The Relationship Between Muscular Strength and Predicted Academic Success Among Selected College Freshmen Male Students at South Dakota State University

Dwain S. Guelle

Follow this and additional works at: https://openprairie.sdstate.edu/etd

Recommended Citation
Guelle, Dwain S., "The Relationship Between Muscular Strength and Predicted Academic Success Among Selected College Freshmen Male Students at South Dakota State University" (1964). Electronic Theses and Dissertations. 2991.
https://openprairie.sdstate.edu/etd/2991
THE RELATIONSHIP BETWEEN MUSCULAR STRENGTH AND
PREDICTED ACADEMIC SUCCESS AMONG SELECTED
COLLEGE FRESHMEN MALE STUDENTS AT
SOUTH DAKOTA STATE UNIVERSITY

BY

IWAIN D. GUDELLE

A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
Physical Education, South Dakota
State University
1964
THE RELATIONSHIP BETWEEN MUSCULAR STRENGTH AND
PREDICTED ACADEMIC SUCCESS AMONG SELECTED
COLLEGE FRESHMEN MALE STUDENTS AT
SOUTH DAKOTA STATE UNIVERSITY

This thesis is approved as a creditable and independent
investigation by a candidate for the degree, Master of Science, and
is acceptable as meeting the thesis requirements for this degree,
but without implying that the conclusions reached by the candidate
are necessarily the conclusions of the major department.

Thesis Adviser

Date

Head, Physical Education Department

Date
ACKNOWLEDGEMENTS

The author wishes to express his profound appreciation to his adviser, Professor Glenn E. Robinson for his sound suggestions, patience, and guidance.

Expressions of appreciation are also due the persons who assisted in the administering of the tests, and to the students in the basic instruction program of physical education at South Dakota State University.

DDG
THE RELATIONSHIP BETWEEN MUSCULAR STRENGTH AND
PREDICTED ACADEMIC SUCCESS AMONG SELECTED
COLLEGE FRESHMEN MALE STUDENTS AT
SOUTH DAKOTA STATE UNIVERSITY

Abstract

IMAIN D. GUELLE

Under the supervision of Associate Professor Glenn E. Robinson

The purpose of this investigation was to determine the relationship between muscular strength and predicted academic success of selected freshmen male college students at South Dakota State University. The muscular strength test used was taken from the cable-tension battery and the predicted academic success factor was represented by the American College Test composite score.

The following procedures were employed in the study. Thirty freshmen male college students were randomly selected according to their American College Test composite score. All athletes and students in strenuous classes of physical education had been previously eliminated. The subjects were then given a four test battery of cable-tension strength tests to determine muscular strength. A linear and multiple correlation was computed by an electric computer.

As a result of the findings obtained during this investigation, the following conclusions appear warranted:

1. The relationship between muscular strength and predicted academic success as determined by this investigation showed only a slight relationship.
2. The sample of subjects was not sufficient.

3. A further investigation should be conducted using all freshmen and not eliminating athletes and those in strenuous physical education classes.
# Table of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I</strong></td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Need for the Study</td>
<td>1</td>
</tr>
<tr>
<td>Statement of Problem</td>
<td>5</td>
</tr>
<tr>
<td>Limitations of Study</td>
<td>5</td>
</tr>
<tr>
<td>Assumption</td>
<td>6</td>
</tr>
<tr>
<td><strong>II</strong></td>
<td></td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>7</td>
</tr>
<tr>
<td><strong>III</strong></td>
<td></td>
</tr>
<tr>
<td>PROCEDURE FOR OBTAINING DATA</td>
<td>13</td>
</tr>
<tr>
<td>Introduction</td>
<td>13</td>
</tr>
<tr>
<td>Selection of Predicted Academic Success Test</td>
<td>13</td>
</tr>
<tr>
<td>Selection of Strength Test</td>
<td>14</td>
</tr>
<tr>
<td>Source of Data</td>
<td>15</td>
</tr>
<tr>
<td><strong>IV</strong></td>
<td></td>
</tr>
<tr>
<td>TREATMENT AND ANALYSIS OF DATA</td>
<td>24</td>
</tr>
<tr>
<td>Reliability of Data</td>
<td>24</td>
</tr>
<tr>
<td>Analysis of Data</td>
<td>25</td>
</tr>
<tr>
<td>Summary of Findings</td>
<td>25</td>
</tr>
<tr>
<td><strong>V</strong></td>
<td></td>
</tr>
<tr>
<td>SUMMARY</td>
<td>27</td>
</tr>
<tr>
<td>Problem</td>
<td>27</td>
</tr>
<tr>
<td>Data</td>
<td>27</td>
</tr>
<tr>
<td>Findings</td>
<td>27</td>
</tr>
<tr>
<td>Conclusions and Recommendations</td>
<td>28</td>
</tr>
<tr>
<td>REFERENCES CITED</td>
<td>29</td>
</tr>
<tr>
<td>APPENDIX A: Test Scores</td>
<td>31</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>I</td>
<td>Trunk Extension</td>
</tr>
<tr>
<td>II</td>
<td>Knee Extension</td>
</tr>
<tr>
<td>III</td>
<td>Shoulder Extension</td>
</tr>
<tr>
<td>IV</td>
<td>Ankle Plantar Flexion</td>
</tr>
</tbody>
</table>
Chapter I

