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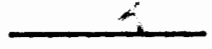
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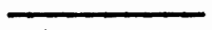
**THE RELATIONSHIP BETWEEN PHYSICAL FITNESS
AND
ACADEMIC ACHIEVEMENT**



**A Thesis
Presented to
the Graduate Faculty
Central Washington State College**



**In Partial Fulfillment
of the Requirements for the Degree
Master of Education**



**by
John Gary Gregor
August 1966**

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APPROVED FOR THE GRADUATE FACULTY

Everett A. Irish, COMMITTEE CHAIRMAN

Robert N. Irving Jr.

Dohn A. Miller

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Many studies have been conducted in the area of physical fitness to determine its effect on academic achievement. These studies indicate that physical fitness is a very important factor in academic achievement.

Very little emphasis was placed on physical fitness in our schools until Kraus and Weber (11:370) published the results of their test. This test pointed out that American youth are far below their European counterparts in certain aspects of physical fitness. These results inspired President Eisenhower to form the President's Council on Youth Fitness. This Council reported: "Physical fitness is but one aspect of fitness; however, it is a very significant aspect and one which is basic to other forms of excellence." (12)

From these two reports the public and schools have again been reminded of the importance of physical fitness among American youth.

I. THE PROBLEM

Statement of the problem. The purpose of this study is to show what relationship exists, if any, between physical fitness and academic achievement among eighth grade junior high school boys.

The criterion for academic success used in this study will be the accumulative grade point average recieved after the first three semesters in junior high school.

Physical fitness will be measured by the Oregon simplification of the Rogers Physical Fitness Index form B, for junior high school boys.

The hypothesis tested:

1. There is a relationship between physical fitness and academic achievement.

Importance of the study. From the launching of the first space satelite, a new era in history was born the space age. As a result, great emphasis has been placed on the study of the sciences. The education program has placed tremendous importance on academic subjects such as mathematics and science, and as a consequence the importance of physical education is being greatly over-shadowed. To create public interest in physical fitness, it is important to stress physical fitness and it's relationship to academic achievement.

John Locke, a philosophical realist, said:

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 wish for; and he that wants either of them will be but little the better for anything else. (11:161)

There have been numerous studies indicating that the physiological organs of the body function more efficiently in the physically fit than the physiological organs of a sedentary person. Dr. Paul Dudley White, a noted heart specialist states:

Physical fitness not only strengthens the heart, arteries, and veins which in turn increases function of the brain, but also builds up muscle tone, improves digestion, increases lung capacity and is also a great help in the nervous system. (5:68)

It is the purpose of the author to show the relationship, if any, of physical fitness to academic achievement.

Limitations of the study. This study was limited to eighth grade boys at Whatcom Junior High School in Bellingham, Washington.

Grades were the only criterion for academic achievement.

Physical fitness was determined by the Oregon Simplification of the Roger's Physical Fitness Index form B.

Intelligence quotient was determined by the California Test of Mental Maturity.

II. DEFINITIONS OF TERMS USED

Physical Fitness Index form B. This test was the Oregon Simplification of the Roger's Physical Fitness Index

form B for junior high school boys. The test consists of four items: leg lift, chins and dips, and right hand grip.

Grades. Each student is enrolled in six classes per semester. For this study only grades from five of these classes were considered. The sixth class which was physical education was not counted.

Academic Achievement. This was denoted by grade point average.

Grade Point Average. The numerical values which determine the grade point average are: A-4, B-3, C-2, D-1, and X-0. The sum of the numerical grades divided by the number of subjects determined the individuals' grade point average.

Intelligence Quotient. This was determined by the California Test of Mental Maturity.

Physical Fitness. The ability of a person's body to meet the demands placed upon it by his work, by his way of life and by the necessity to meet emergency situations. (17) In this thesis the degree of physical fitness will be determined by the score obtained on the Oregon Simplification of the Rogers Physical Fitness Index form B for junior high school boys.

CHAPTER II

REVIEW OF LITERATURE

There have been many studies done verifying the benefits of physical fitness. This interest and emphasis on physical fitness has fluctuated through the years. In times of national emergencies, the emphasis on physical fitness has increased so the country could rise to meet the challenge of the time.

Much has also been written about the beneficial effects of a high level of physical fitness to social, emotional, physical and intellectual success in everyday life. Brownell states, "Fitness may spell the difference between success and mediocrity or failure among the youth of today and citizens of tomorrow." (3)

Today physical fitness is a very important aspect of the physical education program.

Development of physical fitness in a physical education program. Physical education in America has seen a period of great expansion from the Colonial period, when little regard was had for any planned program of activity, until today when programs are required in the public schools in most of our states. (10:227)

During the Colonial period organized physical

education was not considered important. The majority of the people lived an agrarian existence and felt they received enough physical exercise doing farm work. (1:207) In some parts of the New England states the Puritans denounced play as evil. (1:207)

It was not until the time of the American Revolution that physical education began to be of some importance in American society. (1:208) Academies or secondary schools, as they were called at this time, began utilizing games and sports; however, they were still not important enough to occupy a place in the daily school schedule. (1:208) It was not until 1802, when the United States Military Academy was founded, that physical education had a place in school curriculum. (1:209) Also during this period, Beck and Follen, two German gymnasts, introduced gymnastics to America. This program had considerable influence on the already growing physical education profession. (16:111)

