THE RELATIONSHIP OF PRE-ADMISSION PSYCHOMETRIC TEST RESULTS TO THE ACADEMIC PERFORMANCE OF DIPLOMA NURSING STUDENTS

BY

JOAN. M. SCHULTZ

A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
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DEDICATION

TO MY PARENTS

WHO TAUGHT, BY EXAMPLE,

THE IMPORTANCE OF PERSEVERANCE

AND

FAITH

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Abstract

Attrition rates from nursing education programs in Great Britian, the United States and Canada in the range of 35% have caused nurse educators to investigate the effectiveness of admission selection criteria. This research study focused on the Multidimensional Aptitude Battery (Jackson, 1983) as it was used in the admission process of a two year diploma nursing program. One-hundred and forty seven educational records were reviewed in this retrospective design. Relationships between Multidimensional Aptitude Battery (MAB) subtest and total scores and academic performance in the diploma nursing program were analyzed. Results provided little support for the use of the MAB when selecting nursing education candidates. The Vocabulary subtest was identified as one component of the MAB that correlated with weak to moderate strength with academic performance during the first year of the program. Mature status students were identified as having lower scores on the MAB but were proportionally more successful in completing the nursing program than regular status students. Suggestions for future research include a replication study with a different sample and investigation of other factors affecting success including non-cognitive factors. Implications for nurse educators focus on the caution that must be used when reviewing concrete psychometric test results when selecting candidates for a nursing education program.

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1. Statement of the Problem

Attrition rates from nursing education programs are substantial. In Britain, statistics show that 35% of those who start nurse training never reach the professional register (West & Rushton, 1986). One third of all students admitted to nursing schools in the United States fail to successfully complete their programs (Oliver, 1985). As calculated from Statistics Canada data (1989), attrition rates at diploma schools of nursing in Canada ranged from 26% to 30% from 1985 through 1987. Over the last nine years attrition has ranged from 25% to 40% at the diploma school of nursing involved in this study.

The National League for Nursing's 1985 annual survey indicated annual admissions to nursing schools in the United States were down (Rosenfeld, 1987). Diploma programs, where admissions decreased almost 17% in 1985 as compared to 1984 in the United States, experienced the most dramatic drop (Rosenfeld, 1987). Data on associate degree programs and baccalaureate programs also indicate a decrease in enrolment. Admissions to and graduation from baccalaureate and diploma schools of nursing in Canada have remained relatively stable from 1983 through 1987 (Statistics Canada, 1989).

In Manitoba, diploma schools have recovered in admission numbers to 690 in 1987 from a low of 517 in 1985 (Statistics Canada, 1989). At the school of nursing involved in this study, a diploma school affiliated with an urban hospital (now referred to as the "School of Nursing"),

enrolment decreased by approximately 25% in 1988. Enrolment numbers recovered during 1989 and 1990 to within 82-96% of capacity. The dramatic decrease in 1988 may have been an aberration but there is concern that the change in enrolment is a warning of future difficulties; difficulties in attracting candidates to the nursing education program and of keeping up with an expanding demand.

Admission committees of schools of nursing struggle to recruit and admit nursing candidates who have potential for success. In the past, admission committees had the luxury of selecting applicants who were believed to be the best from a large applicant pool. The applicant pool has changed. The applicants are now more likely to be older, have more outside responsibilities and have been away from the educational setting for a longer period of time. Traditional candidates (young, college-eligible women) are turning to other career options (Farrell, 1988).

Attrition from nursing education programs and decreasing admissions are factors contributing to the shortage of practising nurses. Naylor and Sherman (1987) predict that there will be about half as many nurses as needed in the United States by the year 2000. Although the number of nurses working in Canada rose by 175% over a 20 year period ending 1986 while the population increased by just 25% (Baumgart, 1988), concern regarding a nursing shortage in Canada exists. Most of the members of the baby boom generation have already established themselves in the workforce and are moving into middle age. Therefore, the

supply of possible recruits into nursing will decrease while an increase in demand is forecast (Baumgart, 1988). In Canada it was projected that between 1987 and 1995 about 53,000 nursing positions will become available. One quarter of these will be due to expanding demand, the remainder vacated by existing personnel (Minister of State for Youth, Government of Canada, 1988). Based on these predictions, more than 1600 new nursing positions plus 4900 vacant existing positions would be available per year between 1987 and 1995.

In the face of projections regarding the number of new nursing positions and vacancies in present positions, it becomes more important than ever for schools of nursing to select those applicants from the changing applicant pool who have the greatest chance of success.

Admission committees have used a variety of criteria for selecting nursing students. These admission criteria are used as guides to select those applicants who have the greatest chance of success. However, the problem of attrition still exists. Admitting a full complement of nursing candidates and graduating only a portion contributes to the shortage of nurses and is financially costly.

In addition to the cost of attrition, the selection process itself can be costly. For example, the use of psychometric tests in the admission process is costly to the applicant and to the educational institution monetarily and time-wise. The value of psychometric tests within the admission process must be determined.

As the numbers of mature nursing students increase, consideration for their special situation must be given. Mature students have fears and anxieties about returning to school and these are often reinforced by established admission criteria. The effectiveness of outdated transcripts and results of recently taken entrance examinations that require skills that may have been unused for years, is questionable at best (Brandenburg, 1974; Perry, 1986).

With attrition rates from nursing education facilities hovering around 30%, with a change to a less traditional nursing student, with the occurrence of a shortage of practising nurses, and the increasing demand for nurses in Canada, schools of nursing are challenged to make intelligent selections of applicants who can be successful in nursing education.

A review of the literature over the last three decades related to nursing programs, provides numerous studies on cognitive and non-cognitive predictors of successful nursing candidates. The results are widely varied and non-conclusive. The various admission criteria currently used appear unable to discriminate between those students who will be successful and those who will not.

Admission criteria at the "School of Nursing" include the following: (a) a grade 11 and 12 average of at least 65% with credits in English 300, Mathematics 300, and a science 300 at 65% or greater. Mature students may meet this criterion through C grades in selected university

courses, (b) three character references, (c) handwritten autobiographical sketch, (d) personal interview, and (e) psychometric and mathematic test results.

These criteria are not weighted in terms of importance, rather all criteria are reviewed for each applicant. As psychometric tests produce concrete scores there is a danger of placing more credence on the test scores than on other criteria (Estes, 1981). Wigdor and Garner (1982) suggest each institution must justify the use of the admission tests. This study will provide information helpful in determining the usefulness of the psychometric test scores in selecting candidates for the diploma "School of Nursing" program.

The two psychometric tests used at the "School of Nursing" are the Nelson Denny Reading Test (Brown, Bennett & Hanna, 1981) and the Multidimensional Aptitude Battery (Jackson, 1983). The Nelson Denny Reading Test has been criticized for lack of validity of the total and subtest scores for achieving the stated purposes (Hambleton, 1985). Those purposes are ranking student ability in reading comprehension, vocabulary development, and reading rate Since this lack of established validity would have a negative influence on the value of this study's results, it was decided to concentrate on the usefulness of the Multidimensional Aptitude Battery (MAB).

The Multidimensional Aptitude Battery was critiqued by Vernon (1985) as a "carefully constructed test that provides a reliable and valid measure of a broad range of

intellectual abilities" (p. 508). The MAB, which has subtests testing vocabulary and comprehension, also provided data on the abilities that would normally be tested by the deleted Nelson Denny Reading Test.

The Multidimensional Aptitude Battery, closely patterned after the Wechsler Adult Intelligence Scale-Revised, is designed for a "wide-range assessment of intellectual abilities in adolescents and adults" (Jackson, 1984 p. 15). It may be used for a variety of purposes including educational and career counselling. The MAB is a timed test including two groups of scales: the verbal and the non-verbal. The five verbal subtests are information, comprehension, arithmetic, similarities and vocabulary. The five non-verbal or performance subtests are digit symbol, picture completion, spatial, picture arrangement, and object assembly. The MAB yields a verbal IQ, a Performance IQ and a Full Scale IQ as well as individual subtest scores (See Appendix A for Samples of each subtest of the Multidimensional Aptitude Battery).

In this study, psychometric test results will be compared to a variety of academic grades with specific focus on grades at the end of Semester 2 and the end of the "School of Nursing" program. This focus is based on data from the "School of Nursing" indicating that academic performance declines after the completion of Semester 2 courses (personal communication, October, 1989). This decline may be due to the change in emphasis from basic nursing concepts in Semesters 1 and 2 to complex health

problems and nursing care in the later semesters. The area of clinical performance will not be addressed due to the more subjective nature of the evaluation.

The issue of the fairness of admission criteria for mature students will be addressed by studying the similarities and/or differences in prediction of mature versus regular status students. The following questions will be pursued:

1. What is the relationship between scores on the ten subtests of the Multidimensional Aptitude Battery and academic performance in a diploma nursing program up to the end of Semester 2?

2. What is the relationship between scores on the ten subtests of the Multidimensional Aptitude Battery and academic performance in diploma nursing education to the end of the diploma nursing program?

3. What similarities and/or differences are evident in the effectiveness of these predictions between regular status and mature nursing students?

1.1 Definitions

The definitions below will elaborate on terms found in the research questions.

1. End of Semester 2

The end of Semester 2, occurring approximately six months into the nursing program, corresponds with the completion of introductory nursing courses. At the completion of Semester 2 the focus of the nursing program shifts to more complex health problems and nursing care.

2. Average 1

Average 1 is the calculated mean grade of the following courses completed by the end of Semester 2: Nursing 100, Nursing 110, Pharmacology, Microbiology, and Human Growth and Development. (Anatomy and Physiology and Psychology grades were not included due to the letter grading system).

3. End of Semester 4

The end of Semester 4, occurring approximately seven months into the second year of the nursing program, corresponds with the completion of advanced nursing courses.

4. Average 2

Average 2 is the calculated mean grade of the courses completed by the end of Semester 4: Perspectives in Nursing Practice I, Promoting Adaptation in the Adult and Aging Person, Perspectives in Nursing Practice II, and Promoting Adaptation in the Child and Adolescent, the Individual Experiencing Emotional Distress and the Childbearing Family. (Sociology grades were not included due to the letter grading system).

5. Mature students

Those students 21 years of age and over who qualify through obtaining 65% in three 300 level Grade 12 courses or C grades in recommended university level courses.

6. Regular status students

Those students under the age of 21 years who qualify by a Manitoba High School diploma or its equivalent.

7. Successful academic performance

Those final course grades of C+ or greater in academic

courses taught by the "School of Nursing" are considered passing grades. This corresponds to the numerical value of 65 to 69%. Academic grades of less than C+ which have become passing grades through the use of supplementary examinations will be considered successful. Those results of C or greater in academic courses taught by the University or equivalent are considered a passing grade.

8. Success in completion of the program

Those students who receive passing grades in all required academic courses and complete the program.

2. Review of the Literature

This literature review addresses the major areas of study: (a) predicting success in nursing education, (b) the use of psychometric tests as predictors, (c) success of mature students, (d) prediction in alternate health fields, and (e) psychometrics. Selective research from the areas of Allied Health, Adult Education, Medical Education and Psychometrics are included in addition to Nursing in order to provide comprehensive support for the study.

2.1 Predictors of Success in Nursing Education

The nursing literature addresses cognitive and non-cognitive variables when studying predictors of success. Generally, cognitive variables were found to have better value in predicting success. Non-cognitive demographic variables like age, gender (McKinney, Small, O'Dell & Coonrod, 1988) and personality type (McKinney et al, 1988) were found to have no conclusive significance for predictive purposes. Mueller and Lyman (1969) studied 38 predictors of scores on nursing licensure examinations and found aptitude and ability predictors were generally highly positively correlated with licensing examination results. Personality factors, as defined on the 16 Personality Factors test, were found to be lowly and less frequently correlated. In addition, Hayes (1981) found the combining of non-cognitive variables into a regression equation did not contribute to a significant degree beyond what was established through the use of cognitive variables alone.

Although the planned methodologies in these studies on

non-cognitive variables were acceptable, a limitation appeared when sample sizes were reviewed in light of the number of variables and statistical procedures involved. For example, the McKinney study had sample numbers of 89 when personality type was investigated along with 13 other independent variables. In other studies (Hayes, 1981; Mueller & Layman, 1969), results included long regression equations which would take significant effort to implement in an admission process.

Cognitive variables were the most powerful predictors of academic success as they accounted for 62% of the criterion variance when studying graduates and non-graduates of a university nursing program (Hayes, 1981). The most commonly studied cognitive variables were high school rank, marks found on high school transcripts, prerequisite course grade point average (GPA), and psychometric test results. The majority of studies were set in baccalaureate nursing programs with considerable attention to associate degree nursing programs and limited study of diploma nursing programs.

Various facets of high school transcripts have been studied as predictors of success in nursing education. Baccalaureate programs (Boyle, 1986; Seither, 1980) and associate degree programs (Miller, Feldhusen & Asher, 1968;Oliver, 1985; Reed & Feldhusen, 1972) have identified high school rank as a good predictor among those available prior to admission. Biology and English grades showed a significant relationship with academic success when studying

associate degree nursing students (Oliver, 1985). Glick, McCelland and Yang (1986), conversely, found that high school rank was not predictive of nursing marks and license exam results. Glick et al (1986) found Biology GPA and the average of all pre-nursing courses as the strongest predictors of nursing course grades. However, they did not correlate significantly with results on National Council Licensure Examinations for Registered Nurses (NCLEX-RN) examinations. Dyer (1987) determined that overall academic achievement in high school was the best predictor of nursing and university grade point average. When using an exploratory/descriptive case study approach, Clemence and Brink (1978) identified preadmission GPA as the most significant factor relating to success/non-success for students who were in a baccalaureate nursing program.

There is little agreement among these researchers as to the benefit of aspects of high school transcripts as predictors. The applicability of some of these results is questionable. Small sample sizes of 51 (Glick et al, 1986) and 67 (Oliver, 1985) may decrease representativeness of the target population as well as diminish the power of the statistical calculations. The variety of cognitive variables studied as predictors was inconsistent across different types of nursing programs making conclusions difficult to draw.

Prerequisite courses in anatomy and physiology and psychology supplied moderate predictive value for student nurse psychology scores (Crane, Wright & Michael, 1987).

Reading and mathematic tests showed significant but low predictive validity (Felts, 1986; Seither, 1980; Weinstein, Brown & Wahlstrom, 1980).

2.2 Psychometrics and Success in Nursing Education

The psychometric tests most frequently studied in the nursing literature were the Scholastic Aptitude Test (SAT) and the American College Testing Program (ACT).

The SAT is primarily used by college admission officers to test developed verbal and mathematic abilities of applicants (Gardner, 1988). The verbal section measures vocabulary, ability to interpret and relate ideas, and the ability to reason logically as well as to write clearly. The mathematics section measures the ability to use or reason with mathematical concepts (Brownstein & Weiner, 1982). The SAT, as a college admission test, is considered a uniform measure when reviewing college applicants whose previous study occurred at a variety of educational settings.

The College Board has examined the predictive validity of the SAT, namely the ability to predict grade point average at post-secondary institutions through the use of SAT scores. Their study, completed between 1964 and 1981, found the best single predictor of freshmen GPA was the high school record with a correlation of .48. Combined SAT verbal and mathematic scores correlated at .42. High school records added to SAT verbal plus mathematic scores correlated at .55 (Gardner, 1988).

In a critique of the SAT, Gardner (1988) noted that the

SAT is a useful adjunct to the college admission process when dealing with a large number of students. However, predictability when dealing with a large number of students is not the same as dealing with an individual student. There will be some students with low SAT scores who will be successful in college and those with high SAT scores who will not meet their educational capability (Gardner, 1988). Gottfredson and Crouse (1986) suggested that using SAT scores is redundant. They believe the SAT tests the same abilities as high school achievement tests and therefore does not provide distinct information for college admission committees to use.

The American College Testing Program (ACT) consists of academic tests of general educational development including English usage, mathematics, social studies, and natural sciences. Knowledge is tested but emphasis is focused on problem-solving and reasoning abilities (Brownstein & Weiner, 1982). The goal of the ACT is to reduce transitional problems for students entering the college setting (Geisinger, 1984). In addition to the aforementioned academic tests, the ACT Interest Inventory and the ACT Student Profile are included as a survey or self-report component (Geisinger, 1984).

Predictive validity studies determined a correlation coefficient of .465 when examining combined ACT scores to predict freshman GPA. The predictive effectiveness of high school grades resulted in a coefficient of .512. Combining ACT scores with high school grades produced a correlation

coefficient of .576, an increase in prediction of approximately 7% (Geisinger, 1984). The primary difference between the SAT and the ACT is related to the type of questions on the test. The ACT focuses on subject matter that has been previously studied in educational settings. The SAT is aimed at verbal and quantitative reasoning rather than specific subject matter.

The number of nursing articles describing the use of the SAT and the ACT was considerable. The diversity of the research results was troublesome. Through the use of larger samples and multiple regression and/or discriminant analysis, SAT verbal scores were determined to be more predictive of success than SAT math scores (McKinney et al., 1988; Miller et al., 1968; Payne & Duffy, 1986; Reed & Feldhusen, 1972). Woodham and Taube (1986), when studying the relationship of admission criteria and performance on NCLEX-RN examinations, found the SAT verbal scores correlated significantly at .626 while the SAT mathematic scores did not correlate significantly (.199). The SAT verbal scores and the SAT quantitative scores discriminated between success and failure in graduating from a predominantly black baccalaureate nursing program (Dell & Halpin, 1984). Correlational analysis of NCLEX-RN scores with SAT verbal, mathematic and total scores determined the following coefficients: SAT-math .37, SAT-verbal .61, and SAT-total .57 (McKinney et al., 1988).

Yess (1980) used a random sample of 75 students to study the open door policy of nursing education in a

community college setting. He identified, through the use of stepwise multiple regression, SAT math scores to be the single most important predictor. In attempting to identify possible reasons for this result he consulted nursing faculty. Faculty identified the need for mathematic skills in courses like Fundamentals of Nursing. They felt the ability to analyze and apply scientific principles is developed through mathematical application and these abilities are helpful and pertinent in the nursing profession (Yess, 1980).

