A STUDY OF THE VALIDITY OF THE PSYCHOLOGICAL CORPORATION ENTRANCE EXAMINATION FOR SCHOOLS OF NURSING AS A SELECTION TOOL AND PREDICTOR OF SUCCESS FOR NURSING CANDIDATES

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BY

INA VELDA WINSOR

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The undersigned certify that they have read, and do recommend for acceptance a research project report entitled "A Study of the Validity of the Psychological Corporation Entrance Examination for Schools of Nursing as a Selection Tool and Predictor of Success for Nursing Candidates" submitted by Ina Velda Winsor, B.N., B.Ed., in partial fulfillment of the requirements for the degree of Master of Education.

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ABSTRACT

The purpose of this research project was to determine whether the Psychological Corporation Entrance Examination for Schools of Nursing is a valid instrument for predicting success in a nursing education diploma program. The study attempted to establish the extent to which the PCEE battery as a whole, and each of its subtests, discriminates between nursing applicants who are most and least likely to succeed in the nursing program. Success in nursing was defined in terms of the student's academic performance in the nursing program and registration examinations.

The research involved a study of 296 nursing students who were accepted into a hospital school of nursing diploma program during the years 1967-70, inclusive. These students wrote the PCEE after admission into the school; it was not included as part of the selection procedure.

Two main groups were originally identified from the total sample. The successful candidates were designated as the Validation Group, and the unsuccessful candidates as the Withdrawal Group. The Withdrawal Group was subsequently divided into two subgroups. Those who withdrew because of academic failure were called Academic Withdrawals. Those who withdrew for reasons other than academic were known as Non-academic Withdrawals.

A comparison of these three groups indicated a marked similarity between the Validation and Non-academic Withdrawal

Groups on all thirteen subtests of the PCEE, while the Academic Withdrawals showed significantly lower scores on the Ability measures, but very little difference on the Personality measures. Based on this similarity, it was hypothesized that the Non-academic Withdrawal Group could be considered as potentially successful students. The Non-academic Withdrawals were consequently included in the Validation Group, forming a Composite Validation Group of 262 subjects. Comparisons were then made between the Composite Validation Group and Academic Withdrawal Group on the thirteen PCEE subtests.

The data from both groups were subjected to analysis of variance and discriminant analysis. The analysis indicated that the Composite Validation Group could be discriminated from the Academic Withdrawal Group on six of the seven Ability measures, and one of the six Personality measures. These seven statistically significant variables were considered to be the measures that would discriminate between potentially successful, and academically unsuccessful, candidates. The most important discriminants were the Scholastic Aptitude Total (SAT), Verbal Ability, Science, and Numerical Ability, accounting for about 96 percent of the between groups variance.

The efficiency of the discrimination was examined for two decision situations. The first decision situation minimized the total number of errors in classification without regard to the type of error being made. In this situation all the applicants passing the initial selection procedures were classified as successful. This would mean that all students in the Academic Withdrawal Group

would be admitted to the school of nursing. No applicant would be rejected, and errors of classification would be made in 11.6 percent of the cases considered in the total applicant group. The second decision situation was designed to minimize the false acceptance of applicants. In this situation a cutoff discriminant score was selected to ensure the rejection of 67 percent of the Academic Withdrawal Group. Under this rule 33.8 percent of the applicant group was incorrectly classified.

The results of this research project indicate that the PCLE does possess limited usefulness as an applicant screening instrument. The Personality measures are of little value in the selection process. The scores on the Academic Ability measures of the test, however, are of value in indicating which applicants are most likely to succeed in the nursing program. In general, students with low Ability scores are not good admission risks, while applicants who score high on the Ability measures are more likely to be successful in the nursing program and on registration examinations.

ACKNOWLEDGEMENTS

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INTRODUCTION AND STATEMENT OF PROBLEM

One of the most important problems that face the nursing profession today is the necessity to attract and to encourage able applicants to pursue nursing as a career. Problems of recruitment, selection and retention of nursing students continue to be paramount.[1]

"The shortage of nurses at all levels of preparation is a critical national problem."[2] This statement was made in 1963 by the United States Surgeon General's Consultant Group on Nursing. One of the problems contributing to this shortage is the attrition of student nurses from schools of nursing.[3] The spiraling need for nursing services, combined with the relatively small capacity of schools of nursing, have made nurse educators responsible for the selection and education of student nurses acutely aware of the vital need for careful assessment and screening of nursing applicants, with a view to limiting selection to those who appear to have the ability to successfully complete the program.

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[1] Faye G. Abdellah, "Overview of Nursing Research, 1955-1968, Part 3", Nursing Research, 22:239, May-June, 1970.

[2] Report of the Surgeon General's Consultant Group on Nursing, Toward Quality in Nursing: Needs and Goals, Public Health Services Publication No. 992 (Washington: Government Printing Office, 1963), p. 47.

[3] Calvin W. Taylor and others, Selection and Recruitment of Nurses and Nursing Students: A Review of Research Studies and Practices (Salt Lake City: University of Utah Press, 1966), p. 46.

PURPOSE OF THE STUDY

The basic purpose of this research project was to determine whether the Psychological Corporation Entrance Examination for Schools of Nursing (hereafter known as the PCEE) is a valid instrument for predicting student success in the three year nursing education diploma program offered at the General Hospital School of Nursing, St. John's, Newfoundland. The study was aimed at determining the degree to which the battery as a whole and each subtest in the PCEE are valid with respect to predicting success, both in the school of nursing program and registration examinations. It was hoped to draw conclusions from this study regarding the test's value and usefulness as a pre-entrance selection tool which could be used by the school of nursing to increase the probability of selecting nursing students who have the ability to successfully complete the program of studies and pass registration examinations.

BACKGROUND OF THE PROBLEM AND SIGNIFICANCE OF THE STUDY

Health care in Canada today is a rapidly-growing service. Providers of this care are being challenged to make available health services of broadening scope and increasing diversity. This is an age when, perhaps for the first time, health care consumers are beginning to reorganize priorities in order to include the "right to health."[4] As consumer views of the role of health

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[4] John D. Hutcheson, Laretta M. Garland, and James E. Prather, "Toward Reducing Attrition in Baccalaureate Degree Nursing Programs: An Exploratory Study", Nursing Research, 22:530, November-December, 1970.

care providers enlarge the result is an ever-increasing need for health team personnel to staff hospitals, nursing homes, public health agencies and community clinics. The largest single group of practitioners in the health team is nurses; without enough nurses the quality of health care rendered suffers.

During this century Canada has experienced a phenomenal increase in the number of students and graduates within the nursing profession. In 1901 there were 65 schools of nursing with a total of 280 nurses, including students and graduates;[5] in 1971 there were 193 basic programs, 28,883 student nurses and 151,374 registered nurses.[6] However, this period has also seen Canada's population increase from 10 million to approximately 22 million, and along with this has been an overall growth in health care. Consequently, there is still an inability to meet the rapidly increasing needs and demands for nursing service. This imbalance between supply and demand creates a situation which necessitates the improvement of screening procedures to insure efficient utilization of nursing education facilities and resources on the part of those responsible for student selection and education.

The Extent of Attrition from Schools of Nursing

Taylor and others identify student attrition as one of

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[5]Helen Mussallem, Nursing Education in Canada (Ottawa: Queen's Printer, 1964), p. 2.

[6]Canadian Nurses' Association, Countdown 1972, Canadian Nursing Statistics (Ottawa: Dollco Printers, 1972), p. 73.

the problems in the field of nursing which contributes most to the shortage of personnel.[7] According to Mueller, the withdrawal of one-third of the students admitted to schools of nursing prior to graduation, combined with a 14 percent failure rate on the first-trial writing of registration examinations, indicates that valuable and scarce educational resources are being invested in students with low potential for success in the nursing profession.[8]

The problem of a high attrition rate in schools of nursing appears to be universal. A paper presented at the 1969 International Council of Nurses stated that "one out of every three entrants to nursing schools withdraw or are dismissed."[9] In 1962 the National League of Nursing began a study dealing with nurse career patterns. In a report of this study the statement was made that of the students studied there was a 50 percent attrition rate from degree programs and a 50 percent rate from diploma programs.[10] The report of the Royal Commission on Health Services showed Canada's attrition rate to be somewhat lower, with approximately 33 percent attrition from degree programs and 20 percent

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[7] Calvin W. Taylor and others, Selection and Recruitment of Nurses and Nursing Students: A Review of Research Studies and Practices (Salt Lake City: University of Utah Press, 1966), p. 46.

[8] E.J. Mueller, "The Pre-entrance Prediction of Survival in a School of Nursing and Success on the Licensing Examination", Dissertation Abstracts, 29:3335, 1965.

[9] R. Bergmen, "Selection Through Research", Focus on the Future (Switzerland: S. Karger, 1970), p. 103.

[10] Barbara Tate, "Rate of Graduation in Schools of Nursing", International Nursing Review, 15: 339-346, 1968.

attrition from diploma programs. The reported withdrawal rate for Newfoundland was no different than the national average at the time of the Royal Commission.[11] In the sample under investigation in this study 29.5 percent of the students admitted to the diploma program did not complete the three years.

Reducing Attrition by Improving Student Selection

All educational institutions are faced with the serious and continuing problem of attrition. This problem is less severe in schools offering multiple courses of study. If students do not achieve satisfactorily in a chosen course of study they have the option of moving into an alternate course without excessive loss of time, effort, finances and self-esteem. However, the problem assumes much more critical proportions in schools offering only a single course of study. In this situation if a student fails to achieve satisfactorily there is only one alternative - withdrawal. A prime example of such schools is the hospital, or diploma program, school of nursing. In the diploma school the sequential progression approach is used whereby students progress as a class through the educational program in a sequential manner. This approach has definite advantages in that it allows faculty members to interact with students on a continuing basis, and also permits an ongoing feedback system with clinical resource personnel throughout the student's entire program. However, the sequential

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[11] Mussallem, op. cit., p. 28.

progression approach also has a major disadvantage in that if a student leaves the program the resultant vacancy cannot be refilled.[12] Consequently, student selection is a crucial responsibility confronting administrators of nursing education diploma programs. Students who fail to complete their professional studies represent, on the one hand, time and effort spent in pursuit of an unachieved goal that might otherwise have been directed toward a vocation which could give success and satisfaction, and on the other hand, opportunities that could have been available to other applicants who might have successfully completed the program.

This problem of attrition is undoubtedly one of the main contributing factors to the shortage of nurses presently being experienced; therefore it is vital that schools of nursing attempt to minimize attrition.

Student Selection Criteria

One possible way to reduce attrition would be to improve the applicant screening process in order to identify those candidates with the most potential for successful completion, and also identify and eliminate applicants who would not be likely to successfully complete the program.

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[12] John D. Hutcheson, Laretta M. Garland, and James E. Prather, "Toward Reducing Attrition in Baccalaureate Degree Nursing Programs: An Exploratory Study", Nursing Research, 22:530, November-December, 1970.

Until the present time the criteria used by the Admissions Committee of the General Hospital School of Nursing in selecting students were: (1) academic achievement in high school (specifically Grade X and Grade XI) and, when applicable, grades attained at university, (2) an autobiographical sketch, (3) three letters of reference, (4) a medical examination report, and (5) a personal interview, when feasible. The Committee considered all information obtained from these sources, but applicants had been accepted primarily on the basis of academic achievement and an acceptable medical certificate.

