs in Oklahoma as a counseling tool.

The aptitudes measured by the GATB and the definitions of those aptitudes are as follows:

G--Ingelligence--General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgements. Closely related to doing well in school.

V--Verbal Aptitude--The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.

N--Numerical Aptitude--Ability to perform arithmetic operations quickly and accurately.

S--Spatial Aptitude--Ability to think visually of geometric forms and to comprehend the two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movement of objects in space.

P--Form Perception--Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

Q--Clerical Perception--Ability to perceive pertinent detail or tabular material. Ability to observe differences in copy to proofread words and numbers, and to avoid perceptual errors in arithmetic computations. A measure of speed of perception which is required in many industrial jobs even when the job does not have verbal or numerical content.

K--Motor Coordination--Ability to coordinate eyes and hands or fingers rapidly and accurately by making precise movements with speed. Ability to make a movement response accurately and swiftly.

F--Finger Dexterity--Ability to move the fingers and manipulate small objects with the fingers, rapidly or accurately.

M--Manual Dexterity--Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning motion (United States Department of Labor 1970, p. 25-26).

Concurrent validation studies were conducted by the Department of Labor by correlating the GATB scores with supervisory ratings. Cross validation was accomplished through the use of instructor's ratings.

The results of those validation studies are reported below:

TABLE I
VALIDATION INFORMATION PROVIDED BY THE
DEPARTMENT OF LABOR ON GATB

	Validation Sample			Cross Validation Sample		
	M	SD	r	M	SD	r
G	88	10	.25*	102	12	.46**
V	94	12	.12	102	11	.54**
N	87	11	.24	102	15	.29*
S	86	16	.02	104	16	.06
P	90	16	-.08	118	17	.19*
Q	96	12	.10	120	17	.32**
K	101	15	-.06	114	16	.19*
F	100	19	-.04	108	16	.03
M	103	18	.05	104	19	.11

* Significant at the .05 level.

** Significant at the .05 level.

The established cut-off scores are listed as G-85, N-80, Q-85, and M-80. Concurrent validity was indicated as .30 for supervisory ratings and .26 for grade-point averages. The United States Department of Labor (1970) studied the validity of the General Aptitude Test Battery in 1953. The study included 194 graduating practical nurses; 67 from the District of Columbia, 58 from Texas, and 69 from the state of Washington. Correlations were made with final grades achieved by each participant in the District of Columbia and in Texas. The criterion for the Washington sample was instructors' ratings and re-ratings. The subtests found to have significant correlations with both sets of criteria were Intelligence, Numerical Aptitude, and Clerical Perceptions.

A search of the literature did not reveal any specific information regarding correlations on the Numerical Test Subtest Six. It was included as an independent variable in this study on the basis of observed importance over a period of years of testing applicants to a practical nursing program.

The National League for Nursing tests are nationally standardized achievement tests given at specified periods during the school year and utilized by many faculties to determine retention or dismissal of a student.

Two nationally standardized achievement tests have been used as independent variables in this study. The National League for Nursing (1961) prepares both tests--Three Units of Content (TUC) and Nursing Including Pharmacology (NIP). The purpose of these tests is "to

measure attainment of common curriculum objectives of schools of nursing, as a basis for the improvement of nursing education and nursing service."

The test questions are written by instructors who have expertise in the appropriate clinical specialty or subject matter field. The questions are then reviewed by those involved in the test development and others in schools of nursing across the United States. The tests are administered to students in schools of nursing across the United States to test the quality of the questions. The purpose of this administration is evaluation of the test only. An item analysis is done and the results are studied carefully before the item is used as a part of the test.

The Kuder-Richardson formulas are used to measure inter-item consistency. Reliability measures for the TUC and NIP are listed below as reported in the February, 1971, issue of Nursing Outlook.

The State Board Test Pool Examination (SBTPE) was first given in 1947. It was utilized by most of the states by 1958. The American Nurses Association Blueprint Committee makes the general plan for the test. Instructors who have been nominated by their state boards of nursing and selected by the American Nurses Association Special Committee of State Boards of Nursing develop questions. Item analyses are obtained and ultimately the questions must be voted upon by each of the state boards of nursing. A Kuder-Richardson reliability coefficient of 0.92 was reported in February, 1971, issue of Nursing Outlook for the Practical Nurse SBTPE.

TABLE II
KUDER-RICHARDSON FORMULA 21 RELIABILITIES
OF NLN ACHIEVEMENT TESTS

Test	Reliability
Three Units of Content	
Body Structure and Function	.88
Basic Nursing Procedures	.79
Nutrition and Diet Therapy	.85
Total	.93
Nursing Including Pharmacology	
Medical-Surgical Nursing	.80
Maternal-Child Nursing	.74
Pharmacology	.74
Total	.89

Source: February, 1971, Nursing Outlook

A study of National League for Nursing tests reported by Shelley, Kennamer, and Raile (1976) for 117 graduates of a diploma school from 1968 through 1973 indicated that 84 of 89 pairings of National League for Nursing achievement tests, course grades, and SBTPE scores produced correlation coefficients which were significant at the 0.01 level or higher. Only five of the pairings failed to produce significant correlations. Confidence bands were calculated for the regression line of each test score allowing the faculty to predict within a band of scores where each student's score was likely to fall. National League of Nursing achievement scores can therefore be utilized in advising students on

their strengths and weaknesses prior to the scheduled time of the licensing examination. The results may also be used in decisions regarding retention and promotion of students.

Knopf and Tate (1968) studied 3,014 students of practical nursing from 117 schools during a one-year period. Higher withdrawal rates were revealed for students who are under 25, unmarried, without siblings, without religious affiliation, have low academic achievement, or attended high school in communities of over one million. The attrition rate of high school graduates was found to be 20 percent, while those who had not completed high school withdrew or failed to complete at a rate of 30 percent.

A brief biographical sketch of the student most likely to succeed was offered by Knopf and Tate.

A woman over 25 years of age, who shows signs of stability, modest ability, and need. Married, she is feeling a commitment to devote herself to the welfare of others, is of average intelligence and high school accomplishment, and is a member of the lower middle income group. She may have been influenced in her choice of occupation through contacts with others in the nursing-related occupations (p. 28).

Knopf and Tate also presented some interesting data regarding variations in attrition rates related to the geographic location. The lowest attrition rates were found in the Midwest while the highest rates were found in the North Atlantic area.

Although some researchers recommend that factors from all domains be considered in student selection, Best (1968) pointed out that

intellective predictors proved to be the most significant. The predictive power of biographical data was found to be "disappointing." Three affective factors were considered. The two of moderate value were the Test Anxiety Scale and the Taylor Manifest Anxiety Scale, while the semi-projective sentence completion instrument was insignificant.

