A CRITICAL INQUIRY INTO THE USE OF THE NURSING APTITUDE TEST BY MONTANA STATE COLLEGE

by

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ABSTRACT

This research was concerned with the analysis of four years of Nursing Aptitude Test scores for the purpose of improving guidance and counseling of prospective nursing students of Montana State College School of Nursing by high school guidance counselors.

Statistical analysis was used to determine if the Nursing Aptitude Test was a good prognosticator of academic achievement and State Board Test Examination scores of the students in the Montana State College School of Nursing.

The statistical analysis disclosed that the Nursing Aptitude Test excluding the interest pattern is a good prognosticator of academic achievement and State Board Test Examination scores of the students in the Montana State College School of Nursing.

A CRITICAL INQUIRY INTO THE USE OF THE NURSING APTITUDE TEST BY MONTANA STATE COLLEGE

CHAPTER I

THE PROBLEM SITUATION

In this day and age the problem of choosing the vocation best suited to a young woman is quite evident. Career and marriage are often combined and need to be considered in choosing a vocation. In this era with the advent of the space age it is becoming more and more important to be science oriented. A person scientifically oriented is believed to be better equipped to meet the demands and stresses of every day life. Nursing is one of the accepted professions for women and one in which the curriculum contains these basic sciences.

It is believed that the best way to maintain society at its utmost is to guide students to use their ability and interest to full capacity. Many professional fields realize this and are putting effort into this endeavor. The nurse educator is also interested in the guiding of students and one of the problems in guidance will be dealt with in this paper.

Nurse educators in this enterprise go out of the physical science realm into the behavioral sciences and have put to good use the allied fields in devising tests to find approximately where the student's ability and interest lie.

DEFINITION OF TERMS

Nursing Aptitude Test: That battery of tests used by Montana State College School of Nursing in evaluating the probable success of high school students in the collegiate nursing program. Only the variables used by the Testing and Counseling Service at Montana State College in evaluating a high school student's aptitude for nursing were included in this study. These variables were:[1]

1. The student's high school scholastic standing. The high school standing is expressed as follows:

upper third----------7
middle third----------5
lower third----------3

2. The Nursing Aptitude Test is composed of:

a.) A scholastic aptitude test: This test consists of the Linguistic (L) part of the 1947 American Council of Education Psychological Examination. The sub-tests of the L section are: Sentence completion, same-opposites and verbal analogies.

b.) A mathematics test: This test consists of two sections at the present time. Before 1956 only the Arithmetic Reasoning section of the 1947 American Council of Education Psychology Examination was used. Since 1956 section two was added; it is designated as an Arithmetic Fundamental test and was constructed by the Testing and Counseling Service at Montana State College to include arithmetic reasoning problems similar to those

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[1] Harlan C. Riese, Social Science Methods, A Proposal. (Unpublished research). pp. 7-8.

encountered by student nurses in the collegiate program.

The probable college freshman achievement score is derived from an average of the scholastic aptitude tests and the mathematics tests scores and high school rank. This average score is expressed in a stanine as are the scores of the scholastic aptitude and mathematics and is as follows:

Above average----------9,8,7
Slightly above average------6
Average----------5
Slightly below average------4
Below average----------3,2,1

c.) The Kuder Preference Record Vocational Form-C: This is an interest preference instrument. Ten broad areas of interest are measured by this inventory: outdoor, mechanical, computational, scientific, persuasive, artistic, literary, musical, social service and clerical. One additional scale, the verification or V scale is included. This scale is not a measure of vocational preference but is a validity measure, intended to identify persons who have responded carelessly or insincerely.

The Kuder Interest Pattern average scores for nurses is expressed in the following assigned numbers:

Very suitable----------7
Suitable----------5
Probable----------3
Questionable----------1

Bachelor of Science Degree: A degree curriculum offers to a student who has had no previous education in nursing, a combined academic and professional education leading to the Bachelor of Science Degree and qualifies the graduate to write state licensure examination. The

graduate is prepared to give professional nursing care to the patients in hospitals, public health agencies, homes, nursing homes and industries.

Diploma Termination Point: A diploma in nursing is earned after twelve quarters of completion of academic and professional education. The granting of the diploma was discontinued after 1959. The graduate is qualified for beginning staff nursing positions.

Associate Degree Termination Point: This termination point occurs after eight quarters of both academic and professional education is completed. The graduate is qualified to write state licensure examination. The Associate Degree has been granted since 1960. The graduate is prepared to give patient-centered care in beginning positions as a general duty nurse.

State Board Test Examinations: They are written examinations that are used by the various states as a basis for granting nurses a license to practice in that state.

Withdrawals: Withdrawals are those students who withdrew from the nursing curriculum other than at a termination point.

Curriculum: Curriculum refers to a combination of courses arranged in sequence by years which constitute a program of study leading to a degree.

Cumulative Grade Point Average: It is computed by dividing the summation of grade points earned by the summation of credits carried.

A----------4 grade points
B----------3 grade points
C----------2 grade points
D----------1 grade point
F----------0 grade point

Cumulative Credits Earned for Graduation.[2]		*Grade Point Average.
Freshman	0-39	1.4
Sophomore	40-89	1.6
Junior	90-139	1.8
Senior	140 or more	2.0

*Minimum standards computed on credits carried.

The criteria above was used to determine at what level the student was in the nursing curriculum.

Montana State College School of Nursing through the Testing and Counseling Service under the direction of Maurice E. Brookhart have selected four sections of the American Council of Education Psychological Examination, combining the three from the linguistic aptitude section and the arithmetic reasoning series from the quanitative aptitude section plus an added arithmetic fundamental test devised by Testing and Counseling to make up a battery of tests (Nursing Aptitude Test) to determine if the student's capabilities lie in the nursing field. This test with minor variations has been used for a number of years.

Although the question of how valid is the Nursing Aptitude Test in predicting academic achievement has been raised time and time again, no complete studies have been done dealing with this issue.