INTRODUCTION

The strong man has been exalted since the beginning of the human race. Feats of strength have been recorded in pictures, legends, and prehistoric drawings scratched on the walls of caves, telling how early man survived by his strength, his agility, and his courage.

Today the strong man is still a hero in almost every country. Tales told by the old recounting astounding stories of deeds of strength and valor are told to the young. These stories depict the strong man as not merely being strong but as an intelligent man and keen as a fox. Although the stories may not be completely true, they do show man's undying admiration of strength, agility, and courage.¹

¹Theodor Hettinger and Others, Physiology of Strength, p. 3.

Davis² vividly points out that "the great ideas are the composite intellectual realizations, the most profound intelligence of mankind ... mind, body and spirit in supreme balance is the great dimension." Thus the strong man and keen mind have been written about for many centuries before the birth of Christ.

Need for the Study

Although studies have been completed concerning the relationship of strength or fitness to scholastic rank, a search of the
literature failed to reveal studies comparing strength to predicted academic success.

The author believes that strength is an important factor in physical fitness and that the mind functions more efficiently in a strong body. Davis\(^3\) related how John Locke felt about the relationship of body and mind when he stated, "a sound mind in a sound body is a short but full description of a happy state in this world; he that has these two has little more to look for." Davis\(^4\) also related how Mulcaster insisted that "education should be according to nature... that the first consideration in education is the care and training of the body."

As part of a longitudinal study of growth in adolescence at the Institute of Child Welfare, University of California, Berkeley,\(^5\)

the research on the relationship between static dynamometric strength and biological, social and psychological characteristics of children from the time they were 11 years old until they were 17.5 years old, concluded:

Despite the use of meager strength-testing procedures, the study clearly indicates the importance of physical
abilities, especially strength, in the social and psychological adjustment of adolescent boys. Therefore, it becomes obligatory for the physical educator who wishes to meet the individual social needs of his boys to consider the adequacy of their basic strength and to take appropriate steps to improve the status of those who are physically weak.

The apparent lack of fitness of American youth, as determined by draft rejections in World War I and World War II and comparative tests as conducted by the American Association for Health, Physical Education, and Recreation and Kraus, has led to a complete re-evaluation of the place of physical fitness in our schools' physical education program. In light of the discouraging results, the Council on Youth Fitness was established in 1956 by President Eisenhower, with the objectives of improving youth fitness as its goal.

The word fitness today has a greater meaning than in the days of national emergency. Today we think of total fitness which includes mental, spiritual, and physical fitness. President Kennedy stressed these three factors and pointed out the interdependence of one to the other when he stated:

... physical fitness is not only one of the most important keys to a healthy body; it is the basis of dynamic and creative intellectual activity ... intelligence and skill can only function at the peak of their capacity when the body is healthy and strong; ... hardy spirits and tough minds usually inhabit sound bodies.
It is realized that there is great controversy in the area of fitness and that an exacting definition is impossible. The confusion revolves about the phrase, "fitness for what?" One possible answer as stated by Mathews is: "sufficient fitness for performing daily tasks without undue fatigue at the end of a day." Morehouse and Miller in their textbook stated that muscular fitness could be defined:

The optimum amount of muscular strength for a person is slightly above that needed to meet the requirements of daily activity. A reserve of strength allows for emergency physical nutrition and hours of rest are reduced. This reserve has a dual benefit, it also enables the daily tasks to be performed with greater ease and efficiency.

Strength tests have been used as a type of measurement to reflect physical fitness. The tests consist for the most part of the subject applying a force which is measured by some type of scale or dynamometer.