The PCTE had not been used in determining the selection of students, but for the six years prior to this study students accepted into the school were required to write the test following acceptance. However, it would seem that a positive and necessary aspect of the selection process could be the use of properly validated test batteries constructed to predict success or failure in the nursing program. A good selection test, used in conjunction with the other selection tools, could be extremely valuable in identifying indices of nursing potential that would allow rational screening judgements. Foremost among these judgements is whether there is a high probability that the applicant will successfully complete the program.

Use of the PCEE as a Selection Device

Educators have long recognized the value of standardized tests for measuring students' educational development and academic potential, and today most colleges and universities use such

tests as part of their admissions procedure. Over the last four decades schools of nursing in the United States have incorporated into their selection programs screening procedures which use general and specialized standardized tests indicative of vocational and educational aptitudes. Although not yet as widespread as in the United States, screening procedures which include standardized tests are being used more and more extensively by admissions committees of Canadian hospital schools of nursing.[13]

Many reasons have generally been advanced in support of the use of tests as selection devices. Such reasons include the following:

1. The admission of students who later withdraw represents a financial loss to the student, the school and the province.

2. The morale of some students in the class, if not the entire class, may be adversely affected by the admission and subsequent withdrawal of students who encounter considerable difficulty with the program.

3. The quality of instruction may be seriously affected.

4. Some highly qualified candidates, who may have applied late, may be rejected because less qualified candidates have been accepted and the permitted quota reached.

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[13] Elizabeth Anne Willett and others, "Selection and Success of Nursing Candidates: A Critical Survey" (unpublished study, St. Michael's School of Nursing, Toronto, 1970), pp. 1-2.

5. The experience of failing and being forced to withdraw may have a traumatic effect upon the student. Lack of success may seriously affect the psychological growth and development of those less qualified candidates who are forced to withdraw.[14]

6. The results of selection tests are of considerable assistance in the guidance of the student. The strengths and weaknesses revealed by the test scores may well indicate those parts of the program that should be emphasized for the full development of special abilities and for the overcoming of deficiencies.

7. The selection test can help the admissions committee, not only in its selection function but also in its guidance function. There are a variety of educational programs that prepare for nursing, and it is important that the prospective student be guided into the program in which she is most likely to succeed, can make her maximum contribution, and can gain the greatest personal satisfaction.[15]

All of the foregoing emphasize the need for the school of nursing to have, as part of its selection procedure, a test, or tests, that can adequately discriminate between those most and least likely to succeed in the nursing program. Since such

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[14] Ibid.

[15] National League for Nursing, "The NLN Pre-Nursing and Guidance Examination", The Use of Tests in Schools of Nursing, 1:1-2, 1965.

tests are used in arriving at decisions which may have great influence on the ultimate welfare of individuals, on educational standards and practices, and on development and utilization of human resources, it is essential to know what reliance can safely be placed on a given instrument. If the PCEE is to be considered for use as such a selection tool at the General Hospital School of Nursing, then it is important to assess whether or not this test has shown any predictive value in this particular nursing program over the period of time it has been used. Such an assessment would indicate its value as a selection instrument that could be used to assist the school's Admissions Committee to select applicants who can successfully complete the program, and reduce to a minimum the selection of students who have a low potential for success.

RESEARCH QUESTIONS

This study attempted to answer the following questions:

1. Which of the PCEE academic ability measures, if any, differentiates between successful cadidates (Validation Group) and those who withdrew from the program (Withdrawal Group)?

2. Which of the PCEE personality measures, if any, differentiates between the Validation Group and the Withdrawal Group?

3. Which of the PCEE subtests differentiates between the Academic Withdrawal Group and the Non-academic Withdrawal Group?

4. Can the PCEE be used to determine an appropriate basis for classification of applicants in relation to (a) dividing the applicant group for classification purposes, and (b) determining cutoff points for classification, particularly with respect to minimizing the false acceptance of candidates?

DEFINITION OF TERMS

Success in Nursing

For the purpose of this study success in nursing was defined as successful academic performance during the three year nursing education period and the passing of registration examinations. In this study the Validation Group included nine students who failed one subject on first-trial writing of registration examinations, but were successful on second writing.

Registration Examinations

Registration examinations are federal examinations designed to measure minimum competency for the safe practice of professional nursing.

Nursing Education Diploma Program

In this study a diploma program refers to a three year nursing education program in a hospital school of nursing. During the first two years the students are involved in academic and nursing academic courses with concurrent clinical practice. The third year focuses mainly on comprehensive clinical experience. Students are awarded a diploma in nursing upon graduation.

Validation Group

In this study the Validation Group consisted of 209

students who had successfully completed the school of nursing program and passed registration examinations.

Withdrawal Group

This group consisted of 87 students who, after being admitted to the school of nursing, withdrew for either academic or non-academic reasons.

LIMITATIONS

The following limitations of this research project should be noted:

1. The study was limited in that it applied specifically to one diploma program school of nursing in St. John's, Newfoundland. The findings of this study can have broader application only to the extent that other schools of nursing have an educational program, objectives, philosophy, and admission policies similar to those of the school studied in this project.

2. It is recognized that ability, personality traits, and interest may be important factors in determining whether a student will succeed in the basic nursing education program. However, this project was limited in that it did not attempt to establish that these attributes contributed to success, but limited itself to investigating ability and personality characteristic differences between successful and unsuccessful candidates.

3. A further limiting aspect of this project was that the study was carried out on a select group. The students

investigated had passed through the school's established screening procedures and had been admitted into the school of nursing prior to writing the PCEE. Consequently, findings can be generalized only to similar groups of students.

ORGANIZATION OF THE REPORT

Chapter 2 reviews the literature related to this project. In Chapter 3 the procedures are presented, including a description of the PCEE, the sample, data collection, and methods of analysis. Chapter 4 presents the analyses of data and discusses the findings for the group under investigation with relation to the predictive validity of the PCEE. Chapter 5 summarizes the study and sets forth conclusions, implications, and recommendations resulting from it.

Chapter 2

REVIEW OF THE LITERATURE

As in almost every other program of advanced education, selection procedures are used in nursing to help in deciding which applicants will be accepted and which rejected. Since the beginning of schools of nursing young people interested in becoming nursing students have been subjected to various types of procedures and devices presumably designed to assess their suitability for nursing. However, it was not until about 1927 that schools of nursing began using various kinds of tests, along with other instruments, in the selection of students. Since then the use of selection tests has gradually increased. Over the past four decades screening procedures utilizing general and specialized tests indicative of vocational and educational aptitudes have been incorporated into the selection programs of professional nursing education institutions in the United States and, to a lesser degree, in Canada. The National League for Nursing now has an extensive Pre-nursing and Guidance service for schools of nursing, while the Psychological Corporation has been providing test services to many schools of nursing, both in the United States and Canada. Collegiate schools of nursing are also increasingly making use of university test services.

The literature indicates that there appears to be general

agreement that it is essential that schools of nursing make wise use of tests and other selection tools. Nursing schools today are confronted with large numbers of students with the required academic qualifications applying for admittance to nursing programs; at the same time the problem of withdrawals from nursing education programs is an area of major concern for nursing educators, and has been for a considerable period of time.

Concern over this problem of student withdrawals has resulted in considerable recent research in nursing being aimed at attempting to discover determinants of student success. It should be noted that surveys and studies pertaining to nursing have been done to a much greater extent in the United States than in Canada. American nurses and interested researchers of other disciplines have written much more prolifically than their Canadian counterparts. However, because of the proximity of the two countries and the similarities in culture and educational philosophy, many of the surveys and the literature related to nursing have been used on both sides of the border, for, as Stewart says, "the two countries were never far apart in their nursing reforms, and the general trends in nursing education have always been in much the same direction and at about the same rate."[1] Consequently, literature from the United States has had a great impact on the development of nursing in Canada.[2]

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[1]Isabel Stewart, The Education of Nurses (New York: The MacMillan Company, 1943), p. 128.

[2]Helen Mussallem, Nursing Education in Canada (Ottawa: The Queen's Printer, 1965), p. 7.

In reviewing the literature investigation was focused on two areas: (a) research dealing generally with prediction studies in nursing, and (b) research specifically concerned with determining the predictive validity of the PCEE.

PREDICTION STUDIES IN NURSING

The Relationship of Interest and Personality and Prediction of Success in Nursing

Studies involving interest and personality of nursing students began with Elwood back in 1927. Thus far such studies have been unable to provide a really sound basis for predicting success, but they do seem to indicate that success in nursing may be related to interest and personality variables.

In 1967 Taylor and others reported the results of an extensive survey of all nursing schools in the United States and Puerto Rico. This research study was designed to provide information that could be used as a foundation for improving the selection process in nursing. In this survey each school was asked to describe the devices used for selection and to summarize any research they had done into the effectiveness of these selection procedures.

In summarizing the 111 research studies obtained as a result of this survey Taylor stated that the reported studies using interest scores as predictive measures and grades in nursing as criterion measures showed low correlations between interest scores and grades. Similarly, low correlations were shown in studies using personality test scores as predictive measures and grades in nursing school as the criterion measures.

Adjustment in nursing school and clinical performance were rarely used as criterion measures, and when they were used the correlations were near zero.[3]

There have been several studies attempting to determine if interest patterns are related to success in nursing school. Triggs,[4] Womer and Furst,[5] and Healey and Borg[6] carried out such studies. Their findings were essentially the same in that the results showed that high scores in social service and scientific interests emerged as typical patterns in the interest profiles of student nurses and practising nurses. These results appeared to support the assumption that certain interest patterns appear with greater frequency in nurses than in unselected normative groups.

Healey and Borg carried out a second study to try and demonstrate how patterns of interest are related to success in nursing. They compared the Kuder Preference (KPR) patterns of students who successfully completed a nursing program with the patterns of those who withdrew. However, they found very little

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[3]C.W. Taylor and others, "Prediction Studies in Nursing," Research Process in Nursing, ed. D.J. Fox and R.L. Kelly (New York: Appleton-Century-Crofts, 1967), pp. 165-175.

[4]Frances O. Triggs, "Measured Interests of Nurses: Second Report", Journal of Education Research, 42:113-121, October, 1948.

[5]F.B. Womer and E.J. Furst, "Interest Profiles of Student Nurses", Nursing Research, 3:125-126, February, 1955.

[6]Irene Healey and W.R. Borg, "Vocational Interests of Nurses and Nursing Students", Journal of Education Research, 46:346-352, January, 1953.

difference in the mean scores of the two groups, and concluded that the KPR does not significantly differentiate between potentially successful and unsuccessful nursing students.[7]

Doefield, Ray, and Baumberger carried out a study in which they tried to determine the value of the KPR and Strong Vocational Interest Blank (SVIB) as predictors of success in nursing. They concluded that these instruments did not significantly separate successful and unsuccessful students of nursing.[8] Gerstein tested the Nurse Scale on the SVIB and found no significant differences between successful and unsuccessful nursing students.[9] Navran also carried out a study on the Nurse Scale of the SVIB and the results indicated that it failed to predict success in nursing school.[10]

Mowbray and Taylor investigated the validity of the KPR and SVIB as predictors of success in nursing. The results of their study showed that the Social Service Scale of the KPR yielded significant mean differences between the most and least adjusted groups of students and between those who remained in the school and those who did not. On the other hand, the Scientific

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[7]Irene Healey and W.R. Borg, "Personality and Vocational Interests of Successful and Unsuccessful Nursing School Freshmen", Educational Psychological Measurement, 12:761-765, 1952.

[8]Mildred Doefield and others, "A Study of Selection Criteria for Nursing School Applicants", Nursing Research, 7:67-70, 1958.

[9]A.I. Gerstein, "Development of a Selection Program for Nursing Candidates", Nursing Research, 14:254-257, 1965.