Taylor et. al. (1963), studied the problems and practices of nursing student recruitment and selection. A strong recommendation from the Taylor study was that each school attempting to reduce attrition should explore the dropout problem in its own setting. Gleser (1960) suggested that the experiences of others must be given consideration but emphasized the need for verification on the desired population:

The only valid basis for prediction is the experimental verification of the relationship between potential predictors and actual performance of a group of subjects who are representative of the population for which it is desired to make predictions (p. 47).

Summary

A search of the literature revealed many related studies but none in which formulae for predicting practical nurses SBTPE scores were developed or validated. Several studies revealed positive correlations between specific tests and performance in the classroom or on the job. The National League for Nursing Test Services reported correlations between the standardized achievement tests and the SBTPE for registered nurse students only.

Correlation studies have been done on the National League for Nursing Pre-Admission and Classification Examination and the Psychological Corporation Pre-Entrance Examination with the SBTPE which reported correlations of 0.68 and 0.41 respectively. Neither of these tests have been used in Oklahoma. Selection committees have relied on the information provided by the General Aptitude Test Battery and that which could be obtained through a personal interview. A more precise method of providing appropriate guidance is needed.

The literature clearly presents a picture of a nursing shortage throughout the nation. Current data indicates a zero growth rate in the number of schools of nursing as well as the number of graduates being produced. One of the major concerns of most nursing educators is the high attrition rate in schools of nursing throughout the nation which continues to contribute to the nursing shortage. A national attrition rate of 24 percent was reported by the National League for Nursing for practical nursing programs in 1974. A 26 percent attrition rate was indicated by Oklahoma data in 1976. Increasing numbers of failures on the SBTPE also gives rise to concern. Student selection and the identification of predictors of success have been identified as the answer to this portion of the problem.

Many studies have been conducted for the purpose of identifying success predictors. McCormick's study in Oklahoma (1966) related to practical nursing specifically and suggested the need for further studies. Gleser has admonished nursing educators to verify the utility of

predictors on representative subjects for the population to which they wish to generalize.

The need for the proposed study has clearly been identified. Factors to be considered are found throughout the literature. The usefulness of the study will be dependent upon the applicability of the study as perceived by practical nursing educators of Oklahoma.

CHAPTER III

DESIGN AND METHODOLOGY

The purpose of this chapter is to: (1) describe the basic plan of the study; (2) describe the populations and related variables; (3) describe the methods used for data collection; (4) describe the statistical procedures used in the study; and (5) list the research questions and the hypotheses to be tested.

Basic Plan

The basic plan was to obtain pre-entrance test scores and other pertinent data on a group of practical nursing students, derive three formulae from the data, and test the validity of those formulae on the 1976-1977 graduates across the state.

The first phase of the study dealt with the development of the prediction formulae from data provided by a single school. Three formulae were developed due to the increasing available data as the student progresses in school. Formula one was developed from data which were available prior to admission. It was thought that such a formula would be useful as a student selection tool. The second formula was developed from data which were available at the mid-point of the

program. It was thought that such a formula would be useful as a guidance tool and in making decisions regarding retention of students in the program. The third formula was developed from data which were available near the completion of the program. It was thought that such a formula would be useful as a guidance tool especially with those students predicted to have marginal or failing grades. The graduates of all practical nursing programs in Oklahoma have a minimum of one month between graduation and taking the licensure examination. This provides adequate time for extensive study and review if the graduate can be made aware of the need.

The second phase of the study dealt with the validation of the formulae. Each of the formulae was applied to data on students enrolled in ten practical nursing programs statewide during the 1976-1977 school year. The 1976-1977 class from the prediction school was included in phase two of this study and is listed as School #1 in Tables 4, 5, and 6. The validation phase consisted of computing predicted scores using each of the formulae and computing correlations between predicted scores and actual scores.

Prediction Population

One practical nursing program in Oklahoma has maintained a 93 percent completion rate with a 99.4 percent success on state board examinations for an overall 92 percent success for persons entering the program. Data has been obtained consistently throughout the seven

years of this program's existence on each person entering the program. The same selection criteria have been utilized throughout this seven-year period. Nationally standardized achievement tests have been administered and scores recorded at the mid-point and near completion of the program each year. This school was selected to provide data for the development of the prediction formulae, and will therefore be referred to as the prediction school. One hundred seventy-six students were enrolled in the prediction school from 1966 through 1976.

Figure 1 reflects the variables utilized and the procedure for Phase I of this study. Figure 2 identifies the components of both Phase I and Phase II of this study.

The independent variables selected for this study are identified in Figure 1. The data were obtained from the student records of all students enrolled in the practical nursing program at the prediction school from 1969 through 1976. One hundred twenty-nine of the 176 student files contained all of the desired information.

Validation Sample

Practical nursing programs are located in each of the following communities in Oklahoma: Ada, Ardmore, Bartlesville, Burns Flat, Drumright, Duncan, El Reno, Enid, Ft. Cobb, Lawton, Midwest City, Muskogee, Norman, Oklahoma City, Okmulgee, Ponca City, Poteau, Pryor, Shawnee, Stillwater, Tulsa, Wayne, and Woodward. These communities represent the full range of sizes from the rural community