Alichnie and Bellucci (1981) investigated cognitive and non-cognitive variables to predict GPA of freshman nursing students. The Aptitude Test for Nursing had the highest correlation with GPA at .469. The second best predictor was the SAT mathematic scores which correlated at .459 with freshman GPA. Whitley and Chadwick (1986), when investigating an increased failure rate of one class on the NCLEX-RN, determined that the non-successful candidates had significantly lower SAT verbal and mathematic scores, lower pre-admission science GPA's and cumulative pre-entry GPA.

Felts (1986) determined that the ACT scores were the best admission criteria predictor for success in nursing courses when studying associate degree nursing programs. ACT scores were also predictive in studies conducted by Boyle (1986), Sharp (1984), Wittmeyer, Camiscioni, and Purdy (1971), and Yang, Glick and McCelland (1987).

When examining the ability of the ACT scores to differentiate between students who were successful and

unsuccessful in completing a university based nursing program, it was determined that ACT mathematics usage was the only ACT score that differentiated between groups (Wittmeyer, Camiscioni & Purdy, 1971). Yang, Glick and McClelland (1987), when studying 210 baccalaureate in nursing graduates, determined through multiple stepwise regression, that ACT-Comp, chemistry GPA, high school rank, and pre-nursing GPA (in order) contributed the greatest variance to NCLEX-RN scores. Correlation coefficients between ACT social science subscore and the NCLEX-RN results was the highest at .48 ($p < .01$).

Perez (1977), when formulating regression equations for the purpose of predicting baccalaureate nursing students scores on the State Board Examinations, found that the ACT social science reading score could provide more valuable information than ACT natural science score. She speculated that reading ability tested in the ACT social science test may be the common denominator rather than special knowledge of content.

The reviewed nursing research literature highlights the following concerns. The vast majority of these studies used an ex post facto or retrospective approach. This is appropriate for investigating the influence of independent variables on dependent variables like success in nursing programs. Nevertheless, the researchers, in most cases, fail to describe the limitations inherent with this research approach.

Furthermore, there is a lack of discussion regarding

the power of the particular statistical tests that were used. Although some sample sizes were large, for example, over 400 subjects were used by both Dell (1984) and Reed and Feldhusen (1972), the researchers could have increased the reader's confidence in the results by specifically addressing sample size and power of the statistical procedures.

Recognition of publication requirements that may have demanded significantly shorter versions of research studies is important. The editing of aspects of research studies that could have addressed the stated concerns is a legitimate possibility.

Some of the literature (Boyle, 1986; Perez, 1977; Reed & Feldhusen, 1972; and Miller, Feldhusen & Asher, 1968) attempts to identify predictor equations to be applied during the admission process. These regression equations tended to be lengthy and therefore impractical for application in real life settings (Perez, 1977).

A lack of comparative studies is a drawback. It is difficult to make connections between the results obtained from studies on baccalaureate programs, associate degree programs and diploma programs as various methodological approaches have been used and the dependent variables were obviously different. The need for validation studies in alternate settings or with different samples is a frequent recommendation. These suggestions are relevant. However, validation studies have not been discovered during this literature review.

Much of the nursing literature focused on the results of licensure examinations as the dependent variable (McKinney, Small, O'Dell & Coonrod, 1988; Miller, Feldhusen & Asher, 1968; Payne & Duffy, 1986; Perez, 1977; Whitley & Chadwick, 1986; and Woodham & Tuabe, 1986). These studies failed to address the relationship of predictor variables with those students who were unsuccessful with the academic programs and therefore did not write licensure examinations. The samples, in these cases, were less representative of the student population.

Some students, specifically mature students, were not required to produce psychometric test scores such as ACT scores as an admission requirement (Felts, 1986). Missing data of this nature alter the strength of statistical procedures because of decreased sample size.

In the discussion of results many researchers have summarized the results with little analysis of possible causes. Expansion on these reasons could stimulate supplementary research into related areas, for example, the significance of mathematical skills.

Support can be found for almost every aspect of the SAT and the ACT as predictors of success. Whether verbal, mathematics or science is the better or best predictor is unclear. It does appear, however, that both the SAT and the ACT contain some predictive validity in the range of .4 to .5. The question remains as to whether the small increase in predictive validity when the SAT or the ACT scores are

added to high school transcript data justifies their continued use.

2.3 Allied Health

Physical therapy (Levine, Knecht & Eisen, 1986) occupational therapy (Posthuma & Sommerfreund, 1985) and general allied health professionals (Dietrich & Crowley, 1982) have identified similar predictors of success within their professions.

A retrospective study of 42 graduates of a four year baccalaureate program in physical therapy examined the predictability of the following variables: (a) preprofessional GPA, (b) essay score, (c) interview ratings, (d) preprofessional faculty ratings, and (e) mean Allied Health Professions Admission Test (AHPAT) scores (Balogun, 1988). The AHPAT is a preadmission psychometric test including the five subsections of verbal ability, quantitative ability, biology, chemistry and reading comprehension. The stepwise multiple regression analysis for academic performance revealed that preprofessional GPA was the best predictor of academic performance. The AHPAT scores accounted for 38.5% of the variability. The small sample size limits confidence in the results (Balogun, 1988). Levine, Knecht and Eisen (1986), however, found that academic characteristics like pre-admission GPA were not strong predictors of performance in the professional physical therapy educational program.

Posthumas and Sommerfreund (1985) found that previous academic performance did not provide strong correlations

with success in an occupational therapy program. Combining interview scores with previous academic performance provided improved predictability for high school students but no improvement was evident for university students.

Slovensky (1986) studied Medical Record Technician program success using admission GPA, Nelson Denny Reading Test scores, and Tests of Adult Basic Education scores as predictors for 55 students. The Nelson Denny Reading Test did not have any significant correlation with college success. The Adult Basic Education Scores did correlate but not with greater significance than admission GPA. These results moved the college to delete both tests from the admission process and establish other admission criteria.

Pope and Gines (1986), who studied the relationship between ACT scores and preadmisssion grades and success in a dietetics program, found ACT-mathematic scores and pre-professional science grades produced the most statistically significant correlations. Hanson and Fruin (1984), when reviewing the files of 46 graduates of a university dietetics program, determined that overall preadmission GPA was most predictive of academic success in a dietetics program but was unrelated to clinical success.

Dietrich and Crowley (1982) completed a survey of student selection practices at 453 baccalaureate and associate programs in allied health in the United States. Such professions as medical records administration, medical technology, physical therapy, occupational therapy, dental hygiene and respiratory therapy were included. They

determined that the academic record of applicants was the most frequently used admission criterion although interviews, preadmission testing, essays, letters of reference, and demographic data were used also. Dietrich and Crowley suggested that all of these selection practices require evaluation.

Blagg (1985) focused on non-cognitive variables as predictors of academic success when studying cognitive-style and learning-style variables in a graduate allied health education program. No significant relationship was found between academic success and cognitive-style variables. However, he recommends further investigation of learning-style as this variable contributed over 20% of the variance in a stepwise multiple regression equation. An identified limitation of this study was a small population (N=51). "The power of the experimental design to detect a small significant difference was low" (Blagg, 1985, p. 96-97).

Schimpfhauser and Broski (1976) studied 205 complete student records in a university-based allied health program. The focus of the study was ACT scores, pre-admission GPA and scores of AHPAT as predictors of first year academic success. It was determined that pre-professional GPA was the best predictor. ACT scores were superior to AHPAT scores as predictors. Hedl (1987), in a descriptive study of those who completed and failed to complete a bachelor's degree in allied health, found no significant difference between the two groups pre-admission GPA.

Overall, studies in the allied health professions found

that pre-admission GPA and academic record prior to admission provided the best predictive value. Psychometric test results were less predictive but in combination with GPA added strength to the predictive equation.

The Allied Health literature must be viewed with some trepidation. The frequently used retrospective approach was appropriate considering the research problems being investigated. The description of the methodology in these research studies was more detailed and explanatory than methodological presentations in the nursing research. Sample sizes in the allied health research were the most obvious limitation. Samples were significantly smaller than in the nursing literature, ranging from 78 (Posthuma & Sommerfreund, 1985) to 42 (Balogun, 1988). These small samples decrease the strength of the statistical results, particularly the ability to detect a small significant difference.

Another limitation of the reviewed allied health research was the lack of standardization across different types of programs within the allied health field. These programs are at levels ranging from technician to baccalaureate with various lengths, grade requirements, and pre-admission criteria. Comparison of results within the field of allied health are difficult to make.

The challenge in applying the allied health results to nursing education is the lack of an established field of study relationship. Descriptions of the courses studied in these allied health programs were absent. Although results

similar to those in the nursing literature were obtained by various allied health professions, this lack of description of program courses make comparisons to nursing difficult.

2.4 Medical Education

A variety of admission criteria were used to select students to medical education programs. A survey of 113 medical schools in the United States and Canada identified the following pre-admission variables as a sample of those used: total undergraduate GPA, the quality of the degree granting institution, letters of reference, ratings from medical school interviews and Medical College Admission Test scores (MCAT) (Mitchell, 1987). The literature focuses on pre-medical GPA and MCAT as predictors.

Sarnacki (1982) found that pre-medical GPA was not a very successful predictor of academic success among students accepted to medical school. In contrast, Jones and Thomae-Forgues (1984), when studying 18 medical schools in the United States and 2 in Canada, found significant correlations between pre-admission GPA and first year, second year and National Board of Medical Examination (NBME) scores. Median multiple correlation coefficients were calculated at .41, .37, and .30 respectively.

The MCAT was required by 124 of the 126 medical schools in the United States as determined by Wigdor & Garner (1982). MCAT is a psychometric test specifically designed to assist medical school admission committees in selecting applicants. It is a four section exam testing science knowledge in biology, chemistry, and physics, science

problem-solving ability, analytical and reasoning skills in reading,and analytical and reasoning skills with quantitative material ("Medical College", 1986).

When studying students in 20 medical schools the predictability of MCAT for Year 1 grades was .41 when using median multiple correlation coefficient. For Year 2 grades the coefficient was .37 and for the NBME was .54 (Jones & Thomas-Forgues, 1984). When combining pre-admission GPA and MCAT scores the correlations for Year 1, Year 2, and NMBE increased to .52, .51, and .59 respectively (Jones & Thomas-Forgues). Within the MCAT, Chemistry had the highest correlation to Year 1, Year 2, and NBME grades.

When reviewing those students who experienced difficulty in 126 medical schools in the United States, it was found that once MCAT scores in Chemistry and Skills Analysis fell below eight, there was a consistent increase in academic failure (Jones & Vanyur, 1984). However, 50% of the students with the very lowest MCAT scores graduated. This emphasizes the importance of utilizing a variety of admission criteria and of not using a cut-off mark with psychometric tests when selecting applicants.

2.5 Success of Mature Students

Upon review of the literature on education of adults, the variable of age is frequently addressed. Bueche (1986), when investigating progression through developmental tasks of re-entry women (older women returning to school) and traditional age women in college, found both groups basically achieved the same level on a Developmental Task

Inventory. However, re-entry women out-performed traditional age women in the area of developing autonomy. When comparing mature part-time students to their younger full-time counterparts, Bailey (1988) found mature part-time students scored significantly higher overall in formal academic examinations. The suggestion that motivation was an influencing factor was made. Lunneborg, Olch and deWolfe, when studying college performance in older students, determined that "older undergraduates who return to finish their college degrees are not at any overall disadvantage intellectually compared to the typical freshman"(1974, p.219). A study of 384 adult women students attending college discovered that "age, number of children, years away from school, and the amount of college experience were unrelated to academic success" (Thieman & Marsh-Williams, 1984, p. 263). Felts (1986) found age did not influence the ability to perform when studying those who failed and passed nursing licensure examinations.

Although age, as investigated in the aforementioned studies, appeared not to have a negative influence on success, cognitive predictors did not always support this finding. Older students had a larger proportion graduate, pass State Board Examinations, and had higher grade point averages than younger students although their psychometric test scores were not as high (Aldag & Rose, 1983; Safian-Rush & Belock, 1988). Aldag and Rose (1983) studied 555 traditional students and 232 non-traditional students admitted to an associate degree nursing program to determine

the relationship of age and ACT scores to nursing GPA and licensure examination scores. Correlations for age and each subtest of ACT were significant and negative indicating an age bias for the ACT. Older students consistently had more success with graduating and the licensure examinations. Younger age groups consistently scored lower on the licensure examinations than older age groups. Caution is therefore required when reviewing the ACT scores for non-traditional students.

As the applicant pool changes, more attention must be given to the mature applicants. These mature students require a different approach . Perry (1986) suggests that when admission procedures require high school transcripts they are not obtaining information about the students' capability today. Standardized admissions tests require mature students to use skills they have not used for a long time. Some standardized tests, such as the Scholastic Aptitude Test may actually discriminate against older women returning to college (Bradenburg, 1974). Re-entry women tend to have higher educational goals and have higher grade point averages in college compared to younger counterparts (Badenhoop & Johansen, 1980) but may be declined admission to programs because of standard admission criteria.

To summarize, the literature on adult education proposes that older students are more successful academically. Age is not a negative influence. However, older students tended to demonstrate lower scores on pre-admission psychometric tests.

2.6 Psychometrics

The area of psychometrics is laden with research on the use of psychometric tests to predict a variety of characteristics, most notably, intelligence. Whether the test in question is an intelligence test or an aptitude test, controversy flourishes as to the usefulness of the psychometric test results.

The most frequently studied psychometric tests in a variety of literature on post-secondary education were the Scholastic Aptitude Test (SAT) and the American College Testing Service (ACT). Studies were not found in which tests like the MAB were investigated. The MAB will be dealt with in the methodology section.

The major difficulty in using the results of intelligence/aptitude tests revolves around the lack of consensus within the psychology community as to what is being measured. Jensen (1980) suggests these tests measure intelligence but he is unable to construct a specific definition of intelligence. He does, however, strongly support the use of tests to measure this undefined concept. Sternberg (1985) argues intelligence is not what intelligence tests measure but is a broad concept including the context, experience and components of intelligence. The context of intelligence of which Sternberg speaks includes the environment the person is involved in and how that environment influences intelligent behaviour. Adaptive intelligence in one environment may not be adaptive in an alternate environment. The individual's ability to select

an environment or to shape an environment to ensure goodness of fit are considerations when investigating intelligence. Viewing intelligence within it's context provides the opportunity to consider alternative factors as an explanation for intelligence (Sternberg, 1985).

In spite of the confusion regarding the concept of intelligence, cognitive function tests are widely used as admission requirements to educational facilities. In the United States approximately 90% of undergraduate university programs require either the American College Testing Program (ACT) or the Assessment of the Scholastic Aptitude Test (SAT). The majority of Graduate and Professional schools also require a variety of preadmission tests (Wigdor & Garner, 1982). The widespread use of the SAT has led to vast criticism. Jensen (1981) believes this criticism is unfounded as validity coefficients averaging about .50 for predicting overall college grade point average have been published. Jensen's support for SAT is criticized by Grover (1981) who found the predictive validity of high school grades at .50. This was increased by .08 to .58 when SAT was added. She argues that mental measures of intellect should not be used for selection because evidence of the validity is too weak to justify decisions.

Other concerns regarding mental tests include the influences of age, speed, experience with tests, stress, and the misuse of test results. While some believe that performance on intelligence tests plateaus at between 16 and 20 years of age and then declines (Eysenck & Kamin,1981)

others disagree (Brody & Brody, 1976). A methodological weakness in studies which support a decrease in intelligence with age is the frequent use of the cross sectional approach. This approach emphasizes generational changes which occurred over time rather than a change in intelligence. Longitudinal studies were found to show little or no decrease in intelligence with age (Brody & Brody, 1976).

The majority of mental tests are timed tests. The limit of time has questionable influence on test results. While some researchers believe the timing of tests has little influence on the results and that speed is an important aspect of intelligence (Jensen, 1980) others strongly object (Sternberg, 1985). Sternberg found that speed itself is not an important aspect of intelligence. He suggests more intelligent people spend more time solving problems and are not impulsive decision-makers. He believes the most important aspect of time is how it is allocated and not the imposition of an overall time limit. The psychological pressure to respond rapidly even though one may not feel comfortable with the previous answer may influence test results (Grover, 1981).

Test taking experience can influence test results (Jensen, 1980; Sternberg, 1985). In Sternberg's triarchic theory of intelligence he suggests the degrees of novelty and of automatization that people experience will be different and will influence test results (1985). Jensen (1980), referring to this as test sophistication, found that

a test taking practice session facilitated the increase of an average IQ by 5 points and would be especially appropriate for applicants of diverse educational backgrounds or diverse experience with tests. While Jensen agrees that a test taking practice session is appropriate, he generally passes off this increase in IQ as insignificant. Grover (1981) counters that the increases are statistically significant and could have great consequences to students. These gains through practice sessions are about equivalent to score differences between students being accepted or rejected by a college.

The considerable body of the psychometric literature contends that stress is a major influence on test results, in particular when the psychometric test score is considered the most important criterion for admission (Sternberg, 1985). The examinee may experience anxiety to the extent that their performance will be crippled. Jensen (1980) asserts that the overabundance of literature on the influence of test anxiety is the result of the selective nature of publications rather than convincing support for the influence of stress.

Perhaps the greatest and most agreed upon concern regarding mental tests is the misuse of their results. As test scores are a concrete measure, users tend to place too much credence in what they are saying (Estes, 1981). It is easy for an assumption to be made that the values obtained from psychometric testing, are the person. This is erroneous because the psychometric tests only measure one

aspect of the person, the person can change from the testing situation, and the reliabilities and validities of tests are imperfect (Johnson, Porteus & Cattell, 1986). Fluctuations in performance on intelligence tests can be due to the ups and downs everyone experiences. Prior to considering the results of intelligence tests, repeated testing situations should be provided to control for individual differences (Jensen, 1980).

Habitually, tests have been employed as a determinant of admission even though validity for that specific program has not been established. Each institution must justify the use of the admission tests, ideally in the form of a local validity study (Wigdor & Garner, 1982). Mental tests are usually designed to predict academic performance during the first year of a program (Wigdor & Garner, 1982) and therefore have questionable value when considering practical application and success throughout a program. Brody and Brody (1976) suggest use of intelligence tests for selection commits institutions to the status quo and are devices to exclude applicants. A re-focusing on provision of an environment where students have a greater opportunity to be successful would be more appropriate.

Sternberg (1985) theorizes that intelligence tests measure only a small portion of intelligence, contributing to upper limits of validity coefficients of .50. These tests are conceivably inappropriate for many people in the prediction of intelligent behaviours in a variety of situations.