After the Civil War physical education took a big step forward. Programs were established in public schools and the public was becoming aware of the fact that physical education plays an important role for a healthy life. (10:227)

From 1870 to 1890 sports began to achieve some degree of popularity. Tennis, bowling, basketball and other sports were introduced and in 1879 the National Association of

Amateur Athletics of America was developed. (1:211)

Soon after 1900 new concepts of physical education developed. The trend of a regimented European system of physical education was modified and more free play, sports, games and individual participation was brought into the program. (16:111) By 1920 the need for physical education had become accepted and State legislation was passed requiring physical education in public schools. (10:227)

During World War II a new trend of physical education appeared which gave a great amount of emphasis to physical fitness. (1:216) However, after the war people again forgot the importance of physical fitness until the results of the Kraus-Weber test were published. (16:370)

This stimulated President Dwight D. Eisenhower to create the President's Council on Youth Fitness. The purpose of this executive order of 1956 was to promote a higher level of fitness in American youth.

President John F. Kennedy also played a tremendous part in stimulating the physical vitality of our nation and increasing interest in physical fitness in America. In a presidential message to the schools on Physical Fitness of American Youth, he said:

The strength of our democracy is no greater than the collective well-being of our people. The vigor of our country is no stronger than the vitality and will of all countrymen. The level of physical, mental, moral and spiritual fitness of every American citizen must be our constant concern. What better place can we start this, than with vigorous physical fitness in our schools. (23)

With the enthusiasm of the president and the establishment of the President's Council on Youth Fitness, the schools and public have again been reminded of the importance of physical fitness among the American youth.

Physical fitness related to academic achievement.

A number of researchers support the contention that physical fitness is related to academic achievement. Studies in Manchester, England (9:156) revealed that only 2.4 percent of students with good scholarship were below the average in physique, as evidenced by body measurements, but that 39.7 percent with poor scholarship were below the average.

As a consequence of this type of evidence and as a result of many years of observing low fitness individuals, Rogers (8:464) contended that physically unfit boys at all levels of intelligence have greater difficulty in maintaining mental effort and alertness. He explains the phenomenon this way:

The dependence of learning upon muscular strength is better comprehended when it is recalled that the brain (and mind) do not easily tire: what tires is the body. Thus, the bloodstream, clogged with waste products of muscular activity consequent upon all walking life, whether primarily physical or mental, interferes with synaptic change.

Rogers then proposed the Law of General Learning Potential (GLP). (8:464) This law is interpreted to mean that a person's general learning potential for a given level of intelligence is increased or decreased in accordance with

his degree of physical fitness. The individual when fit is more prone to be physically and mentally alert, to be vigorous in his applications, and to suffer less from efficiency-destroying fatigue than when he is unfit. While one may disagree with the formula proposed by Rogers and with the tests he advocates for use with it, certainly the basic concept of the law is tenable. (8:464)

John F. Sweeney, Director of Guidance and Counseling for the Springfield, Missouri public schools, conducted a special study for the Council. The objective: to determine how students who maintain a high level of physical fitness compare academically with their classmates. Students were rated in four areas of academic performance: (1) Grade average for the 1961-62 school year; (2) Attendance; (3) Participation in extra curricular activities; and (4) Attitude toward school. (17:123)

Mr. Sweeney used two groups in the study. The select group consisted of 442 freshmen and juniors. All had passed a comprehensive test of physical achievement, and all ranked in the upper forty percent of their classes on the basis of physical performance. The other group consisted of 200 juniors and freshmen whose records were pulled at random from the school files. Thus they were in no sense a below average group. There were equal numbers of boys and girls in both test groups.

The select group's collective grade point average was three-tenths of a point higher (2.48 to 2.19) than that of random sample.

The select group students participated in 50 percent more extra-curricular activities, and they missed fewer days of school. Also, in the opinions of their deans and counselors, they displayed a far more positive and enthusiastic attitude toward school.

While these figures do not prove that the select group's superior performance was the result of superior fitness, they do refute any argument that physical fitness and intellectual excellence are somehow incompatible. They also would seem to indicate that physical education programs are more likely to abet than impede academic programs. (29:24)

Jarman, citing Popp's study of sophomore high school boys, reported that after giving the Physical Fitness Index test to the boys of Coos Bay, Oregon, Popp selected for his study the top twenty and the bottom twenty boys. He found that "only one boy in the top fitness group failed to graduate with his high school class, while eight boys in the low group did not graduate with their class". (18:10-11)

Jarman (18:99), testing high school boys as a part of the Medford Project, and McMillen, testing high school girls, found that physical fitness tests do predict academic success.

Hollis J. Caswell, President Emeritus of Columbia

University (5:1) states: "During twenty five years of teaching experience, I found there is an undeniable correlation between physical fitness and mental fitness". Dr. Caswell believes that with the ever increasing emphasis on academic subjects, the strong physically fit individual will have a better chance of conquering these academic complexities.

In his study of 296 high school freshmen, Kemp found that "the successful athletes had higher grade point averages and stayed in school longer than the non-successful athletes". (20:29) McCollum supports this study by using the AAHPER Test of Physical Fitness, the California Test of Mental Maturity, and the grade point averages for the whole year. He found no significant difference in IQ between the fit and the unfit, but "the difference in grade point average is significant at the .02 level of confidence". (21:28)

Page (9:155) found that 83 percent of the freshmen male students dismissed from Syracuse University in 1940 because of low grades had physical fitness indexes below the national average of 100. Thirty nine percent of these students had physical fitness indexes below 85. These students had mental aptitude scores on standard tests well above the average. Page then concludes that physical fitness and academic success go hand-in-hand.