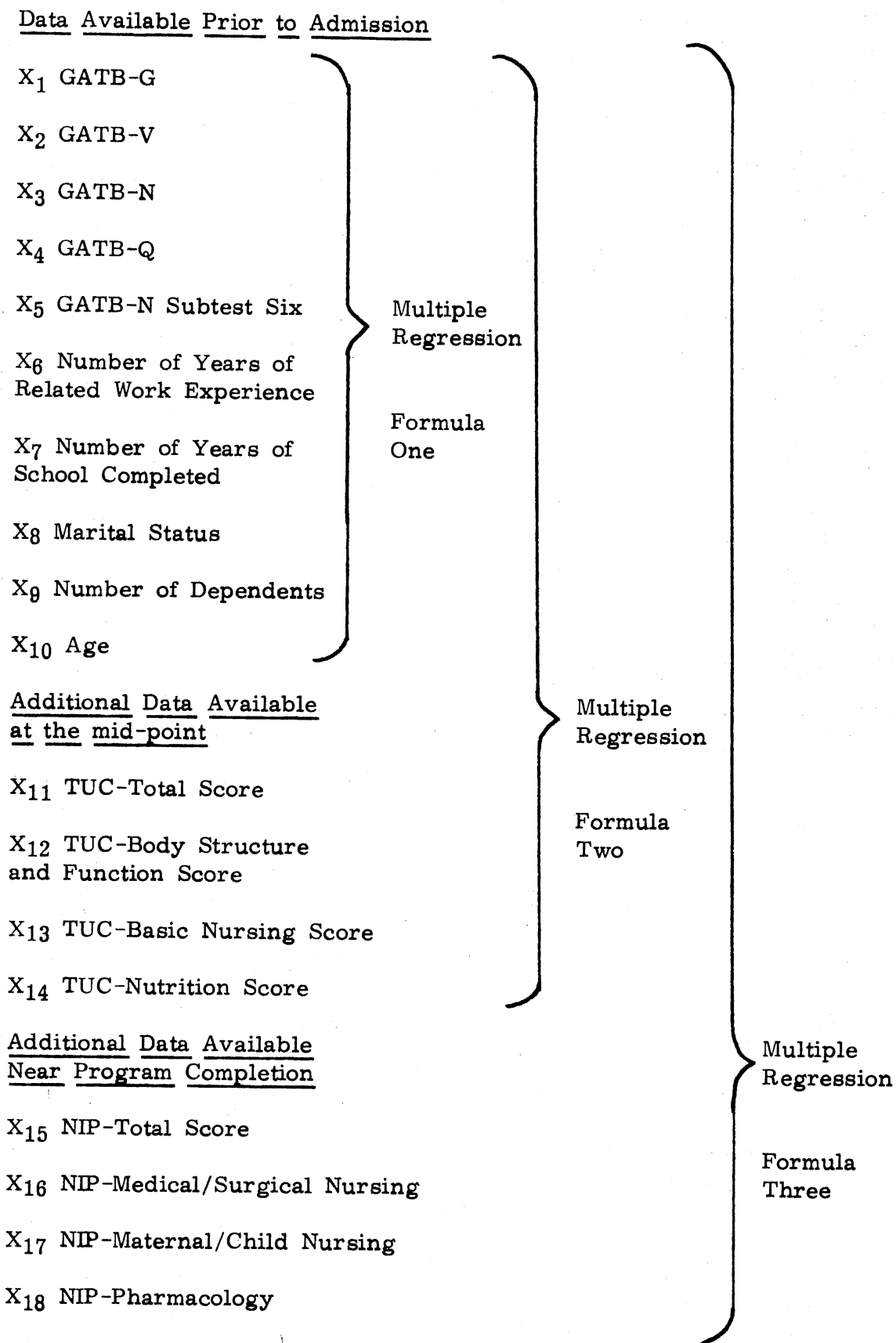


Figure 1. Phase I of the Study

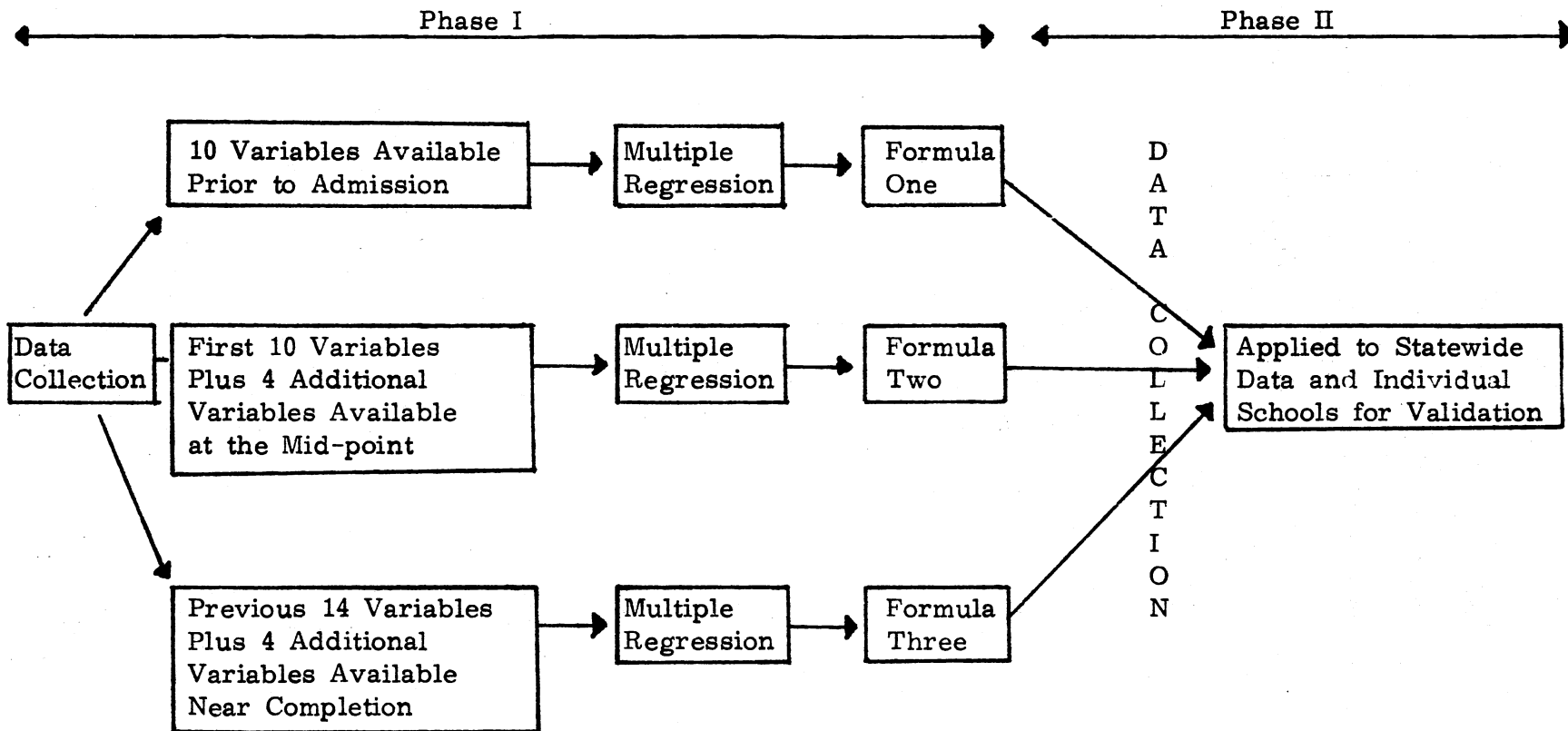


Figure 2. Phase I and II

of less than 10,000 population to a large metropolitan city of 200,000 population.

Some of the practical nursing schools in Oklahoma do not utilize the General Aptitude Test Battery and were unable to provide that data. Others did not retain complete records of all scores and were unable to report the scores for subtest six. All variables utilized in the development of the prediction formulae were considered essential. A total of ten schools reported complete data on two hundred nineteen students. The schools included in the validation phase of this study were: Tri-County AVTS at Bartlesville, Western Oklahoma AVTS at Burns Flat, Central Oklahoma AVTS at Drumright, Red River AVTS at Duncan, Canadian Valley AVTS at El Reno, Midwest City/Del City Public Schools at Midwest City, Moore-Norman AVTS at Norman, Pioneer AVTS at Ponca City, Gordon Cooper AVTS at Shawnee, and Indian Meridian AVTS at Stillwater. For the purpose of this study, the participating schools will be numbered at random and referred to only by number.