Another difficulty with the use of intelligence tests is that the relationship between intelligence and academic achievement is uneven (Eysenck & Kamin, 1981). Intelligence is necessary but not sufficient for high academic success. Estes (1981) indicates there is a very low correlation between intelligence and learning ability. Although tests and testing procedures have continued to be refined there has been little gain in predicting intellectual functioning outside the testing situation. Jensen (1980) points out that intelligence and achievement are correlated but not synonymous. The perfect correlation between intelligence and achievement is lacking because intelligence is not the only determinant of achievement.

2.7 Summary of the Literature

Most researchers support the belief that cognitive variables are more predictive of academic success than non-cognitive variables. Many cognitive variables have been investigated. The wide variety of independent and dependent variables, methodologies and results makes it difficult to identify common themes. The most commonly used psychometric tests as pre-admission criteria are the SAT and the ACT. The SAT, specifically the reading and mathematic scores, demonstrated the strongest correlations with academic success. The use of psychometric tests as pre-admission criteria was evident also in the allied health and medical education literature.

Those studying success of mature students found mature students were as successful academically as younger students

even though they frequently scored lower on psychometric tests. Caution is given regarding a possible bias within psychometric tests against older students.

The psychometric literature identifies a variety of suggestions and concerns when using psychometric test results. One of the more important recommendations is that psychometric test results should not be considered the definitive answer about who will be a successful student.

From this literature review it is clear that some gaps and concerns exist when predicting success in nursing education. Studies based on a Canadian sample are minimal (Jacono, Keehn & Corrigan, 1987; Weinstein, Brown & Wahlstrom, 1979, 1980) and studies using diploma nursing programs as a setting are limited (Weinstein, Brown & Wahlstrom, 1979,1980).

Perry (1986) suggests re-entry women comprise up to 50% of a class and currently used cognitive-based admission criteria may work against re-entry women. Mature students have not been addressed as a special group in the studies on success in nursing education although the literature supports that they are a group with special characteristics and needs.

The psychometric tests frequently included in these studies were the SAT and ACT. Studies were not found which addressed the predictive validity of other psychometric tests like the MAB and other intelligence/aptitude tests. The approaches used in the SAT, ACT and MAB differ significantly. Relating the results of studies on SAT and

ACT to the MAB is challenging.

The amount of literature available on predictors of academic success is tremendous. The task of identifying trends in the results of these studies is difficult. Although the majority of nursing education facilities in Manitoba continue to use pre-admission testing as part of their admission process, (Manitoba Association of Registered Nurses, 1988) the benefits of using psychometric test results are at best, questionable.

2.8 Conceptual Framework

Research questions have been conceptualized within a model of achievement as described by Blaine and Merrifield (1986). Blaine and Merrifield (1986) define achievement as what an individual knows and can do in a specified subject area. Although models of achievement vary in complexity, Blaine and Merrifield suggest the majority of models of achievement focus attention on abilities, personality or temperament factors, aspects of motivation along with the influence of situational variables. Blaine and Merrifield view achievement, then, as a function of ability dimensions, personality dimensions, motivational dimensions and situational dimensions (See Appendix B for this author's depiction of this model). Including situational dimensions in the model allows for influences other than individual differences. This model does not specify the nature of the functional relationship in terms of the weighting of the variables, the equivalency of the variables, or of how the variables or dimensions of the model contribute to the

explanation of achievement. It does not specify how the dimensions relate to one another. Rather, it is a conceptual representation of achievement (Blaine & Merrfield, 1986).

Blaine and Merrifield (1986) envision the ability dimension as latent traits which are part of the psychological structure of individuals. Abilities are stable within individuals and reliably differentiate among individuals. Abilities influence achievement. Psychometric tests like the MAB measure intellectual ability (Jackson, 1984).

The aspect of Blaine and Merrifield's model of achievement (1986) which guides this study is the ability dimension's influence on achievement. As ability represents only one factor requiring consideration when trying to predict achievement, the conclusions drawn from this study will be limited. The personality, motivation, and situational dimensions will not be studied.

Jackson (1984) describes propositions about intellectual abilities which he used as a basis for measurement with the Multidimensional Aptitude Battery. A sample of these paraphrased propositions expands upon the ability dimension of the model of achievement. Jackson (1984) proposes:

1. "Intelligence and intellectual abilities represent hypothetical constructs" (Jackson, 1984, p. 7). Intellectual abilities cannot be observed directly but can be inferred by observing behaviourial examples from a wide

variety of studies including psychometric studies.

2. The emergence of intellectual abilities occurs partially as a biological function during maturation and declines with age.

3. A wide variety of intellectual processes contribute to intellectual behaviour. These processes can be measured by various test contents and formats.

The purpose of almost any test application is to obtain information related to a decision about an individual or program. The more informed a decision is, the better the decision will be (Blaine & Merrifield, 1986). The more systematic the observation is, the more applicable to the decision the information will be.

Psychometric tests provide the means for systematic assessment. The use of psychometric tests in the admission process to a nursing education program should provide information to assist admission committees to make better decisions. The research questions in this study concentrate on the validity of one psychometric test by focusing on the relationship between the measured intellectual abilities and a variety of achievement measures.

3. Methodology

3.1 Research Design

This study was conducted using a non-experimental, retrospective design. A non-experimental approach was appropriate for these research questions as it would have been ethically unwise to manipulate admission criteria without some firm research support for doing so (Wilson, 1985). The retrospective approach permitted the investigator to identify antecedent factors that may have caused the outcome. The outcome in this case was success or failure in a diploma nursing program. This retrospective approach allowed for correlational relationships to be determined without the requirement of manipulating variables (Polit & Hungler, 1985).

The non-experimental retrospective approach has the disadvantage of the researcher being unable to control extraneous variables in order to determine the true nature of the relationships between variables under investigation (Polit & Hungler, 1985). For example, intrinsic factors like characteristics of the study participants could not be controlled. Additionally, the researcher is unable to ensure constancy of conditions under which the information was obtained as the events occurred prior to the involvement of the investigator. As the subjects had already been chosen through the admission process at the "School of Nursing", a randomization process was not possible.

Inclusion of the total group of students was used to facilitate homogeneity of the group of subjects. The

limitation accompanying this approach is that the research findings can only be generalized to the types of subjects involved in the study.

The ability of retrospective studies to highlight causal relationships is considerably less than experimental studies. The findings of retrospective studies, therefore, are not as convincing and require conformation through such approaches as replication (Polit & Hungler, 1985).

In this investigation the psychometric test results, as one aspect of the admission criteria, were compared to success in academic courses. The procedures of this study involved (a) specification of pre-admission variables, (b) collection of data on these pre-admission variables, (c) determination of measurable indicators of success/failure, (d) collection of data on these indicators, and (e) statistical analysis of the data collected on pre-admission variables and indicators of success/failure.

The pre-admission variable of concern in this study was the Multidimensional Aptitude Battery (MAB) (Jackson, 1984). Data collected on the MAB included scores on the following subtests: information, comprehension, arithmetic, similarities, vocabulary, digit symbol, picture completion, spatial, picture arrangement, and object assembly. In addition, the MAB provides scores of verbal IQ, performance IQ, and total IQ.

The verbal scale was comprised of the information, comprehension, arithmetic, similarities, and vocabulary

subtests. These verbal subtests are described as follows (See Appendix A):

1. The information subtest consists of 40 test items asking questions about general knowledge and information.

2. The comprehension subtest includes 28 items testing a person's understanding of a variety of situations and why things are done the way they are.

3. The arithmetic subtest includes 26 items encompassing simple and complex calculations. These range from addition and subtraction calculations to complex numerical reasoning.

4. The similarities subtest is a 34-item test where examinees must decide how pairs of words are alike. The associations range from concrete to abstract.

5. The vocabulary subtest includes 46 items where subjects match words that have the same meaning.

The performance scale was comprised of the digit symbol, picture completion, spatial, picture arrangement and object assembly subtests. The performance subtests are described as follows (See Appendix A):

1. The digit symbol subtest consists of 35 items where the subject must match a string of symbols with the correct numerical string within the item as determined by the coding chart which is printed at the top of the page.

2. The picture completion subtest includes 35 items which are pictures of common objects. These objects are missing one important part, for example, a rabbit without an ear. The examinee will choose the answer from a list of

first letters of five possible missing parts.

3. The spatial subtest has 50 items which test spatial rotation. The examinee must select the correct match for the presented figure from a list of five similar figures which have been rotated to various degrees.

4. The picture arrangement subtest is a 21-item test in which subjects must rearrange five cartoon panels into an order that tells a sensible story.

5. The object assembly subtest includes 20 items in which numbered sections of common objects appear in the wrong order. The examinee must mentally rearrange the parts into the correct order and select the numerical sequence that matches (Vernon, 1985).

The following calculations were completed to determine IQ scores according to Jackson's instructions (Jackson, 1984). Subtest raw scores were converted to scaled scores. These scaled scores were totalled to determine Verbal and Performance scaled scores and Full scaled scores. Verbal, Performance, and Full Scale scaled scores were converted to IQ scores through the use of tables for different age groups ranging from 16-17 to 70-74 years old. The Total IQ score was the one score that was recorded as a pre-admission criterion for review by the Admission Committee.

The Multidimensional Aptitude Battery (Jackson, 1983) has undergone validity and reliability testing by the developers. When equating the MAB to the Wechsler Adult Intelligence Scale-Revised (WAIS-R) (Wechsler, 1981), an equating sample of 117 male and 43 female respondents

ranging in age from 16-35 years was used. These samples did not reflect the total range of ages for which the MAB was designed, namely 16-74 years of age. Rather a calibration process was used to develop tables for older age groups. A large validation study on approximately 5000 Canadian high school students was used to establish Canadian adolescent norms. The interpretation of scores from the MAB, therefore, must be completed with a clear understanding of who the norm group was and how they related to the test group (Krieshok & Harrington, 1985).

Reliability and validity levels of the MAB were established as follows: (a) internal consistency reliability coefficients for the Verbal Scale were .92, for the Performance Scale were .94 and the Full Scale were .95, (b) the test-retest reliability for Verbal Scale, Performance Scale and Full Scale scores were .95, .96, and .97, respectively, (c) validity was studied through correlations of the Verbal Scale at .94, Performance Scale at .79, and Full Scale at .91 with the widely used WAIS-R, (Wechsler, 1981) and (d) the reliability and validity of individual subtests, stated in detail in the MAB manual, ranged from .44 to .89. Research aimed at the timed nature of the test found no significant differences in subtest scores when the subtest time limit varied from seven to ten minutes. Therefore, the seven minute time limit was used to shorten the overall time of the test.

The indicators of success/failure in this study were defined as the final scores in each academic nursing and

support course completed within the program. Data collection included the numerical grade received for those courses taught within the "School of Nursing" and the letter grade for those courses taught at a university setting. (See Appendices C, D and E for course descriptions and curriculum design).

3.2 Setting

A "School of Nursing" affiliated with an urban hospital was chosen for this study. This school provided a two year diploma in nursing program through a combination of university and school based academic courses and hospital based clinical courses during the time for which the data were collected. This setting was chosen because the investigator, as a faculty member, was directly involved with the admission process at this facility.

3.3 Sample

The subjects involved in this study included the educational records of those students who met one of the following criteria:

1. successful completion of the academic and clinical courses of the program.

2. began the program but were unsuccessful in completing the program due to failure in academic and/or clinical courses.

3. withdrew from the program voluntarily.

A convenience sample of the educational records of students who entered the program with the intention of graduating in the years of 1988 and 1989 were reviewed.

These students studied on a full-time basis. External validity was addressed by using all members of two classes of students. By including the total classes the heterogeneity of the group was enhanced. These two class years were selected as they were the first classes to complete the MAB (Jackson, 1983) as an admission criterion. They also had the opportunity to complete the program within the two years, thereby facilitating complete data. The size of this sample for the years of 1988 and 1989 inclusive was 147.

3.4 Method of Data Collection

Permission for access to the "School of Nursing" student records files was requested from the Director of Nursing Education. The "Request for Research/Survey/Study" form of the hospital was submitted.

Data collection on the defined indicators of success/lack of success in the nursing program and the psychometric test results was completed by reviewing the educational records of those students who had completed the program and those students who had not completed the program within the two year period due to academic and/or clinical failure and/or voluntary withdrawal (see Appendix F).

Demographic data were collected from student records according to the demographic data information sheet. These data were used to accurately describe the subjects in the study and delineate regular and mature status students (see Appendix G).

The data collection process was completed by the

researcher without the use of assistants. Student educational records were removed from locked storage to a nearby seminar room during the data collection process.

3.5 Ethical Considerations

The study proposal was submitted to the University of Manitoba School of Nursing Ethical Review Committee. Upon ethical approval from this committee a letter and the completed "Request for Research/Survey/Study" form was submitted to the Director of Nursing Education to request access to the student records (see Appendixes H and I).

Due to the nature of this retrospective study, consent for access was requested of the Director of Nursing Education rather than the students themselves. Student names were not removed from the files prior to data collection as the researcher had access to these files through regular employment in this educational setting. However, confidentiality was maintained by recording demographic data and academic data on separate collection devices which were coded with separate numbers. A master list relating the demographic data to the educational data was stored in a locked cabinet. All data collection sheets were stored in a locked cabinet in a separate location. Coded data were available to the researcher's advisors and a statistician during the course of study. Unidentified data have been included in this thesis. Analysis of data has been described in a global sense to protect the identity of the subjects. Negative effects were not foreseen for the subjects.

3.6 Data Analysis

Statistical analysis of the collected data was completed through the use of the Statistical Analysis System (SAS) available at the University of Manitoba (SAS, 1986). All data were coded and entered onto the computer. The MAB subtest scores recorded in the educational files were used to determine verbal, performance and total IQ scores. Prior to entry of the MAB subtest scores, calculations were made to determine the subtest scores for the nine special age groups as provided in the special profiles by Jackson (1984). Jackson's age groups are 16-17, 18-19, 20-24, 25-34, 35-44, 45-54, 55-64, 65-69, and 70-74 years. Distribution of age groups in this sample will be addressed in the results chapter. The use of these newly calculated subtest scores provided a more accurate basis for interpretation when the subtest scores were viewed independently (Jackson, 1984).

Univariate descriptive procedures were performed including means, standard deviations, modes, ranges, and normal probability plots for stipulated variables. Three subjects who were outliers were identified from this analysis. Each of these subject outliers was notably different in the areas of age and years since high school being that they were older than other subjects in the data set. Two of these subject outliers withdrew from the program prior to the completion of Semester 2. Data for determining Average 1 and Average 2 for these two subject outliers were not available. All statistical procedures

were then run with the remaining subject outlier in and out of the data set. It was determined that removal of the subject outlier did not alter the results and therefore was left in the data set for all data analyses except correlation of MAB scores with success at the end of Semesters 2 and 4 (See Table 5). In the correlation of MAB scores with success at the end of Semester 2 and Semester 4 there was a small difference when the subject outlier was removed. This difference in correlation will be addressed in detail in the presentation of results.

Correlation coefficients were calculated to describe the relationship between two variables (Polit & Hungler, 1989). The correlations provided information on the direction of the relationships between variables as well as the strength of the relationships. Correlation coefficients of less than .3 were considered weak, between .3 and .5 were considered moderate and those greater than .5 were considered strong. Pearson correlation coefficients were calculated on those variables demonstrating a normal distribution and Kendall's tau-b correlation coefficients were calculated on those variables lacking a normal distribution. Correlation coefficients were identified for the following variables: (a) MAB scores and age, (b) MAB scores and Average 1, (c) MAB scores and Average 2, and (d) MAB scores and years since study.

To analyze the frequency distribution of the variables of success/failure by the number of pre-credits the Chi-square distribution was determined. Chi-square is a non-

parametric test used when data are nominally scaled and interest is in the number of responses that fall into two or more categories (Wilson, 1985). The Chi square test compares the frequencies within the sample with those expected if the null hypothesis were true. Chi-square provided approximations of the p-value for the selected variables. The frequency distribution of the variables success/failure by admission status was analyzed using Fisher's Exact Two-tailed Test rather than Chi-square Test. Fisher's Exact Test provides the exact p-values rather than approximations. It therefore is the more accurate test but can only be used for a two by two comparison.

The relationship between psychometric test results including individual subtest scores and academic success/failure as well as admission status was delineated through the use One-way Analysis of Variance and Wilcoxon 2-Sample Test. One-way Analysis of Variance is an inferential statistical procedure used to compare the mean scores of two or more groups (Wilson, 1985). One-way analysis of variance does not provide information of the direction of the relationship, only whether the null hypothesis is accepted or not. Wilcoxon 2-Sample Test provided the same type of comparison as One-way Analysis of Variance but was used when a normal distribution was not present.

In the research proposal it was planned to use the multivariate procedure of discriminant analysis. Discriminant analysis is used to make predictions about membership in categories or groups (Polit & Hungler, 1989).

"The statistical analysis indicates the relative importance of the discriminating variables" (Abdellah & Levine, 1986, p. 385). To determine the benefit of using a procedure like discriminant analysis, the data set was divided into two data subsamples according to the admission status of regular or mature. Data analysis was completed on these two new data sets to determine if there were differences between mature and regular status students.

The statistical procedures completed on the two new data sets included univariate descriptive statistics to assist in describing the groups of regular and mature status students. Correlation coefficients were calculated for the following variables within each group: (a) MAB scores and age, (b) MAB scores and Average 1, (c) MAB scores and Average 2, and (d) MAB scores and years since study. Analysis of Variance or the Wilcoxon 2-Sample Test were used to determine the relationship of age, number of precredits, years since study and MAB scores with success or failure. As this data analysis failed to differentiate between the mature and regular status student group, it was decided that discriminant analysis would not be a helpful procedure.

An attempt was made to determine if certain MAB subtest scores were more predictive of success in some courses than others. This was addressed by calculating Pearson Correlation Coefficients and Kendall's Tau-b Correlation Coefficients for the MAB subtest and total scores with Average 1 and Average 2.

The p-values (critical values) were calculated

separately for each statistical procedure based on the number of independent variables included in the procedure. If a p-value of .05 had been used and many independent variables were involved, the opportunity to acquire a significant result by chance would have been great. This re-calculation of the p-value is a more conservative approach and the investigator can feel more comfortable that the significant results were not obtained by chance. Individual p-values are indicated with the respective tables.

