The relationship of academic achievement to physical fitness as measured by the twelve-minute walk-run test and the AAHPER youth fitness test

John Byron Parsons
The University of Montana

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THE RELATIONSHIP OF ACADEMIC ACHIEVEMENT TO PHYSICAL FITNESS AS MEASURED BY THE TWELVE-MINUTE WALK-RUN TEST AND THE AAHPER YOUTH FITNESS TEST

By
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B.S., University of Montana, 1968

Presented in partial fulfillment of the requirements for the degree of Master of Science in Teaching

UNIVERSITY OF MONTANA

1969

Approved by:

[Signatures]

Dean, Graduate School

Aug 20, 1969
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CHAPTER I

INTRODUCTION

From the time of the ancient Greeks, men have been concerned with the physical performance and mental achievement of their fellow man. At various times in history, the development of the mind has been paramount and the physical dimension of man downgraded. Only in time of war has stress been placed on the physical fitness of man. Writers throughout the years have stressed the "whole man" concept and commented on the relevance of physical fitness to intellectual achievement in the fully functioning individual. The following statements are representative samples of the belief that a relationship exists between physical performance and intellectual achievement. In the year 1650 Comenius made the statement: "Intellectual progress is conditioned at every step bodily vigor."¹ Relative to this, Cozens has written:

The better developed a boy or girl is for his or her age, the more able he or she is in school work.

The general level of physical ability of children who rate high on intelligence tests is distinctly superior to that of children who rate low in intelligence.

There seems to be a direct relationship between ability in physical tests and promotion or scholastic results.²

As a result of observing low physical fitness individuals for many years, Rogers maintained that physically unfit boys and girls at all levels of intelligence have greater difficulty in continuing effort and remaining alert than physically fit boys and girls. He also stated that the potential for learning depends upon both intelligence and physical fitness.³ This can be interpreted to mean that a person's learning potential for a given level of intelligence may increase or decrease in accordance with his level of physical fitness.

John F. Kennedy made the following remarks concerning physical fitness:

Thus the same civilizations which produced some of the highest achievements of philosophy and drama, government and art, also gave us a belief in the importance of the physical soundness which has become a part of the western tradition; from the mens sana in corpore sano of the Romans to the British belief that the playing fields of Eton brought victory on the battlefields of Europe. This knowledge that the physical well being of the citizens is an important foundation for the vigor and vitality of all the nation, is as old as Western Civilization itself.

For physical fitness is not only one of the most important keys to a healthy body; it is the basis of


³Rogers, op. cit., p. 57.
dynamic and creative intellectual activity. The relationship between the soundness of the body and the activity of the mind is subtle and complex. Much is not yet understood. But we do know what the Greeks knew, that intelligence and skill can only function at the peak of their capacity when the body is healthy and strong; that hardy spirits and tough minds usually inhabit sound bodies.4

In support of the contention that physical fitness is related to mental achievement, John Locke wrote that:

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 else to wish for, and he who wants either of them will be little better for anything else.5

Physical education is concerned with the total individual as he manifests himself physically as well as intellectually in an interplay with his environment. As Clarke pointed out, each individual must not only possess emotional stability, knowledge, and insight to solve problems, but also organic soundness, strength, and vitality to fulfill personal needs and societal obligations. Physical education aims at the development of these physical qualities. It has frequently been observed that the ability to work and play with maximum efficiency and to be prepared for emergencies, depends on an adequate level of physical


Because it is the desire of physical educators to satisfy individual student needs and to find more satisfactory means of meeting these needs, studies such as the present study, attempt to determine if there is a relationship between physical fitness and academic achievement, are undertaken.

I. STATEMENT OF THE PROBLEM

The purpose of this study was to determine the relationship between academic achievement as measured by the cumulative grade point average and physical fitness as measured by the twelve-minute walk-run test and the AAHPER Youth Fitness Test battery. The twelve-minute walk-run test was administered to full-time volunteer Air Force ROTC students, and the AAHPER Youth Fitness Test was administered to full-time male volunteer Health and Physical Education majors.

II. DEFINITION OF TERMS

Physical fitness: Refers to fitness as measured by the twelve-minute walk-run test and the AAHPER Youth Fitness

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Test battery.

**Academic achievement**: Refers to the cumulative grade point average of the subjects.

**Cumulative grade point average (GPA)**: Refers to the ratio of the total number of quality points to the total number of quarter hours of credit earned. A quality point is a numerical value assigned to a conventional letter grade. For example, A equals 3, C equals 2, D equals 1, and F equals 0.

III. DELIMITATIONS OF THE STUDY

1. The study was limited to thirty-two Air Force ROTC students and twenty male Health and Physical Education majors.

2. Only full-time students who were enrolled at the University of Montana during the Spring Quarter 1969 were used.

3. The study was limited to physical fitness as measured by one test administration of the twelve-minute walk-run test and the AAHPER Youth Fitness Test.

4. The study was limited to academic achievement as measured by the cumulative grade point average up to and including the Spring Quarter 1969.