Data Collection

The data for Phase I, development of the prediction formulae, were collected through a hand search of the student records at the prediction school. One hundred seventy-six records were reviewed during the summer of 1977. The data considered to be essential were GATB-G, V, N, Q, and N Subtest Six, Number of Years of Related Work Experience, Number of Years of School Completed, Marital Status, Age,

Number of Dependents, Raw Scores on the National League for Nursing Standardized Achievement Tests TUC and NIP, and SBTPE scores. One hundred twenty-nine were found to have complete data available.

A major step in the study was to obtain a commitment from the coordinators of practical nursing programs statewide to provide the needed data for Phase II. Time was arranged for a meeting with the practical nursing coordinators at their annual meeting during the August Vocational-Technical Teachers Conference 1977. The basic plan of the study was explained and forms, on which the data was to be recorded, were distributed and discussed (Sample, Appendix A). All of the coordinators expressed a willingness to participate.

The procedure for recording the data was carefully explained so that the identity of all students would be concealed. It was agreed that none of the participating schools would be linked by name to any specific data.

Some of the data had been received in late November. Follow-up letters were mailed in December, 1977, to those who had not submitted data (Sample, Appendix B). Those who had not responded by January 15, 1978, were contacted by phone. It was determined at that time that all programs with complete data had responded. Complete data were received on 219 students.

Statistical Procedure

Phase I

A Statistical Analysis System (SAS) stepwise regression procedure developed by Barr and Goodnight (1972) at North Carolina State University, Raleigh, was used to develop the three prediction formulae. Multiple regression procedures allow the analysis of collective and separate contributions of several independent variables. It is possible through this procedure to determine the influence of independent variables on a dependent variable. This does not, however, imply a cause-effect relationship. Ten variables were utilized in the first stepwise regression procedure. The regression equation, although handled by computer, would appear as:

$$Y' = a + \sum_{i=1}^{10} b_i X_i$$

Y' = predicted Y

a = intercept constant ($a = \bar{Y} - b\bar{X}$)

b = regression coefficient

X = raw scores of an independent variable

The sums, means, sums of squares, the deviation sums of squares, the deviation cross products and standard deviations must be calculated for all of the independent variables. This is almost always done by computer programs.

Kerlinger (1973) states the reasons for these calculations as:

- (1) to fill in the constants of the prediction equation.

(2) to know the proportion of the variance that the regression equation "accounts for."

(3) to know the relative importance of the difference X's in making the predictions to Y.

(4) to be able to say whether the regression of Y on the X's, the relation between Y and the "best" linear combination of the X's, is statistically significant.

The formula for regression sum of squares is:

$$SS_{reg} = b_1 \Sigma x_1 y + \dots + b_{10} \Sigma x_{10} y \quad SS_{reg} = b_i \Sigma x_i y$$

where $i = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$

small x_j represents $X_j - \bar{X}$ ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$)

Sum of squares residual may be determined by subtracting the sum of squares regression from the sum of squares total.

$$SS_{res} = SS_t - SS_{reg}$$

The coefficient of determination, which tells that portion of the variance of Y which is accounted for by the combined independent variables $X_1 \dots X_{10}$ is calculated by the following formula:

$$R^2 = \frac{SS_{reg}}{SS_t}$$

The multiple correlation coefficient (R) of the predicted Y's can be calculated by determining the square root of the coefficient of determination (R^2).

The significance level can then be calculated using the following formula for F ratio:

$$F = \frac{SS_{reg}/df_{reg}}{SS_{res}/df_{res}}$$

Phase II

Following the development of the prediction formulae, each of the formulae was applied to the statewide data for validation purposes. The predicted scores were subjected to statistical analysis using a Statistical Analysis System (SAS) program developed by Barr, Goodnight, Sall, and Helwig (1976). The essential components needed to calculate the correlation coefficient (R) and the coefficient of determination (R^2) are the explained variation and the total variation. These values are calculated in the following manner:

$$\text{Total Variation} = \Sigma (Y - \bar{Y})^2$$

"

$$\text{Unexplained Variation} = \Sigma (Y - Y')^2$$

+

$$\text{Explained Variation} = \Sigma (Y' - \bar{Y})^2$$

where Y is the actual SBTPE score

where Y' is the predicted SBTPE score

\bar{Y} is the mean SBTPE score

The formula for the correlation coefficient (R) is:

$$R = \frac{\text{Explained Variation}}{\text{Total Variation}} = \frac{\Sigma (Y' - \bar{Y})^2}{\Sigma (Y - \bar{Y})^2}$$

The formula for the correlation coefficient (R) is:

$$R = \pm \frac{\text{Explained Variation}}{\text{Total Variation}} = \pm \frac{\Sigma (Y' - \bar{Y})^2}{\Sigma (Y - \bar{Y})^2}$$

All of the calculations in this study were accomplished through the use of the Statistical Analysis Systems (SAS) computer programs. The correlation coefficients, coefficients of determination and significance levels were calculated for each of the prediction formulae for the total group and for each of the schools participating in the study.

Hypotheses

The issue under investigation in this study concerns the development of three formulae for predicting practical nursing SBTPE scores from data provided by a single practical nursing program and validation of the three formulae using statewide data. The major hypotheses therefore relate to the formulae which were developed and the validation of those formulae. Subhypotheses relate to the variables which contributed to the formulae and the individual schools which participated in the validation process.

HO₁: The correlation between SBTPE scores and the variables in a multiple regression prediction formula derived from ten variables known prior to admission to the practical nursing program (Formula One) will not be statistically significant (0.05 level).

Subhypotheses (1): Variable X_j (j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10) will not contribute significantly to Formula One.

HO₂: The correlation between SBTPE scores and a multiple regression prediction formula derived from 14 variables known at the

mid-point of the practical nursing program (Formula Two) will not be statistically significant (0.05 level).

Subhypothesis (1): Variable X_j ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14$) will not be included in a prediction formula developed through a multiple regression technique.

HO_3 : The correlation between SBTPE scores and a multiple regression prediction formula derived from 18 variables known near the completion of the practical nursing program (Formula Three) will not be statistically significant (0.05 level).

Subhypothesis (1): Variables X_j ($j = 15, 16, 17, 18$) will not contribute significantly to Formula Three.

HO_4 : The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to statewide data.

Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$).

HO_5 : The correlation between predicted SBTPE scores, utilizing Formula Two and actual SBTPE scores will not be statistically significant (0.05 level) when applied to statewide data.

Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula Two, and actual SBTPE scores will not be

statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$).

H_{0g} : The correlation between predicted SBTPE scores, utilizing Formula Three, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to statewide data.

Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula Three, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$).

CHAPTER IV

ANALYSIS OF DATA

The results of the study are presented in this chapter. The chapter is divided into two sections: (1) Phase I of the study which deals with the development of the prediction formulae and disposition of the first three hypotheses, and (2) Phase II which deals with the validation of the formulae and disposition of the last three hypotheses.