Coefield and McCollum (8:462) did a study at the University of Oregon in 1954 comparing the physical fitness

index and the academic success of 78 male freshmen students. They found that the 78 male students with the lowest physical fitness index were among the lowest in scholastic achievement. These same 78 however were superior in scholastic aptitude.

A fitness test was given by Weber (28:471) to entering male freshmen at the University of Iowa. He picked at random 246 students to be used in his study. The physical fitness of each student was measured by four activities: (1) sit-ups for two minutes; (2) pull-ups; (3) 100 yard pick-a-back run; (4) 300 yard shuttle run. Using these physical fitness scores he correlated them with the subjects' grade point average for the year. His conclusion was:

There was a significant relationship between physical fitness scores and grade point averages for a year. The coefficient of correlation was .41 which is significant at the .01 level of confidence. This finding indicates that good physical fitness, as measured, tended to accompany, fairly well, achievement of academic success during the year for the subjects studied. It is possible that physical fitness should be given consideration when one attempts to predict academic success for entering male freshmen. (28:476)

Ray, as stated by Oakes, did a study of 432 Palo Alto, California high school boys with his records covering from one to four years. He used the Terman Group Test, academic grades, and a specially designed decathlon to test physical fitness. (22:9) "Within the limits of IQ group, this study finds physical ability a more reliable predictor of academic standing than is relative IQ". (24:140) Ray continues, "The

athlete is not only superior in mental ability as measured by IQ, but more superior as measured by academic failures". (24:141)

Jarman (9:160) in studying the academic achievement of boys at the ages of nine, twelve and fifteen grouped them into high and low physical groups according to their scores on (1) Strength Index; (2) Physical Fitness Index; (3) McCloy's Arm Strength Score; and (4) McCloy's Classification Index. These groups were equated for each age and for each test by intelligence quotients obtained from a battery of intelligence tests. The academic achievement means of the students who scored low on the physical test were compared with the academic achievement means of students who scored high on the physical tests. Jarman found, "The boys with the high scores on the various physical fitness tests had significantly higher means on standard scholastic achievement tests". (9:161)

According to Gutin "there seems to be a moderate but significant relationship between degree of fitness improvement and degree of improvement in mental task ability following stress". (15:3744) In his study, cited by Oakes, he used a control group of twenty-six Hunter College students who had twelve weeks of physical fitness exercises. The groups were given a series of mental tasks followed by forty-five minutes of a low intensity period of physical and mental exertion.

Both groups were pre-tested and post-tested using the Indiana Motor Fitness Index. (22:11) Analysis of covariance and tests for unmatched groups applied to pre-test and post-test gain scores of mental task scores indicated that:

. . . within each group a correlation coefficient was obtained between the pre-test--post-test fitness gain scores and the mental task gain scores. A coefficient of correlation was derived for both groups combined. (15:3743)

Clarke and Jarman (9:156) cited Rarick and McKee as having studied the scholastic capabilities of two groups of third grade children. One group scored high on a physical fitness test and the other group scored low. Observing these groups in the classroom, they found that groups with superior physical fitness demonstrated more scholastic adjustment.

Jarman cited a study which took place in France and Belgium. The academic load was reduced by two or more hours per day and the time allowed for physical education and physical improvement in health was increased. "As would be expected, a general improvement in health and physical development followed; however, there was also a corresponding increase in academic achievement". (18:22) Stein, as stated by Oakes, discussed a study by Oliver and another by Corder similar to this. Oliver's study involved institutionalized mentally retarded boys twelve to fifteen years old in England. The experimental group improved significantly in

physical fitness and emotional stability. Intelligence quotients increased in twenty-five percent of the experimental group. (22:10) "No significant improvements in IQ were reported among the control group". (27:26) Corder also used retarded boys for his subjects. The group that received the planned physical education period "showed significant gain scores over the control group on the full and verbal scales of the Wechsler Intelligence Scale of Children". (27:26) His study was limited to eight boys in each group.

Herbert Sorensen did a study on nine year olds. He stated:

The correlation is low for any age group. This means that almost as often as not, a person of advanced physical development, (might be) advanced, average, or retarded mentally. The same is true of mental development. One cannot judge accurately a child's physical status from a knowledge of his mental capacity. However, because there is a slight correlation between mental and physical status, more often than not, high mentality is associated with good physical development. (26:24)

Using the movement pattern concept, Godfrey, as cited by Oakes, made a limited study of children eight to eleven years old, who were experiencing school difficulties in one or more subjects but had normal or higher intelligence. The program was conducted by the Department of Physical Education for Women, Purdue University. They used gymnasium activities with the trampoline, mats, apparatus, rhythm movements, and the swimming pool. The program was held once a week for two

hours. The parents attended and were to carry on the program until the next meeting. (22:14) Godfrey states that "all participants showed improvement in school subject grades and achievement test scores. A matched group of nonparticipants did not show comparable results". (14:65) She continued by saying: "The implication would seem to be that physical education has a contribution to make also to academic achievement in the elementary school". (14:66)

Col. Frank Kobes of the United States Military Academy stated:

We have made several studies at the Academy which have convinced us that among the several entrance examinations which are given to candidates, the best single criteria for Cadet success at the Academy is physical ability. (12:161)

H. Harrison Clarke (7:389) cites that Appleton, also of the United States Military Academy, noted over a ten year period, a significant positive relationship existed between the physical abilities of entering cadets and the success or failure to graduate from the Academy. Appleton believes that according to his findings, physical fitness and achievement are definitely related to some degree.