IV. SIGNIFICANCE OF THE STUDY

The concomitants of physical fitness in the area
of academic achievement have by no means been absolutely
defined, and further investigations for future research
have been recommended. The Committee of Research Con-
sultants appointed by the President's Council on Physical
Fitness, for example, has proposed that studies should
investigate if marked differences in some, or all, of the
components of physical fitness are accompanied by measur-
able differences in accomplishments such as school achieve-
ment, work output, and personal-social adjustments. 7

Since the relationship of physical fitness to
academic achievement is not absolutely defined and often
controversial, it is hoped that this study will contribute
to the information available concerning the relationship.

7H. Harrison Clarke, Physical Fitness News Letter
(Mimeographed), School of Health, Physical Education and
Recreation, University of Oregon, September, 1966.
CHAPTER II

REVIEW OF RELATED LITERATURE

In the field of physical education there is much controversy over the place and importance of programs for physical fitness in connection with the total education of the student.

In this chapter, studies will be reviewed in which different physical fitness levels were related to academic achievement. Although this investigation is primarily concerned with college men, some reference will be made to studies of elementary and high school students.

Terman concluded after a twenty-five year study of gifted children that:

The results of the physical measurements and medical examinations provide striking contrast to the popular stereotype of the child prodigy, so commonly predicted as a pathetic creative, over-serious, undersized, sickly, hollow-chested, nervously tense, and bespectacled. There are gifted children who bear some resemblance to this stereotype, but the truth is that almost every element in the picture except the last is less characteristic of the gifted child than the mentally average.¹

Several investigators have reported that there is a tendency for students with high scores on physical fitness

tests to achieve higher academically, and those with low scores to be lower in academic achievement than was expected on the basis of their intellectual potential.

Utilizing an early form of the Strength Index, Rogers studied two groups of college men with nearly equal IQ averages but differing greatly in average muscular strength. The scholarship of the high strength group (IQ mean of 107) was considerably higher than that of the low strength group (IQ mean of 111). It should be noted that a difference in IQ of four points is hardly significant. 2

Hart and Shay reported a significant positive correlation between grade point average (GPA) and Physical Fitness Index (PFI) of sixty sophomore women, all carrying the same program. The following partial correlations were obtained: .66 between PFI and GPA with Scholastic Aptitude Test (SAT) held constant and .63 between PFI and GPA with verbal scores of the SAT held constant. The researchers found that although physical fitness was not a general prediction of academic success, it was high enough to be considered as a necessary factor for the improvement of academic index in the general education of the college

2Frederick Rand Rogers, "The Evaluation of Physical Fitness Tests and Programs," Education, LX (April, 1940), 538.
The initial study of the relationship between physical ability and success at the U.S. Military Academy was reported in 1949 by Dr. Lloyd O. Appleton. A thirteen-year summary has been prepared by Appleton and Kobes. Among the findings contrasting the lowest seven per cent and the highest seven per cent on the physical tests were the following: Failure to graduate, 48.3 per cent in the low group and 18.8 per cent in the high group; cadet discharges, 29.8 per cent in the low group and 11.3 per cent in the high group; academic failures, 17.2 per cent in the low group and 8.2 per cent in the high group.

Page, in 1940, conducted case studies of fifty Syracuse University men with low physical fitness indexes. As one phase of the study, he found that eighty-three per cent of the freshman male students dismissed from the university because of low grades had physical fitness indexes below 100 (the national median). Yet, the median mental aptitude score for these students was at the


4Reported by H. Harrison Clarke, "Fifteen Years at 'Physical Aptitude' Testing at the United States Military Academy," Physical Fitness News Letter (Mimeographed), University of Oregon, April, 1965, 1.
seventy-two percentile.5

Case studies of seventy-eight freshman men with low physical fitness indexes were made by Coefield and McCollum at the University of Oregon. They found that these generally were definitely low in scholastic achievement as compared with all men at the university during the fall term of 1954. However, the low fitness students were generally superior to the other freshmen in scholastic aptitude.6

At Washington State University, Jorgenson found that physical education majors and varsity gymnasts had a higher level of physical fitness, but lower scholastic achievement, than a "non-specific" sample of students. However, the more fit persons did better scholastically than their mental aptitude scores predicted, while the lower fitness group generally failed to meet projected achievement standards.7

Ricci, in comparing the academic averages of the

bottom ten per cent in PFI scores with the top ten per cent of 900 University of Massachusetts freshmen, concluded that the results partially supported his basic hypothesis that students whose physical fitness skills are low may be considered academic risks.  

Dornink reported on the success of 1,338 men during their four years at the University of Oregon. The Physical Fitness Index had been administered to these men upon entrance to the university as freshmen. Two out of five of this group graduated four years later. However, the chances of graduating for low PFI students were one in eight for the lowest one per cent, one in seven for the lowest two per cent, one in six for the lowest three per cent, and one in five for the lowest seven per cent. In addition, the chance of winning a scholarship was about one in five for all students. The chances for the low PFI students were the following: none for the lowest three per cent, three in 100 for the lowest five per cent, and one in twenty-five for the lowest fifteen per cent.

---


Webber studied the relationship of physical fitness (as measured by the Iowa Physical Efficiency Profile) to grade point average of 256 freshmen at the University of Iowa and found a significant positive correlation of .41 which was significant beyond the .01 level of confidence.10

An important finding from these studies relating physical fitness to academic achievement is the fact that while there were generally significant differences in academic achievement between the physically fit and unfit, there usually were no significant differences in intelligence quotient.