4. Results

4.1 Sample

Data were collected on 147 subjects. The average age of the subjects was 22 years with the range being 17 to 51 years (See Figure 1). Over 80% of the subjects were single. Gender division of the sample indicated 142 were female while five were male. The five male subjects were included in the data set but specific references to them were not made in the data analysis because of their small numbers. Slightly more than half of the subjects were admitted into the program as regular status students (See Table 1).

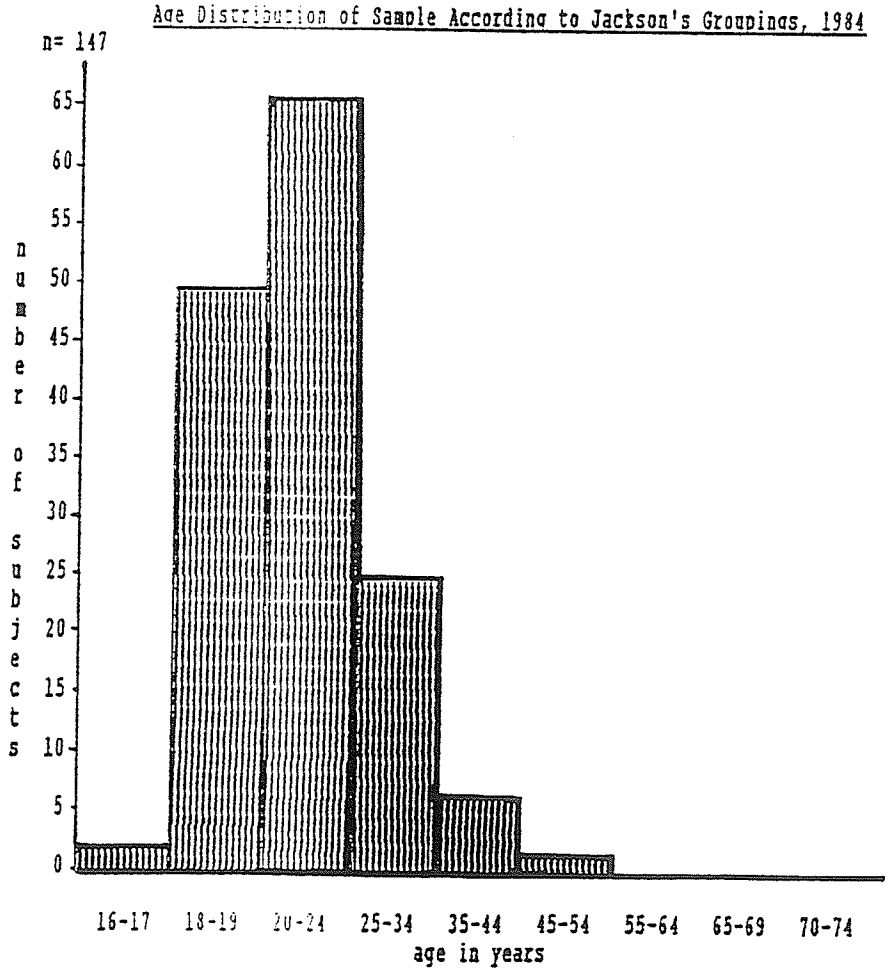
The mean number of years since graduation from high school was 4.22 years with the range being 0 to 30 years. However, most subjects had studied within one year prior to being admitted into the nursing program (See Table 2). Years since study ranged from 0 to 7. Over 70% of subjects had at least one academic credit prior to admission (See Table 3).

As part of the data analysis process, the data were divided into two new samples representing regular status and mature status students. The new data set of regular status students included 79 subjects. All but one subject were female and all were single but two. The mean age was 18.79 years and the subjects had graduated from high school within an average of 1.19 year (See Table 2). Over 45% of these subjects had at least one credit prior to admission to the program.

The second newly formed data set of mature status

students included 68 subjects. Of these, four were male, and 20 were married. The mean age of this group was 24.04 years and they had graduated from high school within an average of 7.79 years (See Table 2). Over 90% of these subjects had at least one credit prior to admission to the nursing program.

Figure 1



Note: Within the 20-24 year age group, 28 subjects were regular status students and 37 were mature status students.

4.2 Description of Individual Variables

MAB subtest and IQ scores were available for all 147

subjects. The mean of the verbal IQ scores was 107.75 with a standard deviation of 8.68 while the mean for performance IQ was 111.66 with a standard deviation of 13.86. The total IQ mean was 109.91 (standard deviation 10.4) (See Table 2). The total IQ scores ranged from 83 to 137 (See Appendix J). When the sample was divided into mature and regular status subsamples the following data were identified. A Total IQ mean score of 113.62 was identified for regular students while the Total IQ mean score for mature students was 105.60 (See Table 2).

Table 1

Demographic Data For Total Sample

n=147	GENDER		MARITAL STATUS			ADMISSION STATUS	
	FEMALE	MALE	SINGLE	MARRIED	SINGLE PARENT	REGULAR	MATURE
FREQUENCY	142	5	119	22	2	79	68
PERCENTAGE	96.6	3.4	83.7	15	1.4	53.7	46.3

Scores in academic courses included the mean of Average 1 (the average of the academic courses taught at the School of Nursing during Semesters 1 and 2) at 78.76%. The mean of Average 2 (the average of the academic courses taught at the School of Nursing during Semesters 3 and 4) was 74.67% (See Table 4). Average 1 and 2 scores were not available for the total sample as attrition had occurred. The sample size for Average 1 was 121 while the sample for Average 2 was 96.

On review of the total sample (n=147) the following was

Table 2

INDEPENDENT VARIABLE MEANS AND STANDARD DEVIATIONS FOR SAMPLES

VARIABLES	TOTAL SAMPLE n=147		MATURE SAMPLE n=68		REGULAR SAMPLE n=79	
	MEAN	SD	MEAN	SD	MEAN	SD
AGE	22.24	5.45	24.04	6.05	18.79	0.89
YEARS SINCE HIGH SCHOOL	4.22	5.26	7.79	5.99	1.19	0.96
YEARS SINCE STUDY	0.37	0.97	0.47	1.31	0.28	0.58
INFORMATION SUBTEST	50.50	6.79	48.74	7.24	52.03	6.04
COMPREHENSION SUBTEST	54.63	5.29	52.71	4.90	56.28	5.08
ARITHMETIC SUBTEST	54.37	8.10	52.22	7.16	56.23	8.44
SIMILARITIES SUBTEST	57.86	4.89	56.65	4.41	58.91	5.07
VOCABULARY SUBTEST	53.12	6.36	52.84	6.94	53.37	5.86
VERBAL IQ	107.75	8.68	104.35	8.42	110.67	7.85
DIGIT SYMBOL SUBTEST	58.38	8.54	55.93	7.09	60.49	9.15
P I C T U R E COMPLETION SUBTEST	50.12	6.20	49.28	6.19	50.84	6.16
SPATIAL SUBTEST	52.13	12.24	50.25	13.47	53.77	10.88
P I C T U R E ARRANGEMENT SUBTEST	59.37	9.00	58.69	6.76	59.96	10.57
O B J E C T COMPLETION SUBTEST	55.38	8.08	52.84	8.68	57.57	6.85
PERFORMANCE IQ	111.66	13.86	107.79	12.08	114.99	14.49
TOTAL IQ	109.91	10.4	105.60	8.76	113.62	10.32

Table 3

Pre-admission Credits for Total Sample

n=147	NUMBER OF PRE-ADMISSION CREDITS				
	0	1	2	3	>3
FREQUENCY	42	20	45	37	3
PERCENT	28.6	13.6	30.6	25.2	2.0

Table 4

MEANS AND STANDARD DEVIATIONS FOR AVERAGE 1 AND AVERAGE 2

VARIABLES	TOTAL SAMPLE		MATURE SAMPLE		REGULAR SAMPLE	
	MEAN	SD	MEAN	SD	MEAN	SD
	n=121		n=58		n=63	
AVERAGE 1	78.76	5.78	79.61	5.47	77.97	5.99
	n=96		n=48		n=48	
AVERAGE 2	74.67	4.91	74.65	4.53	74.69	5.31

Table 5

Descriptive Statistics For Total Sample

n=147	DID NOT LEAVE	REASON FOR WITHDRAWAL			SUCCESS/FAILURE	
		ACADEMIC FAILURE	CLINICAL FAILURE	VOLUNTARY	SUCCESS	FAILURE
FREQUENCY	92	26	6	23	93	54
PERCENT	62.6	17.7	4.1	15.6	63.3	36.7

determined: ninety-two subjects completed the program within the expected two years resulting in an attrition rate of 36.7%. The most commonly stated reason for withdrawal from the program was academic failure with voluntary withdrawal as a frequently used reason (See Table 5).

4.3 Relationship of MAB Scores and Success

All subtest scores of the MAB as well as Verbal IQ, Performance IQ, and Total IQ scores were compared to the success of the subjects in the diploma nursing program through the use of non-parametric one-way analysis of variance procedures. When the MAB scores provided a normal distribution, Analysis of Variance results were used. When the MAB scores did not provide a normal distribution, the Wilcoxon 2-Sample Test was used. To address the possibility of a significant result occurring because of chance, the critical value was calculated at .0029. The results of this analysis indicated that the relationships between MAB subtest scores as well as Verbal IQ, Performance IQ and Total IQ scores when compared to success or failure in completing the program were not significant (See Table 6).

Pearson Correlation Coefficients were calculated to address the possibility of specific MAB subtest scores or IQ scores correlating with certain academic course scores. The variable of Average 1 was used to represent scores in academic courses completed by the end of Semester 2. Using the critical value of .0038 and a sample size of 121, it was determined that there was a significant and a moderately positive relationship at a level of .378 between the

Vocabulary subtest scores and Average 1. When the outlier was removed (n=120), the correlation coefficient for the Vocabulary Subtest was significant at .339. The relationships between all other subtest and IQ scores and Average 1 were not significant (See Table 7).

Table 6

Relationship of Independent Variables and Success/Failure

VARIABLE	ANALYSIS OF VARIANCE	WILCOXON 2-SAMPLE TEST
AGE		0.0624
PRECREDITS		0.1703
INFORMATION SUBTEST		0.7444
COMPREHENSION SUBTEST		0.4384
ARITHMETIC SUBTEST	0.4338	
SIMILARITIES SUBTEST		0.8528
VOCABULARY SUBTEST		0.4684
VERBAL IQ	0.5250	
DIGIT SYMBOL SUBTEST		0.4770
PICTURE COMPLETION SUBTEST		0.7550
SPATIAL SUBTEST		0.9353
PICTURE ARRANGEMENT SUBTEST		0.9084
OBJECT ASSEMBLY SUBTEST		0.5772
PERFORMANCE IQ	0.5942	
TOTAL IQ	0.8987	
YEARS SINCE HIGH SCHOOL		0.0068
YEARS SINCE STUDY		0.1431

n=147
null hypothesis rejected at p<.0029

Table 7

Correlation Coefficients of Averages 1 and 2 with WAB Scores

WAB CATEGORIES	AVERAGE 1 n=121	AVERAGE 1 n=120 outlier removed	AVERAGE 2 n=96	AVERAGE 2 n=95 outlier removed
INFORMATION SUBTEST	0.14575 0.1107	0.09557 0.2991	0.09261 0.3695	0.02353 0.8210
COMPREHENSION SUBTEST	0.22534 0.0130	0.21098 0.0207	0.21045 0.0396	0.19315 0.0607
ARITHMETIC SUBTEST	0.04543 0.6207	0.03851 0.6762	0.01801 0.8617	0.00715 0.9452
SIMILARITIES SUBTEST	0.22362 0.0137	0.19106 0.0366	0.24170 0.0177	0.19729 0.0553
VOCABULARY SUBTEST	0.37810 * 0.0001	0.33938 * 0.0001	0.33976 * 0.0007	0.28308 0.0054
VERBAL IQ	0.20235 0.0260	0.16561 0.0707	0.21099 0.0391	0.16206 0.1166
DIGIT SYMBOL SUBTEST	-0.02435 0.7909	-0.03567 0.6989	0.10277 0.3191	0.08979 0.3868
P I C T U R E COMPLETION SUBTEST	-0.02945 0.7485	-0.04356 0.6366	0.02492 0.8096	0.00893 0.9315
SPATIAL SUBTEST	-0.07984 0.3860	-0.09040 0.3282	-0.17291 0.0938	-0.19056 0.0658
P I C T U R E ARRANGEMENT SUBTEST	-0.12210 0.1821	-0.13316 0.1471	-0.10963 0.2877	-0.12424 0.2303
OBJECT ASSEMBLY SUBTEST	-0.20158 0.0266	-0.20547 0.0244	-0.05452 0.5978	-0.05589 0.5906
PERFORMANCE IQ	-0.17287 0.0579	-0.18501 0.0431	-0.09837 0.3403	-0.11290 0.2760
TOTAL IQ	-0.00924 0.9199	-0.03848 0.6765	0.03742 0.7174	-0.00003 0.9997

null hypothesis rejected at p<.0038
* = significant results

Note: The number pairings for each variable represent the correlation coefficient and the p-value respectively.

The variable of Average 2 was used to represent scores in academic courses completed by the end of Semester 4. Again, using the critical value of .0038 and a sample size of 96, it was determined that there was a significant and moderately positive correlation at a level of .339 between the Vocabulary subtest scores and Average 2. When the outlier was removed (n=95) the relationship between the Vocabulary subtest and Average 2 was no longer significant. The relationships between the remaining subtest and IQ scores were not significant (See Table 7).

4.4 Regular and Mature Status Students

Within the total sample there were 79 regular status and 68 mature status students. The academic performance of both groups of students is demonstrated by comparing means of Average 1 and 2 as well as reviewing the success rate in completing the program. Regular status students revealed mean scores of 77.97% for courses until the end of Semester 2 while mature status students obtained mean scores of 79.61%. By the end of Semester 4 the mean scores for regular students had fallen 3.28% to 74.69% while the mean scores for mature status students had fallen 4.96% to 74.65% (See Table 4). When reviewing the statistics on withdrawal from the program, it was evident that 56.9% of the regular status students had completed the program within the two years while 69.1% of the mature status students had completed the program. Regular status students withdrew from the programs more frequently because of academic failure (22.8% of withdrawals). Mature status students

withdrew because of academic failure 11.8% of the time.

Table 8

Frequency of Success and Failure by Admission Status

	Regular	Mature	Total
Success	45 30.61 48.39 56.96	48 32.65 51.61 70.59	93 63.27
Failure	34 23.13 62.96 43.04	20 13.61 37.04 29.41	54 36.73
Total	79 53.74	68 46.26	147 100.00

Note: Each number column represents the following calculations respectivley: frequency, percent, row percent, column percent.

Although the mature status students had a lower attrition rate and less withdrawal because of academic failure, higher IQ scores did not occur. Regular status students demonstrated superior performance when compared with mature status students on the Performance IQ, Verbal IQ and Total IQ scores. The mean Total IQ score for regular status students was 113.62 while the mean Total IQ score for mature status students was 105.60 (See Table 2).

Non-parametric frequency calculations on the total data set using the Fisher's Exact Test (two-tailed) demonstrated that there was no significant association between admission status and success/failure in the diploma nursing program. The data indicated, however, that of the 36.73% who were unsuccessful in completing the program, 23.13% came from the regular status group while only 13.61% came from the mature

status group (See Table 8).

Table 9

Correlation Coefficients of Years Since Study and Age with MAB

MAB CATEGORIES	AGE n=147	YEARS SINCE STUDY n=147
INFORMATION SUBTEST	-0.23118 * 0.0001	0.19109 0.0048
COMPREHENSION SUBTEST	-0.29095 * 0.0000	0.16850 0.0142
ARITHMETIC SUBTEST	-0.22813 * 0.0001	0.11250 0.0971
SIMILARITIES SUBTEST	-0.25924 * 0.0000	0.15577 0.0229
VOCABULARY SUBTEST	-0.06683 0.2645	0.15827 0.0199
VERBAL IQ	-0.31214 * 0.0000	0.18458 0.0061
DIGIT SYMBOL SUBTEST	-0.17223 0.0041	0.02790 0.6822
PICTURE COMPLETION SUBTEST	-0.15097 0.0118	0.03632 0.5933
SPATIAL SUBTEST	-0.13597 0.0219	-0.06481 0.3355
PICTURE ARRANGEMENT SUBTEST	-0.06555 0.2777	0.07144 0.2972
OBJECT ASSEMBLY SUBTEST	-0.26502 * 0.0000	-0.03734 0.5823
PERFORMANCE IQ	-0.20046 * 0.0007	-0.01004 0.8808
TOTAL IQ	-0.3207 * 0.0000	0.06673 0.3209

null hypothesis rejected @ p<.0038
* = significant results

Note: The number pairings for each MAB category represent the correlation coefficient and the p-value respectively.

When the complete data set was used to calculate correlation coefficients, using a critical value of .0038, there were weakly significant and negative correlations between age and Information, Comprehension, Arithmetic, Similarities, and Object Assembly subtest scores as well as Performance IQ. Moderately negative correlations were evident between age and Verbal IQ at -0.312 and between age and Total IQ at -0.320 (See Table 9).

When investigating the regular and mature subject group, similar results occurred. Analysis of Variance and Wilcoxon Scores for regular and mature admission status indicated that significant relationships existed between admission status and Information, Comprehension, Arithmetic, and Object Assembly subtests as well as Verbal, Performance and Total IQ (See Table 10). To identify the type of relationship that existed, correlation coefficients were calculated. When reviewing the Correlation Coefficients between age and MAB scores within the regular status group meaningful results were obtained. The scores for Information, Picture Completion, and Object Assembly subtests as well as Verbal IQ scores revealed a weak significant and negative correlation. The scores for the Comprehension and Similarities subtest revealed negative correlations of moderate strength. The Correlation Coefficients between age and MAB scores within the mature status group displayed no significant relationships (See Table 11).