[10]Leslie Navran, "Validity of the Strong Vocational Interest Blank Nursing Key", Journal of Applied Psychology, 37:31-32, February, 1953.

Scale on the KPR did not significantly separate the groups. This finding suggested that "while a scientific interest may be helpful to the student in terms of academic work, the over-riding determinant of adjustment and remaining within the school is the social service orientation." The Strong Nurse Scale gave no additional information to that suggested by the KPR Social Service Scale. On the basis of this study the researchers recommended administration of the KPR to prospective students of nursing, with special attention being paid to the amount of social service interest demonstrated by the applicant.[11]

Personality inventories are not generally used as part of the selection procedure of the school of nursing. Nevertheless the personality of the prospective nurse is an area of interest. A study of the recruitment of nurses in Canada by Robson states that "interviewers regard favorably characteristics which represent the picture of an average, well-adjusted, somewhat orthodox girl."[12] In other words, it is considered desirable that nursing applicants have a stable, mature personality.

As stated earlier, studies of personality test scores as predictors of success in nursing have generally shown very low correlations with the criterion measures of grades in nursing school. Thurston was interested in the relationship between

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[11] Jean K. Mowbray and Raymond G. Taylor, "Validity of Interest Inventories for the Prediction of Success in a School of Nursing", Nursing Research, 16:78-81, 1967.

[12] R.A.H. Robson, Sociological Factors Affecting Recruitment into the Nursing Profession (Ottawa: The Queen's Printer, 1967), p. 114.

personality and achievement and he used the Minnesota Multiphasic Personality Inventory (MMPI) to determine if any such relationship existed. From the results of this study it was concluded that "the MMPI cannot be used to predict academic success in nursing education, and if the MMPI were used at all for selecting and counseling student nurses it would be necessary to employ a psychologist who was skilled in the use of the MMPI and willing to submit his judgement to empirical test."[13]

Thurston also used the Luther Hospital Sentence Completion Test (LHSC) to measure the personality characteristics of student nurses. The LHSC was developed specifically to evaluate attitudes and emotions of nursing school applicants and students. The results showed a significant relationship between performance on the LHSC and achievement. However, Thurston did not believe that these results justified recommending general use of the LHSC, but rather that it should be used with caution for screening and prediction purposes.[14]

Michael and others, investigating the academic success of 128 nursing school candidates, used the 16 Personality Factor Inventory (16PF) and MMPI to predict grades in nursing school.

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[13]John R. Thurston and others, The Prediction of Success in Nursing Education: Phase I and Phase II (Wisconsin: Wisconsin State University, 1967), p. 29.

[14]John R. Thurston and others, "The Relationship of Personality to Achievement in Nursing Education, Phase II", Nursing Research, 17:265-268, 1968.

Results showed that the 16PF and MMPI scales "yielded correlations of virtually no predictive value."[15]

In 1970 Goza conducted a study in which he developed profiles of nursing students based on academic potential, academic achievement, and personality. The Gordon Personal Profile (GPP) and the Gordon Personal Inventory (GPI) were used to construct the personality profile. Findings indicated that those students who were successful and graduated had higher means than the dropouts on the Responsibility Scale of the GPP; also, the successful group had significantly higher means than the unsuccessful on the Sociability Scale and Original Thinking Scale of the GPP and GPI. Another finding was that graduates who received a favorable work performance rating had significantly higher means than graduates who received an unfavorable work performance rating on the Ascendancy Scale of the GPP and the Vigor Scale of the GPI. It was felt that this data indicated the GPP and GPI could be used to aid in the identification of potential dropouts and unfavorable work performance.[16]

In summary, it appears that interest and personality inventories have not been too successful in predicting nursing school

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[15]William B. Michael and others, "The Criterion-related Validities of Cognitive and Non-cognitive Predictors in a Training Program for Nursing Candidates", Educational and Psychological Measurement, 13:938-987, 1971.

[16]John Thomas Goza, "An Investigation of the Academic Potential, Academic Achievement, and Personality of Participants in an Associate Degree Nursing Program", Dissertation Abstracts, 31:5442, March, 1971.

achievement and success. It should be noted, however, that while most authorities are generally agreed that there is a lack of objective evidence on the vocational and educational significance of personality factors, they do conclude that personality has a profound effect upon adjustment, both educationally and vocationally.[17] It seems reasonable to assume, therefore, that the personality characteristics of an applicant in relation to ability to adjust should be considered as a possible determinant as to whether or not the individual will remain in the school of nursing or withdraw.

Studies of Attrition in Schools of Nursing

For a number of years the problem of excessive attrition has been a major one for nurse educators, and the literature has suggested that lack of effective selection methods in schools of nursing is a main contributing factor to this attrition problem. Hutcheson, Garland, and Prather undertook an investigation in an attempt to try and identify some of the causes of attrition in baccalaureate degree programs, and to consequently determine whether attrition might be minimized through adapting and coordinating screening processes and institutional practices.

The findings of this study suggested that demographic characteristics and academic potential and achievement have little predictive value in identifying potential dropouts, and may not be as reliable as factors such as clinical performance and the

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[17] Donald E. Super and John O. Crites, Appraising Vocational Fitness (New York: Harper and Row, 1962), p. 516.

student's relationship to nursing faculty and school administration. The researchers suggested that the relationship between clinical performance and attrition could be crucial. They recommended that measures of clinical performance potential should be tested and included in the applicant screening process. Further, the data suggested that developing and strengthening patterns of contact between students and nursing school faculty and administrators, with increased opportunities for counseling and guidance, might be effective in decreasing attrition rates. It should be noted that the data used in this study were quite limited in that only 41 students were involved. The authors recommended broader research in this area using larger quantities of data.[18]

The focus of a recent study by Warnecke, involving a collegiate nursing program, was to approach the problem of attrition in terms of three basic problems the school of nursing must help the student to solve in order to socialize into the nursing role. These problems were defined as: (1) developing an intrinsic committment to the content of the role, (2) providing a definition of the role broad enough to include the professional orientation, and (3) developing a definition that is compatible with the primary roles of the female, that of wife and mother. Warnecke performed a multiple discriminant analysis to determine the extent to which 20 indices reflecting conflict along these dimensions could be used to discriminate between non-dropouts and

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[18] John B. Hutcheson, Jaretta M. Garland, and James E. Prather, "Toward Reducing Attrition in Baccalaureate Degree Nursing Programs: An Exploratory Study", Nursing Research, 22:530-533, November-December, 1973.

four categories of dropouts, namely, liberal arts, diploma nursing, marriage, and employment. The results of the analysis indicated that these dimensions of role conflict did aid in describing the patterns of experience in the collegiate program that led to the observed attrition.[19]

Another interesting piece of research involves an investigation carried out by the Ohio State University School of Nursing. This consisted of a longitudinal study of the reasons for attrition beginning with the entering class of 146 students in 1966. Predictor variables used were the American College Tests Battery (ACT), the 16 PF, the Myers-Briggs Type Indicator (MBI), and the pre-nursing point-hour ratio. The point-hour ratio is computed by multiplying each numerical grade by the number of academic credits given for the course, summing across all courses, and dividing by the total number of academic credits. Criterion variables were completion versus non-completion of the nursing program and performance in nursing. The ACT Battery and the pre-nursing point-hour ratio proved to be the best predictors. However, the point was made that even these predictors would have screened out some students who successfully completed the program.[20]

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[19] R.B. Warnecke, "Non-intellectual Factors Related to Attrition from a Collegiate Nursing Program", Nursing Research, 22:539, November-December, 1973.

[20] Alma L. Wittmeyer and others, "A Longitudinal Study of Attrition and Academic Performance in a Collegiate Nursing Program", Nursing Research, 20:339-347, July-August, 1971.

It has been stated that "with respect to nursing attrition much has been written but the studies seem to display a monotonous similarity."[21] Taylor and others, in summarizing their findings, made a strong case for further careful study in the following statement:

> Further research in this area is sorely needed because of the high cost, both to individuals and institutions, of attrition in nursing schools and turnover among nursing personnel. Estimates of the cost of recruiting, selecting, induction, and training one individual for different occupations in the world of work range from hundreds to thousands of dollars to the organization, not counting the loss of a person in the training spot or the headaches of repeating the entire cycle to get a replacement into the status of a full-fledged worker. There is also an unestimated psychological and financial cost to the individual in terms of loss of time and effort and the personal disappointment and frustration when one has an unsuccessful experience and perhaps even finds himself in the wrong field. When any attempts are made to reduce school attrition or job turnover through some corrective action, we strongly recommend that each attempt be accomplished by a well-designed research study so that the degree to which each particular action is effective can be determined.[22]

The Relationship of Academic Ability and Prediction of Success in Nursing

Taylor and others, in researching the major predictive studies of nursing success and the devices used by nursing schools in selecting students, indicated that the most frequently studied criteria for success in schools of nursing have been measures of academic performance and continuance in the school. Substantial correlations have generally been obtained when

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[21] Ibid., p. 339

[22] Calvin W. Taylor and others, Selection and Recruitment of Nurses and Nursing Students: A Review of Research Studies and Practices (Salt Lake City: University of Utah Press, 1966), p. 339

learning ability tests such as achievement, aptitude, and intelligence tests have been used as predictive measures and grades in schools of nursing and registration examinations are used as criteria measures.[23] This seems to suggest that measures of academis ability predict success in schools of nursing with a substantial degree of accuracy. However, it should also be noted that correlations between the predictors and the criteria measures have been found to vary greatly within any one particular school and across studies.[24]

The inability of students to cope with the academic demands of nursing education has long been an area of concern and investigation. Through the years research has shown that measures of academic ability seem to be the best predictors of success in nursing education. The main criteria of selection are usually related to the academic ability of candidates. Robson has stated that the principal criterion for the selection of students of nursing is their academic ability as measured by their high school grades.[25]

A study conducted by Ruiz, Thurston and Poshek investigated selected personal characteristics of graduates of various nursing schools as these characteristics related to success on licensing examinations. The personal characteristics studied included

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[23]C.W. Taylor and others, "Prediction Studies in Nursing", Research Process in Nursing, ed. D.J. Fox and R.L. Kelly (New York: Appleton_Century_Crofts, 1967), pp. 165-175.

[24]Ibid.

[25]R.A.H. Robson, Sociological Factors Affecting Recruitment into the Nursing Profession (Ottawa: The Queen's Printer, 1967), p. 118.

intelligence, selected life history events, and personality structure. In general, intellectual potential was the most reliable predictor of success, with the other factors playing negligible roles.[26]

Munday and Hoyt conducted a study of the validity of the American College Tests (ACT) for predicting success in schools of nursing. The study reviewed data from the ACT Research Service on the use of the ACT in schools of nursing. The sample consisted of beginning students from seven different schools. Results of this study showed that for the nursing schools used in this sample the ACT had substantial validity for predicting success in a variety of specific courses in the first year such as English, Social Studies, Nursing Fundamentals, and Science, as well as the overall grades achieved in the first year. The correlation of ACT data with overall grades was .70 or higher. Other predictive correlations ranged from .52 to .62. The researchers emphasized, however, that while ACT data appear to be usefully predictive, particularly of first year performance, differences in nursing schools are so marked that it would be hazardous to generalize one school's results to another. It was stressed that validities should be established for individual schools to take into account

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[26] René A. Ruiz, Hester I. Thurston, and Neila A. Peshek, "Intellectual Factors, Biographical Information, and Personality Variables as Related to Performance in the Professional Nurse-licensure Examination", Nursing Research, 16:74-78, 1967.

unique aspects of the school's students, policies, philosophy, and objectives.[27]

A study by Backman and Steindler investigated the relationship of specific admissions criteria to success in a collegiate nursing program and to performance on the State Board examinations. Correlation coefficients were computed between measures of scholastic aptitude and achievement on one hand, and cumulative grade point average at the end of the two year collegiate program and scores obtained on the State Board examinations on the other hand. Measures of aptitude and achievement were the Wechsler Adult Intelligence Scale (WAIS), the Verbal and Mathematics subtest of the Scholastic Aptitude Test (SAT); and high school rank. Results showed that the SAT Verbal had higher correlations with the grade point average and the State Board examinations than did the other measures. Scores on the Vocabulary and Information subtests of the WAIS were also significantly related to grade point average and State Board examinations scores. High school rank appeared to be as good a predictor of college grade point average as the WAIS Full Score and Verbal Score.[28]

A somewhat similar study was done by Kovacs to determine

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[27] Leo Munday and Donald P. Hoyt, "Predicting Academic Success for Nursing Students", Nursing Research, 14:341-344, 1968.