The author felt that in light of the concern for total fitness of youth and the possible effects of muscular strength as a component of total fitness, it would be worthwhile to investigate the
relationship between muscular strength and predicted academic success of selected male college freshmen.

**Statement of Problem**

The primary purpose of this study was to investigate the relationship between muscular strength and predicted academic success of selected college freshman male students.

**Limitations of Study**

This study was limited to 30 freshman male college students enrolled in the basic instruction program of physical education at South Dakota State University during the second semester of the 1963-64 school year.

The subjects were in non-strenuous basic instruction classes of physical education.

Subjects were not engaged in athletic participation, and no distinction was made as to weight, height, or ages of the subjects.

Only the American College Test composite standard scores of freshmen male students were used for the predicted academic success factor. Further reference to the American College Test will be referred to as ACT.

The group was homogeneous only in that they were male freshmen students in the basic instruction program of physical education.
Assumption

The author felt that the use of freshmen not engaged in organized athletics or enrolled in strenuous basic instruction classes of physical education would give a more accurate picture of the average male student at South Dakota State University.
Chapter II

REVIEW OF LITERATURE

In numerous instances, in this country and abroad, the relationship between physical fitness and mental achievement has been studied. Previous opinions on the question have been divided.

Terman,\textsuperscript{10} after studying gifted children for 25 years,


concluded:

The results of the physical measurements and the medical examinations provided a striking contrast to the popular stereotype of the child prodigy, as commonly depicted as a pathetic creature, over-serious and undersized, sickly, hollow-chested, nervously tensed and bespectacled. There are gifted children who bear some resemblance to this stereotype, but the truth is that almost every element of this picture, except the last is less characteristic of the gifted child than of the mentally average.

Studies completed at Manchester, England\textsuperscript{11} showed that only

\textsuperscript{11} David K. Brace, "Some Objective Evidence of the Value of Physical Education," \textit{Journal of Health and Physical Education}, April, 1933.

2.35 percent of the students with good scholastic records were below average in physique, as demonstrated by body measurement, while 39.7 percent of those with poor scholastic records were below average in physique.
Whenever such tests (intelligence tests) have been tried, the correlation between the intelligence quotient and measurement of physical, athletic, or game ability has been approximately zero. This is true even when the I.Q. is correlated with similar index numbers or quotients of athletic and motor skills.

Johnson\(^{13}\) found little or no relationship between physical efficiency and intelligence. In order to determine the physical skill of the subjects in the study, the Johnson Physical Skill Test for Sectioning Classes into Homogeneous Units was administered. This test consisted of a series of ten exercises performed on a chart 15 feet in length which was placed on a gymnasium mat. Since the elements of strength, speed, and endurance were not thought to be involved in successful passing of this test, skill appeared to be the only factor involved. The scores that were earned in the psychological test were then compared with the scores that the student made in the physical skill test. The scores on the psychological test were then compared with the grades earned during the first quarter of university work. Another comparison was made between the scores from the Johnson Test and the academic grades. After the analysis of the data, Johnson concluded that:

\(^{12}\text{Charles H. McCloy, }\text{Tests and Measurements in Health and Physical Education, p. 66.}\)

1. There is no significant relationship between physical skills and mental powers or general intelligence.

2. There is no significant relationship between physical skills and academic grades.

3. There is no major relationship between intelligence and scholastic grades.

4. There is very little relationship between skill and grades in physical education.

In a study by Giaque in which 60 high school senior boys

---


were the subjects, the following findings were reported:

1. The correlation coefficient between PFI and scholastic marks for the whole group was plus .10.

2. The correlation coefficient between PFI and scholastic marks for those pupils whose PFI increased was minus .15.

3. The correlation coefficient between PFI and scholastic marks for those pupils whose PFI decreased was plus .16.

4. The coefficient between the number of extra curricular activities and scholastic marks was plus .10.

5. The coefficient between PFI and I.Q. was minus .25.

In explaining these results, Giaque said:

---

15 Ibid., p. 283.

We must conclude, then, because teachers marks and even Regent's examination ratings are highly subjective and lack any useable norms . . . or any true norms at all . . . that statements concerning the relation between true
scholarship and physical fitness must wait for studies in which scholarship ratings possess provided integrity in norms, reliability, and validity.