Pearson Correlation Coefficients and Kendall Tau-B

Table 10

Relationship of Independent Variables and Admission Status

VARIABLES	ANALYSIS OF VARIANCE	WILCOXON 2-SAMPLE TEST
AVERAGE 1 n=121	0.1205	
AVERAGE 2 n=96	0.9712	
INFORMATION SUBTEST		0.0012 *
COMPREHENSION SUBTEST		0.0000 *
ARITHMETIC SUBTEST	0.0025 *	
SIMILARITIES SUBTEST		0.0108
VOCABULARY SUBTEST		0.3756
VERBAL IQ	0.0001 *	
DIGIT SYMBOL SUBTEST		0.0034
PICTURE COMPLETION SUBTEST		0.1198
SPATIAL SUBTEST		0.1750
PICTURE ARRANGMENT SUBTEST		0.3030
OBJECT ASSEMBLY SUBTEST		0.0008 *
PERFORMANCE IQ	0.0015 *	
TOTAL IQ	0.0015 *	
PRECREDITS		0.0000 *

null hypothesis rejcted at $p<.0031$
* = significant results

Table 11

Correlation Coefficients of Variables with HAB Scores for Regular and Mature Status Students

HAB CATEGORY	AGE		AVERAGE 1		AVERAGE 2	
	REGULAR n=79	MATURE n=68	REGULAR n=63	MATURE n=58	REGULAR n=48	MATURE n=48
INFORMATION SUBTEST	-0.26505 * 0.0029	0.01900 0.8300	0.18648 0.1434	0.18261 0.1701	-0.03996 0.7874	0.21975 0.1334
COMPREHEN-SION SUBTEST	-0.34559 * 0.0001	0.12829 0.1555	0.31061 0.0132	0.27790 0.0347	0.15991 0.2776	0.30318 0.0362
ARITHMETIC SUBTEST	-0.15070 0.0911	-0.14740 0.0960	0.08062 0.5299	0.08988 0.5022	0.00902 0.9515	0.02997 0.8398
SIMILARITIES SUBTEST	-0.38808 * 0.0000	-0.12733 0.1540	0.17059 0.1813	0.36267 0.0051	0.14539 0.3241	0.37836 0.0080
VOCABULARY SUBTEST	-0.21407 0.0170	0.15596 0.0782	0.38024 * 0.0021	0.40264 * 0.0017	0.32831 0.0227	0.36489 0.0108
VERBAL IQ	-0.27073 * 0.0022	-0.02931 0.7394	0.22693 0.0737	0.32028 0.0142	0.13202 0.3711	0.32720 0.0232
DIGIT SYMBOL SUBTEST	-0.02006 0.8222	-0.06465 0.4705	-0.00519 0.9678	0.03597 0.7886	0.11693 0.4286	0.08283 0.5757
PICTURE COMPLETION SUBTEST	-0.29852 * 0.0009	0.02615 0.7678	-0.05269 0.6817	0.02609 0.8459	-0.10140 0.4928	0.16645 0.2582
SPATIAL SUBTEST	-0.17044 0.0553	-0.10810 0.2175	-0.06944 0.5918	-0.05305 0.6925	-0.21659 0.1437	-0.14427 0.3279
PICTURE ARRANGEMENT SUBTEST	-0.01888 0.8326	-0.03179 0.7310	-0.20422 0.1084	0.05716 0.6700	-0.26690 0.0667	0.16774 0.2544
O B J E C T ASSEMBLY SUBTEST	-0.27086 * 0.0027	-0.10554 0.2298	-0.10736 0.4023	-0.23736 0.0728	-0.09141 0.5366	-0.02852 0.8474
PERFORMANCE IQ	-0.13901 0.1143	-0.08906 0.3086	-0.17916 0.1600	-0.09244 0.4901	-0.20274 0.1670	0.03214 0.8283
TOTAL IQ	-0.25183 0.0043	-0.09481 0.2811	-0.02255 0.8608	0.14586 0.2746	-0.09084 0.5392	0.20482 0.1626

null hypothesis rejected at p<.0038
* = significant results
Note: The number pairings for each variable represent the correlation coefficient and the p-value respectively.

Table 12

Relationship of Independent Variables and Success/Failure for Regular and Mature Status Students

VARIABLES	ANALYSIS OF VARIANCE		WILCOXON 2-SAMPLE TEST	
	REGULAR n=79	MATURE n=68	REGULAR n=79	MATURE n=68
AGE			0.2370	0.7961
PRECREDITS			0.4192	0.8575
INFORMATION SUBTEST	0.6581			0.6907
COMPREHENSION SUBTEST			0.2438	0.3779
ARITHMETIC SUBTEST	0.0679	0.6970		
SIMILARITIES SUBTEST		0.1680	0.3867	
VOCABULARY SUBTEST			0.3629	0.6807
VERBAL IQ	0.1506			0.6036
DIGIT SYMBOL SUBTEST			0.4185	0.3977
P I C T U R E COMPLETION SUBTEST		0.3574	0.7133	
SPATIAL SUBTEST	0.6904	0.9844		
P I C T U R E ARRANGEMENT SUBTEST	0.6285			0.9236
OBJECT ASSEMBLY SUBTEST		0.6111	0.4323	
PERFORMANCE IQ	0.8106	0.8637		
TOTAL IQ	0.7093	0.6506		
YEARS SINCE HIGH SCHOOL			0.0327	0.9053
YEARS SINCE STUDY			0.2932	0.3062

null hypothesis rejected @ p<.0029

Correlation Coefficients were also used to investigate the relationships between MAB scores and academic success at the ends of Semesters 2 and 4. The Vocabulary subtest scores showed a moderately positive correlation with academic scores at the end of Semester 2 for both mature and regular status students. All other subtest and IQ scores showed no significant correlation. When correlating MAB scores with academic performance at the end of Semester 4 significant results were not identified for either group of students (See Table 11).

During data analysis the author became aware that variables originally included to describe the sample, such as years since last study, years since high school and the number of pre-admission credits, could be meaningful if added to the investigation. These variables, therefore, were included in the statistical procedures even though they were not addressed in the research questions. The results demonstrated that the influence on success/failure by the variables of the number of precredits, the number of years since graduating from high school and the number of years since study were insignificant for regular and mature status students (See Table 12).

4.5 Summary of Results

The data analysis for the complete data set reveals that the MAB subtest scores and the IQ scores do not correlate positively with academic performance at the end of Semester 2 with the exception of the Vocabulary subtest. The Vocabulary subtest correlated moderately with academic

performance as represented by Average 1. MAB subtest scores and IQ scores did not correlate significantly with academic performance by the end of Semester 4 with the exception of the Vocabulary subtest. When correlations were calculated with the subject outlier removed, the Vocabulary subtest correlation was no longer significant. MAB scores were determined not to be significant when compared to success in completing the program when analysis of variance procedures were applied.

When the data set was divided into regular and mature status students the data analysis showed that although the mature student was more likely to successfully complete the program within two years, their MAB subtest and IQ scores tended to be lower. In fact, several subtest scores and all three IQ scores demonstrated a weak negative correlation with the age of the student when studying the total data set. The division of the data set into two groups, regular and mature status students, resulted in the negative correlations being evident within the regular status group.

The investigation of the additional variables of the number of years since last studying, the number of years since graduation from high school and the number of pre-credits indicated they did not play a significant role in the success or failure of these students.

5. Discussion

This study was designed to determine the relationship between scores on the Multidimensional Aptitude Battery (Jackson, 1983), used as a pre-admission criterion, and academic success in a diploma nursing program. In addition, similarities and/or differences for regular status and mature status students involved with the use of the Multidimensional Aptitude Battery (Jackson, 1983) were addressed.

The research questions of this study were:

1. What is the relationship between scores on the ten subtests of the Multidimensional Aptitude Battery and academic performance in a diploma nursing program up to the end of Semester 2?

2. What is the relationship between scores on the ten subtests of the Multidimensional Aptitude Battery and academic performance in a diploma nursing program up to the end of Semester 4?

3. What similarities and/or differences are evident in the effectiveness of these predictions between regular status and mature status students?

5.1 Relationship of MAB Scores and Success

The MAB, as currently used as an admission criterion at the "School of Nursing", did not provide useful information regarding success in completion of the diploma nursing program. The Total IQ, the score which was reviewed during the admission process into the diploma nursing program, did not correlate significantly with academic achievement. The

results from analysis of variance procedures were not significant. Correlational techniques identified only the Vocabulary subtest score as correlating positively with academic success up to the end of Semester 2 and Semester 4. If the outlier was removed, the significance of the correlation was lost by the end of Semester 4. The correlation of the Vocabulary subtest scores was a moderate one and accounted for a range of 8% to 14% of the variance. All other subtest scores and IQ scores did not correlate significantly with academic performance.

As research focusing on the Multidimensional Aptitude Battery's ability to predict academic success was not found, research on the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1981) was considered. The WAIS is the intelligence test upon which the MAB was based. Feingold (1983), when studying the validity of the Information and Vocabulary subtests of the WAIS to predict college achievement, found the Information and Vocabulary subtests did predict college success as effectively as standardized college level aptitude tests like the Scholastic Aptitude Test (SAT).

In the nursing literature the most frequently studied psychometric test was the Scholastic Aptitude Test (SAT). The SAT appeared to be the psychometric test which was closest in conceptual approach to the MAB. The Scholastic Aptitude Test is a test with a focus on verbal and mathematic abilities. Verbal questions on the Scholastic Aptitude Test address choosing opposites of stated words,

choosing correct meanings, selecting words representing a similar relationship as stated words, and comprehension of a written passage (Carris & Crystal, 1982). In comparison, the MAB verbal section includes arithmetic calculations and testing of specific knowledge as well as identifying relationships and meanings.

SAT verbal scores were found to be more predictive of success than SAT mathematic scores by several researchers (McKinney et al., 1988; Miller et al., 1968; Payne & Duffy, 1986; Reed & Feldhusen, 1972). When SAT verbal scores were correlated with success on the NCLEX-RN, the correlation coefficients were determined at a level of greater than .6 (McKinney et al., 1988; Woodham & Taube, 1986). When reviewing the nursing literature, the other major psychometric test used was the American College Testing Program (ACT). The importance of verbal ability was identified by Perez (1977), who found that the ACT social science reading score helped predict scores on nursing licensure examinations. It was speculated that reading ability required to complete the test may have been the important consideration. The MAB Verbal IQ, studied in this research project, did not correlate significantly with success in completing the nursing program nor with academic scores.

One of the engaging results when correlations were completed on the MAB subtests and IQ scores was found during correlations with academic performance at the end of Semester 2 versus the end of Semester 4. MAB Vocabulary

subtest scores correlated significantly and moderately at a level of .339 (outlier removed) at the end of Semester 2. This moderate correlation disappeared by the end of Semester 4. The notion that psychometric test results are more effective in predicting academic performance in the beginning stages of a program of study was addressed by Wigdor and Garner (1982). They believed that the design of mental tests usually addresses predictability of academic performance during the first year of a program and that they have questionable value for predicting success throughout a program. Although correlations of .339 were considered moderate, a pattern was present which showed that the strength of the correlations decreased as the students moved through the program.

The differences in the strength of the correlations of SAT scores and MAB scores with academic success could be precipitated by a variety of factors. The SAT and the MAB were not equivalent instruments. There were similarities in some aspects of the tests, namely the inclusion of vocabulary and comprehension abilities testing. However, the SAT verbal section moves beyond this level by including testing of the ability to reason logically as well as to write clearly (Carris & Crystal, 1982). In contrast, the MAB Verbal section included knowledge of specific content as well as arithmetic calculations. The greater strength in correlations for the SAT verbal scores when compared to the Vocabulary subtest of the MAB addresses the possibility that verbal abilities beyond vocabulary and comprehension

contribute to the success of nursing students. Additionally, the change in academic expectations from Semester 2 to Semester 4 was considered. Although the examination process was unchanged, the level of examination questions did vary. An examination blueprint for the end of Semester 2 revealed a concentration of questions at the level of knowledge and comprehension. An examination blueprint for the end of Semester 4 revealed a concentration of questions at the level of application and critical thinking.

Knowledge and comprehension level examination questions focused on testing of content that had been discussed in classes or available in textbooks. Application and critical thinking level examination questions required students to apply the acquired knowledge to answer questions related to unique patient care situations. At the end of Semester 2, 65-75% of examination questions were asked at a knowledge/comprehension level with 25-35% at the application and critical thinking levels. By the end of Semester 4, the balance had shifted to 35-40% knowledge/comprehension and 55-65% at the application and critical thinking levels (B. Toews, personal communication, November 23, 1990). The contributions of vocabulary may be considered more important when knowledge and comprehension were tested than when application of knowledge or critical thinking were expected.

The final consideration when looking at the decreasing significance of results of the Vocabulary subtest when

progressing through the program is the smaller sample size. As attrition occurred throughout the program, the sample size decreased from 120 subjects at the end of Semester 2 to 95 by the end of Semester 4. This smaller sample size decreased the power of the statistical analysis. Therefore, the confidence in the final results was less.

The findings of the current study included insignificant correlation coefficients for mathematic abilities. Some nursing literature (Alichnie & Bellucci, 1981; McKinney et al., 1988; Whitley & Chadwick, 1986; Wittmeyer, Camiscioni & Purdy, 1971; and Yess, 1980) supports the consideration that mathematic abilities play an important role in success in nursing education. Yess (1980) found that SAT mathematic scores were the single most important predictor of success in a community college nursing program. The ability to apply scientific principles which may be measured through mathematic problem-solving are also important abilities in nursing education. Correlation coefficients for the Arithmetic subtest scores in the MAB at the end of Semester 2 and at the end of Semester 4 were .045 and .018 respectively. Consideration again must be given to the difference in test structure within the SAT and MAB. Furthermore, the subjects for research projects included in the literature review were drawn from nursing programs whose composition and expectations would have been different than those at the "School of Nursing".

5.2 Regular and Mature Status Students

The sample in this research project well reflected the

changing profile of the student nursing body as described in the literature review. Close to one-half of the subjects who entered the nursing program were classified as mature students. The equality of the numbers of regular and mature status students facilitated statistical procedures on both groups.

The data analysis on the new samples of regular and mature status students indicated that the mean IQ score for regular status students was higher (113.62) than the mean for mature status students (105.60). Pearson Correlation Coefficients calculated on the total sample of 147 subjects identified that Arithmetic, Similarities, Digit symbol, and Object assembly subtests as well as Verbal IQ, Performance IQ and Total IQ were weakly to moderately negatively correlated with age.

Studies in the psychometric literature support the suggestion that intelligence decreases with age (Eysenck & Kamin, 1981). Brody and Brody (1976), however, disagree based on a longitudinal study finding no decrease in intelligence with age. The results of this study showing a decrease in IQ scores with age could have been influenced by several factors.

The experts working in the area of psychometrics do not agree on what is being measured with a psychometric test. Although psychologists like Jensen (1980) argue that intelligence is what psychometric tests measure, intelligence is found to be an extremely difficult concept to define. The possibility exists that scores on IQ tests

may decrease with age but that the test itself does not measure a person's intelligence. Jackson (1984) has attempted to address the issue of alterations in IQ scores with age by developing standard charts for various age groups to be used when determining IQ scores. Although the scores for each age group were calculated and included in the data set, the differences, with this group of subjects, remained evident.

As critiqued by Krieshok and Harrington (1985) the MAB standardization procedure to develop the norm tables included subjects from age 16 to 35 years. A validation study showed positive results but involved a large group of high school students. The total range of ages for which the MAB is applied were not included in these validation studies. Therefore, validity for the age group of nursing students in this study is uncertain.

Other factors to consider when reviewing this difference in IQ scores are the previous experience with testing, the timed nature of the test, and the stress involved in writing. Jensen (1980) agrees that test taking experience can influence IQ scores by up to 5 points. Mature students have, in most cases, been away from immersion in an educational setting where testing is common place. The novelty of the test taking situation when writing the MAB (Jackson, 1983) could have influenced mature student results.

The timed nature of the test could influence all students but perhaps the mature student more so. The MAB is

a test where each of the ten sections is rigorously timed to be completed within 7 minutes. Jackson (1984) addressed the issue of time by completing studies allowing both seven and ten minute time limits for each subtest. The correlations were high between scores obtained during the seven and ten minute time limit for the Verbal Scale. Correlations for the Performance Scale were lower. Based on these results the seven minute time limit was chosen. Jackson, however, does not describe the sample involved in the study thereby making it impossible to determine the age range of the sample. Therefore, determination of the relevance of the MAB timed tests for a group of nursing students was impossible to make. The speed with which mature applicants wrote this type of test may be different than younger applicants and contribute to the difference in scores.

The influence of the timing of the MAB in making it a stressful situation for some applicants is unarguable. The MAB (Jackson, 1983) was designed for use with people with a wide variety of abilities. The number of questions to be answered within the seven minutes was often greater than an average person could manage. The examinees, however, were not aware of this during the testing process. Furthermore, instructions to be read to examinees as stated in the MAB Manual (Jackson, 1984) could contribute to anxiety. Verbal instructions included the following:

> All five parts are timed. You will have seven minutes to work at each section. Work on each test only during the time specified. Do not go back to a previously

> completed test, nor go on to the next test if you happen to finish one test before time is called. This point is extremely important. . . . (Jackson, 1984, p. 20).

Jackson goes on to say "if you have any questions, ask them before the signal is given to begin the test" (1984, p.20). Although the clarity of the instructions is exemplary, the impression left, is one of beginning a race.

Sternberg (1985) supports the notion that stress contributes significantly in a negative fashion to performance on psychometric tests, particularly when they are considered as an important criterion in an admission process. Sternberg believes that test-taking anxiety can be so great that the applicants performance can be crippled.

Anecdotal opinion contributed by the person administering the MAB supported the notion that both timing and anxiety may have contributed to lower scores by mature students. Through observation during years of involvement with the testing situation it was felt that mature students had more difficulty dealing with the spoken directions regarding the timing of the tests and appeared more anxious than younger students (E. Tanner, personal communication, January 14, 1991).

Whether lack of experience with tests, the timing of the test and the stress surrounding the test affects mature status students more than regular status students remains debatable. As mature students are often making their first recent attempt at entrance into the educational system,

they, in particular, may feel additional pressure during the test writing event. Badenhoop and Johansen (1980) suggest that older women returning to school set higher educational goals. These high goals could make the testing process for mature students that much more difficult.

Although mature students tended to have lower mean IQ scores, this did not affect their ability to be successful in the nursing program. A greater percentage of mature students were successful in completing the program within the two years and a greater percentage of regular students contributed to the group that was unsuccessful. Analysis of variance calculations indicated that academic success or failure was not related to age. When reviewing the mean academic marks of the mature students in this study, their performance surpassed that of regular status students until the end of Semester 2. By the end of Semester 4 both the mature and regular students average scores were equal.