Hart and Shay concluded that:

Although physical fitness is not a general predictor of academic success, it is high enough to be considered as a necessary factor for the improvement of academic index in the general education of the college student. (17:445)

Clarke and Jarman (9:156) stated that Terman, after 25 years of studying intellectually gifted children said:

The results of the physical measurements and medical examinations provide a striking contrast to the popular stereotype of the child prodigy, so commonly predicted as a pathetic creature, 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 of the mentally average". (9:156)

To defend his study and to show that gifted children are not always "weak" he states: ". . . when my gifted subjects were young, symptoms of general weakness were reported by the school nearly 30 percent less frequently for the gifted than for the mentally average".

Giauque (13:269), in his writings on educational psychology, quotes Thorndike as saying: ". . . learning depends on readiness, exercise and effect". He continues, ". . . exercise of almost any mental function sooner or later involves physical response too; and the effects of purely mental exercises are poor if the body is tired". Thorndike believes that to be physically fit the body must be able to carry on, minute by minute, hour after hour and day after day.

(13)

The studies mentioned above indicate there is some relationship between physical fitness and academic achievement. Most of the research found had been done either at the elementary school, high school or college level. This author

was unable to find any research reported on the relationship of physical fitness to academic achievement at the junior high school level. For this reason the author has conducted the present study.

CHAPTER III

PROCEDURES

In an attempt to solve the problem of what relationship, if any, existed between physical fitness and academic achievement the author used one hundred six eighth grade boys at Whatcom Junior High School in Bellingham, Washington. The data required to make this comparison was obtained by establishing the grade point average, intelligence quotient and physical fitness index of each individual. After the necessary data were accumulated correlations were computed between: (1) grade point average and intelligence quotient; (2) grade point average and physical fitness index; (3) intelligence quotient and physical fitness index. These were correlated by using the formula for the computation of the Pearson product moment correlation coefficient.

Subjects. The subjects used in this study were eighth grade boys at Whatcom Junior High School in Bellingham, Washington. The majority of these boys are from middle class families, whose home environment and socioeconomic status have been relatively the same. The age of these boys ranged from twelve to fifteen with the majority being between thirteen and fourteen years old. Physical education is required for all eighth grade boys. During the year each

student participates in physical education class three times a week. Physical fitness is a very important aspect of this physical education program. Ten to fifteen minutes at the beginning of each class period is devoted to vigorous calisthenics. There was no discrimination in selection for all of the eighth grade boys were tested. Before each test session, the classes were given exercises to warm up in preparation for the tests.

Physical Fitness Scores. The physical fitness scores were obtained by using the Oregon Simplification of the Roger's Physical Fitness Index form B. Before the author administered the above physical fitness test to the eighth grade boys, Dr. Irving, an expert in testing, demonstrated and explained the methods and techniques used in the test. After practicing the methods and techniques on college male students, the author, with the guidance of Dr. Irving, became a competent tester. This test contained: (1) leg lift; (2) pull-ups; (3) dips; (4) right hand grip. The following information was also needed for each student; (1) chronological age to the nearest month; (2) height to the nearest one-half inch; (3) weight to the nearest pound. After recording the data on a score card and following the procedure in the book (7:195) the Physical Fitness Index was found.

An example of the score card used for recording physical fitness test scores is shown in figure I.

FIGURE I

SCORE CARD FOR RECORDING
RESULTS OF P.F.I. TEST

Name _____	Date _____
	Raw Score Predicated Score
Age	_____
Weight	_____
Height	_____
Pull-ups	_____
Dips	_____
Arm Strength	_____ X .99 _____
Leg Lift	_____ X 1.12 _____
Right Grip	_____ X 5.19 _____
	Constant <u>129</u>
	Achieved Strength Index _____
	Normal Strength Index _____
	Physical Fitness Index _____

	<u>Semester Grades</u>			<u>Accume.</u>	<u>I.Q.</u>	<u>P.F.I.</u>
				<u>G.P.A.</u>		
1st.	2nd.	3rd.	_____	_____	_____	_____
_____	_____	_____				

Grade Point Average. Every grade that each student received from the first semester of the seventh grade to the second semester of the eighth grade was used except the physical education grades to determine grade point average. The physical education grades were disregarded because the athlete benefited more than the non-athlete. By leaving out the physical education grade it was believed a truer measure of academic achievement could be obtained.

The grades were taken from the student's permanent file in the principal's office. The grade point average was calculated by giving each grade a numerical number: (1) A-4; (2) B-3; (3) C-2; (4) D-1; (5) X-0. After recording all the grades for each student and changing them to a numerical value, the sum was then divided by the number of subjects to determine the accumulative grade point average.

Intelligence Quotient. The intelligence quotient for each student was also obtained from the permanent file in the principal's office. The California Test of Mental Maturity was the most recent measure of intelligence so was used for this study.