McCloy has stated that whenever intelligence tests have been used, the correlation between the intelligence quotient and measurement of physical, athletic, or games ability has been approximately zero. This has been true even when the IQ is correlated with similar index numbers or quotients of athletic and motor skills.11 Other studies have indicated similar results.


of no correlation.  

Recent studies have also shown that a relationship exists between fitness and academic achievement.  

Richardson tested eighty-six college women divided into high and low achieving groups and found that skilled performers had a higher college achievement score than less skilled performers. The scholastic grade point average was significantly greater for the group with higher motor ability.  

With high School boys as subjects, Garland McCol-lum compared the academic achievement of the twenty-eight highest with the twenty-eight lowest on scores on the AAHPER Youth Fitness Tests (ten per cent of all boys in each group). The mean intelligence scores of the two groups were approximately the same. However, the fit group had a GPA of 2.68, while the unfit group had a GPA

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of 1.91, a difference of .77 or forty per cent.14

Sweeney compared the academic achievement of two
groups of freshmen and junior boys and girls in high school.
One group ranked in the upper forty per cent on a physical
achievement test and the other group was a random sample.
The grade point average of the fitness group (2.48) was
higher than that of the random sample (2.19).15

Using freshmen at the University of Oregon, Wilson
found that a low physical fitness group had higher mean
scores in both the psychological rating and predicted fall
term grade point average than a high fitness group. How­
ever, the high fitness group had higher mean GPA's for both
the fall and winter terms. Thus it was concluded that the
low fitness students in this study did have more difficul­
ties maintaining a satisfactory GPA, comparable to their
scholastic aptitude, than the students with high fitness.16

Arnett studied the relationship between physical

14Garland L. McCollum, "A Comparison Between the
Physically Fit and the Physically Unfit in Intelligence,
Academic Achievement, and Attendance in School," (Microcard

15John F. Sweeney, "Physical Fitness and Academic
Performance," Physical Fitness News Letter (mimeographed),
University of Oregon, December, 1962, 4.

16Peter C. Wilson, "Personality Traits, Academic
Achievement, and Health Status of University Freshman Men
with Low and High Physical Fitness Scores," (unpublished
fitness and academic success in 827 college women. Grade point averages determined for each fitness classification revealed statistically significant differences in GPA among those who were high, fair, or poor in physical fitness achievement. Those groups achieving higher GPA's were also high on the fitness scores.  

I. SUMMARY OF RELATED LITERATURE

There is much controversy among researchers as to the actual relationship between physical fitness and academic achievement. Part of this controversy may be explained by the various tests of physical fitness and the various ways they are evaluated.

In summarizing the relationship between physical fitness and mental alertness and the quantity and quality of mental effort, Clarke concluded that the results point in a positive direction.  

Recent studies have indicated a relationship between physical fitness and academic achievement. In most studies concerning this subject, it was found that

17Chappelle Arnett, "Interrelationships Between Selected Physical Variables and Academic Achievement of College Women," Research Quarterly, XXXIX (May, 1968), 227-270.

students with high scores on the various physical fitness tests had significantly superior grade point averages in their class work. Some studies have indicated that students with high scores on fitness tests have higher means on standard scholastic achievement tests, while others have shown that more physically fit students have lower mean scores but do better scholastically than their scores predicted. The lower fitness groups generally failed to meet projected achievement standards.

Although the general finding of a majority of the studies was that those individuals with high academic achievement performed better on various physical fitness tests, this is not to be interpreted as a cause-and-effect relationship.

In research concerning intelligence and physical fitness, most studies conclude that there was no substantial evidence to indicate that students with high motor ability also have high mental ability.
CHAPTER III

PROCEDURES

In this chapter, the procedures utilized to determine the relationship between academic achievement and physical fitness are presented. In doing so, the subjects are mentioned, the criteria of academic achievement are discussed, the experimental variables are described and evaluated, and the research processes employed are indicated.

I. THE SUBJECTS

The Air Force ROTC subjects were all full-time undergraduate students enrolled at the University of Montana during the Spring term of 1969. There were thirty-two volunteer men, of whom twelve were freshmen, eight were sophomores, four were juniors, and eight were seniors.

The subjects for the second group of the study were all full-time male health and physical education majors enrolled at the University of Montana during the Spring term of 1969. There were twenty majors of whom one was a freshman, two were sophomores, seven were juniors, and ten were seniors.

The students from both groups were all physically normal to the extent that they were free from physical
abnormalities as determined by Air Force ROTC and the University of Montana Health Service medical examination. Both groups of students were between the ages of nineteen and twenty-three.

Full-time male Air Force ROTC students were chosen for two reasons. First, because of a similar study conducted by Sanders and reported by Cooper in which Sanders found that academic performance was directly related to endurance performance on the twelve-minute walk-run test. Sanders used male subjects from a twelve-week United States Air Force officer training course. It was felt by the author that there was also a possible relationship between academic achievement and performance on the twelve-minute walk-run test for Air Force ROTC students.

The second reason for the choice of Air Force ROTC students was because of the accessibility and willingness of the ROTC students to participate in the study.