Too often students without any guidance choose a vocation for which they lack the ability but have the interest. This presents another problem as the student who does not succeed in the nursing curriculum returns to her home community disillusioned. The student frequently does

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[2]Montana State College Bulletin (Bozeman: Reporter Printing and Supply, 1960), p.52.

not admit her failure but blames the school of nursing, the profession itself, her high school teachers or her family. The school of nursing incurs a financial loss as well as a prospective professional nurse.[3]

From the results of this study the investigators believed that the high school counselors would gain more insight into the use of the Nursing Aptitude Test as a guidance tool. Although no test is an absolute predictor and much success obtained in using tests depends upon the knowledge of their limitations, test do provide valuable information for the purpose of guidance and counseling. It is for this reason the investigators have attempted to analyze the the validity of the Nursing Aptitude Test given to junior and senior high school students in the various high schools throughout Montana.

REVIEW OF LITERATURE

Frances O. Triggs (1947) has done many studies with the Kuder Preference Record in regard to professional nurses and nursing students.[4] She used her results for the purposes of counseling both nursing students and professional nurses. Dr. Triggs found differences between nurses and other women-in-general as well as differences among nurses in various nursing fields: public health nurses, nurse educators, private duty

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[3]Florrie Erb Burton, "Some Implications of National Pre-Nursing Tests for the Selection of Students for Alabama Hospital Schools of Nursing," Nursing Research. 3:61, October, 1954.

[4]Frances O. Triggs, "The Measured Interests of Nurses," Journal of Educational Research. 41:25-34, September, 1947.

nurses, supervisors, head nurses and general staff nurses. Using this information counselors of nursing students could guide students into the special fields of nursing where they were most likely to succeed. She further stated that with improved nursing education these results would no longer be of value.[5] New studies need to be done to find the profiles of modern professional nurses in various geographical areas.

There has always been a shortage of nurses in this country. There are three problems relating to this shortage. They are: recruitment, selection and preparation. This study deals primarily with the selection problem. Since Montana State College accepts all students who have graduated from a Montana high school, the school of nursing cannot use a battery of tests for the purpose of selection. Montana State College uses this battery of tests for the primary purpose of assisting guidance and counseling in high school. In Montana the Nursing Aptitude Tests were used by sixteen of the nineteen high schools studied by Gayle Holland.[6] She found that pre-nursing students were not receiving optimum testing and guidance because: 1) Almost two-thirds of the respondents desired additional nursing literature and the method of distribution of the nursing literature to interested students varied somewhat. 2) A variety of interest, ability and aptitude tests were administered to students.

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[5]Frances O. Triggs, "The Measured Interests of Nurses: A Second Report," Journal of Educational Research. 42:113-121, October, 1948.

[6]Gayle Holland, A Survey of Testing and Counseling Programs Available to Pre-Nursing Students in Selected Montana High Schools, (Unpublished Master's technical paper, Montana State College, Bozeman). 1960. p. 46.

Those tests which were recommended for Montana by the State Department of Public Instruction were not always administered but comparable tests were used. 3) Approximately two-thirds of the respondents were not full time guidance directors, and felt they definitely did not have adequate time in which to perform the guidance duties.

A study done by Florrie Erb Burton[7] found that students taking National Pre-Nursing Guidance Tests and receiving high scores were students more likely to succeed. Those students with low scores on the Pre-Nursing Guidance Tests were the students likely to withdraw or to be dismissed. Mrs. Burton also found the degree of success on state board examinations was not directly related to the scores on the Pre-Nursing Guidance Tests.

Donna Freshman[8] found in her study of the Miller Knowledge Interest Test (an experimental test devised by Adam W. Miller, Jr.) and the Montana State College Placement Test Battery that using either of these two alone had limited predictive value in distinguishing among academically competent, average and failing nursing students. When the results of these two tests were combined they were an accurate predictor of academic success.

STATEMENT OF THE PROBLEM

The problem of this study was stated as follows: Are the Nursing

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[7]Burton, op. cit. p. 72.

[8]Donna Freshman, The Use of Interest Testing as a Prognosticator of Academic Success in One School of Nursing. (Unpublished Master's technical paper, Montana State College, Bozeman.) 1960. p. 43.

Aptitude Tests administered to high school students of value in predicting academic achievement and state board examination scores of the students in the Montana State College School of Nursing?

PURPOSES

The purposes of the study were:

1. To determine if there is a relationship between the predicted probable freshman college achievement (based on high school rank, mathematic stanine score and linguistic raw score) and interest pattern (based on the Kuder Preference Record Vocational Form-C scores) from the Nursing Aptitude Test and the cumulative freshman grade point average.
2. To determine if there is a relationship between the predicted probable freshman college achievement (based on high school rank, mathematic stanine score and linguistic raw score) and interest pattern (based on the Kuder Preference Record Vocational Form-C scores) from the Nursing Aptitude Test and completion of the requirements for the Associate Degree or Diploma or Bachelor of Science Degree from the School of Nursing at Montana State College and withdrawals from the the School of Nursing at Montana State College.
3. To determine if there is a relationship among the probable freshman college achievement (based on high school rank, mathematic stanine score and linguistic raw score) and interest pattern (based on the Kuder Preference Record Vocational Form-C

score) from the Nursing Aptitude Test, the cumulative grade point average at the end of each year of the nursing curriculum and the average of the state board examinations.

HYPOTHESES

The hypotheses of the study were:

1. There is a positive relationship among the predicted probable freshman college achievement and interest patterns from the Nursing Aptitude Test scores obtained by seniors in high school and the cumulative freshman grade point average, sophomore grade point average, junior grade point average, senior grade point average and the average of state board examination scores.
2. There is a positive relationship between the predicted probable freshman college achievement and interest patterns from the Nursing Aptitude Test scores obtained by juniors in high school and the cumulative freshman grade point average.
3. There is a significant difference between the juniors and seniors as to correlations between the predicted probable freshman college achievement scores and interest pattern based on the Nursing Aptitude Test.
4. The scores of the students who took the Nursing Aptitude Test in their senior year of high school are of more predictive value for the freshman cumulative grade point average than those scores of the students who took the Nursing Aptitude Test in their junior year of high school.