Procedure for Analyzing Data. Pearson's product moment method of computing the coefficient of correlation was used in determining the relationship between the different variables used in this study. Comparisons were made between: (1)

intelligence quotient and grade point average; (2) intelligence quotient and physical fitness index; (3) grade point average and physical fitness index.

The mean physical fitness of the high group was compared to the mean physical fitness of the low group. The intelligence quotient and grade point average of each group was also compared. These comparisons were made in an attempt to determine the relationship between the students physical fitness index and grade point average.

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to examine the effect physical fitness had on determining grade point average for eighth grade boys at Whatcom Junior High School in Bellingham, Washington. For each eighth grade boy the Oregon Simplification of the Roger's Physical Fitness Index Test form B was used to determine physical fitness. Along with physical fitness each boy's intelligence quotient and grade point average was also established.

The following formulas were needed to calculate the above information: (7)

1. Arm Strength:

$$\left(\frac{\text{wt.}}{10} + h - 60\right) (c + d)$$

2. Strength Index

$$\text{S.I.} = 1.12 (\text{L.L.}) + .99 (\text{A.S.}) + 5.19 (\text{R.G.}) + 129$$

3. Physical Fitness Index

$$\text{P.F.I.} = \frac{\text{Achieved S.I.}}{\text{Normal S.I.}} \times 100$$

4. Product-Moment Correlation Coefficient

$$\frac{N \cdot \sum X Y - \sum X \cdot \sum Y}{\sqrt{[N \cdot \sum X^2 - (\sum X)^2][N \cdot \sum Y^2 - (\sum Y)^2]}}$$

The three variables, physical fitness, grade point average and intelligence quotient were inter-correlated to determine the relationship between them. The correlations between the different variables are reported in table I.

TABLE I
CORRELATIONS BETWEEN THE
THREE TEST VARIABLES
N 106

Variables	P.F.I.	I.Q.
Grade Point Average	.676	.613
Intelligence Quotient	.085	

The above correlations are significant to this study, for they indicate the importance each variable is to academic achievement. Table I indicate's there is very little relationship between intelligence quotient and physical fitness index (.085). The relationship between grade point average and intelligence quotient is (.613). The relationship between Physical Fitness Index and grade point average is (.676). Physical fitness index and grade point average have a higher relationship than does the grade point average and intelligence quotient, indicating, that physical fitness index in this study is a more important variable in determining

grade point average then is intelligence quotient.

These subjects were divided into two groups according to Roger's Physical Fitness Index. The first group contained the top twenty students with the highest physical fitness index and the second group contained the twenty students with the lowest physical fitness index. The intelligence quotient and grade point average of these two groups was also shown. Table II shows the physical fitness index, grade point average and intelligence quotient of the highest group based on Physical Fitness Index.

TABLE II

TOP TWENTY STUDENTS
IN PHYSICAL FITNESS

Number (ranked)	Physical Fitness Index	Grade Point Average	Intelligence Quotient
1	153	3.0	111
2	146	3.3	135
3	142	3.0	124
4	140	2.7	120
5	137	3.1	96
6	136	3.2	132
7	136	3.1	89
8	135	2.4	104
9	135	3.8	112
10	135	2.6	82
11	134	2.7	93
12	133	3.0	99
13	132	3.3	106
14	131	3.5	104
15	130	2.5	155
16	128	3.0	122
17	128	2.9	95
18	128	2.9	128
19	128	2.7	98
20	128	2.1	135

Table II denotes the importance of physical fitness in determining individual grade point average. For example, subject numbers; 5,7,10,12,17, and 19 have intelligence quotients ranging from eighty-two to ninety-nine. The grade point average of these students range between 2.6 and 3.1. This is a good grade point for students who have intelligence quotients in the eighties and nineties. According to table II those students who were below ninety-nine in intelligence quotient had physical fitness indices of above one hundred twenty eight.

It can be concluded from the evidence in table II that physical fitness plays a more important role in determining grade point average than intelligence quotient.

Table III shows the physical fitness index, grade point average and intelligence quotient for the twenty students in the lower group.

TABLE III
 LOWER TWENTY STUDENTS
 IN PHYSICAL FITNESS

Number (ranked)	Physical Fitness Index	Grade Point Average	Intelligence Quotient
1	66	1.3	79
2	74	1.7	101
3	78	2.1	122
4	82	1.5	86
5	83	1.7	110
6	86	1.7	109
7	86	1.7	93
8	87	1.6	111
9	88	0.9	107
10	88	1.6	111
11	88	1.6	100
12	90	2.0	125
13	90	2.7	136
14	92	1.3	84
15	92	1.4	106
16	92	2.0	112
17	94	1.6	99
18	95	1.9	93
19	95	2.5	118
20	96	1.9	121

In table III it is interesting to compare the grade point averages with the low physical fitness indexes. For example, subjects three and twelve have above average intelligence quotients of 100 (122 and 125). Their grade point average is 2.0 and 2.1. The physical fitness index of these two students is below the average of 100 (78 and 90). It can be concluded from table III that even if the intelligence

quotient is relatively high and the physical fitness index is low the student may do poor academically.

The mean physical fitness index, grade point average and intelligence quotient for the two groups were compared to show the influence physical fitness has on grade point average. Table IV shows the comparison of the two groups.