It was felt that a curriculum pursued by students with the particular professional objectives of health, physical education, and recreation, may be more homogeneous


than would be true of all the students at the University of Montana taken as a group. It seemed probable that a heterogeneous group of students might vary with regard to factors which have value in promoting academic success. Also, evidence might show that standards used in grading students in various curricula, may not be equivalent; consequently, a GPA for students majoring in one curriculum may not have the same meaning as for a similar average or curriculum. Thus, the decision was made to utilize those students pursuing a major in health, physical education, and recreation.

II. CRITERIA FOR ACADEMIC ACHIEVEMENT

Cumulative grade point average was utilized in this study as a measure of school accomplishment or academic achievement. The justification for using the grade point average is that the grade point average is universally used to represent the student's success in mastery of school subjects at the university level.

In order to establish each pupil's grade point average on a numerical basis, the grade point system used at the University of Montana was applied as follows: A, four points; B, three points; C, two points; D, one point; and F, 0 points.
III. TWELVE-MINUTE WALK-RUN TEST

When assessing fitness for prolonged physical activity, one must expose the subject to continuous hard work in order to test him accurately. This procedure is required primarily because the easier the work, the smaller and less regular are the differences between the fit and unfit.3

Newton stated that oxygen consumption during exhausting work is not only the best single physiological indicator of the capacity of a man for sustaining hard muscular work, but it is also the most objective method by which one can determine the physical fitness of an individual as reflected by his cardiovascular system.4

The maximal oxygen consumption or intake (maximum Vo₂) is a laboratory measurement determined most frequently during exhausting work on either a motor driven treadmill or a bicycle ergometer. In as much as laboratory determination of maximum Vo₂ is impractical for large groups, notable efforts have been made to develop a field test of fitness that correlates well with laboratory tests. One such


attempt has been made by Balke in which he utilized a fifteen-minute field test in which the subjects would walk or run as far as possible. At the end of the exercise period the distance covered, measured in meters per minute, was calculated and related to maximum oxygen consumption, which had previously been calculated on a treadmill run.

Cooper used a modification of the Balke field test of fitness on 115 United States Air Force male officers and airmen. The officers and airmen were evaluated on a twelve-minute field performance test and on a treadmill maximal-oxygen-consumption test. The correlation of the field-test data with the laboratory-determined oxygen-consumption data was 0.897. The significance of this relationship makes it possible to estimate with considerable accuracy the maximal oxygen consumption from only the results of the twelve-minute performance test. This test is readily adaptable to large groups, requires minimum equipment, and appears to be a better indicator of cardiorespiratory fitness than the more commonly accepted 600-yard run. Because of the high

5B. Balke, "A Simple Field Test for the Assessment of Physical Fitness," CARI Report, LXIII (Oklahoma City: Civil Aeromedical Research Institute, Federal Aviation Agency, September, 1963), 18.


correlation with maximal oxygen consumption, it can be assumed that the twelve-minute performance test is an objective measure of physical fitness reflecting the cardiorespiratory status of an individual. As a result of Cooper's study, levels of physical fitness have been established and reported for the twelve-minute walk-run test.⁸ (Refer to Appendix C.)

IV. AAHPER YOUTH FITNESS TEST

The AAHPER Youth Fitness Test battery has been widely used as a test of physical fitness in the United States and abroad.⁹

Klesius conducted a study on various combinations of measures collected in the administration of the AAHPER Youth Fitness Test to determine the reliability of the selected test items and the relative efficiency of the performance measures. The findings of the study demonstrated that the selected test items appear to be reliable and that the number of trials and measures recommended by the

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Youth Fitness Test Manual, to represent performance, seems justified. Klesius also indicated that the first trial produced a satisfactory index of performance.  

Falls, Ismail, and MacLeod helped to validate the Youth Fitness Test as a test of physical fitness. The correlation of the AAHPER test items with maximum O₂ uptake/kg body weight was found to be .760. It was also found that the best single estimation of maximum O₂ uptake among the Youth Fitness items is the 600-yard run-walk.  

Bigbee and Doolittle also correlated maximum oxygen intake for the 600-yard run-walk and found a correlation of .62.  

Berger and Mabee found a correlation coefficient of .564 between the AAHPER Youth Fitness Test and total dynamic strength. This also indicates the importance of the dynamic strength component in the fitness test.  


12Bigbee and Doolittle, op. cit., p. 493.  

Only six items of the AAHPER Youth Fitness Test were administered in this study. The items used were the following: the standing broadjump, shuttle run, fifty-yard dash, pull-ups, sit-ups, and 600-yard walk-run. The softball throw for distance was eliminated from the testing because of the recommendation made by the Ad Hoc Committee of the Physical Education Division of the AAHPER. The committee met July 9, 1968 and recommended that the softball throw for distance be eliminated from the test battery and therefore should be transferred to the sports skills test battery of the AAHPER.

V. TESTING PROCEDURE

This study was primarily concerned with determining the relationship between the fitness level of the two groups of students to their academic achievement. Every effort was made to administer the physical fitness tests without disrupting the students' school program. In keeping with this policy, the specifics regarding time of testing and order of students tested were left to the students.