ASSUMPTIONS

The investigators assumed the following for this study:

1. The majority of high school students who participated in the Nursing Aptitude Test program were considering nursing as a possible career.
2. The Nursing Aptitude Test and the state board examination was administered according to established standarized procedures by qualified test administrators.
3. Clerical errors in scoring and recording were negligible as the tests were machine scored and recorded by competent operators for both the Nursing Aptitude Test and the state board examinations.
4. The students met the scholastic requirements of a student at Montana State College and were eligible to take licensure examinations.
5. The grade point average was computed by competent personnel.
6. The high school counselor used the results of the battery of tests to counsel high school students.

LIMITATIONS

The limitations of this study were:

1. The 1954-1955 starting freshman had been given only one mathematic and one linguistic test. The probable freshman college achievement was computed by the average of the high school rank, the mathematic stanine score and linguistic raw score. The

1956-1957 starting freshman had been given two mathematic tests and one linguistic test. The two mathematics scores were treated as one factor. This factor plus the factor of the linguistic test score and the factor of high school rank was computed to form the probable freshman college achievement for this group.

2. The group of students actually entering the school of nursing at Montana State College could have been affected by the test results interpreted by high school counselors.
3. Since the Nursing Aptitude Test is given in Montana high schools to junior and senior students and only to those who volunteered to take the tests, not all students who entered the Montana State College School of Nursing had taken it.
4. The finding could be affected by the number of students used in making the analysis due to the restricted and select group.
5. The investigators of this study recognize that no test is an absolute predictor and that much of the success obtained in using tests depends upon the knowledge of their limitations. Therefore the findings of this study:
   a. Are subject to the limitations inherent in the tests used in the battery.
   b. Can only be valuable in appraising certain prequisites considered necessary for preparation as a nurse, and that personality and desire to become a nurse are important but not measured by the tests in the Nursing Aptitude Test.

OVERVIEW OF REMAINDER OF THE STUDY

The remainder of this study is presented in the subsequent chapters. Chapter II conveys a detailed methodology. Chapter III presents a short summary of the interpretation of the Nursing Aptitude Test currently in effect at Montana State College School of Nursing. The investigator's statistical analysis of the Nursing Aptitude Test appears in Chapter IV. Chapter V presents the summary, conclusions and recommendations.

CHAPTER II

METHODOLOGY

Although the Nursing Aptitude Test has been used by the Testing and Counseling Service and the school of nursing at Montana State College for several years, no research projects have been completed giving evidence of the validity and reliability of this battery of tests. The investigators believed the results from a research project would be benefical both to high school students and high school counselors. Testing and Counseling Service and the school of nursing at Montana State College recommended that for the Nursing Aptitude Test to be used successfully in counseling and guidance of prospective nursing students, an analysis of the results should be done.

This chapter will consist of the selection of the sample and its profound characteristics. The method selected to analyze the data will also be discussed.

The population for this study was a select sample, consisting of only those girls who attended Montana high schools, who presumably were interested in nursing as a career, and who volunteered to take this test during their junior or senior year in high school. There were 1916 students who participated in the Nursing Aptitude testing program during the years of 1954-1957 inclusively. The breakdown of the total students (1916) who participated in the Nursing Aptitude testing program is as follows:

Years	Number of Students
1954	425
1955	476
1956	509
1957	506

Only 5.5 per cent of the 1916 students who took the Nursing Aptitude Test entered the Montana State College School of Nursing during the years of 1954-1957 inclusively. Another limiting factor was that all of these students started college at Montana State College as Autumn quarter freshman during the years 1954-1957 inclusively. Only 36 per cent (108) of the 298 students who entered the Montana State College School of Nursing during 1954-1957 had taken the Nursing Aptitude Test. This small number (108) could affect the findings.

Since thirty students participated in the Nursing Aptitude testing program in their junior year[1] of high school and seventy-eight students participated in the Nursing Aptitude testing program in their senior year[2] of high school, each group was dealt with separately. This division was made because of a marked educational growth occurs during the last two years of high school.[3] If the student had taken the test when both in her junior and senior year of high school, the test scores of the senior

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[1] In the remainder of this study the students who took the test in their junior year will be known as Group I.

[2] In the remainder of this study the students who took the test in their senior year will be known as Group II.

[3] M.E. Brookhart, "Report and Interpretation of Scholastic Achievement and Aptitude Tests," (Montana State College, Testing and Counseling Service, 1960, Unpublished paper).

year were used.

Multiple problems were met in using student records for four consecutive years of starting Autumn quarter freshman nursing students. During these four years, 1954-1957, many changes had taken place in the nursing curriculum. Among these changes was the adoption of the Associate Degree termination point to replace the Diploma termination point. The Associate Degree termination point gives the student the opportunity to complete a suitable portion of nursing education which qualifies her to take the licensure examination and give competent bedside nursing care. Previously a similar goal was accomplished at the Diploma termination point.

The curriculum was also revised so that the completion of the requirements of the Associate Degree was the foundation for the education needed for the Bachelor of Science Degree. The student continues for six more quarters at the Montana State College School of Nursing if she so chooses to complete requirements for the Bachelor of Science Degree.

In 1958, Montana State College instituted a change in computing the grade point average from the three point system to the four point system. The revision is as follows:

Three Point System		Four Point System	
Grade	Grade Points	Grade	Grade Points
A	3	A	4
B	2	B	3
C	1	C	2
D	0	D	1
F	0 credits not counted	F	0 credits counted

The student enrolled in college at the time of the revision had the prerogative of remaining in the original grading system, which three of the students in this study did. For the purpose of this study, these three students' grade point averages' were converted to the four point grading system.

The students also had to meet the requirements of grade point average and credits of the college to move on to the following sequence of courses. (See definitions page 5.)

The State Board Test Examination scores were averaged for this study. Since the State Board Test Examination evaluates five special fields of knowledge in nursing[4], the investigators believed an average score would facilitate a more accurate comparision with the cumulative grade point average, which is a summary of the students total academic achievement. A student is eligible to take the State Board Test Examination at various levels of termination points. There may be a difference in the average of the scores due to the time interval between these termination points. This was recognized but was not dealt with in this study. The reason for withdrawal was not dealt with in this study.