[28] Margaret S. Backman and Frances M. Steindler, "Let's Examine: Prediction of Achievement in a Collegiate Nursing Program and Performance on State Board Examinations", Nursing Research, 20:546, November-December, 1971.

the effectiveness of measures of intelligence, rank in high school class, and performance on the SAT in predicting completion of a basic baccalaureate program in conjunction with successfully passing State Board examinations. It was concluded from this study that the Verbal and Total SAT scores appeared to be more useful than measures of intelligence and high school rank in predicting success in the baccalaureate program.[29]

Burgess, Duffey, and Temple used 56 intellective, interest, personality, and educational variables as possible predictors of success in a collegiate program of nursing. The results of this study showed the pre-nursing grade point average to be the single most significant predictor of success.[30]

Goza, in his study, developed profiles of students in a collegiate program based on academic potential, academic achievement, and, as stated earlier, personality. The California Test of Mental Maturity (CTMM), the American College Testing Program (ACT), and the Diagnostic Reading Tests (DRT) were used to construct profiles of academic potential. The final grade point average and the results of 14 National League of Nursing Achievement Tests were used to construct profiles of academic achievement. The profiles indicated that the successful students had significantly higher means than the dropouts on the final grade point

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[29]Alberta R. Kovacs, "Predicting Success in Three Collegiate Schools of Nursing", Nursing Research, 20:547, November-December, 1971.

[30]M.M. Burgess, M. Duffey, and F.G. Temple, "Two Studies of Prediction of Success in a Collegiate Program of Nursing", Nursing Research, 21:357-366, July-August, 1972.

average. Graduates who passed the State Board examinations had means significantly higher than those who failed on the ACT, CTMM, final grade point average, and all the National League of Nursing tests. One of the conclusions drawn from this study was that the academically superior students had greater success on the State Board examinations.[31]

The literature has revealed an appreciable background of studies dealing generally with prediction of success in nursing. These studies have demonstrated that scholastic aptitude and achievement are of value in predicting success in the school of nursing and on registration examinations. High school grades and tests of learning ability can, with some accuracy, predict academic success in nursing. It would seem, therefore, that the most usual predictors of success in nursing education and the main criteria of selection are related to the academic ability of the student. It should be pointed out, however, that these prediction studies have been conducted on select samples. In general, the subjects under investigation had been originally screened, selected, and admitted to the nursing programs on the basis of scholastic aptitude and achievement.

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[31] John Thomas Goza, "An Investigation of the Academic Potential, Academic Achievement, and Personality of Participants in an Associate Degree Nursing Program", Dissertation Abstracts, 31:5442, March, 1971.

PREDICTIVE VALIDITY OF THE PSYCHOLOGICAL CORPORATION ENTRANCE EXAMINATION FOR SCHOOLS OF NURSING

The recognition of the relationship between academic ability and success in nursing education has led to the development of a variety of intelligence and achievement tests specifically designed for the selection of nursing students. One such test is the Psychological Corporation Entrance Examination for Schools of Nursing (PCEE).

The literature has not revealed any studies or research projects done specifically to determine the predictive validity of this particular selection test. However, Taylor and others, in their survey related to effective selection devices, found that substantial correlations existed between the PCEE Ability measures and grades in nursing school and on State Board examinations. Taylor's research indicated that the PCEE battery and the National League for Nursing battery appeared to predict success in nursing school equally well, but that the PCEE battery was not as good a predictor of State Board examinations as the National League for Nursing battery.[32] The Psychological Corporation recommends the Scholastic Aptitude Total as the best single score to use in predicting academic grades and State Board examinations scores.

In 1967 the Psychological Corporation published the results of a validity study of the PCEE. The Corporation carried out this study using eight schools of nursing in the United States. The

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[32] C.W. Taylor and others, "Prediction Studies in Nursing", Research Process in Nursing, ed. D.J. Fox and R.I. Kelly (New York: Appleton-Century-Crofts, 1967), pp. 165-175.

report stated that "there is good evidence that Ability test scores predict success or failure in nursing school."[33] Personality measures were not included in this validity study.

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[33]The Psychological Corporation, "Prediction Validities of Entrance Examination", Nurse Testing Bulletin (New York: The Psychological Corporation Professional Examinations Division, 1967), p. 2.

Chapter 3

PROCEDURES

This chapter discusses the sampling, instrumentation, and statistical procedures used in this study.

SAMPLING

Two main groups were identified from the total sample of 296 nursing students. The Validation Group comprised 209 students and the Withdrawal Group numbered 87 students. The makeup of the groups by year is shown in Table 1.

Table 1

Number of Students in each Classification Category for the Years 1967-1970

	Year				
Classification	1967	1968	1969	1970	Total
Validation Group					
1. Those who completed the nursing program and passed registration examinations on first trial	16	65	59	60	200
2. Those who completed the nursing program and passed registration examinations on second trial	5	3	0	1	9
Withdrawal Group					
1. Those who withdrew for academic reasons	4	10	11	9	34
2. Those who withdrew for non-academic reasons	9	17	14	13	53
Total	34*	95	84	87	296

*In 1967 there were 90 students admitted to the school of nursing. Only 34 of this number wrote the PCEE.

The Validation Group

As indicated in Table 1, the Validation Group had two subdivisions. The first subdivision was made up of 200 students who successfully completed the nursing program and passed registration examinations on first trial writing. The second subdivision involved those students who successfully completed the school of nursing program but were unsuccessful on first trial writing of registration examinations. This group numbered nine students, or approximately 4.9 percent of the total Validation Group. It should be noted that these nine students failed only one section of the registration examinations, and all were successful on the second trial writing.

The Withdrawal Group

This group was also subdivided. The first subdivision was the Academic Withdrawal Group. This group was made up of 34 students who withdrew from the school of nursing because of academic failure. The second subdivision was the Non-academic Withdrawal Group. There were 53 students in this group, all of whom withdrew from the school for reasons other than academic.

These samples were studied with reference to scores obtained on the PCEE to ascertain the extent to which success or failure in the nursing program and registration examinations was associated with the level of scores attained on the test. The students wrote the PCEE after acceptance into the school of nursing; therefore the test was not used as a selection device for these students.

INSTRUMENTATION

In 1962 the Psychological Corporation issued a revised Entrance Examination for Schools of Nursing, the PCEE Form I, for the identification of qualified applicants for schools of nursing. The test consists of Academic Ability tests and a Personality inventory, constructed especially to meet the selection needs of nursing schools. During 1962-63 a second form of the Entrance Examination was developed, the PCEE Form II, to be used as an alternate for Form I. The Corporation has said that the five Ability tests on the two forms are parallel in structure, content, difficulty, and meaning, but contain no duplication of questions. The Personality measures are identical in both forms.[1]

Ability Measures

The Ability measures of the PCEE consist of a battery of five tests of academic ability. These five tests yield scores for seven measures, namely, Verbal Ability, Numerical Ability, Science Information, Reading Comprehension, Arithmetic Processes, General Information, and a composite Scholastic Aptitude Total (SAT). This composite score is obtained from the Verbal Ability, Numerical Ability, Science, and Reading tests.[2]

Personality Measures

The Personal Preference Schedule (PPS) of the test measures

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[1] The Psychological Corporation, "Predictors of Success in Schools of Nursing", Nurse Testing Bulletin (New York: The Psychological Corporation Professional Examinations Division), April, 1965.

[2] Ibid.

six personality characteristics, namely, Achievement, Orderliness, Persistence, Congeniality, Altruism, and Respectfulness. This battery of tests is designed primarily to assess the applicant's attitudes and feelings. These tests are recommended by the Psychological Corporation as being helpful in understanding and counseling new students. They are not recommended for use in the selection procedure.[3]

Reliability of the PCEE

The reliability data for the Ability subtests of the PCEE, as reported by the Psychological Corporation, are found in Table 2.

Table 2

Reliability Coefficients of Ability Subtests

Subtest	Reliability Coefficients	
	Form I	Form II
Verbal Ability	.93	.93
Numerical Ability	.91	.90
Science Information	.85	.87
Reading Comprehension	.74	.75
Arithmetic Processes	.82	.76
General Information	.88	.90
Scholastic Aptitude Total	.96	.96

Reliability coefficients were computed for each test of each form and, as can be seen from Table 2, the reliabilities were very similar for the corresponding tests in Form I and Form II.

[3]Ibid.

The Corporation's reliability report states: "The reliability coefficients, as computed by the Kuder-Richardson Formula 21 are large, indicating high internal consistency for each part of the battery."[4] The report goes on to say: "The large intercorrelations of the subtests in the two forms give evidence of strong alternate-form reliability. The parallel construction of the two forms, supported by the correlational data, indicates a high degree of equivalence."[5] According to the Psychological Corporation, reliability statistics for the PCEE Ability subtests are "entirely satisfactory."[6] No reliability data for the Personality subtests of the PCEE were reported by the Psychological Corporation.

Validity of the PCEE

In 1965 the Corporation established a research program to study the validity of the PCEE Ability measures as predictors of academic and professional performance. Eight schools of nursing in the United States agreed to participate in this research program. The results of this study were published in the Nurse Testing Bulletin for May, 1967. The report presented validity information in relation to the following criteria: (1) admitted vs. not admitted, (2) age differences, (3) amount of pre-nursing education, (4) academic dropouts, (5) correlation with grades, (6) yearly and overall grade averages, (7) individual course grades, (8) achievement test scores, (9) licensure examination scores, and (10) success vs. failure. The results of this validity study, as published by the Psychological Corporation,

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[4]Ibid., p. 2. [5]Ibid., p. 4. [6]Ibid., p. 2.

are summarized as follows:[7]

Admitted vs. not admitted. Students admitted to the nursing schools studied scored higher on all subtests than students who were not admitted. The report stated that this result indicated that the PCEE played an important part in the selection of students for schools of nursing.

Age differences. Students under 30 years of age excelled on the Numerical, Reading and Arithmetic Processes measures. Students over 30 years of age scored higher than the younger students on the Verbal, Science, and General Information subtests. The Scholastic Aptitude Total was not related to age.

Amount of pre-nursing education. The Ability subscores were positively related to level of pre-nursing education. Most noteworthy was the significant increase of the composite score (SAT) with greater educational background.

Academic dropouts. Those failing during the first year tended to score lower on the subtests than those remaining in the nursing school. Of the seven Ability measures, the SAT score was most significantly related to the pass-fail criterion.