The twelve-minute walk-run test was administered from nine to twelve A.M. and from one to four P.M. on the

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14AAHPER, "Memorandum to the Ad Hoc Committee of the Physical Education Division of the AAHPER," (July 29, 1968).
second, third, fourth, and fifth of June, 1969. The students were allowed to participate at their own discretion. The testing occurred on a regulation outdoor quarter-mile cinder track. The test was explained to each individual before actual testing. Timing of each individual was done with a stop watch with a one-minute warning signal before the completion of the test. The track was marked off in ten-foot intervals in which each student was to record the closest interval at the time of the gun signal. The distance covered by each student was checked and recorded on the data collecting sheet by the administrator of the test. Only one trial was allowed per student. A sample of the data collecting sheet appears in Appendix B. The data was later transferred to cumulative data sheets for ease in making the final analysis of results.

The AAHPER Youth Fitness Test was administered from nine to twelve A.M. and from one to four P.M. on the nineteenth, twentieth, twenty-sixth, and twenty-seventh of May, 1969. The testing occurred both in a gymnasium and outdoor track (fifty-yard dash and 600-yard walk-run). Each test item was explained to each student before participation. The test administration and number of trials was the same as that recommended by the Youth Fitness Test Manual. The scores for each test item of the AAHPER Youth Fitness Test were recorded on the individual data sheets at five percentile
intervals as described in the AAHPER Youth Fitness Test Manual. The percentile ranking of each individual student for each of the six test items was transferred to cumulative data sheets for the purpose of analysis. Both test administration directions and a data sheet appear in Appendixes A and B respectively.

The cumulative grade point averages for both groups were taken from the permanent records of the Office of the Registrar of the University of Montana. Only cumulative grade point indexes up to and including the Spring term of 1969 were used.

VI. TREATMENT OF THE DATA

The statistical analysis used for the twelve-minute walk-run test was the Pearson product-moment correlation coefficient for raw scores as explained by Downie and Heath. The correlation was calculated by determining the sum of the variables, finding the sum of the product of the variables. These values were then substituted into the formula. Testing the significance of the Pearson r was computed as described by Downie. (Refer to Appendix E.)

15AAHPER, op. cit., p. 65.
17Ibid., pp. 154-159.
The statistical procedure utilized for each of the six tests of the AAHPER Youth Fitness Test was the Spearman Rank-Order Correlation Coefficient (Rho) as described by Downie.\textsuperscript{18}

The rank-order correlation coefficient was computed by taking the grade point average scores and ranking them by giving the high score one, the second highest score two, and so forth for all scores. The second variable, the test items, were also ranked in this manner. The difference between the two sets of ranks for each individual were obtained and squared. The sum of the squares was then determined. The computed data was substituted into the formula. (Refer to Appendix E.)

The product-moment correlation coefficient was determined and interpreted as described by Downie.\textsuperscript{19}

\textsuperscript{18} Ibid., pp. 206-208.
\textsuperscript{19} Ibid., pp. 154-159.
CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

The results of the correlations between the scholastic achievement measure and the twelve-minute walk-run test and AAHPER Youth Fitness Test will be presented in this chapter under two major headings.

I. RELATIONSHIP BETWEEN GRADE POINT AVERAGE AND THE TWELVE MINUTE WALK-RUN TEST FOR THE AIR FORCE ROTC STUDENTS

The Pearson product-moment correlation coefficient for raw scores was computed and found to be $r = 0.225$. In order for the correlation to be significant at the .05 percent level of confidence it must be at least equal to $0.3490$.\(^1\) It was therefore concluded that the correlation was not significant.

The Pearson $r$ was also calculated by the use of the scattergram method and found to be $r = 0.223$, which also was not significant at the five percent level of confidence. Data for the twelve-minute walk-run test is in Appendix D.

II. RELATIONSHIP BETWEEN GRADE POINT AVERAGE AND THE AAHPER YOUTH FITNESS TEST FOR THE HEALTH AND PHYSICAL EDUCATION MAJORS

The Spearman rank-order correlation was computed

\(^1\)Ibid., pp. 83-90.
between grade point average and physical fitness and was found to be .65. The size of the t needed in order to be significant at the .05 per cent level of confidence must be at least equal to 2.101. The correlation and significance of each of the test items appear in Table 1.

### TABLE I

CORRELATION COEFFICIENT AND SIGNIFICANCE OF THE ITEMS OF THE AAHPER YOUTH FITNESS TEST

<table>
<thead>
<tr>
<th>Test Items</th>
<th>Rho</th>
<th>t</th>
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<tbody>
<tr>
<td>Standing broad jump</td>
<td>.34</td>
<td>1.46</td>
</tr>
<tr>
<td>Shuttle run</td>
<td>.11</td>
<td>.47</td>
</tr>
<tr>
<td>Fifty-yard dash</td>
<td>.03</td>
<td>.13</td>
</tr>
<tr>
<td>Pull-ups</td>
<td>.34</td>
<td>1.54</td>
</tr>
<tr>
<td>Sit-ups</td>
<td>.05</td>
<td>.23</td>
</tr>
<tr>
<td>600-yard walk-run</td>
<td>.14</td>
<td>.62</td>
</tr>
</tbody>
</table>

Since the differences were not statistically significant, it may be concluded that there was no statistical difference between cumulative grade point average and each of the test items.