Ray, however, in a study involving high school senior boys reported that, "the athlete is not only superior in mental ability as reported by I.Q., but more superior as measured by number of academic failures." He concluded that,

Within the limits of an I.Q. group, this study finds physical ability a more reliable predictor of relative I.Q. at the rate of low I.Q. levels, some unmeasured quality seems to influence achievement of all sorts in the individuals who persist in school attendance.

Appleton completed a study at the United States Military Academy in 1949 to determine the relationship between physical ability and official measures used to determine cadet success. A high positive curvilinear relationship was found to exist between physical ability upon entrance to the Academy and a success-failure criterion which had been developed. There were twice as many failures among the cadets who were in the lowest 7 percent of the physical ability range.

---


17. Ibid., p. 142.

However, he found no significant relationship between physical fitness upon entrance and academic success as measured by academic grades at West Point.

Jorgenson\(^1\) tested 100 regular students, thirteen physical education students and eight varsity gymnasts, in an attempt to determine the relationship between physical fitness and optimum scholastic achievement. The University of Indiana Motor Fitness Indices No. 1 was used to determine the fitness ratings of the subjects. This index was derived from push-ups, chin-ups, and vertical jump performance scores. The achievement level of each student was represented by grade point averages. The ability level of each student was indicated by the scores achieved on the American Council of Education Psychological Examination. He found a coefficient of correlation of -0.13 between physical fitness ratings and grade point averages, which was not significant. The physical fitness ratings and ability level test scores were then correlated and a correlation coefficient of -0.07 was found. This correlation was also insignificant. He also found that physical education students and varsity gymnasts achieved grade point averages higher than those expected from indications of ability level test scores. Those two groups, for example, achieved as well in grade point average as the average school group, even though their ability level.
test scores averages were significantly lower than that of the latter group.

Appleton\textsuperscript{20} found that physical proficiency measures were fairly good predictors of non-academic aspects of success. This was particularly true at the lower range of physical proficiency. The findings showed that of the applicants whose scores were among the lowest 10 percent of those tested for physical ability, none came above the classification of being more than average at the Academy.

The substance of these studies indicates the following:

1. There is no apparent relationship between physical fitness and intelligence as measured by several psychological tests.

2. There seems to be a positive but low degree relationship between physical fitness and success in academic endeavors.

3. There seems to be a positive but low degree relationship between physical fitness and the non-academic aspects of success in various levels of schools.

\textsuperscript{20}Appleton, \textit{op. cit.}, p. 94.
Chapter III
PROCEDURE FOR OBTAINING DATA

Introduction

The description of the measuring devices employed, the selection of subjects, and procedures are included in this chapter. This study treats the relationship between muscular strength and predicted academic success. The subjects used were freshmen male college students enrolled in the basic instruction program of physical education during the spring semester 1963-64 at South Dakota State University.

Selection of Predicted Academic Success Test

The author selected through advice from a professional jury the ACT as the best means of predicting academic success. This panel was composed of experts from the Psychological Testing Bureau, Student Personnel, and the counseling service of South Dakota State University. The ACT Program\(^{21}\) is designed to measure as precisely as possible the


ability of a student to perform those intellectual tasks he is likely to face in his college studies.

The basic battery of the ACT Program consists of four tests, the English Usage Test, Mathematics Test, Social Studies Reading Test, and Natural Sciences Reading Test.
The composite score is the mean (average) of the four educational-development scores. It is viewed as an index of total educational development and has proven to be the best single predictor of freshmen success in college.

**Selection of Strength Test**

The author, after reviewing the literature, selected the H. Harrison Clarke and Theodore G. Schopf revision strength test for determining individual strength. Although the test was designed for grades 4, 5, and 6, the authors indicated that their test could be used for older groups. The selection of a battery of four tests was the result of a selection of the minimum number of cable-tension strength tests that would best represent the 18 tests given of the original battery. Product-moment correlations were computed among all strength tests and the criterion which was the mean of the 18 strength tests. Thus the four battery test was accepted by the authors as being valid.

A coefficient of multiple correlation was computed by the use of the Wherry-Doolittle method; the criterion was the dependent variable and the 18 individual strength tests were the independent variables. These four tests, therefore, were selected to compose the strength test battery in this study. The strength tests used were...

---


23 *ibid.*, p. 517.
based on the measurement of individual muscle groups by cable-tension methods. 24


Before the testing of the subjects, the author and his assistant conducted a pilot study using graduate students and male members of a rhythms class to familiarize themselves with the testing procedures.