Phase I

Development of Formula One

It was hypothesized that the correlation between SBTPE scores and the variables in a multiple regression prediction formula derived from ten variables known prior to admission to the practical nursing program (Formula One) would not be statistically significant at the 0.05 level. The ten variables, GATB-G, V, N, Q and N Subtest Six, Number of Years of Related Work Experience, Number of Years of School Completed, Marital Status, Age, and Number of Dependents were studied through a multiple regression technique. The resulting prediction formula (Formula One) was:

$$\begin{aligned}
 Y' = & 148.40675577 + 2.34874734 X_2 \text{ (GATB-V)} \\
 & + 13.14689381 X_9 \text{ (\# of Dependents)} \\
 & + 6.84675319 X_5 \text{ (GATB-N Subtest Six)} \\
 & + 1.51035813 X_{10} \text{ (Age)}
 \end{aligned}$$

A correlation of 0.63 was found between the variables in Formula One and the SBTPE scores. The coefficient of determination was 0.39 and the significance level was found to be 0.0001 as indicated in Table III. The significance level was greater than 0.05 and H_{O1} was rejected. Thirty-nine percent of the variance in SBTPE scores can be accounted for by the variables in Formula One prior to admission of students to the practical nursing program.

A subhypothesis dealing with the contribution of each variable to the formula was stated as: Variable X_j ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$) will not contribute significantly to Formula One. The subhypothesis was accepted for X_1 , GATB-G; X_3 , GATB-N; X_4 , GATB-Q; X_6 , Number of Years of Related Work Experience; X_7 , Number of Years of School Completed; and X_8 , Marital Status; and rejected for X_2 , GATB-V; X_5 , GATB-N Subtest Six; X_9 , Number of Dependents; and X_{10} , Age. Only GATB-V, GATB-N Subtest Six, Number of Dependents, and Age were found to contribute significantly to Formula One.

Development of Formula Two

It was further hypothesized that the correlation between SBTPE scores and a multiple regression prediction formula derived from 14 variables known at the mid-point of the practical nursing program

(Formula Two) would not be statistically significant at the 0.05 level. The 14 variables, the 10 used in Formula One plus the results of the TUC Achievement Test, were studied through a multiple regression technique. The resulting prediction formula (Formula Two) was:

$$Y' = 180.64623925 + 3.05180520 X_{11} \text{ (TUC-Total Score)} \\ + 7.47701217 X_9 \text{ (# of Dependents)} \\ + 0.78859904 X_2 \text{ (GATB-V)}$$

A correlation of 0.79 was found between the variables in Formula Two and the SBTPE scores. The coefficient of determination was 0.63 and the significance level was found to be 0.0001 as indicated in Table III. The significance level was greater than 0.05 and H_0 was rejected. Sixty-three percent of the variance in SBTPE scores can be accounted for by the variables in Formula Two at the mid-point in the program.

A subhypothesis dealing with the contribution of each variable to the formula was stated as: Variable X_j ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14$) will not contribute significantly to Formula Two. The subhypothesis was accepted for X_1 , GATB-G; X_3 , GATB-N; X_4 , GATB-Q; X_5 , GATB-N Subtest Six; X_6 , Number of Years of Related Work Experience; X_7 , Number of Years of School Completed; X_8 , Marital Status; X_{10} , Age; X_{13} , TUC-Basic Nursing Score; and X_{14} , TUC-Nutrition Score; and rejected for X_2 , GATB-V; X_9 , Number of Dependents; and X_{11} , TUC-Total Score. Only the GATB-V, Number of Dependents, and TUC-Total Score contributed significantly to Formula Two.

Development of Formula Three

It was further hypothesized that the correlations between SBTPE scores and a multiple regression prediction formula derived from 18 variables known near the completion of the practical nursing program (Formula Three) would not be statistically significant at the 0.05 level. The 14 variables utilized in Formula Two plus the NIP Achievement Test scores were studied through a multiple regression technique. The resulting prediction formula (Formula Three) was:

$$\begin{aligned}
 Y' = & 40.53794566 + 3.45695075 X_{15} \text{ (NIP-Total Score)} \\
 & + 1.55729300 X_{11} \text{ (TUC-Total Score)} \\
 & + 6.33490091 X_9 \text{ (# of Dependents)} \\
 & - 3.24534985 X_{18} \text{ (NIP-Pharmacology)} \\
 & + 0.62472159 X_2 \text{ (GATB-V)}
 \end{aligned}$$

A correlation of 0.84 was found between the variables in Formula Three and the SBTPE scores. The coefficient of determination was 0.71 and the significance level was found to be 0.0001 as indicated in Table III. The significance level was greater than 0.05 and H_0 was rejected. Seventy-one percent of the variance in SBTPE scores can be accounted for by the variables in Formula Three.

A subhypothesis dealing with the contribution of each variable to the third formula was stated as: Variable X_j ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,$ and 18) will not contribute significantly to Formula Three. The subhypothesis was accepted for X_1 , GATB-G; X_3 , GATB-N; X_4 , GATB-Q; X_5 , GATB-N Subtest Six; X_6 , Number of Years of Related Work Experience; X_7 , Number of Years of

School Completed; X₈, Marital Status; X₁₀, Age; X₁₂, TUC-Body Structure and Function Score; X₁₃, TUC-Basic Nursing Score; X₁₆, NIP-Medical/Surgical Nursing; and X₁₇, NIP-Maternal/Child Nursing as they did not contribute significantly. The subhypothesis was rejected for X₂, GATB-V; X₉, Number of Dependents; X₁₁, TUC-Total Score; X₁₅, NIP-Total Score; and X₁₈, NIP-Pharmacology due to the fact that GATB-V, Number of Dependents, TUC-Total Score, NIP-Total Score, and NIP Pharmacology did contribute significantly to Formula Three.

Summary of Phase I

The correlations between the three prediction formulae and the SBTPE scores were all significant at the 0.0001 level. The variables in Formula One accounted for 39 percent of the variance in the SBTPE scores, Formula Two for 63 percent, and Formula Three for 71 percent. The researcher felt that to be able to predict that portion of the variance in SBTPE scores would have value for persons selecting and counseling students in practical nursing. It was therefore decided to proceed with Phase II of the study.

TABLE III
 R^2 VALUES, R, AND SIGNIFICANCE LEVELS
 OF PREDICTION FORMULAE

Formula	R^2 Value	R	Significance Level
One			
$Y' = 148.40675577 +$	0.39	0.63	0.0001
$2.34874734 X_2 +$			
$13.14689381 X_9 +$			
$6.84675319 X_5 +$			
$1.51035813 X_{10}$			
Two			
$Y' = 180.64623925 +$	0.63	0.79	0.0001
$3.05180520 X_{11} +$			
$7.47701217 X_9 +$			
$0.78859904 X_2$			
Three			
$Y' = 40.53794566 +$	0.71	0.84	0.0001
$3.45695075 X_{15} +$			
$1.55729300 X_{11} +$			
$6.33490091 X_9 -$			
$3.24534985 X_{18} +$			
$0.62472159 X_2$			

Phase II

Practical nursing coordinators statewide were asked to provide the necessary data on students enrolled in their programs during the 1976-1977 school year. The data were acquired from November through December of 1977.