### III. DISCUSSION OF RESULTS

The relationship of physical fitness to academic achievement for the Air Force ROTC students was .225. Although this was not statistically significant, it did indicate that a relationship exists. The correlation does not agree with those found in the review of literature. The correlation of .225 does not substantiate the direct relationship between academic achievement and physical fitness.
as reported by Cooper,² although Cooper used twenty-eight-year-old enlisted male officers and Air Force officer examinations instead of eighteen to twenty-three-year-old Air Force ROTC students and university academic grade point averages, respectively.

An analysis of the correlations in Table I indicates that the six test items of the AAHPER Youth Fitness Test were not statistically significant at the .05 per cent level of confidence. It is noted that the standing broad jump and pull-ups yielded the highest correlation while the fifty-yard dash and sit-ups yielded the lowest correlation. Studies such as McCollum's³ have indicated a high relationship with the AAHPER Youth Fitness Test. However, McCollum used high school boys and divided them into high and low fitness groups.

The correlations for the twelve-minute walk-run test and the AAHPER Youth Fitness Test are not high enough to be predictive, which may be considered logical since other factors such as intelligence, motivation, interest, and study habits have significant influences on grades.

Gruber, in summarizing the literature concerning the relationship between physical fitness and academic achievement found that growth and strength data added little to the prediction of academic achievement and that the measures of

²Cooper, "The Role of Exercise in Our Contemporary Society," p. 23.
³McCollum, op. cit., p. 9.
coordination, balance, and kinesthesis may be more predictive.\textsuperscript{4} A possible reason for this is that coordination movements require an individual to think through the performance pattern before execution. Gruber also concluded that speed and strength have low predictive capacity for estimating intellectual achievement.\textsuperscript{5}

Although research indicates that the twelve-minute walk-run test and the AAHPER Youth Fitness Test are valid indicators of physical fitness, the results shown in the study may indicate weaknesses with the study. Such weaknesses may include the size of groups used (possibly all members of the Air Force ROTC and men Health and Physical Education majors should have been used), the use of maximal effort tests for the groups studied, and the use of volunteer groups. Individuals with low grade point averages and those with low physical fitness status may have been reluctant to participate in the study.

The low test correlations would substantiate the concern for further research concerning the relationship. A longer and more comprehensive study is needed to determine if there is a relationship between physical fitness and academic achievement.

\textsuperscript{4}Joseph J. Gruber, "Exercise and Mental Performance," a report to the American Association for the Advancement of Science, 134th Meeting (Dallas, Texas, Dec. 27, 1968), pp. 30-31.

\textsuperscript{5}Ibid., p. 12.

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CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to determine if a relationship exists between academic achievement and performance on the twelve-minute walk-run test for the thirty-two volunteer Air Force ROTC students and also performance on six tests of the AAHPER Youth Fitness Test for twenty volunteer Health, Physical Education, and Recreation majors.

The physical fitness tests used in the study are among the most currently used. A pupil's scholastic achievement during the testing period may not be a true reflection of his ability. No effort was made in this study to assess the interest in and motivation toward maintaining good grades, the skill and effectiveness of different teachers, and the amount of time devoted to study. Two other influential factors not treated in this study were heredity and the physical and social environment. This study made no attempt to control intelligence by partialling out the intelligence quotient.

The statistical analysis used for the twelve-minute walk-run test was the Pearson product-moment correlation coefficient for raw scores.
The statistical procedure utilized for each of the six tests of the AAHPER Youth Fitness Test was the Spearman Rank Order Correlation Coefficient (Rho).

II. CONCLUSIONS

Although the twelve-minute walk-run test is a valid indicator of physical fitness, the correlation obtained for the thirty-two Air Force ROTC students was not statistically significant.

The AAHPER Youth Fitness Test has also been shown a valid test of physical fitness. The six test items of the fitness test showed a low positive relationship; however, none of the individual test items comprising the AAHPER Youth Fitness Test were significantly related to academic achievement. Therefore, it may logically be concluded that physical fitness is not as important a factor in academic achievement as some studies have indicated.

III. RECOMMENDATIONS

Based upon the findings of this study, the following recommendations are made.

1. Individual analysis should be carried out on groups of students with low, average, and high physical fitness scores, and that contrasts between these groups be made with regard to their academic achievement and intelligence.
2. The relationship between personality variables and also social adjustment variables, physical fitness, and academic achievement, should be further investigated.

3. Students who are rated as exceptionally good or exceptionally poor performers in school work should be given standardized achievement tests to validate their classification and comparisons should be made to their performance on fitness tests.

4. A longitudinal study should be made at the University of Montana to investigate more thoroughly the role of physical fitness in academic achievement.
BIBLIOGRAPHY

A. BOOKS


B. PERIODICALS


"Selections from Great Educators Throughout the Ages," *Journal of Health and Physical Education*, IV (March, 1933), 57.


C. THESES AND DISSERTATIONS


D. OTHERS


Gruber, Joseph J. "Exercise and Mental Performance." A report to the American Association for the Advancement of Science, 134th Meeting. Dallas, Texas, December 27, 1968.