The basic raw data used in this study was assembled from several sources. Nursing Aptitude Test results were obtained from the files of the Testing and Counseling Service at Montana State College. The grade point average and State Board Test Examination scores were obtained

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[4] The special fields of knowledge in nursing are: medical nursing, surgical nursing, obstetrical nursing, nursing of children and psychiatric nursing.

from the individual's cumulative records maintained by the Montana State College School of Nursing. For the collection of this data the tool was a revision of the Basic Data Consolidation Form originated by Harlan C. Reise. (See Appendix p. 44.)

After consulting subject-matter specialists in the fields of Testing and Counseling, Psychology, and Mathematics, statistical methods were decided on for the analysis of the data. The statistical method was chosen to show the relationship among the Nursing Aptitude Test results, cumulative grade point average, the average score of State Board Test Examination for Group II. For Group I the statistical method was computed between the Nursing Aptitude Test results and the cumulative freshman grade point average. It was felt the group became too small beyond the freshman year to yield any significant results.

The Nursing Aptitude Test variables were the linguistic raw score[5], mathematic stanine score[6], and interest pattern average score. High school rank which placed the student into the upper, middle or lower third of her graduating high school class was also used. The State Board Test Examination scores were stated in standard score form.[7]

Because of the many variables, two methods of correlation were used. The statistical method used between the variables was the coeffi-

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[5]A raw score is the first quantitive result obtained in scoring a test.

[6]A stanine score is a unit that divides the norm population into nine groups.

[7]The mean of the State Board Test Examination scores is 500 and the standard deviation is 100.

cient of correlation. The multiple correlation was used for the comparison of the linguistic raw score, mathematic stanine score and high school rank with the cumulative grade point average at the end of the freshman, sophomore, junior and senior year of college and the State Board Test Examination average score. This was done to determine the predictive value of the independent variables acting together. The t-test was used to show the relationship of students who withdrew and students who completed requirements for the Associate Degree, Diploma or Bachelor of Science Degree.

CHAPTER III

INTERPRETATION OF THE CURRENTLY USED MONTANA STATE COLLEGE NURSING APTITUDE TEST

One of the most common methods of discovering where the student's main interest and abilities lie is through the use of psychological testing. It must be remembered, however, that there are other methods that can be used in guiding students.

Super[1] states that psychological tests information concerning the general intelligence of an individual, his interests and his abilities must be known before proper educational-vocation guidance may occur. He cautions, however, that users in educational-vocational guidance frequently fail to take into account the specific validity of the tests used.

As shown in Gayle Holland's study[2], not all of the high schools in Montana had a full or part time guidance and counseling program. In view of this pertinent fact Montana State College School of Nursing through Testing and Counseling Service designed a series of tests (Nursing Aptitude Test) to:[3]

1. Assist high school students, especially girls, in an evaluation of their aptitudes for the professional career in nursing; and

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[1] Donald E. Super, Appraising Vocational Fitness. (Harper and Brothers, New York, 1949.) p. 1.

[2] Gayle Holland, A Survey of Testing and Counseling Programs Available to Pre-Nursing Students in Selected Montana High Schools, (Unpublished Master's technical paper, Montana State College, Bozeman). 1960. p. 43.

[3] Harlan C. Reise, Social Science Methods, A Proposal, (Unpublished Research). p. 2.

2. Encourage those who apparently have the aptitude, interest and abilities to enter the collegiate nursing program.

The Testing and Counseling Department has done extensive study in the area of interpreting the results of the Nursing Aptitude Test. A short summary of their findings is as follows:[4] Aptitude for college level training programs in nursing is determined by several factors. The best single factor for predicting scholastic success in college is the students' high school grade average. The next best predictive factors are scores attained on scholastic aptitude and achievement tests. Probable college freshman achievement in the Montana State College School of Nursing is evaluated on the basis of these factors. Many students whose scores are low can, with diligent study, improve their standing markedly by next year. The chart (page 23) only indicates where the student is at present and not where she will be in the future. Mathematic test results are interpreted as: Freshman students scoring "5" or above on the mathematics test usually can achieve C's, B's or A's in their first quarter of college chemistry. Students scoring "4" or less may be required to take additional mathematics prior to taking chemistry.....
The Kuder Preference Record is interpreted as:

1. The results of the Kuder Preference Record for each student have been plotted on a profile sheet which compares her interest pattern with that of a group of student nurses in Montana and