Testing of Formula One

It was hypothesized that the correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores would not be statistically significant at the 0.05 level when applied to statewide data. The correlation between predicted SBTPE scores, utilizing Formula One, and the actual SBTPE scores on statewide data was 0.566 which was significant at the 0.01 level as indicated in Table IV. The variables in the first prediction formula accounted for 32 percent of the variance in the SBTPE scores. Therefore, the fourth null hypothesis was rejected.

A subhypothesis dealing with the correlation between predicted SBTPE scores and actual SBTPE scores in individual schools was stated as: The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$). The subhypothesis was accepted for school number seven, eight and ten. The subhypothesis was rejected for school number one, two, three, four, five, six, and nine. The correlations and significance levels for the subhypothesis are also found in Table IV.

TABLE IV
 FORMULA ONE -- R^2 , R, AND
 SIGNIFICANCE LEVELS

	R^2	R	Significance Level
Total	.32	.566	.01
School #1	.24	.490	.0329
School #2	.36	.6	.0051
School #3	.39	.623	.0007
School #4	.39	.625	.0009
School #5	.26	.510	.0072
School #6	.58	.762	.0001
School #7	.12	.346	.1799
School #8	.04	.200	.3681
School #9	.56	.748	.0001
School #10	.22	.469	.056

Testing of Formula Two

A fifth null hypothesis was stated as: The correlation between predicted SBTPE scores, utilizing Formula Two and actual SBTPE scores will not be statistically significant (0.05 level) when applied to state-wide data. The correlation between predicted SBTPE scores, utilizing

Formula Two, and the actual SBTPE scores on statewide data was 0.748 which was significant at the 0.01 level as indicated in Table V. The variables in the second formula accounted for 56 percent of the variance in the SBTPE scores. Therefore, the fifth null hypothesis was rejected.

TABLE V
FORMULA TWO -- R^2 , R, AND
SIGNIFICANCE LEVELS

	R^2	R	Significance Level
Total	.56	.748	.01
School #1	.29	.539	.0181
School #2	.64	.800	.0001
School #3	.70	.837	.0001
School #4	.65	.806	.0001
School #5	.77	.878	.0001
School #6	.82	.906	.0001
School #7	.30	.548	.0221
School #8	.33	.575	.0053
School #9	.38	.616	.0019
School #10	.69	.831	.0001

A subhypothesis dealing with the correlation between predicted SBTPE scores and actual SBTPE scores in individual schools was stated as: The correlation between predicted SBTPE scores, utilizing Formula Two, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$). The correlations were significant at better than the 0.05 level in each case. Therefore, the subhypothesis for the fifth null hypothesis was rejected in total.

Testing of Formula Three

It was further hypothesized that the correlation between predicted SBTPE scores, utilizing Formula Three, and actual SBTPE scores would not be statistically significant at the 0.05 level when applied to statewide data. The correlation between predicted SBTPE scores, utilizing Formula Three, and the actual SBTPE scores on statewide data was 0.812 which was significant at the 0.01 level as indicated in Table VI. The variables in the third prediction formula accounted for 66 percent of the variance in the SBTPE scores. The sixth null hypothesis was therefore rejected.

A subhypothesis dealing with the correlation between predicted SBTPE scores and actual SBTPE scores in individual schools was stated as: The correlation between predicted SBTPE scores, utilizing Formula Three, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h ($h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$).

Because the correlations were significant at better than the 0.05 level in all schools, the subhypothesis was rejected in total.

TABLE VI
FORMULA THREE -- R^2 , R, AND
SIGNIFICANCE LEVELS

	R^2	R	Significance Level
Total	.66	.812	.01
School #1	.53	.729	.0004
School #2	.61	.781	.0001
School #3	.70	.834	.0001
School #4	.70	.837	.0001
School #5	.82	.903	.0001
School #6	.81	.901	.0001
School #7	.47	.682	.0026
School #8	.36	.601	.003
School #9	.71	.840	.0001
School #10	.68	.825	.0001

Specific correlations for all ten schools are listed in Table VI. The percentage of variance which can be accounted for ranged from 36 to 82 percent for individual schools. The correlation for an individual school ranged from 0.601 to 0.903.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

Many studies have been done which have evaluated the value of specific selection criteria, such as the PACE, the GATB, the OTIS Quick-Scoring Mental Ability Test, the Nelson-Denny Reading Test, the Minnesota Multiphasic Personality Inventory, and others. None of these studies attempted to combine various aptitudes and sociologic factors to determine prediction formulae to be used as counseling tools prior to and during the practical nursing program.

The overall purpose of this study was to develop and validate three formulae for predicting SBTPE scores. The first formula was to be derived from the information which was available prior to admission of students to the practical nursing program. This formula could then be used as a tool in student selection. A second formula would be derived from preadmission information plus additional information available at the mid-point of the program. This formula could be used to determine retention and promotion of students and as a guidance tool. A third formula would be derived from all previous data and additional

information available near the completion of the program. This formula could be utilized as a guidance tool at the time of graduation.

Summary

The formulae were to be developed utilizing data from a single school over a seven-year period. The school was selected on the basis of consistent admission procedures, an attrition rate of seven percent and a 99.4 percent success rate on the SBTPE over the seven-year period.

Three formulae were produced from the available data. The first formula resulting from the ten variables available prior to admission of practical nursing student was:

$$\begin{aligned}
 Y' = & 148.4067557 + 2.34874734 X_2 \text{ (GATB-V)} \\
 & + 13.14689381 X_9 \text{ (\# of Dependents)} \\
 & + 6.84675319 X_5 \text{ (GATB-N Subtest Six)} \\
 & + 1.51035813 X_{10} \text{ (Age)}
 \end{aligned}$$

The correlation between the predictor variables in Formula One and the actual SBTPE scores was 0.63, which was significant at the 0.0001 level. The coefficient of determination was 0.39. The variables found to contribute significantly (0.05 level) to that formula were the GATB-V Score, the Number of Dependents, the GATB-N Subtest Six Score, and the Age of the Applicant. None of the other variables contributed significantly.

The correlation between the variables in Formula One and the SBTPE scores for individual schools ranged from 0.2 to 0.762. The

correlations were significant in seven of the ten schools. The formula accounted for as much as 58 percent of the variance in SBTPE scores. On this basis, each school would have to determine the desirability of utilizing the prediction formula in selecting students.

The second formula resulting from data available after the first trimester of the practical nursing program was:

$$Y' = 180.64623925 + 3.05180520 X_{11} \text{ (TUC-Total Score)} \\ + 7.47701217 X_9 \text{ (# of Dependents)} \\ + 0.78859904 X_2 \text{ (GATB-V)}$$

The correlation between the predictor variables in Formula Two and the actual SBTPE scores was 0.79, which was significant at the 0.0001 level. The coefficient of determination was 0.63.