APPENDIX A

TEST ADMINISTRATION
TWELVE-MINUTE WALK-RUN TEST

Equipment

A regulation quarter-mile track or a measured one-mile smooth surface. Ten-foot interval markings for the quarter-mile track or mile surface. A stopwatch for each individual or group. Score sheets and pencils for each individual. Appropriate running attire.

Description

Each student begins with a signal from a standing position behind the start line. Student runs or walks as far as possible within the twelve-minute limit. A signal is given one minute before the completion of the twelve minutes. When the finish signal is given the student notes the closest ten-foot interval position and waits there for final recording. The only rule given is that the student covers the greatest distance possible by running or walking in the prescribed twelve minutes.

Scoring

The distance covered is recorded in feet on the data sheets and then converted to mile or miles and/or per cent of a mile. The fitness level can be determined from this distance.
AAHPER YOUTH FITNESS TEST

I. PULL-UPS

Equipment

A metal or wooden bar approximately 1½ inches in diameter is preferred. A doorway gym bar can be used and, if no regular equipment is available, a piece of pipe or even the rungs of a ladder can serve the purpose.

Description

The bar should be high enough so that the pupil can hang with his arms and legs fully extended and his feet free of the floor. Use the over-hand grasp (palms away from face). After assuming the hanging position, the pupil then raises his body by his arms until his chin can be placed over the bar and then lowers his body to a full hang as in the starting position. The exercise is repeated as many times as possible.

Rules

1. Allow one trial unless it is obvious that the pupil had not had a fair chance.

2. The body must not swing during the execution of the movement. The pull must in no way be a snap movement. If the pupil starts swinging, check this by holding
your extended arm across the front of the thighs.

3. The knees must not be raised and kicking of the legs is not permitted.

Scoring

Record the number of completed pull-ups to the nearest whole number.

II. SIT-UPS

Equipment

Mat or floor.

Description

The pupil lies on his back, either on the floor or on a mat, with his legs extended and feet about two feet apart. His hands are placed on the back of the neck with the fingers interlaced. Elbows are retracted. A partner holds the ankles down, the heels being in contact with the mat or floor at all times.

The pupil sits up, turning the trunk to the left and touching the right elbow to the left knee, returns to starting position, then sits up, turning the trunk to the right and touching the left elbow to the right knee. The exercise is repeated, alternating sides.

Rules

1. The fingers must remain in contact behind the
neck throughout the exercise.

2. The knees must be on the floor during the sit-up but may be slightly bent when touching elbow to knee.

3. The back should be rounded and the head and elbows brought forward when sitting up as a "curl" up.

4. When returning to starting position, elbows must be flat on the mat before sitting up again.

Scoring

One point is given for each complete movement of touching elbow to knee. No score should be counted if the fingertips do not maintain contact behind the head, if knees are bent when the pupil lies on his back, or when he begins to sit up, or if the pupil pushes up off the floor from an elbow. The maximum limit in terms of number of sit-ups shall be: 50 sit-ups for girls, 100 sit-ups for boys.

III. SHUTTLE RUN

Equipment

Two blocks of wood, 2in. X 2 in. X 4 inx., and stop watch. Pupils should wear sneakers or run barefooted.

Description

Two parallel lines are marked on the floor 30 feet apart. The width of a regulation volleyball court serves as
a suitable area. Place the blocks of wood behind one of the lines. The pupil starts from behind the other line. On the signal "Ready? Go!" the pupil runs to the blocks, picks one up, runs back to the starting line and places the block behind the line; he then runs back and picks up the second block, which he carries back across the starting line. If the scorer has two stop watches or one with a split-second timer, it is preferable to have two people running at the same time. To eliminate the necessity of returning the blocks after each race, start the race alternately, first from behind one line and then from behind the other.

**Rules**

Allow two trials with some rest between.

**Scoring**

Record the better of the two trials to the nearest tenth of a second.

**IV. STANDING BROAD JUMP**

**Equipment**

Mat, floor or outdoor jumping pit, and tape measure.

**Description**

Pupil stands with the feet several inches apart.
and the toes just behind the take-off line. Preparatory to jumping, the pupil swings the arms backward and bends the knees. The jump is accomplished by simultaneously extending the knees and swinging forward the arms.

Rules

1. Allow three trials.

2. Measure from the take-off line to the heel or other part of the body that touches the floor nearest to the take-off line.

3. When the test is given indoors, it is convenient to tape the tape measure to the floor at right angles to the take-off line and have the pupils jump along the tape. The scorer stands to the side and observes the mark to the nearest inch.

Scoring

Record the best of the three trials in feet and inches to the nearest inch.

V. 50-YARD DASH

Equipment

Two stopwatches or one with a split-second timer.

Description

It is preferable to administer this test to two pupils at a time. Have both take positions behind the
starting line. The starter will use the commands "Are you ready?" and "Go!" The latter will be accompanied by a downward sweep of the starter's arm to give the timer a visual signal.

Rules

The score is the amount of time between the starter's signal and the instant the pupil crosses the finish line.

Scoring

Record in seconds to the nearest tenth of a second.

VI. 600-YARD RUN-WALK

Equipment

Track or area marked off for 600 yards and a stopwatch.