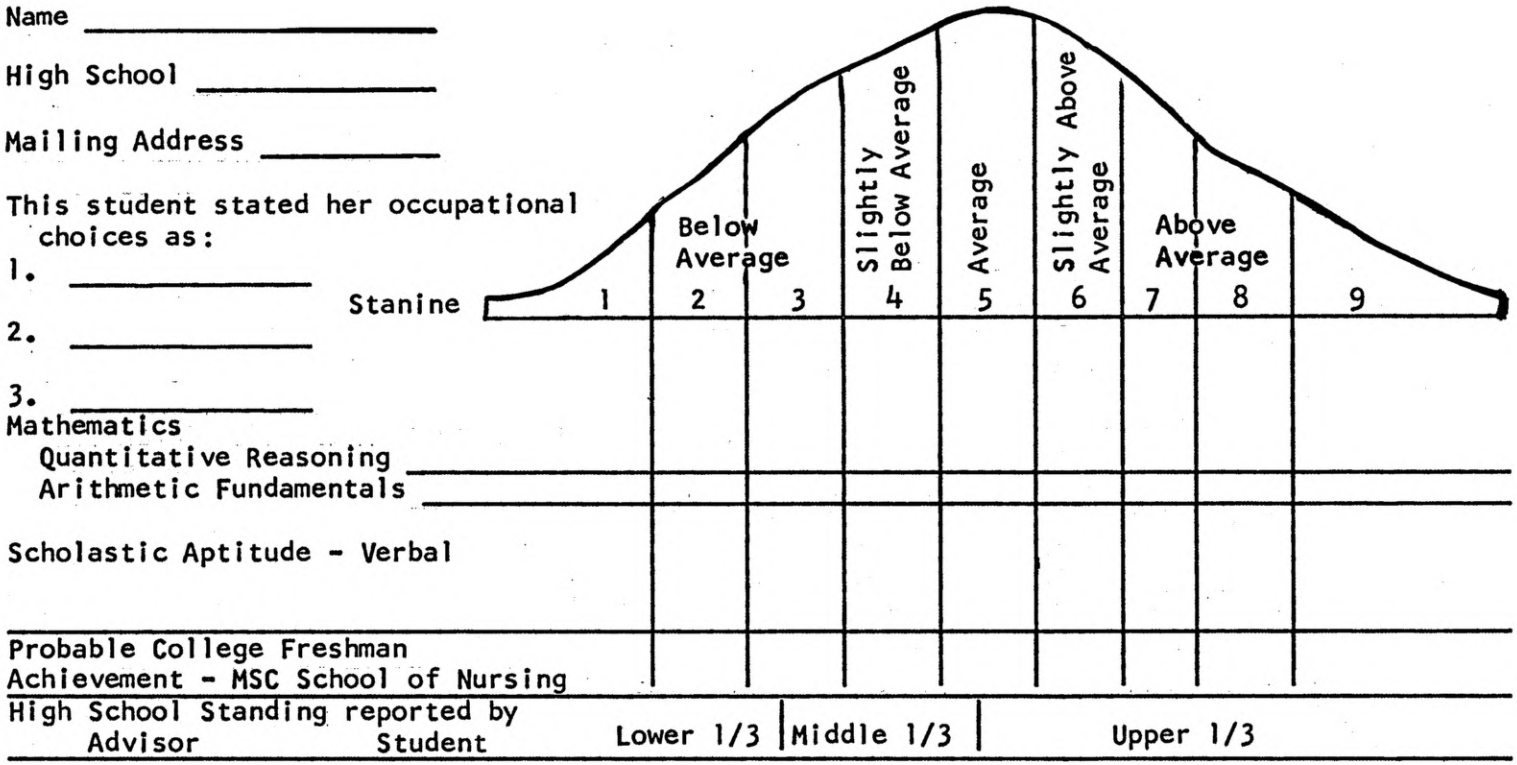
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[4]Nursing Aptitude Test Results as outlined by Testing and Counseling Service, Montana State College. (unpublished paper).

a group of student nurses and Registered nurses in Texas. Research indicates that these groups are very similar with respect to mean scores and standard deviation.

2. The high Outdoor preference of student nurses is not only a part of Montana culture but also a preference for activity which is found among all nurses. Some natural science interest is often indicated by an above average score in the Outdoor area.
3. Among eighty-three student nurses tested in Montana, in 1956, only one had a high score pattern (above Kuder's 75 per centile line) in Art, Music and Literary; only one in Art and Literary; two in Literary and Music; three in Music and Art; and only one had high scores in Clerical and Computational.
4. Only four of the eighty-three student nurses had a Social Service below Kuder's 50 per centile.
5. A high Science preference is indicated among the majority of student nurses and R.N.'s.
6. A majority of the student nurses and R.N.'s disliked Clerical.

To enable the reader to understand the method in which the Nursing Aptitude Test results are interpreted, a copy of the same appears on page 23.



Measured Interest Pattern appears to be:

_____ Very suitable for nursing
_____ Suitable for nursing
_____ Probably suitable for nursing
_____ Such that suitability for nursing is questionable. Student should be encouraged to explore, with her advisor, other possible objectives.

FIGURE I

NURSING APTITUDE TEST RESULTS, AUTUMN 1961

CHAPTER IV

ANALYSIS OF THE DATA

The importance of the use of the Nursing Aptitude Test in the guidance and counseling of young women in nursing has been discussed in the preceding chapters. Through statistical analysis of the validity and reliability of the Nursing Aptitude Test it was hoped this would benefit both student and faculty in the guidance and counseling the student in the field of nursing. In the investigators opinion if guidance and counseling were improved through predicted information students with abilities and interest would enter a collegiate school of nursing and the standards of professional nursing could be raised. Those likely to be unable to meet the requirements of the nursing curriculum would not need to experience failure in order to realize that they are not suited for a collegiate nursing program.

The data was dealt with in two separate groups: Group I (those thirty students who took the test in their junior year of high school) and Group II (those seventy-eight students who took the test in their senior year of high school).

To determine if there was a relationship between the variable of linguistic raw score, mathematic stanine score, high school rank, cumulative grade point average, probable freshman college achievement stanine score, Kuder interest pattern score and State Board Test Examination average score a coefficient of correlation was computed using the formula:

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{N\Sigma x^2 - (\Sigma x^2)} \quad \sqrt{N\Sigma y^2 - (\Sigma y^2)}}$$

To determine if the variables of the Nursing Aptitude Test as a group had a relationship with cumulative grade point average, multiple correlation was computed using the formula:

$$R_{123} = \sqrt{\frac{r_{12}^2 + r_{13}^2 - 2r_{12}\, r_{13}\, r_{23}}{1 - r_{23}^2}}$$

The standard error of correlation was computed.

> When a result is obtained which is very unlikely to have arised by chance it is said that the result is statistically significant. By this it is meant that it would be rather fantastic to ascribe it to chance, that the difference must in all common sense, be accepted as a real difference. Since the judgement is based on probability, falling short of absolute certainty, the degree of confidence in reality of the difference is indicated by describing it as 'Probably Significant' or 'Significant' or 'Highly Significant'. Thus a result that would only arise in one trial in twenty on the basis of pure chance would be described as 'Probably Significant' (p=.05). A result that would arise on the basis of pure chance only once in a hundred trials would be described as 'Significant' (p=.01). A result that would arise by chance only once in a thousand trials should be described as 'Highly Significant' (p=.001).[1]

The criterion used for the analysis of the data is as follows:

Group II	Number of Students	Level of Significance 1%	5%
Freshman	78	.283	.217
Sophomore	62	.325	.250
Junior	51	.354	.273
Senior	34	.449	.349
State Board Test Examination average score	52	.354	.273

[1] M.J. Moroney, Facts From Figures. (London: William Clowes and Sons, 1958). p. 218.