At the mid-point in the program the only additional variable found to contribute significantly to the prediction was the Three Units of Content Total Score. The other variables available at that time were found to be insignificant. The GATB-N Subtest Six and the Age were also dropped from the formula at this time due to loss of significance.

The third formula was derived from data available near the completion of the practical nursing program. Formula number three was:

$$Y' = 40.53794566 + 3.45695075 X_{15} \text{ (NIP-Total)} \\ + 1.55729300 X_{11} \text{ (TUC-Total)} \\ + 6.33490091 X_9 \text{ (# of Dependents)} \\ - 3.24534985 X_{18} \text{ (NIP-Pharmacology)} \\ + 0.62472159 X_2 \text{ (GATB-V)}$$

The correlation between the predictor variables in Formula Three and the actual SBTPE scores was 0.84, which was significant at the 0.0001 level. The coefficient of determination was 0.71.

The additional variables contributing significantly at the time of development of the third formula were the Nursing Including Pharmacology Total Score and the Pharmacology Score. All variables contained in Formula Two were retained in Formula Three.

Gleser has cautioned that, "The only valid basis for prediction is the experimental verification of the relationship between potential predictors and actual performance of a group of subjects who are representative of the population for which it is desired to make predictions." Once the formulae were developed, it was necessary to validate them using statewide data in order to render them useful statewide. Complete data were obtained from ten schools across the state. The formulae then were applied to the data and the coefficients of determination were calculated from the prediction scores. The product-moment correlations and significance levels were also determined. A comparison was then made to determine the difference in accuracy of prediction between the schools which provided data.

The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores was 0.566 which was significant at the 0.01 level. The coefficient of determination was 0.32. Correlations between predicted scores and actual scores in individual schools ranged from 0.2 to 0.762. The correlation between the predicted SBTPE scores and the actual SBTPE scores in a subsequent class at the prediction school (School #1) was 0.49. Six of the other schools had higher correlations between their predicted scores and their actual

scores than the prediction school. Only three schools had lower correlations. The significance level on the statewide correlation was 0.01.

Correlations between predicted SBTPE scores and actual scores using Formula Two were 0.748 and 0.539 for the statewide data and the prediction school respectively. The range for individual schools was 0.539 to 0.906. The predictions derived from Formula Two were more accurate for all other schools than for the prediction school. The significance level was 0.02 or greater in all cases.

Correlations between predicted SBTPE scores and actual scores using Formula Three ranged from 0.601 to 0.903 in individual schools. The significance level in all cases was 0.01 or greater. The correlation between predicted scores and actual scores on statewide data was 0.812.

Table VII indicates the disposition of each of the hypotheses and the subhypotheses.

TABLE VII
DISPOSITION OF THE NULL HYPOTHESES

Hypothesis	Disposition
HO ₁ -The correlation between SBTPE scores and the variables in a multiple regression prediction formula derived from ten variables known prior to admission to the practical nursing program (Formula One) will not be statistically significant (0.05 level).	REJECTED

TABLE VII (Continued)

Hypothesis	Disposition
Subhypothesis (1): Variable X_j ($j = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$) will not contribute significantly to Formula One.	
X_1 GATB-G	ACCEPTED
X_2 GATB-V	REJECTED
X_3 GATB-N	ACCEPTED
X_4 GATB-Q	ACCEPTED
X_5 GATB-N Subtest Six	REJECTED
X_6 Number of Years Related Work Experience	ACCEPTED
X_7 Number of Years School Completed	ACCEPTED
X_8 Marital Status	ACCEPTED
X_9 Number of Dependents	REJECTED
X_{10} The Age of the Student	REJECTED
HO ₂ -The correlation between SBTPE scores and a multiple regression prediction formula derived from 14 variables known at the mid-point of the practical nursing program (Formula Two) will not be statistically significant (0.05 level).	REJECTED
Subhypothesis (1): Variable X_j ($j = 11, 12, 13, 14$) will not contribute significantly to Formula Three.	
X_{11} The TUC Total Score	REJECTED
X_{12} The Body Structure and Function Score on TUC	ACCEPTED
X_{13} The Basic Nursing Score on TUC	ACCEPTED
X_{14} The Nutrition Score on TUC	ACCEPTED
HO ₃ -The correlation between SBTPE scores and a multiple regression prediction formula derived from 18 variables known near the completion of the practical nursing program (Formula Three) will not be statistically significant (0.05 level).	REJECTED
Subhypothesis (1): Variable X_j ($j = 15, 16, 17, 18$) will not contribute significantly to Formula Three.	
X_{15} The NIP Total Score	REJECTED
X_{16} The Medical/Surgical Nursing Score on NIP	ACCEPTED

TABLE VII (Continued)

Hypothesis	Disposition
X ₁₇ The Maternal/Child Nursing Score on NIP	ACCEPTED
X ₁₈ The Pharmacology Score on NIP	REJECTED
HO ₄ -The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to statewide data.	REJECTED
Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula One, and actual SBTPE scores will not be statistically significant (0.05 level when applied to school h (h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).	
h ₁	REJECTED
h ₂	REJECTED
h ₃	REJECTED
h ₄	REJECTED
h ₅	REJECTED
h ₆	REJECTED
h ₇	ACCEPTED
h ₈	ACCEPTED
h ₉	REJECTED
h ₁₀	ACCEPTED
HO ₅ -The correlation between predicted SBTPE scores utilizing Formula Two and actual SBTPE scores will not be statistically significant (0.05 level when applied to statewide data.	REJECTED
Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula Two, and actual SBTPE scores will not be statistically significant (0.05 level when applied to school h (h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).	
h ₁	REJECTED
h ₂	REJECTED
h ₃	REJECTED
h ₄	REJECTED
h ₅	REJECTED
h ₆	REJECTED

TABLE VII (Continued)

Hypothesis	Disposition
h ₇	REJECTED
h ₈	REJECTED
h ₉	REJECTED
h ₁₀	REJECTED
HO ₆ -The correlation between predicted SBTPE scores, utilizing Formula Three, and actual SBTPE scores will not be statistically significant (0.05 level) when applied to statewide data.	REJECTED
Subhypothesis (1): The correlation between predicted SBTPE scores, utilizing Formula Three and actual SBTPE scores will not be statistically significant (0.05 level) when applied to school h (h = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).	
h ₁	REJECTED
h ₂	REJECTED
h ₃	REJECTED
h ₄	REJECTED
h ₅	REJECTED
h ₆	REJECTED
h ₇	REJECTED
h ₈	REJECTED
h ₉	REJECTED
h ₁₀	REJECTED

Findings

The findings of this study are summarized as:

1. The General Aptitude Test Battery-Verbal Score is a significant factor in predicting SBTPE scores of practical nursing students.