Description

Pupil uses a standing start. At the sign "Ready? Go!" the subject starts running the 600-yard distance. The running may be interspersed with walking if the subject tires. It is possible to have a dozen subjects run at one time by having the pupils pair off before the start of the event. Then each pupil listens for the partner's time as
the latter crosses the finish. The timer merely calls out the times as the pupils cross the finish.

Rules

Walking is permitted, but the object is to cover the distance in the shortest possible time.

Scoring

Record in minutes and seconds.
APPENDIX B
TWELVE MINUTE WALK-RUN
DATA COLLECTION SHEET

NAME _______________________

AGE, YEAR ______ month ______

YEAR OR CLASS IN SCHOOL (Include Spring Quarter)

"PF" Cat. ________________

<table>
<thead>
<tr>
<th>LAPS</th>
<th>FEET</th>
<th>12-MINUTE DISTANCE</th>
</tr>
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<tbody>
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</table>

G P A ____________________

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APPENDIX B
A.A.H.P.E.R. YOUTH FITNESS TEST
DATA COLLECTION SHEET

NAME ____________________________

TELEPHONE ____________________________

YEAR OR CLASS IN SCHOOL
(Include Spring Quarter)____________

AGE, YEAR MONTH __________________

G P A ____________________________

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<tr>
<th>Trials</th>
<th>SBJ</th>
<th>SR</th>
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<th>PULL-UPS</th>
<th>SIT-UPS</th>
<th>600</th>
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### APPENDIX C

**LEVELS OF CARDIOVASCULAR FITNESS BASED ON TWELVE MINUTE PERFORMANCE AND MAXIMAL OXYGEN CONSUMPTION**

<table>
<thead>
<tr>
<th>DISTANCE (Miles)</th>
<th>MAXIMAL OXYGEN CONSUMPTION (ml./kg./min.)</th>
<th>FITNESS LEVEL</th>
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<td>1.0</td>
<td>25.0</td>
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</tr>
<tr>
<td>1.0 - 1.24</td>
<td>25.0 - 33.7</td>
<td>Poor</td>
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<td>1.25 - 1.49</td>
<td>33.8 - 42.5</td>
<td>Fair</td>
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<td>1.50 - 1.74</td>
<td>42.6 - 51.5</td>
<td>Good</td>
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<tr>
<td>1.75 or more</td>
<td>51.6 or more</td>
<td>Excellent</td>
</tr>
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</table>

1Cooper, *Aerobics*, pp. 36.
APPENDIX D

AIR FORCE 12 MINUTE WALK-RUN TEST DATA AND GRADE POINT AVERAGE

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>DISTANCE (Miles)</th>
<th>GPA</th>
<th>SUBJECTS</th>
<th>DISTANCE (Miles)</th>
<th>GPA</th>
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<td>M.S.</td>
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APPENDIX D
H & PE A.A.H.P.E.R. YOUTH FITNESS TEST DATA AND GPA

<table>
<thead>
<tr>
<th>SUBJECTS</th>
<th>SBJ</th>
<th>SHUTTLE RUN</th>
<th>50-yd DASH</th>
<th>FULL UPS</th>
<th>SIT UPS</th>
<th>600-yd RUN-WALK</th>
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APPENDIX E

MATHEMATICAL PROCEDURE FOR TWELVE MINUTE WALK-RUN TEST DATA

Pearson Product Moment Correlation

\[ r = \frac{32(144.75) - (54.45)(84.7)}{\sqrt{32(93.43) - (54.45)^2} \cdot 32(234.16) - (84.7)^2}} \]

\[ = \frac{20.1}{89.23} \]

\[ = .225 \]

Significance

\[ t = \frac{.22}{1.21} \]

\[ = .19 \]

\[ = 1.21 \]
### APPENDIX E

**MATHEMATICAL PROCEDURE FOR A.A.H.P.E.R. YOUTH FITNESS TEST DATA**

<table>
<thead>
<tr>
<th>TEST</th>
<th>SPEARMAN RANK-ORDER CORRELATION</th>
<th>SIGNIFICANCE</th>
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<tbody>
<tr>
<td>SBJ</td>
<td>$1 - \frac{6(684.5)}{7980}$</td>
<td>$\frac{.335}{.99} \times 4.28$</td>
</tr>
<tr>
<td>SHUTTLE RUN</td>
<td>$1 - \frac{6(1181)}{7980}$</td>
<td>$\frac{.11}{.99} \times 4.28$</td>
</tr>
<tr>
<td>50-yd DASH</td>
<td>$1 - \frac{6(1293.5)}{7980}$</td>
<td>$\frac{.03}{.99} \times 4.28$</td>
</tr>
<tr>
<td>PULL UPS</td>
<td>$1 - \frac{6(883)}{7980}$</td>
<td>$\frac{.34}{.94} \times 4.28$</td>
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<tr>
<td>SIT UPS</td>
<td>$1 - \frac{6(1259.5)}{7980}$</td>
<td>$\frac{.053}{.99} \times 4.28$</td>
</tr>
<tr>
<td>600-yd RUN-WALK</td>
<td>$1 - \frac{6(1137)}{7980}$</td>
<td>$\frac{.145}{.99} \times 4.28$</td>
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