Source of Data

Freshmen men engaged in athletics and strenuous physical education classes were listed by the author by checking athletic and physical education records and submitted to the machine records department. With the assistance of this department, those freshmen male students enrolled in college the second semester and engaged in athletics and strenuous physical education classes of weight training and wrestling were eliminated as subjects in the study.

The remaining 709 freshmen male student IBM cards were arranged according to their ACT composite scores. The range of the ACT composite score ranged from a low of 8 to a high of 32. The range of the ACT composite score is from 0 to 36. 25 All procedures and ACT composite scores were kept confidential.

To get an adequate frequency distribution, all ACT composite scores were divided into increments of four. Using a table of random numbers, 26 a random sample of five students was taken from each of the groups. In the event the procedures selected students who had dropped from college or were not classified as freshmen, the remaining names were replaced in the proper increment and additional names were then randomly selected in that frequency. Distribution of the students and their scores are as follows:

<table>
<thead>
<tr>
<th>ACT Composite Scores</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 0-7</td>
<td>None</td>
</tr>
<tr>
<td>8-11</td>
<td>8</td>
</tr>
<tr>
<td>12-15</td>
<td>47</td>
</tr>
<tr>
<td>16-19</td>
<td>164</td>
</tr>
<tr>
<td>20-23</td>
<td>243</td>
</tr>
<tr>
<td>24-27</td>
<td>192</td>
</tr>
<tr>
<td>28-31</td>
<td>54</td>
</tr>
<tr>
<td>32-36</td>
<td>1</td>
</tr>
</tbody>
</table>

The author contacted each selected subject individually to make sure all would be willing to take part in the strength testing. The project was fully discussed with each subject and all agreed to take part in the study. No scores of the ACT were revealed to the subjects either before or after their participation in the study. The
composite scores of all subjects appear in Appendix A. Descriptions, directions, and pictures of the test battery appear on the following pages. The strength test scores in pounds for the four battery tests for each subject appear in Appendix A.
The Cable-Tension Strength Test

Test No. 1--Trunk Extension

Starting Position--Subject is in a prone position; hips 180-degree extension and adduction; knees fully extended; hands clasped behind back.

Attachments--Trunk strap around chest, close under armpits; pulling assembly attached beneath subject through slit in table.

Precautions--Prevent lifting of hips by bracing.

(See Figure I).

Test No. 2--Knee Extension

Starting Position--Subject in sitting position, leaning backward, arms extended to rear, hands clasping sides of table; left knee (test side) in 115-degree extension.

Attachments--Regulation strap around leg midway between knee and ankle joints; pulling assembly attached to hook at lower end of table.

Precautions--Prevent lifting buttocks; prevention of flexion of elbows. (See Figure II).
Figure II. Knee Extension
Test No. 3--Shoulder Extension

Starting Position--Subject in prone position, hips and knees flexed, test resting comfortably on table; upper left arm (test side) adduction at shoulder to 190-degrees, shoulder flexed to 90-degrees, elbow flexed with wrist in prone position.

Attachments--Regulation strap around humerus midway between shoulder and elbow joints; pulling assembly attached to wall at subject's head.

Precautions--Prevent shoulder elevation by bracing with hand; prevent humerus abduction by guiding elbow.

(See Figure III).

Test No. 4--Ankle Plantar Flexion

Starting Position--Subject in prone position, hips in 180-degree extension and adduction, knees in 180-degree extension, arms folded on chest; left ankle (test side) in 90-degree flexion, mid-position of inversion and eversion.

Attachments--Regulation strap around foot above metatarsal-phalangeal joint; pulling assembly attached to wall at subject's head.

Precautions--Prevent inversion or eversion at ankle joint, extension of metatarsal-phalangeal joint, and raising of leg; brace behind shoulders to stabilize subject. (See Figure IV).
Figure III. Shoulder Extension
The primary purpose of this study was to determine the relationship between muscular strength and predicted academic success among selected college freshman male students at South Dakota State University. Thirty subjects were tested using the four tests of the cable-tension series.27

27 H. Harrison Clarke, loc. cit.

The raw scores (tension pounds) obtained on the strength test were converted to pounds before the analysis. The ACT composite scores obtained in this investigation required no conversion.

Reliability of Data

The reliability of the four tests employed in this investigation was obtained through a test-retest method. A rho or a rank order correlation was computed for each test, as described by Garrett.28


The subjects were graduate students and upperclassmen at South Dakota State University. The reliability scores were as follows: trunk extension .87, knee extension .94, shoulder extension .84, and ankle plantar flexion .77.
Analysis of Data

Each of the four tests used to determine muscular strength, in this study, was correlated with the ACT composite score and a multiple correlation was run to ascertain the relationship between the composite strength tests and predicted academic success.