2. The number of dependents for whom the student is responsible is a significant factor in predicting SBTPE scores of practical nursing students.

3. The General Aptitude Test Battery - Numerical Score - Subtest Six is a significant factor in predicting SBTPE scores of practical nursing students.

4. The Age of the Student is a significant factor in predicting SBTPE scores of practical nursing students.

5. The NLN-TUC Total Score is a significant factor in predicting SBTPE scores of practical nursing students.

6. The NLN-NIP Total Score is a significant factor in predicting SBTPE scores on practical nursing students.

7. The NLN-NIP Pharmacology Score is a significant factor in predicting SBTPE scores of practical nursing students.

8. A formula developed from data available prior to admission to the practical nursing program has significant predictive ability.

9. A formula developed from data available at the mid-point in the practical nursing program has significant predictive ability.

10. A formula developed from data available near the completion of the practical nursing program has significant predictive ability.

11. The prediction formulae developed from data provided by a single school have significant predictive ability when applied to state-wide data.

12. The predictive formula derived from data available prior to admission to the practical nursing program has significant predictive ability when applied to statewide data.

13. The prediction formula derived from data available prior to admission to the practical nursing program may not have significant predictive ability when applied to small populations such as individual schools.

14. The prediction formulae which include standardized achievement scores have more consistent predictive ability and are significant on statewide data and on individual school data.

15. The more nationally standardized test data included in the predictive formula, the more accurate it becomes.

Conclusions

1. Although this study has indicated that SBTPE scores may be predicted with a reasonable degree of accuracy, the prediction formulae should be used in conjunction with other selection techniques and counseling tools.

2. The variance which cannot be "accounted for" prior to admission is substantial enough that practical nursing educators should continue to seek additional predictive variables.

3. The significance of the National League for Nursing standardized test scores in predicting SBTPE scores would perhaps lend credence to the suggestion by Weber, King, and Pitts that the Pre-Nursing

Assessment and Classification Examination (PACE) be used as a pre-entrance test for admission to practical nursing programs. The PACE examination is provided by the National League for Nursing.

4. The standardization of the information required and the pre-entrance test given prior to admission would increase the data available for future studies.

Recommendations

The following recommendations are presented as a result of this study:

1. All practical nursing programs in the state should employ standard admission criteria in an attempt to reduce attrition and the number of failures on the SBTPE.

2. The model suggested by this study can be employed for many of the schools within the state in selecting students.

3. The model suggested by this study can be employed by all participating schools in counseling students at the mid-point and near completion of the program.

4. Additional admission criteria should be sought which will account for the 68 percent of the variance in SBTPE scores which cannot be accounted for in the variables presently known at the time of admission.

5. Schools which did not participate in this study should seek to identify a similar method of predicting SBTPE scores in an attempt to reduce attrition and increase the pass rate on the SBTPE.

6. Practical nursing programs in Oklahoma should consider the use of the National League for Nursing Preassessment and Classification Examination (PACE) as a pre-entrance selection device and evaluate its effectiveness as compared to the model suggested by this study.

Recommendations for Further Research

1. Replication of the validation portion of this study should be undertaken to increase confidence in the use of the formulae which have been developed.

2. Schools which utilize different pre-admission tests should evaluate their effectiveness through similar studies.

3. A study should be developed which derives prediction formulae from statewide data and validates those formulae on subsequent classes in individual schools.

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APPENDIXES

APPENDIX A

DATA SHEET

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.		
GATB-G																																		
GATB-V																																		
GATB-N																																		
GATB-Q																																		
Subtest Six																																		
Work Exp. (rel.)																																		
# Yrs. School Com.																																		
Marital Status																																		
# of Dependents																																		
Age																																		
TUC Total																																		
BSF																																		
BN																																		
NUT																																		
NIP Total																																		
M/S																																		
MCN																																		
Pharm.																																		
STATE BOARD																																		

Name _____ (Last name) (First name) (Middle initial) Date _____

COMMENTS: _____

Adult B-1001

Grade 9 B-1002

Grade 10 Form: A B C D

G A T B
INDIVIDUAL APTITUDE PROFILE

Part	B-1002	B-1001	Raw Score	G	V	N	S	P	Q	K	F	M
1	B											
2	D											
3	H											
4	J											
5	A											
6	I											
7	L											
8	K											
9	M											
10	N											
11	O											
12	P											
Aptitude Scores												
1 SEM				6	6	6	8	9	9	7	12	11
Aptitude Scores + 1 SEM												

OAP NUMBERS*

All H's	23	46
12	35	58
1	24	47
13	36	59
2	25	48
14	37	60
3	26	49
15	38	61
4	27	50
16	39	62
5	28	51
17	40	
6	29	52
18	41	
7	30	53
19	42	
8	31	54
20	43	
9	32	55
21	44	
10	33	56
22	45	
11	34	57

*CIRCLE IN RED FOR GRADE H
CIRCLE IN BLACK FOR GRADE M
CROSS OUT FOR GRADE L

APPENDIX B

FOLLOW-UP LETTER TO
PRACTICAL NURSING
COORDINATORS

Dear Colleague:

I am asking that you take some of your precious time to assist me in gathering data for a dissertation. In return, I hope to provide you with a formula which you can use prior to admission and at the end of each trimester to predict state board scores. I believe that this can be used as a tool in guidance of students.

In completing the data sheet, please do not identify students by name. Complete all data available on each student who entered your program from January 1, 1976, through December 31, 1976, whether or not they completed the program. This should include all students who took the state board examination through October of 1977. Your school or students will not be identified in any way with specific data. The data will be reported only on subjects enrolled in practical nursing in Oklahoma during the identified time period.

GATB scores requested are those circled on the enclosed sample card. Work experience should be reported as full or half years in the health field only, i.e. 2.5, 4, 7.5, etc. Years of school completed should be reported as actual full years of school attended, not G.E.D. equivalency. Marital status should be recorded as S-single, M-married, D-divorced, W-widowed, or I-separated. Number of dependents should be the number of children in the home plus one for a dependent spouse in case of a disabled spouse or one who is attending school full time. Age should be reported as the age at the time of admission to the program. National League for Nursing scores should be reported as TUC total raw score, BSF raw score, Basic Nursing raw score, Nutrition raw score, NIP total raw score, Med/Surg raw score, Maternal/Child Nursing raw score, and Pharmacology raw score. The final entry will be the state board score reported to you in late November in most cases. Please complete the data sheet at your earliest convenience so that maximum input will be obtained. If the data can be keypunched in December or January, you will have some feedback by the end of the second trimester. Your time and effort will be greatly appreciated.

Please contact me if you need further information or clarification.

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VITA²

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Doctor of Education

Thesis: A MODEL FOR PREDICTING SUCCESS OF OKLAHOMA
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Major Field: Vocational-Technical and Career Education

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