Correlations with grades. Ability test scores were positively related to academic performance in high school and

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[7]The Psychological Corporation, "Prediction Validities of Entrance Examination", Nurse Testing Bulletin (New York: Psychological Corporation Professional Examinations Division), May, 1967.

in the first year of nursing school, but showed a stronger relationship to grades in nursing school than in high school. The SAT score was the best predictor of first-year grade average in nursing.

Grade averages. Students obtaining an average grade of A or B performed higher on the PCEE than those obtaining an average of C or D. These differences were evident on all the Ability subtests, but were most outstanding on the SAT. Correlations between SAT scores and grade averages in nursing school showed that the SAT and overall grade average had a correlation averaging .35. Correlations between the PCEE scores and the yearly grade averages showed a decrease with each year in nursing school, with average correlations of .44, .27, and .22 for the first, second, and third years, respectively.

Individual course grades. The SAT scores showed a positive relationship to the academic and nursing theory courses, with correlations of .36 and .34 respectively. The correlation of .04 between SAT scores and clinical practice grades indicated that the Ability test scores do not predict success in these courses. According to the report, this is because the types of skills important in clinical practice are probably different from those in the more academic courses.

Achievement Test scores. Several of the schools in the study used the standardized Achievement Tests published by the Corporation. The report stated that, in general, the Achievement Test scores were related to the SAT score (correlations of .26 to

.67), and to overall grade average in nursing school (correlations of .17 to .72).

Licensure examination scores. Students demonstrating higher scholastic ability on the PCEE made significantly higher average scores on the licensure examination. The SAT was again the best predictor. Correlations for licensure examination scores with SAT scores ranged from .37 to .49, while correlations for licensure scores with high school rank were from .24 to .29. According to the validity report, this indicated the Ability test scores were better predictors of licensure Examination scores than academic achievement in high school.

Success vs. failure. The report said that students who graduate from nursing school showed significantly higher scores on the Entrance examination than those who withdrew for academic reasons. The mean SAT score for failing students was considerably below that of passing students. Differences in the same direction appeared on all of the subtest scores, but the SAT score seemed to make the best differentiation.

PCEE Prediction Scale. The Psychological Corporation recommends the SAT as the best single score to use in predicting academic grades and registration examination scores. A scale on the test report, located below the Ability measures, indicates an estimated prediction of how easy or difficult the applicant is likely to find the academic work in the school of nursing. This

judgement is based on the SAT percentile. The prediction is made on the following basis:[8]

SAT Percentile	Prediction
90-99	Very Easy
75-85	Rather Easy
30-70	Average Difficulty
12-25	Rather Difficult
01-10	Very Difficult

In the validity study report the percent of students who passed or failed at different ability levels was presented in an expectancy table. This information is shown in Table 3.[9]

Table 3

Expectancy Table for Predicting Success or Failure in Nursing School from the SAT Score

		Percent of Admitted Students	
SAT Score	SAT Percentile	Passing	Failing
227-280	90-99	98%	2%
204-226	80-90	93%	7%
177-203	55-75	86%	14%
0-176	01-50	77%	23%

This expectancy table was based on pass-fail information from all schools involved in the study. As shown by Table 3, there

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[8]The Psychological Corporation, Interpretation of Individual Report (New York: Professional Examinations Division).

[9]The Psychological Corporation, "Prediction Validities of Entrance Examination", Nurse Testing Bulletin, May, 1967, p. 2.

is a definite trend for the percent of academic dropouts to increase as the SAT score decreases. The report emphasized that this table was presented as a very general indication of the effectiveness of the SAT score as a predictor of success in nursing school. It was recommended that each school should look at its own data in terms of developing an expectancy table.[10]

Finally, since only students admitted to nursing schools were considered in the comparisons, it should be recognized that the differences reported would probably be smaller than if the data had been based on an unselected sample. Nevertheless, the report stated that even with this selected sample there was good evidence that the Ability test scores of the PCEE predict success or failure in nursing school.[11] However, it should be noted that validation by the test of significance alone gives no indication of the efficiency of the PCEE in making screening decisions. Furthermore, the study does not indicate how well the test predicted when all subtest scores were considered together. Personality measures were not included in the validity study.

STATISTICAL PROCEDURES

The basic analysis problem was to determine if the various subtests of the PCEE discriminated between the Validation and Withdrawal Groups and between the two subdivisions of the Withdrawal Group. The first three research questions were examined using the analysis of variance (ANOVA) to test the differences in the means of each of the subtests of the PCEE. The purpose of

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[10] Ibid., p. 2. [11] Ibid., p. 1.

this procedure was to decide which, if any of the subtests, had other than random between groups differences.

The fourth research question was answered through the following procedure. First, based on the outcome of the analysis for the first three research questions, an appropriate grouping was selected as the basis for establishing the discriminating efficiency of the PCEE. This was the essence of the problem of validation. The appropriateness of the grouping was substantiated by multivariate analysis of variance (MANOVA). Next, those variables for which significant differences were found for the selected grouping were taken. MANOVA was performed to test the overall significance of the mean vectors of the basis groups. The rationale for this was that since the discriminant function was based on group differences on the various subtests, it made no logical sense to include a variable if it had already been decided that there were no group differences as measured by that variable.

If the MANOVA test was significant, a final step in the analysis was contemplated. A significant outcome on the MANOVA would indicate only that the set of subtests would discriminate between the groups. More complete validation would require that the efficiency of the discrimination between the groups be described. The procedure used was to compute the discriminant function and then to find the number of classification errors made under two decision rules: (1) minimize the total number of classification errors, and (2) correctly reject 67 percent of the Withdrawal Group. The procedures used throughout the analysis were as

described by Cooley and Lohnes,[12] and were calculated through the use of a computer program supplied by Dr. William H. Spain of the Department of Educational Psychology, Guidance and Counseling, Memorial University.

Throughout this study tests at the .05 level of confidence were considered significant.

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[12]William W. Cooley and Paul R. Lohnes, Multivariate Data Analysis (New York: John Wiley & Sons, Inc., 1971), pp. 243-261.

Chapter 4

ANALYSIS OF DATA

This chapter presents the statistical analysis of the results of this study with respect to the four research questions presented in Chapter 1. In examining these questions the scores of the PCEE variables were analyzed using descriptive statistics and analysis of variance (ANOVA) for each variable. Discriminant analysis was used to determine the most effective discriminators from among seven selected variables.

RESEARCH QUESTION ONE

> Which of the PCEE Academic Ability measures, if any, differentiates between successful candidates (Validation Group) and those who withdrew from the program (Withdrawal Group)?

In examining this question a comparison was made of the mean scores of the Validation Group and the Withdrawal Group on each of the PCEE Ability tests. Table 4 shows the mean raw scores and standard deviations on the Ability measures for the total Validation sample and the total Withdrawal sample. F ratios are shown for the comparisons between the mean raw scores of the two groups.

Table 4

Comparison of Validation and Withdrawal Groups on the PCRE Ability Measures

Variable	Validation Group (N=209) Mean	S.D.	Withdrawal Group (N=87) Mean	S.D.	ANOVA F
Verbal	46.5	16.94	42.6	15.92	3.07
Numeric	44.4	8.12	43.1	8.98	0.89
Science	44.3	10.95	40.1	10.88	7.72*
Reading	27.3	5.73	25.6	4.99	4.53*
Arithmetic	21.9	6.33	20.9	4.73	1.46
General Info.	40.6	11.48	38.3	10.11	2.21
SAT	162.3	31.57	151.3	32.74	5.83*

*Significant at the .05 level of confidence

A study of the seven Ability measures in Table 4 shows that the mean scores of the Withdrawal Group were lower than the mean scores of the Validation Group on all the Ability tests. ANOVA revealed statistically significant differences on the Science, Reading, and SAT variables. No other significant differences were noted between the mean scores of the Ability measures of the two groups.

RESEARCH QUESTION TWO

Which of the PCRE Personality measures, if any, differentiates between the Validation Group and the Withdrawal Group?

In examining this question a comparison was made of the mean scores of the Validation Group and the Withdrawal Group on

each of the Personality measures of the PCEE. The results of this comparison are presented in Table 5.

Table 5

Comparison of Validation and Withdrawal Groups on the PCEE Personality Measures

	Validation Group (N = 209)		Withdrawal Group (N = 87)		ANOVA
Variable	Mean	S.D.	Mean	S.D.	F
Achievement	12.2	3.73	11.5	3.33	2.15
Orderliness	11.9	4.09	11.7	3.99	0.11
Persistence	14.2	4.11	13.9	4.64	0.17
Congeniality	16.0	3.44	15.3	3.71	1.83
Altruism	15.7	4.01	15.8	4.56	0.11
Respectfulness	12.2	3.48	12.7	3.38	1.39

A study of the means and standard deviations of the six Personality measures shows very little difference between the two groups. The means of the Validation Group were slightly higher on Achievement, Orderliness, Persistence, and Congeniality. The Withdrawal Group showed slightly higher means on Altruism and Respectfulness. ANOVA revealed that the Validation and Withdrawal Groups showed no significant differences on the Personality measures of the PCEE.

RESEARCH QUESTION THREE

Which of the PCEE subtests differentiates between the Academic Withdrawal Group and the Non-academic Withdrawal Group?

To examine this question the total Withdrawal Group was

divided into two subgroups, the Academic Withdrawal Group and the Non-academic Withdrawal Group. These subgroups are described in Table 6.

Table 6

Subdivisions of the Withdrawal Group

Withdrawal Group Divisions	No. of Students	Percent
Academic Withdrawals		
Students who withdrew because of academic failure	34	39.1
Non-academic Withdrawals		
Students who withdrew for reasons other than academic failure	53	60.9
Total Withdrawal Group	87	100.0

The mean raw scores of students who withdrew for academic reasons were compared with the mean raw scores of students who withdrew for non-academic reasons. This comparison was made on the scores of the Ability and Personality measures of the PCEE. Table 7 presents information on the mean performance of the Academic Withdrawal Group as compared with the Non-academic Withdrawal Group. There appears to be very little difference between the two groups on the Personality measures, but a study of the means and standard deviations of the Ability measures for both these subgroups shows more marked differences within the total Withdrawal Group than between the Validation and Withdrawal Groups.

Table 7

Comparison of Academic and Non-academic Withdrawal Groups on the Ability and Personality Measures of the PCEE

	Academic Withdrawals (N = 34)		Non-academic Withdrawals (N = 53)		ANOVA
Variable	Mean	S.D.	Mean	S.D.	F
Verbal	36.4	13.03	46.4	16.40	9.51*
Numeric	41.3	7.43	44.3	9.74	2.30
Science	36.4	8.02	42.5	11.85	7.08*
Reading	24.5	3.96	26.3	5.49	2.57
Arithmetic	19.9	4.75	21.5	4.66	2.40
General Info.	34.1	7.66	41.0	10.62	10.73*
SAT	138.4	24.12	159.5	35.05	9.33*
Achievement	10.8	3.14	11.9	3.40	2.22
Orderliness	11.5	4.10	11.8	3.97	0.07
Persistence	14.5	5.20	13.5	4.25	1.02
Congeniality	15.4	3.97	15.3	3.58	0.01
Altruism	15.8	4.41	15.8	4.70	0.01
Respectfulness	13.2	3.11	12.3	3.52	1.65

*Significant at the .05 level of confidence

Table 7 indicates that there was very little difference between the two groups on the Personality measures. The Academic Withdrawal Group showed slightly higher mean scores on Persistence, Congeniality, and Respectfulness. The Non-academic Withdrawal Group showed slightly higher means on Achievement and Orderliness.