Group I	Number of Students	Level of Significance 1%	5%
Freshman	30	.478	.374

It should be borne in mind that these correlations apply equally whether the correlation coefficient is negative or positive.

In analysis of this data it must be retained in mind the limited sample (108) investigated. Only those correlations which were at the 1% .1% or 5% level of significance are discussed in this analysis.

According to the statistical analysis of Group II, Table I indicates there is a positive relationship at the 1% level of significance between freshman grade point average and the following variables:

High school rank (.64)
Linguistic raw score (.47)
Mathematic stanine score (.50)
Probable freshman college achievement stanine score (.64)

There is also a positive relationship at the 1% level of significance between sophomore grade point average and the following variables:

High school rank (.56)
Linguistic raw score (.46)
Mathematic stanine score (.47)
Probable freshman college achievement stanine score (.64)

A positive relationship at the 1% level is indicated between junior grade point average and the following variables:

High school rank (.42)
Probable freshman college achievement stanine score (.48)

A positive relationship at the 5% level is indicated between

junior grade point average and the following variables:

Linguistic raw score (.34)
Mathematic stanine score (.34)

A positive relationship at the 1% level of significance was found between the senior grade point average and the probable freshman college achievement stanine score (.45). A positive relationship at the 5% level of significance between the senior grade point average and high school rank (.39) was indicated.

A positive relationship at the 1% level of significance was indicated between the State Board Test Examination average score and the following variables:

High school rank (.36)
Linguistic raw score (.54)
Mathematic stanine score (.37)
Probable freshman college achievement stanine score (.55)

Interestingly enough the correlation of the variables with the Kuder interest pattern scores of all four years showed no significance.

The statistical analysis for Group I, Table II indicates that a positive correlation at the 5% level of significance exists between freshman grade point average and high school rank. No other statistical significance was found for Group I.

A correlation between freshman cumulative grade point average and sophomore, junior and senior year cumulative grade point average and State Board Test Examination average score was computed. As indicated on Table III a 1% level of significance was found between the freshman grade point average and the following variables:

Sophomore grade point average (.95)
Junior grade point average (.89)
Senior grade point average (.84)
State Board Test Examination (.59)
average score

A multiple correlation (R) was computed between the variables of high school rank, linguistic raw score and mathematic stanine score and cumulative grade point average at the end of the freshman, sophomore, junior and senior year and State Board Test Examination average scores. The level of significance computed for the multiple R is as follows:

	Number of Students	Level of Significance[2]	
Group II		1%	5%
Freshman	78	.386	.324
Sophomore	62	.414	.348
Junior	51	.470	.397
Senior	34	.558	.476
State Board Test Examination average score	52	.470	.397
Group I			
Freshman	30	.590	.506

As indicated by Table IV a 1% level of significance was established between the multiple R and freshman grade point average, sophomore grade point average, junior grade point average and State Board Test Examination average score. A 5% level of significance was indicated between the multiple R and senior grade point average.

A t-test was used to show the relationship of students who withdrew from the nursing curriculum and the students who terminated at the

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[2]See Appendix page 45 for standard error of multiple correlation and confidence level.

Associate Degreem Diploma or Bachelor of Science Degree point. The t-test was used to determine if the results obtained were due to factual evidence or due to pure chance.[3]

The formula used to determine this was: $\frac{m_1 - m_2}{\sigma \text{ difference}}$

With the comparison of the withdrawal and the Associate Degree termination point with the variables: high school rank, linguistic raw score, mathematic stanine score, probable freshman college achievement stanine score and freshman cumulative grade point average it was found that the high school rank and freshman cumulative grade point average were at the 1% significant level. The linguistic raw score and the mathematic stanine score were at the 5% significant level. (See Table VI).

The Diploma and Bachelor of Science Degree termination points were compared in the same manner. The mathematic stanine score was at the .1% significant level. The probable freshman college achievement stanine score was at the 1% significant level. (See Table VI).

The withdrawals and Bachelor of Science Degree termination points were also compared for level of significance. The high school rank and probable freshman college achievement were at the .1% significant level. The mathematic stanine score and linguistic raw score were at the 1% significant level. (See Table VI).

With the comparison of the Associate Degree and Bachelor of Science

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[3]See explanation on page 25 for statistical definition of significance.

Degree termination points with the variables the freshman cumulative grade point average was at the .1% significant level. (See Table VI).

TABLE I

CORRELATION OF SCORES OF NURSING APTITUDE TESTS WITH CUMULATIVE FRESHMAN, SOPHOMORE, JUNIOR AND SENIOR GRADE POINT AVERAGE AND STATE BOARD TEST EXAMINATION AVERAGE SCORE FOR GROUP II

	Number of Students	High School Rank	Linguistic Raw Score	Mathematic Stanine Score	Probable Freshman College Achievement	Interest Pattern
Freshman Cumulative Grade Point Average	78	.64	.47	.50	.64	-.03
Sophomore Cumulative Grade Point Average	62	.56	.46	.47	.65	.17
Junior Cumulative Grade Point Average	51	.42	.34	.34	.48	.18
Senior Cumulative Grade Point Average	34	.39	.24	.28	.45	.12
State Board Test Examination Average Score	52	.36	.54	.37	.55	.07

TABLE II

CORRELATION OF SCORES OF NURSING APTITUDE TESTS
WITH CUMULATIVE FRESHMAN GRADE
POINT AVERAGE FOR GROUP I

	Number of Students	High School Rank	Linguistic Raw Score	Mathematic Stanine Score	Probable Freshman College Achievement	Interest Pattern
Freshman Cumulative Grade Point Average	30	.37	.22	.28	.34	.005

TABLE III

CORRELATION OF FRESHMAN CUMULATIVE GRADE POINT AVERAGE WITH SOPHOMORE, JUNIOR AND SENIOR CUMULATIVE GRADE POINT AVERAGE AND STATE BOARD TEST EXAMINATION AVERAGE SCORE FOR GROUP II