TABLE IV
MEAN SCORES OF
THE TWO GROUPS

	Physical Fitness Index	Grade Point Average	Intelligence Quotient
Top Group	130.25	2.9	112
Lower Group	87.1	1.73	106.1
Mean Difference	43.15	1.17	5.9

Table IV shows the mean score and mean difference between the three variables of the two groups. The mean difference between the two groups in intelligence quotient was 5.9. The mean difference for grade point average was 1.17 and for physical fitness index 43.15.

In table V the student t was established to determine if there was a significant difference between the two groups (high and low) in Physical Fitness Index, intelligence quotient or grade point average.

TABLE V
STUDENT t's
FOR HIGH AND LOW GROUPS

Physical Fitness Index	Intelligence Quotient	Grade Point Average
5.28	1.10	6.84

Table V shows the student t's for the high and low group comparing the means of the high group in physical fitness index, intelligence quotient and grade point average to the means of the low group in physical fitness index, intelligence quotient and grade point average. In comparing the mean intelligence quotient (112) of the high group to the mean intelligence quotient (106.1) of the low group a t of 1.10 was found. According to the Fisher t table a t of 2.02 is needed to be significant at the .05 level and 2.71 at the .01 level for 38 degrees of freedom. Therefore there was no significant difference in the intelligence quotients of the high and low groups. Comparing the mean physical fitness index (130.25) of the high group and mean

physical fitness index (87.1) of the low group a t of 5.28 was established. This shows that the physical fitness index is significant at the .01 level of confidence. When mean grade point average (2.9) of the high group and mean grade point average (1.17) of the low group was compared a t of 6.84 was found. This is also significant at the .01 level of confidence.

With a significant difference at the .01 level of confidence in grade point average and physical fitness index, but no significant difference in intelligence quotient, it can be concluded that the Physical Fitness Index is more important in determining grade point average than is the intelligence quotient.

In summary, students in the top twenty physical fitness group did better academically with lower intelligence quotients than students in the lower twenty physical fitness group did with higher intelligence quotients.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

The purpose of this study was to determine what relationship existed between physical fitness as measured by the Oregon Simplification of the Roger's Physical Fitness Test form B and academic achievement as measured by grade point average. This study also indicated the important role physical fitness plays in determining the grade point average of eighth grade boys at Whatcom Junior High School in Bellingham, Washington.

SUMMARY

1. The subjects used for this study were all the eighth grade boys at Whatcom Junior High School. One hundred-six boys took part in this study.
2. The test used to determine physical fitness was the Oregon Simplification of the Roger's Physical Fitness Test form B.
3. The testing was administered by the author with the help of Mr. Frank Geri, physical education instructor, at Whatcom Junior High School.
4. The testing was administered on two consecutive days.

5. The tests were treated statistically to determine:
 - a. The relationship between physical fitness and grade point average.
 - b. The relationship between physical fitness and intelligence quotient.
 - c. The relationship between grade point average and intelligence quotient.
 - d. The mean scores and difference between mean scores for physical fitness, intelligence quotient and grade point average for the top twenty and bottom twenty subjects in physical fitness in each group.

Results

1. The results of this study were significant for they showed that the hypothesis which states: there is a relationship between physical fitness and academic achievement was positive.

2. The correlation between intelligence quotient and physical fitness was very low (.085) indicating that there is very little relationship between the two variables.

3. The correlation between intelligence quotient and grade point average was (.61). This showed that intelligence quotient and grade point average have some relationship.

4. The correlation between physical fitness and grade point average was very significant (.676). The relationship in this study indicated that physical fitness is a more important factor in determining grade point average than the intelligence quotient.

5. The mean score for the group of twenty with the highest physical fitness index and for the group of twenty with the lowest physical fitness index also showed a very significant difference. The mean difference was:

- a. Grade Point Average (1.17)
- b. Intelligence Quotient (5.9)
- c. Physical Fitness Index (43.15)

Conclusions

As a result of this study it appears that:

1. The intelligence quotient has little predicative value in determining physical fitness.
2. The boys with the higher degree of physical fitness were more successful academically.
3. The Roger's Physical Fitness Index was a better determining factor for obtaining academic success than intelligence quotient.

Recommendations

1. To conduct this same study using the same variables with boys at other grade levels to determine if the results

will be the same.

2. To conduct a study among girls of the same age group and using the same variables to determine physical fitness, intelligence quotient and grade point average.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Bucher, Charles A. Foundations of Physical Education, St. Louis: C.V. Mosby Company, 1956. 446 pp.
2. Bucher, Charles A. "Health, Physical Education and Academic Achievement", National Education Association Journal, 54:38-40, May 1965.
3. Brownell, Cliff. "A Profile of Fitness in Education", Teachers College Record, 59:396, April, 1958.
4. Campbell, William Giles. Form and Style in Thesis Writing, Boston: Houghton Mifflin Company, 1954.
5. Caswell, Hollis L. Physical Education News Letter, Letter 19, Vol. 8, June 1964.
6. Champan, A. L. "The Latest on Exercise", Readers Digest, 75:67-70, September, 1959.
7. Clarke, H. Harrison. Application of Measurement to Health and Physical Education, New Jersey: Prentice-Hall Inc., 1950.
8. Clarke, H. Harrison. "Physical Fitness Benefits", Education, 78:460-467, April, 1958.
9. Clarke, H. Harrison and Boyd Jarman. "Scholastic Achievement of Boys 9, 12, and 15 Years of Age as Related to Various Strength and Growth Measures", Research Quarterly, 32:155-163, May, 1961.
10. Duncan, Margaret M. and Ralph H. Johnson. Introduction to Physical Education, Health Education and Recreation, New York: Prentice-Hall, Inc., 1954. 388 pp.
11. Espenchade, Anna S. "Contributions of Physical Activity to Growth", Research Quarterly, 31:351-364, May, 1960.
12. Forbes, Ted. "Physical Fitness and Our Youth", National Association of Secondary-School Principals Bulletin, 46:156-160, March, 1962.