The abilities of mature students were supported by the literature. Age was not seen as a disadvantage for older students returning to school (Felts, 1986; Lunneborg, Olch, & deWolfe, 1974; Thieman & Marsh-Williams, 1984). Bailey (1988) presented that older students scored significantly higher overall on academic examinations. Criticisms of psychometric test scores were presented by Aldag and Rose (1983) and Safian-Rush and Belock (1988) who found that older students were more successful academically even though their psychometric test results were lower.

The number of years since the student last studied did

not correlate significantly with MAB scores nor did it relate to the success or failure rate of the students. It therefore was not a significant disadvantage for students if they had been away from academic study for varying lengths of time of up to seven years. Thieman and Marsh-Williams (1984) supported this finding in their study of adult women students returning to college.

Since more mature students were successful in completing the nursing program even though their IQ scores tended to be lower and they had been away from study longer, consideration must be given to factors other than intelligence. Non-cognitive factors such as motivation and self-expectations, although more difficult to quantify, must be weighed as possible influences on the success rate of mature students.

5.3 Support for the Model of Achievement

If the assumption is made that the Multidimensional Aptitude Battery does measure intelligence as stated by Jackson (1984), the findings of this study support the belief that intelligence is not the only factor to consider when identifying candidates who could be successful in a diploma nursing program. The conceptual model of achievement upon which the research questions of this study were based, consisted of components other than intelligence. Blaine and Merrifield (1986) identified four main areas that contribute to achievement, those being ability, personality, motivation and situation. This research study supports the opinion presented by Eysenck and Kamin (1981) that ability,

as measured by intelligence, is necessary but it will not ensure academic success. The reader is reminded that the lowest Total IQ score within the sample was 83. The two subjects with Total IQ scores of 83 were successful in completing the program. Their academic scores for Average 1 and Average 2 ranged from 70% to 76% (See Appendix I). The results of this research study would support the belief that intelligence scores beyond a certain minimum do not contribute greatly to achievement or at least is only one factor to consider. How well intelligence scores represent ability has not been established.

The other factors included in the conceptual model must be considered as important stimuli towards achievement. One factor identified in the nursing literature which received considerable support as a player in achievement was motivation. Yess (1980) found that motivation, as measured by the intent to pursue further education, was a non-cognitive factor that influenced the students success in a nursing program. Motivation was also considered an important factor for mature nursing students and may partially explain why mature students tend to be the same or more successful academically even though their IQ scores tend to be lower (Bailey, 1988).

Personality was studied and supported in the nursing literature as a positive factor toward predicting success (Baker, 1975; Jones, 1975; Lewis, 1980; Munro, 1980). Personality factors such as conscientiousness, perseverance, imagination, social awareness and emotional control were

identified in successful nurses (Lewis, 1980). The inclusion of personality factors to enhance the ability to predict academic achievement requires further exploration.

A number of factors were applicable to the situational dimension. Situational factors included in the nursing research literature were ethnicity (Clemence & Brink, 1978), previous work experience (Allan, Higgs & Holloway, 1988; Oliver, 1985; Yess, 1980) and family support (Billings, 1987). Previous work experience was found to be an insignificant factor. Ethnicity and family support were identified as significant variables.

Support for Jackson's propositions about intellectual abilities was not as evident (Jackson, 1984). Jackson proposes that intellectual abilities can be inferred from psychometric studies and intellectual processes contribute to intellectual behaviour. The results of this study neither support nor negate these propositions. The results of this study did not support the total IQ score as significant in relation to success in a diploma nursing program. The question raised is whether the MAB measures intellectual behaviour.

Another of Jackson's propositions indicates that intellectual abilities emerge with maturation and decline with age. Support for a decrease in IQ score with age was evident. However, this did not have an adverse effect on the ability to successfully complete the program.

The review of Blaine and Merrifield's Model of Achievement (1986) within the context of this research

study, provides guidance and direction for future nursing research in the areas of motivation, personality and situational factors. A review of Jackson's propositions regarding intelligence raises questions regarding their accuracy.

5.4 Summary of Discussion

The one significant relationship identified during data analysis was that the Vocabulary subtest score correlated positively and moderately with academic marks up to the end of Semester 2. Other significant results were not identified. When considering academic performance at the end of Semester 4 there was no longer a significant relationship with any aspect of the MAB. Vocabulary subtest scores were no longer significant. The MAB subtest or IQ scores did not provide useful information as a selection criterion into the diploma nursing program for the selected sample.

When reviewing the dependent variable of academic success, it was evident that the percentage of mature status students who were successful was greater than the regular status group. The MAB results were no more predictive for the regular status students than they were for the mature status students even though the mature students tended to obtain lower MAB scores.

5.5 Considerations of the Study

The following points should be considered within the realm of this study.

1. An assumption was made that the "School of Nursing"

examinations that were used to determine the academic success or failure of the subjects were valid indicators of student progress.

2. A limitation in relation to external validity of the study was that the population was pre-selected by the School of Nursing using the previously stated admission criteria. The population included in this study may be representative of upcoming classes but not of all applicants. As the files of applicants who were unsuccessful in gaining admission to the program were not available, they were not be included in the sample. The study sample (applicants who were accepted) was therefore not representative of the target population (applicants who were accepted and rejected). Future research will be required to address this limitation.

3. An inherent problem with non-experimental research is the establishment of internal validity. Various explanations for the outcomes have been identified. Lack of a control group contributes to the concern of internal validity. Cook, Lomax and Mark (1977) suggest that having a large sample size would increase statistical conclusion validity. Using the general rule of fifteen to twenty observations per variable with multivariate analysis the reviewing of 150 files helped contribute to internal validity (J. Sloan, personal communication, January 3, 1990).

4. Several aspects affecting reliability were beyond the control of the researcher. The psychometric testing

procedure was carried out by a third party. Although strict guidelines are provided by the author of the instrument, the researcher did not have control over the conditions during measurement or over the consistency of the procedure. The reliability of the documentation can not be established although it is known that one individual had been responsible for the testing procedure and documentation for several years. This individual is the secretary in the School of Nursing. Calculation of the results was completed by this secretary. Interpretation of these results was completed by members of the admission committee.

5. The variable of "reason for withdrawal" encompassed several reasons including voluntary withdrawal. During the data collection process it was evident that voluntary withdrawal was documented by the "School of Nursing" when students who were doing poorly academically withdrew before the failure occurred. This may have distorted the reason for withdrawal statistics. Voluntary withdrawal students, however, were included in the unsuccessful category according to the variable definition.

6. Attrition throughout the program resulted in a decrease in sample size when academic performance was reviewed at the end of Semester 4 and when success was studied at the end of the two year program.

7. When the data set was divided to investigate the regular and mature status student groups separately, the subsamples were considerably smaller. Sample sizes of 63 for regular status students and of 58 for mature status

students at the end of Semester 2 and 48 for regular status students and mature status students by the end of Semester 4 were observed. These smaller sample sizes resulted in lower power of the statistical procedures. This causes one to place greater confidence in any significant result as the procedures only had low to moderate power of detecting a large effect. It also holds implications for results that were observed as insignificant. Larger sample sizes may have provided opportunity for identification of more subtle effects for those subtests that displayed insignificant results in this study.

8. Statistical analysis was completed on combined data and therefore provides information on how the group performed. It does not, however, provide information about individual students. Specific students may have performed in a completely different fashion from that which was demonstrated by the group statistics.

9. The study does not address the many other variables which may contribute to success in diploma nursing programs as identified in the Model of Achievement (Blaine & Merrifield, 1986). It does support, however, the notion that other variables do require consideration and research.

5.6 Implications for Nursing Research

The present study has reinforced the importance of future research in the area of preadmisson criteria. The use of the Multidimensional Aptitude Battery (Jackson, 1983) was revealed as an admission criterion that was not very effective in predicting success in a two year diploma

nursing program for the selected sample.

This study sample was drawn from two classes of students with a total of 147 subjects. To increase external validity, consideration should be given to replicating this study with a new sample. The subjects in the next two classes of students for which the Multidimensional Aptitude Battery scores are available, those being the graduating classes of 1990 and 1991 could be utilized. Replication of the study could establish the limits of the findings or verify the results of the present study.

In addition to a replication study to increase confidence in the results, a somewhat different focus to the sample could also be helpful to address the difference in mature student functioning. The present study was only able to include those applicants who were accepted into the nursing program as data were not available on those who were not accepted. The feasibility of collecting and storing data on those applicants who were not accepted should be reviewed. Inclusion of data on those students who were not accepted would not add to the information on the effectiveness of the MAB in predicting success in the nursing program. It would provide additional information on the effect of age and admission status on the scores received on the MAB. Determination of the identity of those applicants who were not accepted into the nursing program and inclusion in the data set would facilitate representativeness of the total applicant pool.

As the literature supports the use of high school or

pre-admission GPA as having a relatively strong relationship (correlation coefficients of approximately .5) with success in some programs (Geisinger, 1984), the effectiveness of this criterion should be studied within the current setting. Data collection on high school and/or pre-admission average on the subjects included in this study would allow for a comparison of the predictability of the two criteria. This future research could provide the opportunity for the School of Nursing to make an informed decision regarding the most cost-effective way of admitting candidates.

Other criteria currently in use that would benefit from study include the personal interview. The usefulness and purpose of this interview could be reviewed. Investigation of the decisions that were reached from the interview process alone in comparison to the students success in the program would be an interesting avenue to pursue. Determining the benefits of including a personal interview in the admission process would be helpful.

The literature indicates that psychometric test results correlate with academic success at an upper limit of 0.5. The correlations of SAT scores with academic success were particularly strong. This research project did not identify correlations as high. Thought should be given to investigating the effectiveness of the SAT scores in place of the MAB scores for correlation with success in a diploma nursing program.

The low correlation of the MAB with academic success implies that variables other than psychometric test scores

are important. This statement is supported by the Model of Achievement (Blaine & Merrifield, 1986). One variable that has been identified in the literature as a possible reason that mature students tend to be more successful than regular students is motivation. The influence of motivation is one requiring investigation. Identifying the role motivation plays in academic success through further research could provide educators with guidance when selecting applicants and when planning strategies to assist students to be successful. Additionally, the Model of Achievement provides direction for investigation of personality factors and situational factors.

The investigation of a combination of variables such as intelligence with motivation or intelligence with personality factors could provide further insight into the mystery of why some students are successful and others are not.

5.7 Implications for Nursing Education

As nurse educators review admission information such as psychometric scores, it is imperative that they are knowledgeable regarding what the score means. Educational psychologists emphasize that the greatest difficulty with data like IQ scores is the misuse of the results (Estes, 1981). As an IQ test provides a numerical value, there may be an unconscious tendency to place too much credence in the scores. Nurse educators must consider that these test scores have been obtained on one particular day and are not necessarily representative of that person's ability over an

extended period of time. The person's ability over time may be more clearly demonstrated by reviewing previous academic performance. Those persons responsible for selecting nursing school candidates must always be aware that IQ scores can be misleading.

Nurse educators could be misled by reviewing the Total IQ score. This composite score does not provide information regarding performance on individual subtests. For example, a high score on the Vocabulary subtest could be negated by a low score on the Arithmetic subtest. Review of all subtest scores should be given thought.

If the desire to utilize pre-admission tests remains, investigation to identify other tests that may be more applicable to nursing may be beneficial. The correlation coefficients for the MAB in this study were not as high as those in the literature using other psychometric tests such as the SAT.

If the Multidimensional Aptitude Battery (Jackson, 1984) remains a criterion within the admission process, nurse educators may be served well to review the Vocabulary Subtest scores rather than the Total IQ score. The Vocabulary Subtest score was the only score that correlated positively with academic success. This type of review would require a readjustment of the presentation of the admission data prior to the decision-making process.

Admission committees must recognize that mature students are different than regular status students. The tendency presented in this study was that mature student

scores on the Multidimensional Aptitude Battery were lower than regular students but that mature students were proportionally more successful in completion of the program. If the members of Admission Committees are consistent between regular and mature status students in the application of the stated admission criteria, there is a possibility that mature students would have less opportunity for entrance into the nursing program. The age bias of psychometric tests as discussed in the literature review may come into effect. A review of the use of the psychometric test as an admission criterion may be in order in light of these findings. Identification of mature student's strengths and concentrating on those would be a logical avenue to follow.

All nurse educators have a difficult balancing act when considering the shortage of nurses and the attrition rates that occur in nursing education programs. If the shortage of nurses is the priority, questions must be raised as to the logic of using criteria for selection that may delete applicants who may be successful practising nurses. Educational institutions that have open-door admission policies choose to focus on providing the supports for all applicants to be successful rather than denying "unqualified" applicants admittance. If the trend in nursing numbers continues, nurse educators may need to redirect this approach of choosing the "best" candidates to one of selecting candidates who meet the most basic of admission criteria (ie. grade 12 education). Nurse

educators' energies must then be focused on providing an educational environment conducive to student success.

5.8 Summary of Research Study

This research study addressed the relationships between success in a diploma nursing program and scores on the Multidimensional Aptitude Battery (Jackson, 1983) as well as identifying similarities and differences between regular and mature status students. The results of the data analysis represented the MAB as a psychometric test that did not provide significant information about the success or failure of diploma nursing students. Furthermore, mature nursing students were more successful in completing the nursing education program in spite of lower MAB scores than regular status students.

Selection of candidates for nursing education who have an opportunity to be successful is becoming a more perplexing endeavour to accomplish. Implications for nurse educators include the need to use caution when considering psychometric test results as an admission criterion. The broad view of achievement as presented by Blaine and Merrifield (1986) provides direction for future research in the areas of personality, motivation and situation.

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APPENDIX A

Samples of Multidimensional Aptitude Battery

Note: The following items are from the Multidimensional Aptitude Battery by D. N Jackson, 1983, London, Ontario: Research Psychologists Press, Inc.

Verbal Scale: Information Subtest

26. The Hundred Years' War was between

A. England & Russia.
B. England & Prussia.
C. Russia & Japan.
D. France & Prussia.
E. England & France.

33. Halley's Comet returns approximately every

A. 5 years
B. 10 years
C. 50 years
D. 75 years
E. 85 years

Verbal Scale: Comprehension Subtest

2. It is good to know how to read and write in order to

A. communicate better in a complex society.
B. complete the necessary documents for taxes.
C. correspond by mail with friends out of town.
D. be able to read articles in magazines.
E. do better on tests.

20. The main reason labour unions have developed is

A. as a means of getting even with companies.
B. in order to improve social interaction among workers.
C. to improve productivity.
D. to man picket lines during strikes.
E. as a means of collective bargaining.

Verbal Scale: Arithmetic Subtest

15. A club has a monthly income of $125. Of this, $50 is budgeted for food. What percentage does the club budget for food?

    A. 30% B. 50% C. 25% D. 40% E. 75%

23. A piece of rope 36 feet long is to be cut into two pieces so that one piece is ⅓ as long as the other piece. How many feet long will the shorter piece be?

    A. 24 B. 12 C. 27 D. 18 E. 9

Verbal Scale: Similarities subtest

8. How are rakes and shovels alike?
   A. used for forest fires
   B. outdoor implements
   C. both have handles
   D. made of metal
   E. people enjoy using them

25. How are the North Star and the Sun alike?
   A. both are stars
   B. both reflect light back to earth
   C. both are circled by the earth
   D. both are in outer space
   E. the North Star shines at night and the Sun shines in the day

Verbal Scale: Vocabulary Subtest

1. attempt
   A. try
   B. succeed
   C. obtain
   D. do
   E. fail

18. implicate
   A. involve
   B. extract
   C. penetrate
   D. conclude
   E. reveal

Performance Scale: Digit Symbol Subtest

DIGIT SYMBOL

1	2	3	4	5	6	7	8	9
∧	=	/	X	\	+	–	‖	⌜

4. ∧ = /

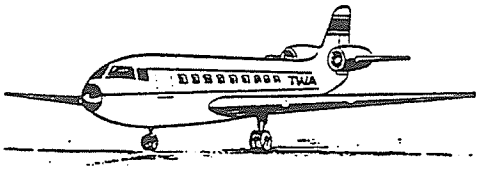
A. 3 2 1
B. 1 8 5
C. 1 2 3
D. 1 2 5
E. 1 8 3

9. / = X \

A. 3 2 4 5
B. 3 8 6 7
C. 2 3 4 5
D. 5 8 4 6
E. 5 2 4 3

Performance Scale: Picture Completion Subtest

32

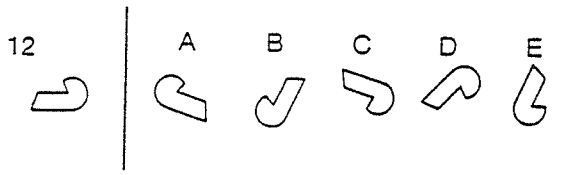


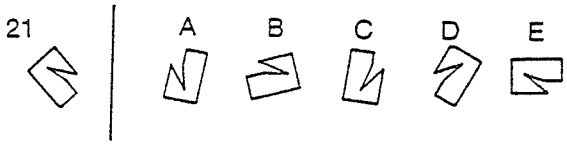
A. A
B. D
C. P
D. W
E. S

33

A. S
B. R
C. L
D. E
E. B

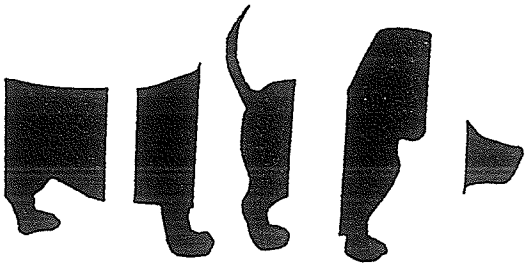
Performance Scale: Spatial Subtest





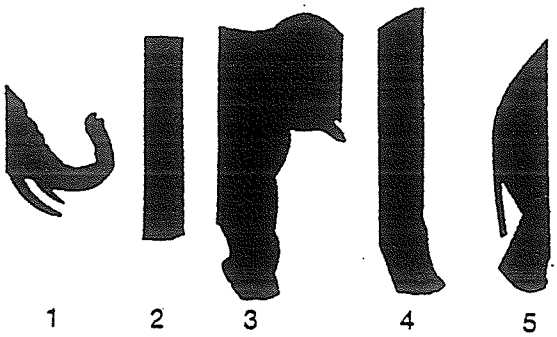
Performance Scale: Object Assembly Subtest

5.