All data were transferred to punch cards. Linear correlations and a multiple correlation were obtained using an electronic computer.

The linear correlations between the different tests of strength and ACT composite score are presented below:

<table>
<thead>
<tr>
<th></th>
<th>( X_2 )</th>
<th>( X_3 )</th>
<th>( X_4 )</th>
<th>( X_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X_1 )</td>
<td>.1078</td>
<td>-.1007</td>
<td>-.1652</td>
<td>-.4266</td>
</tr>
<tr>
<td>( X_2 )</td>
<td></td>
<td>-.0900</td>
<td>-.2866</td>
<td>-.4122</td>
</tr>
<tr>
<td>( X_3 )</td>
<td></td>
<td></td>
<td>.0968</td>
<td>-.0669</td>
</tr>
<tr>
<td>( X_4 )</td>
<td></td>
<td></td>
<td></td>
<td>.1500</td>
</tr>
</tbody>
</table>

Trunk extension, knee extension, shoulder extension, ankle plantar flexion, and ACT composite are represented respectively by \( X_1, X_2, X_3, X_4, \) and \( X_5 \).

The multiple correlation coefficient between the four tests of strength and ACT composite score was .5809.

Summary of Findings

After the scores were computed by the IBM computer, the following findings were revealed:
1. The linear relationship between ACT and trunk extension was -.4266.

2. The linear relationship between ACT and knee extension was -.4122.

3. The linear relationship between ACT and shoulder extension was -.0669.

4. The linear relationship between ACT and ankle plantar flexion was +.1499.

5. The relationship between ACT and the composite muscular strength test score by use of a multiple correlation was .5809.
Chapter V
SUMMARY

Problem

The purpose of this study was to investigate the relationship between muscular strength and predicted academic success among selected college freshmen male students at South Dakota State University.

Data

The subjects were 30 freshmen enrolled in the basic instruction program in physical education. All subjects were in non-strenuous classes and were non-athletes.

The data that were collected included the subjects’ American College Test composite test score from the records department of South Dakota State University. Strength tests administered from the cable-tension test manual were trunk extension, knee extension, shoulder extension, and ankle plantar flexion. The subjects were tested in the afternoon during the week of April 6-10, 1964.

Findings

The relationship between muscular strength and predicted academic success, as determined in this study, showed a slight relationship as determined by the use of a linear correlation and by a multiple correlation.
Conclusions and Recommendations

In the author's opinion, the findings of this study did not disclose a significant relationship between strength and predicted academic success. The results indicated, however, a need for further investigation for the following reasons:

1. The number of subjects used was too small and there is need of a study employing a larger sample.

2. That factors such as age, weight, and height should be included in further study.

3. That athletes and those engaged in strenuous activity should not be eliminated from further studies.

4. That consideration be given to the family background of the subjects such as rural or urban influences.
REFERENCES CITED

American Association for Health, Physical Education, and Recreation, 

American College Testing Program, "Using The ACT On Your Campus," 

Appleton, Lloyd O. "The Relationship Between Physical Ability and 
Success at the United States Military Academy." Unpublished 

Brace, David K. "Some Objective Evidence of the Value of Physical 

Clarke, H. Harrison, Application of Measurement to Health and Physical 

Clarke, H. Harrison, Cable-Tension Strength Tests Manual, Springfield, 

Clarke, H. Harrison, and Theodore G. Schopf. "Construction of a Mus­ 
cular Strength Test for Boys in Grades 4, 5, and 6," Research 

Davis, Elwood Craig, Philosophies Fashion, Dubuque, Iowa; Wm. C. Brown 
Company Publisher, 1963.

Davis, Elwood Craig, The Philosophic Process in Physical Education, 

Garrett, Henry E., Elementary Statistics. New York: David McKay 

Giaque, C. C., "Interrelationship of Physical and Mental Abilities of 
High School Boys," Supplement to the Research Quarterly VI, March, 
1953.

Hettinger, Theodor and Others. Physiology of Strength. Springfield: 

Johnson, G. B., "A Study of the Relationship that Exists Between Physi­ 
cal Skills Measured, and the General Intelligence of College 

Jorgenson, Robert. "The Relationship of Physical Fitness to Optimum 
Scholastic Achievement." Unpublished Master's thesis; State 