13. Giaouque, Charles D. "Inquiry Into the Correlation Between Physical Fitness and Scholastic Standing", Supplement to the Research Quarterly, Vol. 6, March, 1935, pp. 269-75.
14. Godfrey, Barbara. "Motor Therapy and School Achievement", Journal of Health Physical Education and Recreation, 35:65-66, May, 1964.
15. Gutin, Bernard. "The Effect of an Increase in Physical Fitness Upon the Performance of Mental Tasks Following Physical and Mental Stress", Dissertation Abstracts, 26:3743-3744, No. 7, January 1966.
16. Hallberg, Edmond C. and Ann Paterson. Background Readings for Physical Education, New York: Holt, Rinehart and Winston, 1965.
17. Hart, M. E. and C. T. Shay. "Relationship Between Physical Fitness and Academic Success", Research Quarterly, 35:443-445, October, 1964.
18. Jarman, Boyd O. "Interrelationships Between Academic Achievement and Selected Maturity, Physique, Strength, and Motor Measure of Fifteen Year Old Boys", Microcarded Thesis (ED. D.) University of Oregon, 1965, 112 pp.
19. Jones, Frank B. "President's Message: Additional Support for the Daily Required Program of Physical Education", CAHPER Journal, 28:4-5, No. 3, January/February, 1966.
20. Kemp, Paul Clement. "A Study of Academic Achievement of Nonsuccessful and Successful Athletes", Microcarded Thesis (M. A.) State University of Iowa, 1959, 49 pp.
21. McCollum, Garland L. "A Comparison Between the Physically Fit and the Physically Unfit in Intelligence, Academic Achievement, and Attendance in School", Microcarded Thesis, Arkansas State College, 1962, 36 pp.

22. Oakes, Shirley M. "A Relationship Between Physical Fitness and Social and Academic Achievement of Junior High School Girls", Unpublished Master's Thesis, Central Washington State College, pp. 56, 1966.
23. President's Council on Youth Fitness, "Youth Physical Fitness", (Suggested-Elements of a School Centered Program), Washington D.C., United States Government Printing Office, July, 1961.
24. Ray, Howard C. "Interrelationship of Physical and Mental Abilities and Achievements of High School Boys", Research Quarterly, 11:129-141, 1940.
25. Sills, Frank D. "Special Conditioning Exercises for Students with Low Scores on Physical Fitness Tests", Research Quarterly, 25:333-337, October, 1954.
26. Sorenson, Herbert. Psychology in Action, McGraw-Hill, 1940.
27. Stein, Julian U. "The Potential of Physical Activity for the Mentally Retarded Child", Journal for Health, Physical Education and Recreation, 37:25-28, No. 4, April, 1966.
28. Weber, John Robert. "Relationship of Physical Fitness to Success in College and to Personality", Research Quarterly, 24:271-477, December, 1953.
29. _____ . "Youth and Fitness, Where Do We Stand", Senior Scholastic, 82:24, February, 1963.

APPENDIX

TABLE VI
 TEST RESULTS FOR 106
 EIGHTH GRADE STUDENTS

Subject	Physical Fitness Index	Grade Point Average	Intelligence Quotient
1	128	2.9	120
2	120	2.6	69
3	102	2.4	103
4	126	2.4	98
5	92	1.6	111
6	87	1.7	93
7	106	1.7	79
8	117	2.1	86
9	108	2.5	137
10	66	2.0	125
11	110	1.2	73
12	97	1.5	107
13	90	1.7	101
14	94	1.5	86
15	96	2.5	107
16	146	3.3	128
17	106	2.3	132
18	120	2.5	118
19	100	2.1	125
20	128	3.0	132
21	153	3.0	98
22	142	3.0	104
23	134	2.7	106
24	130	2.5	96
25	118	2.4	108
26	92	1.7	110
27	116	1.8	92
28	120	2.7	110
29	135	2.4	89
30	96	1.7	87
31	88	2.5	118
32	124	2.6	84
33	73	2.0	102

Subject	Physical Fitness Index	Grade Point Average	Intelligence Quotient
34	104	2.8	110
35	108	2.3	101
36	115	1.6	97
37	123	2.6	141
38	119	2.7	100
39	102	1.9	115
40	100	2.1	111
41	135	3.8	135
42	78	0.9	107
43	135	2.6	95
44	96	1.3	84
45	103	1.4	96
46	118	2.4	97
47	133	3.0	135
48	103	2.0	124
49	86	1.9	121
50	98	1.7	115
51	112	3.2	123
52	115	2.4	116
53	124	2.3	94
54	111	2.1	77
55	140	2.7	122
56	112	2.3	115
57	128	2.9	111
58	126	3.0	127
59	95	2.0	112
60	136	3.2	124
61	97	1.6	80
62	116	2.8	107
63	88	1.6	111
64	104	2.2	105
65	128	2.7	93
66	131	3.5	155
67	126	3.3	130
68	106	2.0	103
69	98	3.6	133
70	112	2.7	123