A study of the Ability measures in Table 7 shows the Academic Withdrawal Group had lower mean scores on all seven of the Ability measures than the Non-academic Withdrawals. The

difference in the mean scores for the Academic and Non-academic Withdrawals is greater on all the Ability measures than the difference in Ability mean scores obtained in the comparison between the Validation Group and total Withdrawal Group. It is also interesting to note that the Academic Withdrawal Group appeared to represent a more homogenous sample than the Non-academic Withdrawals in that the standard deviations on all Ability tests were smaller in the Academic Withdrawal Group. Since homogeniety of variance is assumed in ANOVA, F ratios were computed to test this assumption. This data is presented in Table 8.

Table 8

Comparison of Variances of the Academic Withdrawal Group and Non-academic Withdrawal Group

	Variance		
Variable	Academic Withdrawals (N = 34)	Non-academic Withdrawals (N = 53)	F
Verbal	170.78	268.96	1.57
Numeric	55.20	94.87	1.72
Science	64.32	130.42	2.27*
Reading	15.68	30.14	1.92*
Arithmetic	22.56	21.72	1.04
General Info.	58.68	112.78	1.92*
SAT	581.77	1228.50	2.11*
Achievement	9.86	11.56	1.18
Orderliness	16.81	15.76	1.06
Persistence	27.04	17.96	1.56
Congeniality	15.60	12.82	1.21
Altruism	19.45	22.09	1.13
Respectfulness	9.67	12.46	1.28

*Significant at the .10 level of confidence

A level of confidence of .10 was selected as there was greater concern with Type II error in rejecting the null hypothesis. Table 8 shows that four subtests differed significantly between the groups. These were Science, Reading, General Information and the SAT. This possibly had the effect of making the ANOVA test more conservative since in cases of unequal variances and unequal group sizes, when the smaller variance is associated with the smaller group, the probability of Type I error is less than alpha, the stated level of significance.[1] Following the test of homogeneity of variance, ANOVA revealed statistically significant differences between the means of four of the Ability subtests, namely, Verbal, Science, General Information, and the SAT.

RESEARCH QUESTION FOUR

> Can the PCEE be used to determine an appropriate basis for classification of applicants in relation to (a) a basis for dividing the applicant group for classification purposes, and (b) a basis for determining cutoff points for classification, particularly with respect to minimizing the false acceptance of candidates?

Research Question One showed some differences between the Validation and Withdrawal Groups on Ability measures. Research Question Three showed differences on Ability measures between the Academic and Non-academic Withdrawal Groups. The answers to these questions suggest a need to determine if the PCEE would discriminate between the three groups, that is, the Validation Group, the Academic Withdrawal Group and the Non-academic

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[1] Gene V. Glass and Julian C. Stanley, Statistical Methods in Education and Psychology (Toronto: Prentice-Hall of Canada Ltd., 1970), p. 372.

Withdrawal Group. This three group comparison was made on all thirteen of the PCE variables. The results are shown in Table 9.

A study of Table 9 reveals a similarity between the Validation and Non-academic Withdrawal Groups in that very small differences were found between the Ability measures mean scores for these two groups. It is interesting to note that the means for the Non-academic Withdrawals on the Verbal and General Information subtests were slightly higher than those of the Validation Group. The SAT mean score for the Validation Group was 162.3, for the Non-academic Withdrawals 159.5, and for the Academic Withdrawals 138.5.

Table 9 also shows that there appeared to be very little difference between the three groups on Personality measures mean scores. The variable showing the most difference was Achievement, with a mean score of 12.2 for the Validation Group, 11.9 for the Non-academic Withdrawals, and 10.8 for the Academic Withdrawals. The Academic Withdrawal Group scored slightly higher on Respectfulness and Persistence than did the Validation and Non-academic Withdrawal Groups.

ANOVA in Table 9 indicates statistically significant differences between the three groups on Reading, Verbal, Science, General Information, and the SAT.

To summarize, in this three group comparison the results, as shown in Table 9, indicate a marked similarity between the Validation Group and the Non-academic Group on all thirteen

Table 9

Comparison of Validation Group, Non-academic Withdrawal Group, and Academic Withdrawal Group on the Ability and Personality Measures of the FCEE

	Validation Group (N = 209)		Non-academic Withdrawals (N = 53)		Academic Withdrawals (N = 34)		ANOVA
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	F
Verbal	46.5	16.19	46.6	16.40	36.4	13.03	6.14*
Numeric	44.4	8.12	44.3	9.73	41.3	7.43	2.01
Science	44.3	10.95	42.5	11.85	36.4	8.02	7.93*
Reading	27.3	5.73	26.3	5.49	24.5	3.96	3.91*
Arithmetic	21.9	6.33	21.5	4.66	19.9	4.75	1.69
General Info.	40.6	11.48	41.0	10.62	34.1	7.66	5.42*
SAT	162.3	31.57	159.5	35.05	138.4	24.12	8.35*
Achievement	12.2	3.73	11.9	3.40	10.8	3.14	2.24
Orderliness	11.9	4.09	11.8	3.97	11.5	4.10	0.13
Persistence	14.2	4.11	13.5	4.25	14.5	5.20	0.75
Congeniality	16.0	3.44	15.3	3.58	15.4	3.97	1.22
Altruism	15.7	4.01	15.8	4.70	15.8	4.41	0.02
Respectfulness	12.2	3.48	12.3	3.52	13.2	3.11	1.36

*Difference of means significant at the .05 level of confidence

variables of the PCEE. The Academic Withdrawal Group showed significant differences from the other two groups on the Ability measures. However, very little difference was observed between the three groups on the Personality measures.

This study was primarily concerned with establishing the validity of the PCEE for Schools of Nursing as a predictor of success or failure in the nursing program. All comparisons thus far seemed to indicate that the PCEE does not appear to be a strong discriminator between potentially successful and unsuccessful applicants. The test's predictive strength seemed to lie in the Academic Ability measures. The similarities and differences in academic ability between the groups were best revealed in Table 9.

An interesting development in the three group comparison was the definite similarity revealed between the Validation Group and Non-academic Withdrawal Group. This similarity served to promote speculation that the Non-academic Withdrawals had the academic potential to be successful in the nursing program. This raised an interesting question: Would the PCEE show a greater ability to predict success or failure in the nursing program if a comparison was made in which the Validation Group was expanded to include the Non-academic Withdrawal Group, and the Withdrawal Group reduced to include Academic Withdrawals only? This question was meaningful from the point of test validity because it would fit into the selection situation; that is, it would clearly indicate the ability of the test to identify applicants who were potential withdrawals for academic reasons.

Comparison of a Composite Validation Group with the Academic Withdrawal Group

On the basis of the similarities and differences revealed in Table 9, the 53 Non-academic Withdrawals were considered as potentially successful applicants and included with the successful students, giving a total of 262 subjects in this expanded group, hereafter known as the Composite Validation Group. The Academic Withdrawal Group consisted of 34 students who left the school of nursing because of their inability to meet the academic requirements. The groups were compared on the thirteen variables of the ICEE. Table 10 presents the results of this comparison.

Table 10

Comparison of the Composite Validation Group and the Academic Withdrawal Group on the Ability and Personality Measures of the ICEE

	Composite Validation Group (N = 262)		Withdrawal Group (N = 34)		ANOVA**
Variable	Mean	S.D.	Mean	S.D.	F.
Verbal	46.5	16.31	36.4	13.03	12.32*
Numeric	44.4	8.42	41.3	7.43	4.03*
Science	43.9	11.11	36.4	8.02	14.72*
Reading	27.1	5.68	24.5	3.96	6.41*
Arithmetic	21.8	6.06	19.9	4.75	3.18
General Info.	40.7	11.39	34.1	7.66	11.00*
SAT	161.7	32.25	138.4	24.12	16.40*
Achievement	12.1	3.67	10.8	3.14	4.15*
Orderliness	11.9	4.06	11.5	4.10	0.21
Persistence	14.0	4.14	14.5	5.20	0.37
Congeniality	15.9	3.47	15.4	3.97	0.67
Altruism	15.7	4.15	15.8	4.41	0.03
Respectfulness	12.2	3.48	13.2	3.11	2.70

*Significant at the .05 level of confidence

**MANOVA: F = 1.94; df 13, 282; Significant at the .05 level of confidence

A comparison of the Ability measures' mean scores of the Composite Validation Group and Academic Withdrawal Group in Table 10 indicated that the 209 students who successfully completed the program, and the 53 potentially successful students who withdrew for non-academic reasons, scored significantly higher on six of the seven Ability tests than did those students who withdrew because of academic failure.

In the Personality variables, Table 10 showed that the Composite Validation Group scored significantly higher than the Academic Withdrawal Group on the Achievement variable. The Composite Validation Group had slightly higher mean scores than the Academic Withdrawal Group on Orderliness and Congeniality, while the mean scores of the Academic Withdrawal Group were slightly higher than those of the Composite Validation Group on Persistence, Altruism, and Respectfulness.

ANOVA in Table 10 indicated statistically significant differences between these two groups on six of the seven Academic Ability measures. No significant difference was found on the Arithmetic variable. A significant difference was found on one of the six Personality variables. The Composite Validation Group showed a significantly higher mean score on the Achievement variable, which is designed to measure the individual's desire to attain recognition and be successful.

Discriminant Analysis

Table 10 indicates that, using ANOVA, statistically significant differences were found for six of the seven PCEE Academic

Ability measures, and one of the six ICEE Personality measures. This seemed to identify the ICEE variables which provide statistically significant discrimination between applicants who have the potential for academic success in the school of nursing, and those who do not possess the required academic ability. Therefore, these seven variables were considered to be potential predictors of success or failure in the nursing program, while the remaining six variables were considered to be non-discriminating, and were eliminated from the analysis.

A MANOVA test showed that the two groups differed significantly on the seven selected subtests, taken together. This indicated that the mean vectors of the two groups were different, and that the Composite Validation Group should have different discriminant scores than the Academic Withdrawal Group.

Table 11 indicates the discriminant weights and proportions of between groups variance for the seven variables involved in the discriminant analysis. The computer program provided scaled discriminant vectors, allowing the comparison of variables in order to determine the most important discriminating variables. The discriminant weight of each single variable provided the proportion of between groups variance accounted for by that particular variable, independent of the between groups variance accounted for by the other variables.[2]

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[2]William W. Cooley and Paul R. Lohnes, Multivariate Data Analysis (New York: John Wiley & Sons, Inc., 1971), pp. 243-261.

Table 11

Discriminant Weights and Proportions of Between Groups Variance

Variables	Rank Order	Scaled Discriminant Weight	Proportion of Between Groups Variance	Cumulative Proportions
SAT	1	-167.395	.5019	.5019
Verbal	2	108.051	.2104	.7123
Science	3	102.635	.1889	.9012
Numeric	4	58.571	.0629	.9641
Achievement	5	27.777	.0147	.9788
General Info.	6	23.728	.0113	.9901
Reading	7	22.331	.0099	1.0000

MANOVA: $F = 3.14$; $df = 7, 288$; Significant at the .05 level of confidence

Scholastic aptitude total (SAT). The SAT was the top ranking variable in the discriminant analysis. This variable accounted for about 50 percent of the between groups variance; therefore a high SAT was associated with success in nursing.

Verbal ability. The second ranking variable was Verbal Ability. This variable accounted for approximately 21 percent of the remaining variance. Again, a high Verbal score was associated with success in nursing.

Science. The third ranking variable was Science. This variable accounted for about 19 percent of the remaining variance. A high Science score was also associated with success in nursing. These first three variables together accounted for 90 percent of the between groups variance.