	Freshman Cumulative Grade Point Average
Sophomore Cumulative Grade Point Average	.95
Junior Cumulative Grade Point Average	.89
Senior Cumulative Grade Point Average	.84
State Board Test Examination Average Score	.59

TABLE IV

MULTIPLE CORRELATION OF SCORES OF NURSING APTITUDE TESTS WITH CUMULATIVE FRESHMAN, SOPHOMORE, JUNIOR AND SENIOR GRADE POINT AVERAGE AND STATE BOARD TEST EXAMINATION AVERAGE SCORES FOR GROUP II

	MULTIPLE R*
Freshman Cumulative Grade Point Average	.70
Sophomore Cumulative Grade Point Average	.64
Junior Cumulative Grade Point Average	.52
Senior Cumulative Grade Point Average	.43
State Board Test Examination Average Score	.61

*Multiple R contains variables of high school rank, linguistic raw score and mathematic stanine score.

TABLE V

MULTIPLE CORRELATION OF SCORES OF NURSING APTITUDE TESTS WITH CUMULATIVE FRESHMAN GRADE POINT AVERAGE FOR GROUP I

	MULTIPLE R*
Freshman Cumulative Grade Point Average	.40

*Multiple R contains variables of high school rank, linguistic raw score and mathematic stanine score.

TABLE VI

LEVELS OF SIGNIFICANCE AMONG WITHDRAWAL FROM NURSING CURRICULUM AND STUDENTS WHO COMPLETED ASSOCIATE DEGREE, DIPLOMA OR BACHELOR OF SCIENCE DEGREE TERMINATION POINT

		WITH-DRAWALS	A. D.		DIPLOMA	B.S. DEGREE		WITH-DRAWALS	B.S. DEGREE		A. D.	B.S. DEGREE	
	Number	26	13		10	29		26	29		13	29	
HIGH SCHOOL RANK	Mean	5.46	6.23	b	5.80	6.66		5.46	6.66		6.23	6.66	
	S. D.*	1.278	.973		1.33	.756		1.278	.756		.973	.756	
LINQUISTIC RAW SCORE	Mean	54.23	61.69	a	57.5	64.2		54.23	64.2	b	61.69	64.2	
	S. D.	14.57	16.05		11.87	13.3		14.57	13.3		16.05	13.3	
MATHEMATIC STANINE SCORE	Mean	3.88	5.38	a	3.60	5.86		3.88	5.86	b	5.38	5.86	
	S. D.	2.03	1.78		1.02	1.91	c	2.03	1.91		1.78	1.91	
PROBABLE FRESHMAN COLLEGE ACHIEVEMENT	Mean	4.27	5.23		4.70	5.896	b	4.27	5.896	c	5.23	5.896	
	S. D.	1.63	1.31		.90	1.21		1.63	1.21		1.31	1.21	
INTEREST PATTERN	Mean	4.92	5.30		5.00	4.86		4.92	4.86		5.30	4.86	
	S. D.	1.96	1.73		2.00	1.96		1.96	1.96		1.73	1.96	
FRESHMAN CUMULATIVE GRADE POINT AVERAGE	Mean	1.565	2.293	b	2.609	2.561		1.565	2.561		2.293	2.561	c
	S. D.	1.105	.656		.425	.690		1.105	.690		.656	.690	

Level of significance a = 5%, b = 1%, c = .1%

* Standard Deviation

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The primary objective of this study was to determine if the Nursing Aptitude Tests administered to high school students are of any value in predicting academic achievement and state board examination scores of the students in the Montana State College School of Nursing.

The purposes of this study were:

1. To determine if there is a relationship between the predicted probable freshman college achievement and interest pattern from the Nursing Aptitude Test and the cumulative freshman grade point average.
2. To determine if there is a relationship between the predicted probable freshman college achievement and interest pattern from the Nursing Aptitude Test and completion of requirements for the Associate Degree or Diploma, or Bachelor of Science Degree from the School of Nursing at Montana State College.
3. To determine if there is a relationship among the probable freshman college achievement and interest pattern from the Nursing Aptitude Test, the cumulative grade point average at the end of each year of the nursing curriculum and the average of the state board examinations.

Data was collected from the files of Testing and Counseling and the individual's cumulative records maintained by Montana State College

School of Nursing. The data was divided into two groups: Group I, those thirty students who took the Nursing Aptitude Test in their junior year of high school and Group II, those seventy-eight students who took the Nursing Aptitude Test in their senior year of high school.

The analysis of the data was computed by statistical methods. The coefficient of correlation was computed between the variables of the Nursing Aptitude Test scores (high school rank, linguistic raw score, mathematic stanine score, probable freshman college achievement stanine score and interest pattern) and cumulative grade point average of students at the end of their freshman, sophomore, junior and senior year and their State Board Test Examination average scores. Due to the small number of students who took the Nursing Aptitude Test in their junior year of high school and entered Montana State College School of Nursing, a coefficient of correlation was computed for the freshman cumulative grade point average only.

A multiple correlation was computed for the comparison of linguistic raw score, high school rank, mathematic stanine score with the cumulative grade point average at the end of the freshman, sophomore, junior and senior year of college and State Board Test Examination average scores.

A t-test was used to determine the relationship of the students who withdrew from the nursing curriculum at Montana State College and students who completed the requirements for the Associate Degree, Diploma or Bachelor of Science Degree at Montana State College.

In summary, the statistical analysis indicated there was a positive relationship among the predicted probable freshman college achievement

stanine score obtained from the Nursing Aptitude Test by Group II and cumulative freshman grade point average, sophomore grade point average, junior grade point average and senior grade point average and the average score of the state board examinations.

The coefficient of correlation did not show any significant relationship between the interest pattern from the Nursing Aptitude Test scores obtained by Group I or Group II.

Group I did not show any significant relationship between freshman cumulative grade point average and probable freshman college achievement.