Subject	Physical Fitness Index	Grade Point Average	Intelligence Quotient
71	132	3.3	104
72	108	1.6	82
73	97	1.8	101
74	137	3.1	112
75	119	1.7	96
76	86	1.3	79
77	115	2.7	111
78	90	2.7	136
79	136	3.1	82
80	118	2.6	140
81	102	1.9	97
82	108	1.7	89
83	120	3.2	126
84	74	1.6	99
85	116	2.7	117
86	115	1.9	90
87	114	1.9	91
88	119	2.8	112
89	103	1.8	120
90	99	2.3	115
91	110	2.4	93
92	82	1.4	106
93	83	1.6	100
94	106	2.3	112
95	102	1.6	112
96	114	2.7	104
97	110	2.9	130
98	95	2.1	122
99	88	1.7	109
100	108	2.3	94
101	116	1.5	84
102	92	1.9	93
103	98	2.0	127
104	102	1.7	100
105	128	2.1	99
106	102	3.1	121

OREGON SIMPLIFICATION OF THE
ROGER'S PHYSICAL FITNESS TEST FORM B

TEST I

RIGHT HAND GRIP FOR STRENGTH

EQUIPMENT: Manuometer or hand dynamometer

TEST

- PROCEDURE:
1. The tester should take the right-hand corner of the manometer between the thumb and forefinger of his right hand and place it in the palm of the subject's hand while holding the hand to be tested with his left hand in such a manner that the convex edge of the manometer is between the first and second joints of the fingers and the rounded edge is against the base of the hand. The thumb should touch, or overlap, the first finger. The dial of the manometer should be placed face down in the hand.
 2. In taking the test, the subject's elbow should be slightly bent and his hand should describe a sweeping arc downward as he squeezes the manometer. The hand should not be allowed to touch the body, or any object, while the test is being administered. If it does, the score should not be read at all, and a retest should be given after a short rest period of 30 seconds.
 3. Scores should be read to the nearest pound.
 4. A cake of magnesium carbonate should be available for dusting the hand if it should become moist and slippery.
 5. The indicator should be returned to zero after each test.

TEST II

LEG - LIFT

EQUIPMENT: Leg dynamometer with belt

TEST

- PROCEDURE:**
1. The subject should hold the bar with both hands together in the center, both palms down, so that it rests at the junction of thighs and trunk. Care should be taken to maintain this position after the belt has been put in place and during the lift.
 2. The loop end of the belt is slipped over one end of the handle or cross bar; the free end of the belt should be looped around the other end of the bar, tucking it in under so that it rests next to the body. In this position, the pressure of the belt against the body and the resultant friction of the free end against the standing part holds the bar securely. The belt should be placed as low as possible over the hips and gluteal muscles.
 3. The subject should stand with his feet in the same position as for the back lift. The knees should be slightly bent. Maximum lifts occur when the subject's legs are nearly straight at the end of the lifting effort. Experienced testers become adept at estimating the potential lift by noting the degree of muscularity of the subject's legs; as a consequence, they will start the stronger subjects at a lower chain link, so as to allow for the extra distention in the dynamometer. If too high a link is used the subject's knees may snap into hyperextension during the lift, although an alert tester can always anticipate such an occurrence and interrupt the performance.
 4. Before the subject is instructed to lift, the tester should be sure that the arms and back are straight, the head erect, and the chest up. These details are of great importance to accurate testing. Beginners will err in results

by from 100 to 300 or more pounds if the single detail of leg angle is wrong. Therefore, even experienced testers repeat leg-lift tests for most subjects immediately, changing slightly the length of chain (even by twisting, if a link seems to great).

5. Record the best of two to three tests.

TEST III
PULL-UP OR CHINS

EQUIPMENT: Chinning bar or rings

TEST

- PROCEDURE:**
1. In taking the pull-up test, the subject hangs from the bar by his hands, and chins himself as many times as he can. In executing the movement he should pull himself up until his chin is even with the bar, then lower himself until his arms are straight. He should not be permitted to kick, jerk, or use a kip motion. (use the forward hand grip without the rings)
 2. Half-counts are recorded if the subject does not pull all the way up, if he does not straighten his arms completely when lowering the body, or if he kicks, jerks, or kips in performing the movement. Only four half-counts are permitted.

TEST IV

PUSH-UP OR DIP

EQUIPMENT: Regular gymnasium parallel bars or wall dipping bars

TEST

- PROCEDURE:**
1. The bars should be adjusted at approximately shoulder height.
 2. The subject should stand at the end of the parallel bars, grasping one bar in each hand. He jumps to the front support with arms straight (this counts one). He lowers his body until the angle of the upper arm and forearm is less than a right angle, then pushes up to the straight-arm position (this counts two). This movement is repeated as many times as possible. The subject should not be permitted to jerk or kick when executing push-ups.
 3. At the first dip for each subject, the tester should gauge the proper distance the body should be lowered by observing the elbow angle. He should then hold his fist so that the subject's shoulder just touches it on repeated tests.
 4. If the subject does not go down to the proper bent-arm angle or all the way up to a straight-arm position, half-credit only is given, up to four half-credits.