Numeric ability. This was the fourth ranking variable. It accounted for approximately 6 percent of the between groups variance.

The three remaining variables, Achievement, General Information, and Reading, contributed only about 1 percent each to the remaining between groups variance. This suggested that the nature of the intercorrelations between the seven variables was such that most of the variance measured by these variables was also accounted for by the other four variables.

Classification Efficiency

It was assumed that the discriminant scores obtained from the discriminant function would be normally distributed.[3] Further, it was assumed that the proportion of students in the Academic Withdrawal Group and the Composite Validation Group would remain constant in other samples. Under these two assumptions, the efficiency of the discrimination was examined for two decision situations.

Decision rule one. The first decision situation was one in which it was desirable to minimize the total number of errors in classification without regard to the type of error being made. The procedure described by Cooley and Johnes[4] was used for this purpose. Using this rule, all the applicants passing the initial selection procedures were classified as successful. This would mean that all students in the Academic Withdrawal Group would be admitted, but no applicant would be rejected, for an error rate of 11.6 percent of the total applicant group.

Figure 1 shows why all the Academic Withdrawal Group was misclassified under decision rule one. Under the assumption

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[3] Ibid. [4] Ibid.

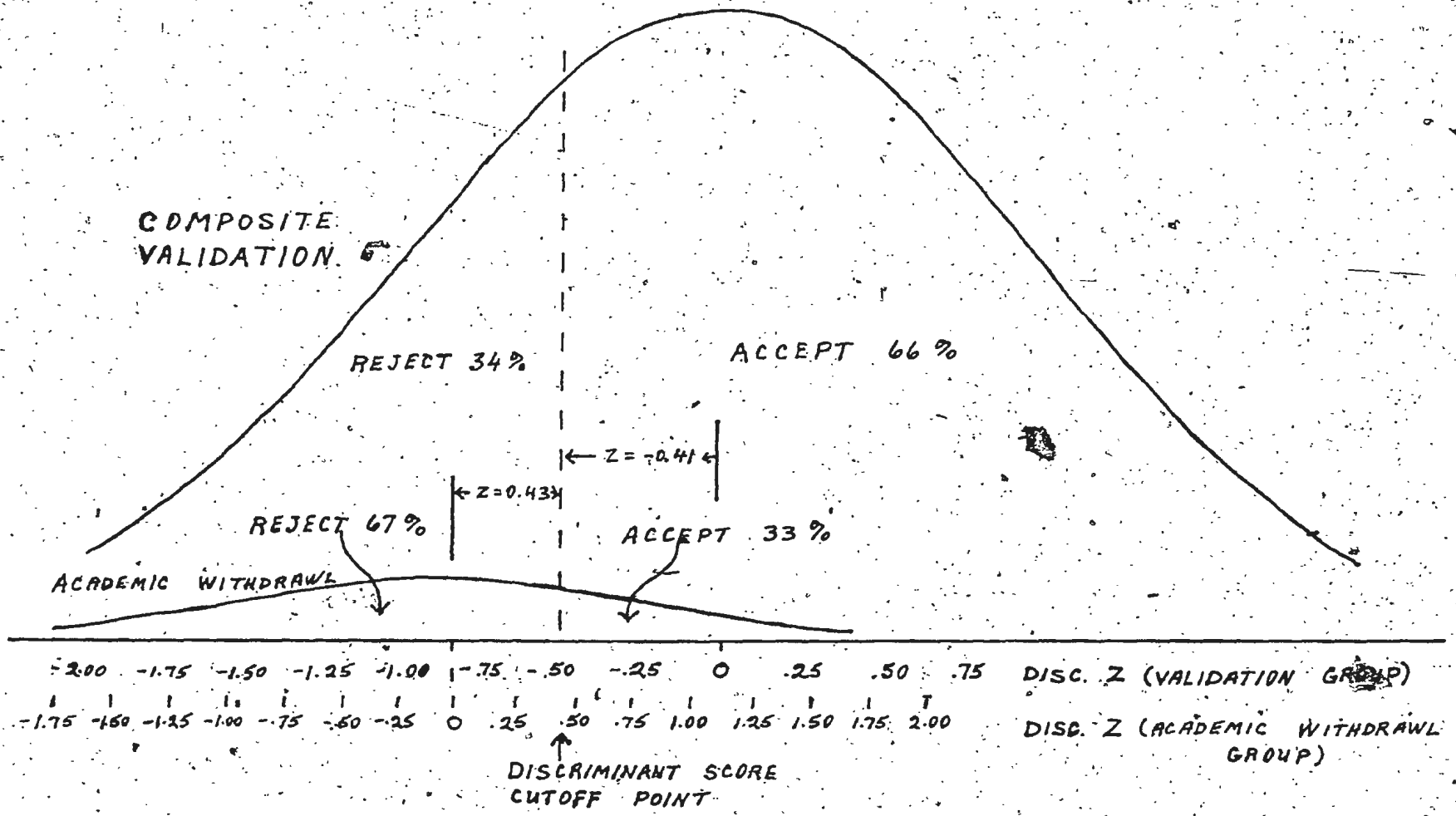

Figure 1

Relative Distributions of the Composite Validation and Withdrawal Groups

that the relative proportion of the applicant group in each classification category would be constant, the ratio of the Composite Validation Group to the Academic Withdrawal Group would be 7.72:1. This means that for equivalent standardized discriminant scores, the ordinates of the respective normal curves would be in the same ratio. As can be seen, the ordinate of the curve for the Academic Withdrawal Group never exceeds that for the Composite Validation Group. Therefore, for a given discriminant score, one would expect to find more applicants in the Composite Group than in the Academic Withdrawal Group. In selection, under decision rule one, one would always accept, as this would minimize the number of classification errors.

Decision rule two. The second decision situation was designed to minimize the false acceptance of applicants. A cutoff discriminant score was selected which would insure the rejection of 67 percent of the Academic Withdrawal Group. The efficiency of the classification was found using the descriptive statistics for the discriminant scores given in Table 12.

Table 12

Means and Variances of Discriminant Scores

Group	Mean	Variance
Composite Validation	27.7	27.52
Academic Withdrawal	23.4	14.36

Figure 1 shows the relative distribution of the discriminant scores of the Composite Validation Group and the Academic

Withdrawal Group, given the two assumptions previously stated. After computing discriminant scores, the proportion of each group falling into acceptance and rejection categories was found by reference to a table of normal distributions. The proportion of the total group which was incorrectly classified for each category is shown in Table 13.

Table 13

Proportion of Total Group Classifications for Decision Situation Two

	Correctly Classified		Incorrectly Classified	
Group	Approx. number	Percent total group	Approx. number	Percent total group
Composite Validation	173	58.4	89	30.5
Academic Withdrawal	23	7.8	11	3.3
Total	196	66.2	100	33.8

As can be seen from Table 13, decision rule two incorrectly classified 33.8 percent of the applicant group. Eighty-nine percent of those incorrectly classified subsequently completed the diploma nursing course successfully.

FCEE PREDICTION SCALE

The FCEE Prediction Scale, based on the Ability measures, appears to have a degree of value in predicting success in the school of nursing. Table 14 categorizes the total number of students involved in this study according to the FCEE Prediction

Scale and their actual achievement, that is, whether the student was academically successful, withdrew for academic reasons, or withdrew for non-academic reasons. The relationship between the Prediction Scale and student achievement was tested by means of the Chi-square test of independence, and was found to be significant at the .05 level of confidence.

Table 14

PCEE Prediction Scale and Actual Achievement of the Total Sample

SAT Percentile	PCEE Prediction	Successful Students	Withdrawals		No. of students
			Academic	Non-Academic	
90-99	Very Easy	15 (78.9%)	0	4 (21.4%)	19
75-85	Rather Easy	16 (72.7%)	1 (4.5%)	5 (22.7%)	22
30-70	Average Difficulty	107 (78.7%)	8 (5.8%)	22 (16.0%)	137
15-25	Rather Difficult	50 (64.1%)	13 (16.6%)	15 (19.2%	78
01-10	Very Difficult	21 (52.5%)	12 (30.0%)	7 (17.5%)	40
Total		209	34	53	296

$\chi^2 = 15.51$, df = 8, $p < 0.05$

From Table 14 it appears that students who fall within the categories of Very Easy, Rather Easy, and Average Difficulty on the PCEE Prediction Scale, have a good probability of success in the nursing program. For students categorized on the scale as find-

ing the course Rather Difficult and Very Difficult the percentage of success was somewhat lower, but still above 50 percent. It should be noted that if the 118 students classified in these two categories by the Prediction Scale had not been admitted to the school on the basis of the prediction, 71 successful students would not have been given the opportunity to enter the nursing program. These 71 students account for 65.7 percent of the 118 students, and 34 percent of the total number of 209 successful students comprising the initial Validation Group.

An interesting observation is that the proportion of Non-academic Withdrawals in each prediction category is relatively constant, varying from about 16 percent to about 21 percent of the students falling into each category. This suggests that membership in the Non-academic Withdrawal Group is relatively independent of membership in any prediction category, and that the relationship described in the preceding paragraph is confined to the Academic Withdrawal Group.

Validity of the PCEE Prediction for Rural Applicants

A final question related to the use of the PCEE in selection is the possibility that the test discriminates against applicants from the rural areas in favor of those applicants who come from urban areas. In order to test this possibility, the total sample was studied to determine if there was a relationship between the PCEE Prediction Scale and whether the student came from a rural or urban background. Table 15 categorizes the total sample of 296 students according to the PCEE Prediction Scale and home community

background. The Chi-square test of independence was used to determine the relationship between the PCEE Prediction Scale and community background of the student, and was found to be significant at the .05 level of confidence.

Table 15

PCEE Prediction Scale and Community Background

Community Background	Very Easy	Rather Easy	Average Difficulty	Rather Difficult	Very Difficult	Total
Urban	10 (7.7%)	17 (13.1%)	60 (46.5%)	32 (25.8%)	10 (7.7%)	129
Rural	9 (5.4%)	5 (2.9%)	77 (46.1%)	46 (27.5%)	30 (17.9%)	167
Total	19	22	137	78	40	296

$\chi^2 = 15.59$, $df = 4$, $p < 0.05$

Table 15 indicates that students coming from a rural background were predicted by the PCEE as less likely to find the course Very Easy, or Rather Easy, than those students coming from an urban background. In the category predicting Average Difficulty there appeared to be no difference between rural and urban students, while the prediction of Rather Difficult showed more rural than urban students in this category. The greatest difference between urban and rural students is seen in the Very Difficult category. The proportion of urban students in this category is somewhat lower than the proportion of rural students.

The total sample was then classified according to community

background and membership in the Composite Validation Group or Academic Withdrawal Group, as shown in Table 16.

Table 16

Community Background and Group Membership

Community Background	Group Membership: Composite Validation Group	Group Membership: Academic Withdrawal Group	Total
Rural	151	16	167
Urban	111	18	129
Total	262	34	296

Table 16 indicates that 16 (9.5 percent) of the 167 rural students withdrew because of academic failure, while 18 (13.8 percent) of the 129 urban students were academic withdrawals. The Fisher test of exact probability was carried out in order to determine if there was a relationship between community background and potential success or failure in nursing, as indicated by membership in the Composite Validation Group and the Academic Withdrawal Group. A probability of .237 was found, indicating no significant relationship between community background and potential success or failure in nursing school.

SUMMARY

ANOVA of all the PCEE variables revealed significant differences between the Composite Validation Group and the Academic With-

drawal Group on six of the seven Academic Ability measures. The variable showing no difference was Arithmetic. Significant differences between the two groups were found on only one of the Personality variables, namely, Achievement.