There is a definite difference between the Nursing Aptitude Test scores of Group II and Group I (excluding the interest pattern) in predictive value. The variables of the Nursing Aptitude Test and freshman cumulative grade point average of Group II are at the 1% level of significance. The high school rank and freshman cumulative grade point average of Group I is at the 5% level of significance. The remaining variables of the Nursing Aptitude Test and the freshman cumulative grade point average of Group I had no statistical significance.

The t-test for Group II appears to indicate there is a positive relationship between the high school rank and the freshman cumulative grade point average received by students withdrawing from the nursing curriculum at Montana State College and those students who completed the requirements for an Associate Degree.

It also appears to indicate a positive relationship between the mathematic stanine score and the probable freshman college achievement

stanine score of the Diploma students and of the Bachelor of Science Degree students.

A positive relationship between high school rank, linguistic raw score, mathematic stanine score and probable freshman college achievement stanine score for the withdrawal and for the degree students was also revealed. A positive relationship was also found between the freshman cumulative grade point averages of the Associate Degree student and that of the Bachelor of Science Degree student.

Interestingly enough the interest pattern did not seem to show any significance in any comparison of the four groups of students.

CONCLUSIONS

Although the interest pattern appears to have no value in predicting academic achievement or the scores received in State Board Test Examination, the primary conclusion of this study indicates that the Nursing Aptitude Test is a good prognosticator of academic achievement and state board examination scores of the students in the Montana State College School of Nursing. When the Nursing Aptitude Test is taken in the senior year of high school the tests seem to have more predictive value.

The factors that seem to indicate this are: 1) a positive correlation of scores excluding the interest pattern existed with the cumulative freshman grade point average and the sophomore cumulative grade point average; 2) a positive correlation of high school rank and probable freshman college achievement stanine score existed with junior grade

point average; 3) a positive correlation of the probable freshman achieve- stanine score existed with the senior cumulative grade point average; 4) a positive correlation of Nursing Aptitude Test scores, excluding the interest pattern, existed with State Board Test Examination average scores.

In making these conclusions the investigators have used the 1% level of significance in predictive value.

In the analysis made, the interest pattern did not show any relationship in predicting academic achievement or State Board Test Examination scores.

The investigators feel the high school rank and probable freshman college achievement score should be considered carefully when counseling a student. Also the freshman grade point average should be considered before the student enters her sophomore year of nursing education.

RECOMMENDATIONS

As far as can be determined no follow-up research projects had been done of this battery of tests. It was believed that the Nursing Aptitude Test could be a more precise tool in guiding and counseling the prospective professional nurse, not only to the student herself but to the high school and/or college counselor as well if the battery of tests could be determined to be valid and reliable.

After completing this analysis the investigators would recommend the following research studies to be made.

1. In the analysis of the Nursing Aptitude Test the investigators believe that there should be a critical inquiry into the validity of the

Kuder Preference Record in predicting academic achievement.

2. A follow-up study is recommended for those students who were scored as "questionable" or "probably suitable" for nursing on the interest pattern and completed one of the termination points at Montana State College School of Nursing to see if their interest pattern has changed.

3. The investigators feel that a further research should be done to determine if there is a comparison of the results found in this study with transfer students who had taken the Nursing Aptitude Test in a Montana high school.

4. A recommendation is advocated for a study to determine if there is a difference in the State Board Test Examination scores at the Associate Degree and Bachelor of Science Degree level with the aptitude scores and high school rank held constant.

5. The investigators recommend that within the next four to five years this critical inquiry be repeated to disclose that by using a larger number of students the statistical significance would be changed.

6. The investigators recommend the starting freshman at Montana State College School of Nursing beginning Fall of 1962 be given the Kuder Preference Record Vocational Form-C along with the Montana State College Placement Test Battery which is given yearly to all Montana State College freshman to determine if these two tests predict academic achievement.

7. The investigators recommend a study be done to compare the 64% of the students who did not take the Nursing Aptitude Test with those 36% who took the Nursing Aptitude Test between the years of 1954-1957.

APPENDIX

BASIC DATA CONSOLIDATION FORM

Name

Home Address

Date entered Date Graduated

	Upper 7	Middle 5	Lower 3
High School Rank			

	Junior	Senior
Year Taken When In High School		

Degree		A.D.		Withdrawal	

N. A. T. Scores

Scholastic Aptitude Test		
	Raw	Stanine
Linguistic or Verbal Scores		

Mathematics		
	Raw	Stanine
Quanitative or Arith Reasoning Scores		
Arith. Fundamentals Scores		

	Kuder	Percentile
	V	
0	Outdoor	
1	Mech.	
2	Computational	
3	Scientific	
4	Persuasive	
5	Artistic	
6	Literary	
7	Musical	
8	Social Service	
9	Clerical	

Probable Freshman College Achievement	
Stanine	

Interest Pattern	
Very Suitable	
Suitable	
Probable	
Questionable	

Grade Point Average	
Year	
Freshman	
Sophomore	
Junior	
Senior	

State Board Exam Scores	
Medical Nursing	
Surgical Nursing	
Obstetrical Nursing	
Nursing of Children	
Psychiatric Nursing	

CONFIDENCE LEVEL AND STANDARD ERROR OF
MULTIPLE CORRELATION FOR
GROUPS I AND II

	Multiple R	σ_{1234}	σ_R
GROUP I			
Freshman Cumulative Grade Point Average	.40	.852	.165
GROUP II			
Freshman Cumulative Grade Point Average	.70	.677	.060
Sophomore Cumulative Grade Point Average	.69	.548	.069
Junior Cumulative Grade Point Average	.52	.435	.106
Senior Cumulative Grade Point Average	.43	.851	.149
State Board Test Examination Average Score	.61	63.746	.091

MEAN AND STANDARD DEVIATION FOR GROUP I *

	Mean	Standard Deviation
High School Rank	6.333	1.075
Linguistic Raw Score	55.9	14.770
Mathematic Stanine Score	4.167	1.985
Probable Freshman College Achievement	4.567	1.783
Interest Pattern	5.467	1.910
Freshman Cumulative Grade Point Average	2.169	.929

*Number of students=30

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