A.	1	2	3	4	5
B.	3	1	4	2	5
C.	3	1	2	4	5
D.	2	1	3	4	5
E.	5	1	4	2	3

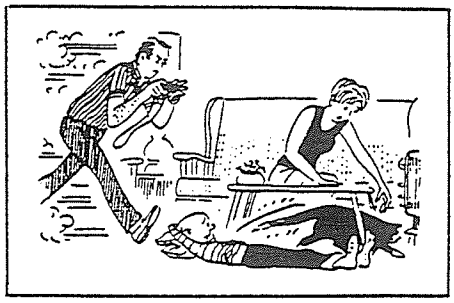
12.

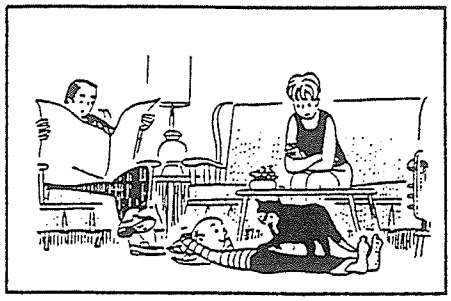


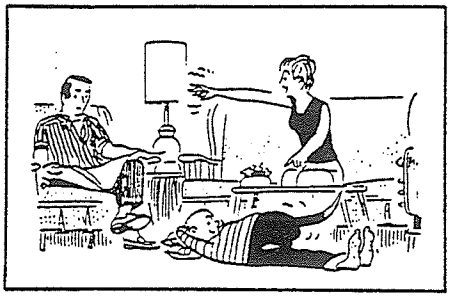
A.	4	2	1	3	5
B.	5	4	2	3	1
C.	5	2	3	4	1
D.	5	3	2	4	1
E.	5	3	4	1	2

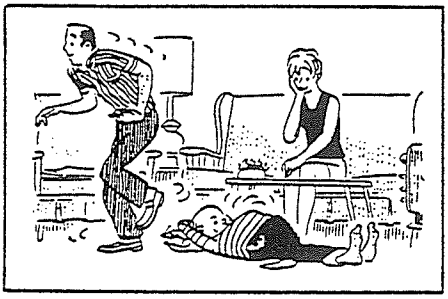
Performance Scale: Picture Arrangement Subtest

4.

1. 

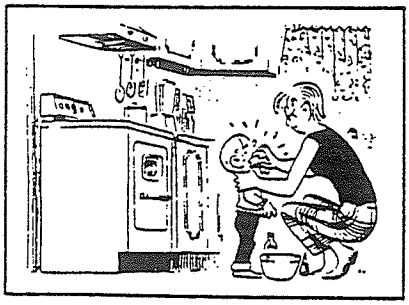
2. 

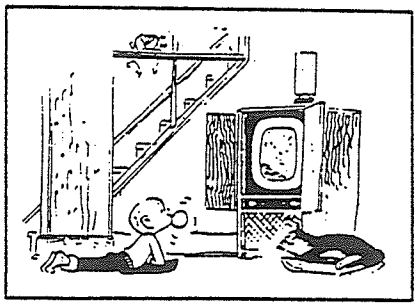
3. 

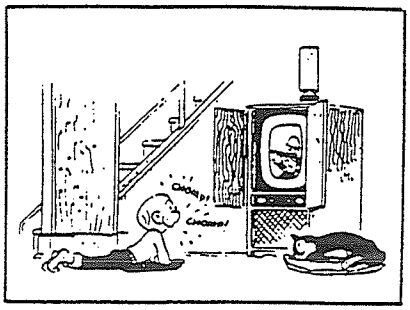
4. 

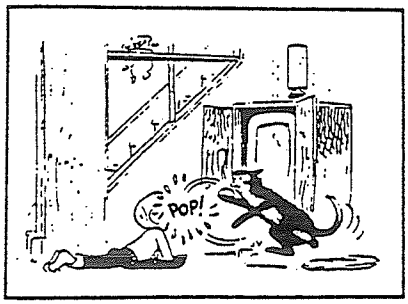
A. 4 3 2 1
B. 1 3 2 4
C. 3 4 1 2
D. 2 3 4 1
E. 1 2 3 4

5.

1. 

2. 

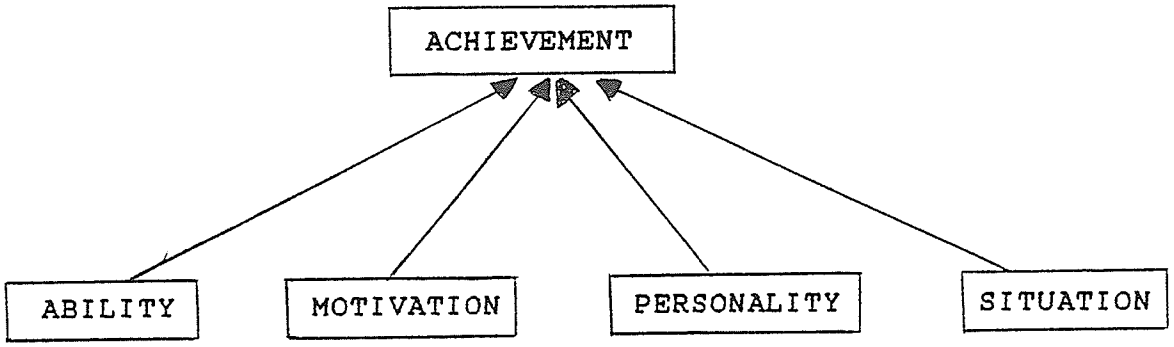
3. 

4. 

A. 2 3 4 1
B. 4 1 2 3
C. 3 2 1 4
D. 1 2 3 4
E. 3 2 4 1

APPENDIX B

Model of Achievement



A representation of a model described by Blaine and Merrifield, 1986.

APPENDIX C

Nursing Course Descriptions

Adapted from School of Nursing Course Descriptions

Semester 1

Introduction to Nursing
This course is designed to introduce the student to some basic concepts about nursing, health and health issues. A significant feature of the course is the introduction to the Roy Adaptation Model of Nursing and the Adaptation Nursing Process which provide the organizing framework for all of the nursing courses in the program. The student studies basic concepts about communication in nursing, historical development, and an introduction to moral, legal and ethical aspects of nursing.

Microbiology
This course introduces the student to basic information about microbiology. Included is content on microorganisms which may cause human disease and the application of this content to the practice of nursing. The student will participate in laboratory sessions to reinforce learning.

Human Growth and Development
Human Growth and Development is a course which spans Semester 1 and 2. The content of this course will include determinants and principles of growth and development as well as developmental processes throughout the life span. The human organism will be studied at all ages and stages with attention to biology, psychology and sociology.

Semester 2

Introduction to Nursing
This course continues to introduce the basic concepts about nursing which were begun in Semester 1. Additional study in the area of communication in nursing is included. The teaching-learning process is introduced. The professional development of the nurse is addressed with the inclusion of content related to patient advocacy, confidentiality and values clarification.

Pharmacology
This course introduces the student to basic information about pharmacology, pharmacodynamics, pharmacokinetics and drug administration. An important aspect of the course is the study of the metric system and its application in the accurate calculation of drug dosages. A brief introduction to broad classifications and groups of drugs is included.

Semester 3

Perspectives for Nursing Practice 1
This course is designed to introduce the student to concepts applicable to the nursing care of patients in a variety of settings and throughout the life cycle. A significant feature of the course is the inclusion of content related to the moral-ethical-spiritual component of the individual's self-concept and nursing approaches related to a person's needs within this component. The student studies a number of major factors influencing an individual's adaptation, complex health problems, and advanced communication skills. Selected bioethical health issues are addressed.

Promoting Adaptation in the Childbearing Family
This course is designed to help the student acquire knowledge and develop skills necessary to give nursing care to childbearing families. The focus of the course is the nurses role in promoting adaptation of the family during the developmental stages of childbirth and childbearing. The Roy Adaptation Model of Nursing provides the framework for viewing the individual and family, and the nurse's role in the promotion of adaptation of the childbearing family. Knowledge of the biological and social sciences is incorporated throughout the course.

Promoting Adaptation in the Child and Adolescent
This course focuses on pathophysiology as an influencing stimulus to the adaptive child and adolescent. The student studies common health problems that disrupt physiological and psychosocial adaptation. The Roy Adaptation Model of Nursing and the Adaptation Nursing Process provide the framework for viewing each health problem with emphasis placed on the nurse's role in assisting an individual and family to maintain, regain or attain physiological and psychological adaptation.

Promoting Adaptation in the Person Experiencing Emotional Distress
This course is designed to integrate concepts from the biological and social sciences as a basis for deeper understanding of human behaviour. The student studies common disruptions within the psychosocial modes; these include anxiety, guilt, loneliness, alienation and depression. The impact of these disruptions on physiological adaptation is also addressed. The Roy Adaptation Model of Nursing and the Adaptation Nursing Process provide the framework for viewing each disruption, with emphasis placed on the nurse's role in assisting individuals and families to maintain, regain or attain psychosocial adaptation.

Semester 4

Perspectives for Nursing Practice 2
This course is designed to introduce the student to concepts applicable to the nursing care of patients in a variety of settings and throughout the lifecyle. The student studies culture and the environment as influencing stimuli to the adaptive person. Several complex adaptation problems are included. The psychosocial modes are addressed with the inclusion of content related to the individual as a sexual being and common disruptions in psychosocial adaptation. The professional development of the nurse focuses on leadership in nursing, the health care system in Canada and selected bioethical health issues.

Promoting Adaptation in the Adult and Aging Person
This course focuses on pathophysiology as an influencing stimulus to the adaptive adult and aging person. The student studies common health problems that disrupt adaptation in all components of the physiological mode and have impact on all psychosocial modes. The Roy Adaptation Model of Nursing and the Adaptation Nursing Process provide the framework for viewing each health problem, with emphasis placed on the nurse's role in assisting a person to maintain, regain or attain adaptation.

Semester 5

Socialization into the Nursing Role
This course is designed to introduce the student to concepts relevant to professional development and practice. Trends in nursing practice and issues in health care will be examined. In addition, factors affecting the nurse's adaptation to the workplace will be discussed.

APPENDIX D

University Course Descriptions

From the University Calender, 1990

Semesters 1 and 2

Anatomy and Physiology

This course is provided for students in the RN programmes of several local hospitals. It deals with the biological study of the human organism; microscopic and gross anatomy; cellular and general physiology and human genetics.

Introductory Psychology

This course provides and introduction to the scientific analysis of behaviour and mental activity from the biological, social and individual perspectives. Major topics include: perception, motivation, learning, memory, intelligence, personality, states of consciousness, social interaction, developmental processes, heredity and environmental influences, abnormal psychology, and therapeutic methods. Students will participate directly or indirectly in the Department's ongoing research programmes.

Semesters 3 and 4

Introduction to Sociology

This course provides an introduction to the study of society and to the discipline of sociology. Topics to be covered include methods, culture, socialization, groups, social processes, the community, social stratification, the major institutions - the family, the economic, the political, the religious, and the educational - and social change in its contemporary setting.

APPENDIX E

SEMESTER 1 12 weeks August 24, 1990 - November 16, 1990	SEMESTER 2 14 weeks November 19, 1990 - March 15, 1991 Christmas break - Dec. 21 - Jan. 7 Spring break - Feb. 11 - 15	SEMESTER 3 22 weeks March 18, 1991 - October 11, 1991 Summer break - June 28 - Aug. 26	SEMESTER 4 21 weeks October 14, 1991 - March 27, 1992 Christmas break - Dec. 20 - Jan. 6 Spring break - Feb. 10 - 14	SEMESTER 5 13 weeks March 30, 1992 - June 26, 1992
Nursing 100: Introduction to Nursing 72 hrs.	Nursing 110: Introduction to Nursing 82.5 hrs.	Nursing 200: Perspectives for Nursing Practice 72 hrs.	Nursing 210: Perspectives for Nursing Practice 54 hrs.	Nursing 300: Socialization into the Nursing Role 25 hrs.
Nursing 103: Skills for Nursing Practice 12 hrs.	Nursing 113: Skills for Nursing Practice 13 hrs.	Nursing 203: Skills for Nursing Practice 11 hrs.	→ 2 hrs.	Nursing 305: Clinical Practice 450 hrs.
Nursing 105: Clinical Practice 56 hrs.	Nursing 115: Clinical Practice 104 hrs.	Nursing 205: Clinical Practice 357.5 hrs.	Nursing 215: Clinical Practice 338 hrs.	
Microbiology: 108 25 hrs.	Pharmacology: 114 23 hrs.	Nursing 204-1: Promoting Adaptation in the Childbearing Family * 64 hrs.	Nursing 204-1: Promoting Adaptation in the Childbearing Family * 64 hrs.	
Human Growth & Development: 102 24 hrs.	→ 26 hrs.			
Biology 05: 1112-1 Human Anatomy & Physiology 54 hrs.	→ 87 hrs.	Nursing 204-2: Promoting Adaptation in the Individual Experiencing Emotional Distress * 35 hrs.	Nursing 204-2: Promoting Adaptation in the Individual Experiencing Emotional Distress * 35 hrs.	
Introductory Psychology 44:1000-1 30 hrs.	→ 48 hrs.	Nursing 204-3: Promoting Adaptation in the Child and Adolescent * 32 hrs.	Nursing 204-3: Promoting Adaptation in the Child and Adolescent * 32 hrs.	
		Nursing 206: Promoting Adaptation in the Adult and Aging person * 124 hrs.	Nursing 206: Promoting Adaptation in the Adult and Aging Person * 124 hrs.	
		Introduction to Sociology 50:1101-1 15 hrs.	→ 63 hrs.	
NURSING COURSES - THEORY 84 hrs. - PRACTICE 56 hrs. SUPPORT COURSES 133 hrs.	NURSING COURSES - THEORY 95.5 hrs. - PRACTICE 104 hrs. SUPPORT COURSES 184 hrs.	NURSING COURSES - THEORY 394 hrs. - PRACTICE 695.5 hrs. SUPPORT COURSES 78 hrs. * Students will study these courses in Semester 3 or 4		NURSING COURSES - THEORY 25 hrs. - PRACTICE 450 hrs.

APPENDIX F

code _____

Psychometric and Academic Scores

1. Psychometric Test Scores

(a). Multidimensional Aptitude Battery

Verbal Scale

Information subtest _____

Comprehension subtest _____

Arithmetic subtest _____

Similarities subtest _____

Vocabulary subtest _____

Verbal IQ _____

Performance Scale

Digit Symbol subtest _____

Picture Completion subtest _____

Spatial subtest _____

Picture Arrangement subtest _____

Object Assembly subtest _____

Performance IQ _____

Total IQ _____

2. Academic Scores

(a) Semester 1 Scores

Introduction to Nursing _____

Microbiology _____

(b) Semester 2 Scores

Introduction to Nursing _____

Pharmacology _____

Human Growth and Development _____

Introductory Psychology _____

Anatomy & Physiology _____

(c) Semester 3 Scores

Perspectives for Nursing Practice 1 _____

Childbearing Family _____

Child & Adolescent_____

Emotional Distress _____

(d) Semester 4 Scores

Perspectives for Nursing Practice 2 _____

Adult & Aging Person _____

Introductory Sociology _____

(e) Semester 5 Scores

Socialization into the Nursing Role _____

Success in program _____

Failure in program _____

APPENDIX G

code _____

Demographic Information

1. Gender: male _____ female _____

2. Date of Birth _____

3. Marital Status: _____

4. Admission Status

regular status _____

mature status _____

5. For those who did not complete the program, reason for leaving_____

_____

6. Year of graduation from highschool _____

7. Year of last academic study_____

APPENDIX H

Letter Requesting Access to School of Nursing

May 2, 1990

Dear Director of Nursing Education:

I am a candidate in the Master of Nursing Program at the University of Manitoba and I am writing to request access to your school for research purposes. The purpose of my study is to examine the ability of psychometric admission tests to predict success in academic courses in your Diploma of Nursing Program. I hope to further understand the effectiveness of the admission process in predicting nursing student success.

I would like permission to have access to student educational records for those students who entered your program with the intention of graduating in the years of 1988 and 1989. Data collected from these records will include test scores on the Multidimensional Aptitude Battery as well as academic grades obtained in your program. Demographic data, excluding student name, will be collected to accurately describe the subject group. All data sheets will be coded to ensure confidentiality of the student. Data will be stored under lock and key. Coded data will be shared with the thesis committee, included in the thesis report and analyzed from a group perspective. I have included a copy of the research proposal for your examination.

I do not anticipate involvement of School of Nursing staff. Requirements of supplies and equipment of the School of Nursing will be limited to the use of a seminar room for the data collection process.

The study is being supervised by a thesis committee consisting of Professor Cynthia Cameron, School of Nursing, University of Manitoba; Professor Judy Scanlan, School of Nursing, University of Manitoba; and Dr. Dexter Harvey, Faculty of Education, University of Manitoba. The study proposal will be submitted to the University of Manitoba School of Nursing Ethical Review Committee. A copy of their approval for this study will be submitted to you.

Data collection should begin in May, 1990 and be completed within three months. A copy of the results will be made available to the School of Nursing upon request. If you require further information regarding this study please contact me at 4 - . I will be pleased to meet with you.

Sincerely,

Joan Schultz, R.N., B.Sc.N.

APPENDIX I

REQUEST FOR RESEARCH/SURVEY/STUDY

I. IDENTIFICATION

DATE May 2, 1990

NAME Joan M. Schultz

ADDRESS _____

TELEPHONE NUMBER _____

Check One Of The Following:

[ ] Medical Staff [x] Hospital Staff [x] Student [ ] Other

FOR MEDICAL STAFF ONLY:

Department _____ Department Head _____

FOR STUDENTS ONLY:

School or University/College University of Manitoba

Faculty/Department School of Nursing

Course For Which Research Is Required Thesis, Master of Nursing

Course Instructor Professor C. Cameron, Chairperson, Thesis Committee Telephone 474-8240

If affiliated with the Hospital, indicate Supervisor and Department:

Director, Nursing Education

Please Note: A letter from the Course Instructor identifying the student and outlining the purpose of the project is required.

FOR ALL OTHER APPLICANTS

Organization _____

Position Held _____

Supervisor (Name & Job Title) _____

Relationship To Hospital If Any _____

II. DESCRIPTION OF RESEARCH/SURVEY/STUDY (Use additional sheets as required.)

1. Purpose of Research - Outline the intent of the research. ie. What are you trying to prove or discover.

To discover the relationship between psychometric pre-admission test results and success in diploma nursing programs. To determine if the psychometric tests are more effective in predicting success for regular status students than mature students.