A discriminant analysis procedure was used which considered the seven significant variables. From this it was determined that the SAT, Verbal, Science, and Numeric variables were the most important discriminators between the Composite Validation Group and the Academic Withdrawal Group.

The efficiency of the discrimination was examined for two decision situations. The first decision situation minimized the total number of errors in classification without regard to the type of error being made. In this situation, all the applicants passing initial selection procedures would be admitted to the school. No applicant would be rejected, with an error rate of 11.6 percent of the total group. In the second decision situation, a cutoff discriminant score was selected to insure the rejection of 67 percent of the Academic Withdrawal Group. Under this rule 33.8 percent of the applicant group was incorrectly classified.

The PCEE Prediction Scale appeared to have a degree of value in predicting success in the school of nursing. The Chi-square test of independence established a significant relationship between the Prediction Scale and student achievement.

The Prediction Scale also indicated that students coming from a rural background were more likely to find the nursing program difficult than students from an urban background. The Fisher

test of exact probability indicated no significant relationship between community background and potehtial success or failure in the school of nursing.

Chapter 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The basic aim of this study was to determine the degree to which the Psychological Corporation Entrance Examination for Schools of Nursing (PCEE) is a valid instrument for predicting success in a nursing education diploma program. It was believed that this research would give an indication as to whether the PCEE adequately discriminates between nursing applicants who are most and least likely to succeed in the nursing program.

This research project involved a study of 296 nursing students who were accepted into the General Hospital School of Nursing, St. John's, Newfoundland, during the years 1967-1970, inclusive. These students wrote the PCEE after admission to the school; therefore it was not used as part of the selection procedure by the school Admissions Committee.

Two main samples were originally identified from the total number. The Validation Group was comprised of students who had successfully completed the school of nursing program and passed registration examinations. The Withdrawal Group, or unsuccessful students, was subdivided into the Academic Withdrawal Group, which consisted of students who withdrew because of academic failure, and the Non-academic Withdrawal Group, comprised of students who withdrew for non-academic reasons. These samples were studied with reference to scores obtained on the PCEE to ascertain the

extent to which success or failure in completing the nursing program was associated with the level of scores attained on the PCEE.

CONCLUSIONS

The main conclusions resulting from the statistical analyses are discussed in relation to the four research questions of the study.

Research Question One

Which of the PCEE Ability measures, if any, differentiates between successful candidates (Validation Group) and those who withdrew from the program (Withdrawal Group)?

On the basis of the comparison between the Validation and Withdrawal Groups it was concluded that the Science, Reading, and SAT scores differentiated between the two groups in a systematic fashion.

Research Question Two

Which of the PCEE Personality measures, if any, differentiates between the Validation Group and the Withdrawal Group?

As a result of the comparison between the Validation and Withdrawal Groups it was concluded that none of the Personality measures differentiated between the two groups in a systematic fashion.

Research Question Three

Which of the PCEE subtests differentiates between the Academic Withdrawal Group and the Non-academic Withdrawal Group?

Of the 296 students involved in this study, 87 withdrew before completing the program. A major reason for withdrawal was academic failure. A comparison of the Academic Withdrawal and Non-academic Withdrawal Groups showed that students in the academic failure group earned lower scores on the PCEE Academic Ability measures than did students who withdrew for non-academic reasons. Significant differences between the two groups were established on four of the seven Ability measures, namely, Verbal Ability, Science, General Information, and the SAT. The PCEE Academic Ability tests are primarily designed to measure scholastic aptitude, therefore it is reasonable to expect these scores to differentiate students who withdrew because of academic failure from students who withdrew for other reasons such as financial problems, ill health, marriage, family responsibilities, and so forth. No significant differences were established between the two groups on the Personality measures of the PCEE.

Research Question Four

> Can the PCEE be used to determine an appropriate basis for classification of applicants in relation to (a) dividing the applicant group for classification purposes, and (b) determining cutoff points for classification, particularly with respect to minimizing the false acceptance of candidates?

In relation to this question, a three group comparison involving the Validation Group, the Non-academic Withdrawal Group, and the Academic Withdrawal Group revealed a marked similarity between the Ability scores of the Validation and Non-academic Withdrawal Groups, while the Academic Withdrawal Group showed significantly

lower scores on the Ability measures. On this basis, it was hypothesized that the Non-academic Withdrawals could be considered as potentially successful students, and thus should be included in the Validation Group. Consequently, the Validation Group was expanded to include the 53 Non-academic Withdrawals. A comparison was then made between the Composite Validation Group (N = 262), and the Academic Withdrawal Group (N = 34), on the thirteen PCE variables.

As a result of the analysis it was concluded that the Composite Validation Group could be discriminated from the Academic Withdrawal Group on seven subscores of the PCEE. These were all the Academic Ability measures, except Arithmetic, and the Achievement subscale of the Personality Inventory. The remaining six variables (one Ability and five Personality) were eliminated from further consideration. The seven statistically significant variables were considered to be the measures that would discriminate between potentially successful and academically unsuccessful candidates. The most important discriminants were the SAT, Verbal Ability, Science, and Numerical Ability. These four accounted for about 96 percent of the between groups variance between the Composite Validation Group and the Academic Withdrawal Group.

The efficiency of the PCEE in classifying the Composite Validation and Academic Withdrawal Groups was determined on the basis of discriminant analysis. It was determined that misclassification of all types would be minimized if all applicants passing the initial screening were accepted, regardless of their PCEE scores. Granting, however, that the variables do discriminate,

cutoff discriminant scores could be selected to minimize either type of the two classification errors. It was found, for example, that if a cutoff were selected to eliminate 67 percent of false acceptances, about 30 percent of the total group would be falsely rejected.

From the findings of this study it was concluded that the Personality measures of the PCEE have little value as a selection device as they do not differentiate between the Validation and Withdrawal Groups. However, most of the tests comprising the Academic Ability battery of the PCEE do appear to possess a sufficient degree of validity to make them of limited usefulness in selecting nursing students. Whether a student actually does successfully complete the program probably depends on many factors besides her academic ability to do so. A student may withdraw from the school for any one of numerous reasons that may be completely unrelated to her scholastic ability. The findings of this study suggest that the PCEE Ability measures would prove to be more effective in identifying applicants who are capable of successfully completing the nursing program, rather than identifying those who will complete.

Finally, it was concluded that, while the PCEE predicts more rural than urban students will find the nursing program difficult, the relationship between community background and success or failure in nursing school is not significant. Consequently, use of the PCEE in selection would tend to reduce the proportion of rural applicants admitted, even though the evidence

suggests that the rural applicants, as a group, perform as well as urban applicants despite the somewhat lower PCEE scores.

IMPLICATIONS

The results of this study have established that the PCEE Ability measures provide information which is of limited value in selecting applicants who have the ability to achieve successfully in the school of nursing. The important question is: How does the school of nursing use this information to find a solution to the dual problem of selecting students in such a way as to reduce to a minimum both the number admitted who will fail to complete the program, and the number rejected who, if they had been admitted, would have been successful?

It is necessary to recognize that, as shown in the analysis, it is not possible to realize these goals simultaneously, since the minimization of one type of error must result in an increase in the second type of error. The higher the PCEE admission standards of the school of nursing, the less likely it is that unsuccessful students will be admitted. At the same time, the higher these standards are set, the greater the probability of rejecting applicants who would be successful if given the opportunity to enter the program. This is an important aspect which cannot be overlooked. If a potentially good candidate for admission to the school of nursing is rejected, a human resource is wasted, and the individual's right for an opportunity to try to succeed is arbitrarily taken away. On the other hand, if a potentially poor candidate is admitted into the school, she may not be able to complete the program,

with the result that money, resources, and equipment used by this student will be wasted.

The school of nursing can make use of the information resulting from this study to help improve student selection and reduce attrition. By considering the seven identified potential predictors of the PCEE, and establishing cutoff discriminant scores, the rate of academic attrition can be reduced. Applicants could be required to achieve at, or above, the level of the cutoff score in order to be considered for acceptance. The larger the discriminant score required for acceptance, the less likely would be academic withdrawal.

An important consequence of this is that as the cutoff is set higher, the size of the applicant pool must be increased in order to ensure that it contains enough similarly qualified applicants for selection into the available positions. In the case of a cutoff which would eliminate 67 percent of the Academic Withdrawals, the pool of applicants who had passed to the final screening phase would have to be increased by 50 percent.

As an alternative to establishing a cutoff, the final applicants could be selected simply by ranking them in order by PCEE discriminant score, and selecting from the top of the order until the available positions were filled. This procedure would ensure that the best academically qualified applicants were selected, and the reduction in academic attrition would become a function of the size of the applicant pool. This procedure would permit splitting the applicant pool into rural and urban segments, making

a policy decision regarding the rural-urban composition of the nursing class, and then selecting the highest ranking PCEE discriminant scores until the desired composition was obtained.

Another possible alternative is that, given adequate resources to ensure the maintenance of the present quality of nursing education, false rejections could be decreased by lowering the discriminant score cutoff points while increasing the size of the class admitted.

It is essential to recognize that, while the test scores do have value as a predictive index of success or failure, this value is limited, and there are probably many other factors over and above scholastic ability which play important roles and are just as significant as test scores in determining whether or not a student will be successful. An applicant who scores high on the PCEE Ability measures may not be a good admission risk if she is not motivated to succeed, or if her reasons for entering nursing are unrealistic. Conversely, the applicant with relatively poor scores who is highly motivated and persevering, may be quite successful.

The results of this research project indicate that the PCEE does possess limited usefulness as an applicant screening instrument. The Personality measures are of little value in the selection process. The scores on the Academic Ability measures of the test, however, are of value in indicating which applicants are most likely to succeed in the nursing program. In general, students with low Ability scores are not good admission risks, as they are more likely to perform poorly in the school, and quite

likely to withdraw or fail registration examinations. Applicants who score high on the PCEE Ability measures are more likely to be successful in the nursing program and on registration examinations.

It is emphasized that no single source of information can give an accurate picture of the individual. Therefore, it is imperative that the school of nursing maintain the present selection procedures, and that all available information relative to the applicant be considered before the final step of administering the PCEE and making a decision as to whether an applicant is to be accepted or rejected.

RECOMMENDATIONS

1. The school of nursing should maintain all present selection procedures to establish a final applicant pool. This pool should be increased by one-half the established acceptance number; that is, if the number of applicants to be accepted is 100, the final selection pool should consist of 150 applicants. This would allow for the 30 percent misclassification of rejects that the study has shown will occur if it is desired to reduce false acceptances by two-thirds. The administering of the PCEE would be the final procedure used to select 100 students from the pool of 150 applicants.

2. Research is needed to investigate the effectiveness of the PCEE Personality Preference Schedule as a counseling tool, specifically in relation to providing insight into the problem of non-academic withdrawals.

3. A longitudinal study should be done of students admitted to the school of nursing after having written the PCEE as part of the selection procedure. Such a follow-up would be worthwhile in establishing whether or not a decrease in attrition results from the inclusion of the PCEE in the selection procedures.

4. Research into the selection validity of the PCEE in the total applicant pool should be done in relation to (a) comparison of applicants and non-applicants, and (b) comparison of those selected and rejected in the initial screening procedures.

5. Research should be conducted to determine the relationship between high school grades, PCEE scores, and success in nursing, and the predictive efficiency of the PCEE in the context of other predictor variables, such as high school grades.

6. A similar study should be carried out with students in other schools of nursing using the PCEE, in order to try and determine to what extent the findings of this study are supported.

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