2. Methodology - How will the research or survey be carried out? Include what information is required from the Hospital, and what will be done with this information. Be specific.

A non-experiemntal ex post facto methodology will be used. The source of data will be the educational records of students who entered the diploma in nursing program with the intention of graduating in the years 1988 and 1989. Data for collection include Multidimensional Aptitude Battery test results, academic course results and demographic data. Correlation coefficients, t-tests, and discriminant analysis will be used to analyze the data.

3. If information sought is patient related, check applicable boxes:

- [ ] Medical Records — Number_____
- [ ] Interviews — Number_____
- [ ] Physical Examinations — Number_____
- [ ] Questionnaires — Number_____
- [x] Other (Specify) student educational records — Number 150

Please note that if patient contact is anticipated it will be necessary to obtain consent from both the patient and the patient's physician. If only patient charts will be consulted, consent must still be obtained from the physician, Department or Medical Executive. (Please attach copy of the proposed consent form and questionnaire [if applicable]).

4. Confidentiality of Patient Information. (student)

a) Who will have access to this information?

Data will be shared with members of the thesis committee: Professor C. Cameron, Professor J. Scanlan, Dr. D. Harvey. A statistician may be involved in the data analysis process.

b) Will names of patients or caregivers be identified? (Students)

☐ Yes ☒ No

c) If yes, in what manner will names of patients or caregivers be identified?

Student names will be accessible to the researcher only. All data will be coded to ensure confidentiality. Analysis of data will be global in nature to protect the identity of individual students.

III. **RESOURCE REQUIREMENTS**

The purpose of this section is to identify the involvement of resources in your research/survey/study project.

1. What contacts will be required with staff? (List the staff members whose aid will be required, by title and department, and amount of their time that will be utilized.)

Assistance of department staff will not be required for this study. Access of student records will be gained through the Director of Nursing Education.

2. List hospital supplies and equipment that may be required to carry out the project, ie. photocopying, with estimates of number and expense.

Hospital supplies and equipment will not be required for this study other than access to student educational files.

3. List the space requirements of the researcher.

Use of a designated seminar room will be required for the data collection process.

4. Duration of Project Data collection will be completed within 3 months

Anticipated Start Date May 15, 1990

Ending Date August 15, 1990

***It may take up to two (2) months for approval to be granted.**

IV. **PLANS FOR PUBLICATION**

1. Will research material be published? [x] Yes [ ] No

Indicate where and when, if known Analysis of this data will be included in a thesis document available at Elizabeth Dafoe Library, University of Manitoba. This information may be published at a later date in a nursing journal.

2. Will Hospital be identified in the study? [x] Yes [ ] No

3. Will you submit a copy of the completed project to the Hospital?

[x] Yes [ ] No A presentation of the completed study will be made to the Faculty of Nursing if requested.

(Signature of Applicant)

FOR HOSPITAL USE ONLY (To be completed by the Assistant Executive Director or the Medical Director)

1. In your opinion, is this the type of project with which Hospital should be associated?

[ ] Yes [ ] No

If not, explain

2. Is the subject matter being tested appropriate to our particular organization at this time?

[ ] Yes [ ] No

If not, explain

3. Are the resource estimates realistic? ☐ Yes ☐ No

If not, state your estimates:

a) Number of personnel involved, their departments and time required:

_____

b) Supplies necessary and cost estimates:

_____

_____

c) Space Requirements:

_____

_____

d) Time required for completion of projects:

_____

_____

4. Keeping in mind the above considerations, as well as the implications for confidentiality, plans for publication, and ethical implications, check one of the following:

☐ Approval Granted

☐ Conditional Approval Subject To_____

_____

_____

☐ Approval Denied Because_____

_____

_____

DATE_____ SIGNATURES:

_____
(Assisant Executive Director/
Medical Director)

_____
(Executive Director)

FOR MEDICAL EXECUTIVE:

Date Of Approval _____

Signature _____

Comments Of Department Head(s) affected:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Form #364703
Rev. July, 1987

APPENDIX J

MAB AND AVERAGES 1 AND 2 FOR EACH SUBJECT

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
1	37	44	47	51	44	95	58	48	46	52	43	103	100	80.4	72.3
2	39	52	53	56	48	98	56	48	76	63	59	123	109	70.6	--
3	54	52	60	58	49	107	64	42	65	65	59	121	114	87.4	80.3
4	45	47	45	55	46	94	64	38	39	43	53	93	93	74.4	--
5	60	59	63	59	51	114	58	47	52	47	61	104	110	--	--
6	49	58	66	66	63	121	62	47	45	65	51	109	117	--	--
7	58	59	57	63	52	113	62	49	56	69	65	123	117	--	67.3
8	47	57	51	55	57	105	64	56	55	67	64	123	114	84.0	79.5
9	56	61	63	67	60	120	60	58	--	38	51	92	107	92.6	84.8
10	48	64	71	58	53	119	58	57	58	58	65	124	121	82.0	74.6
11	48	57	62	61	55	111	56	39	40	60	59	101	107	88.4	83.3
12	62	59	54	59	53	115	50	54	56	63	60	117	117	83.4	74.5
13	56	63	51	66	61	120	58	50	51	47	53	104	114	83.2	80.0
14	44	50	32	49	48	90	56	48	28	52	53	95	92	74.0	--
15	50	52	60	54	52	109	73	49	65	62	67	132	120	81.6	79.3
16	43	45	47	56	50	96	56	39	51	49	65	104	100	79.8	73.3
17	54	61	68	56	55	114	48	60	58	58	59	113	115	81.2	74.5

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
18	59	63	60	59	56	115	62	61	65	65	63	129	124	78.6	72.8
19	44	61	62	55	45	104	67	45	60	74	61	125	108	72.0	--
20	63	59	62	60	64	121	60	45	41	71	55	110	117	--	--
21	54	59	57	66	55	112	73	64	66	58	65	133	124	68.2	--
22	43	52	54	53	53	101	46	44	51	60	46	99	99	81.6	--
23	45	58	49	58	53	105	51	44	50	48	41	109	106	83.8	80.8
24	61	61	71	66	62	126	55	61	58	76	61	127	130	74.8	73.8
25	53	58	51	56	49	104	51	46	53	54	53	101	104	--	--
26	61	58	63	66	59	124	51	49	50	54	57	105	116	74.2	--
27	49	59	45	59	68	114	37	53	51	56	54	98	107	85.0	80.3
28	43	54	51	56	53	101	53	42	52	47	51	97	100	80.6	72.8
29	48	54	56	55	49	104	58	44	50	60	61	110	106	79.2	72.0
30	49	47	53	57	50	102	51	58	51	56	63	113	107	69.4	--
31	54	56	57	62	61	113	62	52	45	63	62	114	113	89.2	86.0
32	48	59	51	64	52	107	53	49	57	58	47	104	106	79.8	66.3
33	48	49	50	55	48	99	72	48	57	67	59	123	110	77.8	71.0
34	45	47	33	51	59	96	48	43	46	43	39	89	93	--	--
35	47	52	59	63	55	109	60	42	34	63	45	98	103	81.6	--

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
36	50	50	62	59	53	108	65	55	62	63	63	125	117	80.6	72.5
37	58	63	60	66	53	117	67	63	66	62	69	132	127	--	--
38	51	59	48	60	59	108	58	58	50	58	63	115	112	75.0	67.5
39	47	59	48	59	56	105	53	55	70	65	57	123	114	70.0	--
40	41	49	47	56	48	96	58	44	40	71	55	108	101	83.6	74.5
41	56	61	66	67	61	123	62	49	37	54	63	105	115	82.6	76.8
42	60	54	65	60	60	118	51	52	62	63	67	120	120	85.6	75.5
43	51	52	54	55	50	103	67	60	55	60	64	122	111	--	--
44	62	64	68	67	64	121	80	57	71	65	67	137	133	77.2	--
45	70	60	58	68	73	128	63	54	57	63	55	117	125	92.0	86.8
46	50	56	47	64	62	110	54	48	51	63	37	101	106	77.6	70.5
47	42	44	47	48	46	92	54	37	21	52	35	76	83	75.0	70.0
48	56	59	51	56	49	111	35	46	58	32	57	91	102	78.0	74.5
49	51	56	57	62	53	109	58	49	23	54	55	94	103	--	--
50	54	50	56	48	47	101	51	50	54	56	43	102	101	--	--
51	47	56	55	58	54	107	58	58	62	67	61	121	115	--	--
52	50	58	54	60	59	110	55	60	49	62	57	113	112	82.2	78.0
53	54	61	66	64	51	115	62	53	55	58	53	112	115	73.0	70.8

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
54	50	58	48	66	59	109	53	53	50	51	63	107	109	86.4	81.8
55	59	59	57	59	57	113	64	63	55	62	67	126	120	--	--
56	53	58	45	59	56	110	62	60	68	76	59	135	123	--	--
57	55	63	66	67	60	125	71	53	70	72	65	142	137	81.2	74.5
58	54	57	71	56	58	117	56	56	68	71	67	131	126	77.4	73.0
59	59	59	65	56	53	115	63	52	51	49	55	109	112	81.1	71.0
60	47	56	41	59	53	102	56	50	27	56	47	94	99	88.8	84.3
61	52	61	71	56	52	115	79	48	50	74	61	128	123	81.2	75.0
62	39	47	42	54	44	95	58	47	27	60	44	91	93	83.6	76.8
63	39	52	57	59	41	103	51	60	62	63	64	120	110	81.0	76.3
64	51	58	54	56	53	111	60	47	41	69	47	105	108	82.4	80.0
65	53	64	45	64	51	112	67	50	50	69	47	105	108	82.4	80.0
66	58	52	62	57	65	116	58	45	44	60	51	103	109	90.0	81.8
67	47	47	53	57	45	99	56	44	59	60	49	108	102	83.6	76.3
68	42	54	57	49	46	98	51	53	46	63	42	102	99	85.8	78.5
69	54	40	53	56	55	102	63	52	69	67	67	130	115	--	74.8
70	49	54	56	53	60	107	51	44	43	56	49	88	98	73.4	--
71	61	61	53	61	58	116	56	48	32	60	41	91	104	80.4	76.8

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
72	42	52	48	60	48	102	55	49	46	54	49	102	103	--	--
73	43	49	62	51	53	102	45	47	43	56	57	98	100	78.2	72.5
74	49	56	56	59	58	110	63	48	60	60	43	111	110	86.4	74.0
75	56	49	56	64	58	112	49	42	54	60	51	102	107	83.0	--
76	41	52	50	52	53	98	56	44	43	49	43	92	96	84.0	78.8
77	49	56	57	56	59	104	53	49	43	62	65	108	106	81.2	78.8
78	58	52	47	57	53	105	45	48	49	67	53	105	105	71.8	67.0
79	37	52	51	58	63	103	60	47	48	45	46	99	100	82.8	76.0
80	64	57	54	66	69	122	51	58	24	56	52	96	108	75.4	71.8
81	50	54	65	57	41	106	72	45	51	67	59	119	112	69.6	--
82	56	58	54	62	53	116	64	58	57	65	55	125	120	75.2	70.0
83	49	52	66	56	53	112	60	47	50	69	63	119	115	67.8	--
84	56	59	54	62	58	113	48	50	70	80	65	128	121	79.4	69.8
85	47	50	56	56	52	104	63	47	59	60	57	115	108	76.4	70.8
86	60	57	59	60	51	113	45	58	49	60	65	112	113	80.0	69.0
87	56	56	66	59	62	116	69	44	66	56	42	110	113	86.0	--
88	43	55	37	53	39	94	54	54	43	59	49	103	97	--	--
89	59	59	35	56	54	111	56	50	46	56	47	106	110	--	--

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
90	38	42	50	55	43	94	58	53	62	56	57	115	103	80.0	70.3
91	54	56	40	57	52	103	58	50	44	56	53	105	102	80.8	76.0
92	42	50	47	48	45	93	60	44	39	45	43	91	92	78.8	69.0
93	43	56	48	51	56	100	51	39	40	60	48	95	97	--	--
94	39	50	45	53	46	93	55	46	53	56	50	104	97	78.0	71.5
95	55	57	59	56	56	111	56	52	53	52	57	109	109	69.0	68.5
96	44	59	56	59	51	106	60	48	63	60	41	110	108	78.8	77.5
97	42	45	50	46	45	97	74	40	34	38	47	97	97	73.0	--
98	64	57	54	62	62	117	51	58	68	56	56	116	117	81.0	73.3
99	47	52	60	64	49	107	73	49	51	47	67	115	111	73.4	--
100	58	52	54	62	50	111	78	60	72	83	61	146	132	--	--
101	58	52	57	55	50	107	60	60	54	63	64	121	113	79.4	80.3
102	50	57	53	55	50	112	79	48	70	67	63	137	128	79.2	70.5
103	45	57	56	53	50	111	67	45	60	71	60	129	120	--	81.0
104	45	56	50	53	41	105	47	34	42	56	45	94	101	72.0	67.0
105	53	54	54	63	51	111	53	49	63	65	55	118	114	72.6	--
106	45	57	50	57	45	101	60	47	37	63	49	103	102	82.8	80.5
107	44	47	44	56	45	95	65	48	34	52	53	102	98	69.8	--

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
108	54	54	41	53	54	112	63	53	54	52	51	119	115	86.0	81.3
109	49	47	57	55	53	103	55	55	75	60	67	127	114	70.2	70.5
110	37	52	42	59	47	95	55	41	51	63	52	105	99	74.8	73.0
111	56	56	60	64	55	113	60	57	53	43	55	106	110	--	79.5
112	65	63	71	66	72	130	78	53	62	69	65	132	135	89.0	83.0
113	59	63	51	67	55	114	46	47	51	65	53	108	113	75.2	70.5
114	49	54	68	59	49	121	76	61	74	74	65	150	138	73.4	71.0
115	44	52	56	56	49	108	58	47	47	63	57	115	112	68.4	--
116	42	50	47	60	61	103	51	40	46	41	47	90	97	85.6	76.6
117	48	50	62	53	50	104	45	45	64	63	63	114	108	72.2	--
118	38	56	41	53	44	80	56	36	32	56	47	89	83	75.8	71.8
119	50	58	39	56	51	100	60	55	58	76	65	128	113	71.0	--
120	48	52	50	59	50	103	58	45	55	56	63	112	107	73.6	68.8
121	43	44	53	52	51	107	67	48	44	52	47	110	109	73.0	--
122	46	50	60	61	51	104	62	41	38	56	52	99	101	86.2	77.8
123	62	64	63	68	72	124	60	57	63	32	61	113	124	--	--
124	51	58	63	62	53	116	55	52	65	65	67	127	122	73.2	--
125	55	59	59	57	49	117	63	55	53	60	61	124	121	77.0	--

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
126	45	59	56	61	50	106	60	50	48	63	49	110	108	84.4	74.8
127	48	56	51	58	55	105	55	47	62	56	48	107	105	--	--
128	51	56	54	54	48	103	55	53	56	60	50	110	105	83.2	79.3
129	62	56	68	56	57	117	71	58	37	62	55	113	115	72.6	66.3
130	49	54	56	59	58	116	63	53	54	67	67	129	125	73.8	--
131	50	56	53	57	48	104	63	55	77	56	67	130	117	79.8	72.8
132	47	42	47	59	47	102	49	44	20	45	47	85	93	77.4	73.0
133	49	53	46	50	55	100	31	47	32	56	43	99	100	--	--
134	45	50	56	56	48	102	45	59	62	63	47	112	106	84.4	71.3
135	47	45	53	57	53	101	49	50	59	52	59	109	103	--	70.0
136	58	61	62	61	61	120	51	61	61	67	57	121	122	79.8	74.0
137	56	57	47	48	56	105	58	48	61	63	55	115	109	77.6	72.0
138	48	56	63	55	48	110	64	53	63	62	65	129	118	78.4	70.3
139	45	49	53	60	46	107	60	55	57	52	57	120	114	71.0	--
140	56	59	48	59	63	111	64	53	35	60	48	105	107	81.4	80.3
141	47	47	51	50	47	97	51	50	22	60	50	94	95	71.6	--
142	56	49	51	55	53	103	60	49	47	63	40	103	103	77.6	75.0
143	48	56	50	51	53	102	58	47	44	49	45	97	100	78.6	68.0

SUBJECT	INFORMATION	COMPREHENSION	ARITHMETIC	SIMILARITIES	VOCABULARY	VERBAL IQ	DIGIT SYMBOL	PICTURE COMPLETION	SPATIAL	PICTURE ARRANGEMENT	OBJECT ASSEMBLY	PERFORMANCE IQ	TOTAL IQ	AVERAGE 1	AVERAGE 2
144	47	51	51	56	46	102	55	50	52	62	57	113	107	67.0	--
145	54	42	48	58	46	97	71	50	68	62	61	127	110	--	--
146	55	50	65	60	47	116	76	55	75	89	67	150	136	71.6	66.8
147	48	56	42	46	49	96	53	45	61	56	54	108	100	73.2	69.3

The University of Manitoba

SCHOOL OF NURSING

ETHICAL REVIEW COMMITTEE

Proposal Number N#90/07

Proposal Title: "The Relationship of Pre-admission Psychometric Test Results to the Academic Performance of Diploma Nursing Students."

Name and Title of Researcher(s): Joan Schultz, R.N., B.N.
Graduate Student, Master of Nursing Program
University of Manitoba

Date of Review: April 02, 1990

Decision of Committee: Approved: Apr.23/90 Not Approved: _____

Approved upon receipt of the following changes:

APPROVED with the changes and corrections submitted on April 16, 1990.

Date: April 25th 1990.

Theresa George, RN, PhD Chairperson
Associate Professor
University of Manitoba
Position

NOTE:

Any significant changes in the proposal should be reported to the Chairperson for the Ethical Review Committee's consideration, in advance of implementation of such changes.

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May 8, 1990

Mrs. Joan Schultz
717 Campbell Street
Winnipeg, Manitoba
R3N 1C4

Dear Joan:

I am pleased to report that your request to access student educational records for the purpose of completing your research proposal as part of your Masters of Nursing Program has been granted.

We wish you success in completion of your educational program and wish you all the best!

Yours truly,

Elizabeth Yallowega (Miss)
Asst. Executive Director, Nursing

EY/kl
cc C. Vogt