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An Empirical Study of Factors Associated with Physical Fitness of Sixth Grade Students

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AN EMPIRICAL STUDY OF FACTORS ASSOCIATED WITH PHYSICAL FITNESS OF SIXTH GRADE STUDENTS

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I. INTRODUCTION

The physical fitness of its citizens has been a concern of the United States for many years. Since 1790, more than sixty bills and resolutions have been presented by congress aimed at improving the fitness of youth. Prior to 1918, the bills were designed to develop fitness through military training. Since that time the bills presented to congress have as their goal the development of physical fitness prior to induction into the military (12:196-203).

The emphasis on physical fitness in recent years began as a result of an article published by Kraus and Weber which was brought to the attention of President Eisenhower. In June 1956, the first President's Conference on Fitness of American Youth took place at the United States Naval Academy, Annapolis, Maryland. At this conference the President's Council on Youth Fitness was established (27:208).

Richard Nixon, in his keynote address to the first Conference on Fitness of American Youth, stated:

> We are not a nation of softies but we could become one if proper attention is not given to the trend of our time, which is toward the invention of all sorts of gagetry to make life easier and in so doing reduce the opportunity for normal physical health-giving exercise.
>
> The object of an adequate physical fitness program can be summed up in one word--participation--participation on the part of every boy and girl in America in some form of healthy recreational and physical activity (42).

John F. Kennedy continued the program initiated by President Eisenhower and re-emphasized the need for physical fitness when he said:

> The strength of our democracy is no greater than the vitality and well being of our countrymen. The level of physical, mental, moral and spiritual fitness of every citizen must be our major concern (33:i).

The President's Council on Youth Fitness established in 1956, set forth a number of principles for an effective physical fitness program. They are as follows:

1. Programs to improve physical fitness must provide vigorous activities that will develop the physique, increase the efficiency of the cardiovascular system, and contribute to the development of physical skills.

2. Progressive resistive exercise involving increased work loads for longer periods are essential to increase the level of fitness.

3. Endurance develops in proportion to the total work done over a period of time.

4. Strength is increased through activities requiring more than 50 per cent of total strength capacity.

5. Organic efficiency is improved where rhythmical muscular activities is continued over a long unbroken period.

6. Physical fitness is directly proportional to the levels of strength, power and endurance achieved.

7. The school physical education program should include a core of developmental and conditioning activities, appropriate to each grade level.

8. The school health program provides knowledge and understanding based on scientific facts and principles in order to develop desirable health attitudes and behavior for promotion of physical fitness (45:5-6).

With these principles as guidelines the Council made three recommendations to the schools in order to improve physical fitness. These recommendations were:

1. Identify the physically underdeveloped pupil and work with him to improve his physical capacity.

2. Provide a minimum of fifteen minutes of vigorous activity for all pupils.

3. Use valid tests to determine pupils' physical abilities and evaluate their program (45:5-8).

As a result of the recommendations of the President's Council, fifty-six per cent of one-hundred thousand public schools improved their program during one school year (5:117).

II. THE PROBLEM

Statement of the Problem

The purpose of this study is to determine if there was a relationship between the scores achieved on the Elementary School Fitness Test and the following factors:

(1) the economic level of the neighborhood in which the schools were located; (2) family size; (3) achievement scores on the Iowa Basic Skills Test; (4) absenteeism of the students; and (5) health history of students.

Importance of the Study

The purpose of this study is to determine if there was a relationship between physical fitness and the various factors selected for this study without attempting to determine a cause and effect relation.

Johnson and Capobianco have reported:

> Among many groups of people there seems to be a necessity for finding that handicapping situations, especially those affecting educational growth, are caused by physical factors and may be curred or substantially alleviated by the removal or correction of these disabilities (29:3).

Future studies may attempt to discover a cause and effect relationship.

The school administrator must concern himself with the physical fitness of students because of the tremendously important relationship between it and the total educational program.

School administrators must never lose sight of the fact that they are working with the "whole" individual. The principal, therefore, must be concerned with the contribution of physical fitness to the development of the "total fitness" of each child (4:186).

The principal exists to help the pupils achieve the goals they desire in order to live happy, productive, healthful and meaningful lives (4:62).

Jenny stated that "physical fitness is a phase of total fitness and total fitness is not possible without physical fitness" (27:115).

Total fitness, according to Williams, involves the emotional, social, and spiritual welfare as well as physical welfare (48:78).

Bucher pointed out several concepts of a physical fitness program to be considered by an administrator. They are as follows:

1. Fitness implies more than physical fitness.
2. Physical fitness includes more than muscular strength.
3. Physical education is not the same as health education.
4. Both health education and physical education contribute to physical fitness.
5. Health education and physical education must be an integral part of the educational program in order to most effectively achieve the goal of physical fitness.
6. Physical fitness is not synonymous with physical education.
7. Administrative support and understanding are needed to achieve physical fitness (5:109-112).

Pruddin stated:

> Clinical studies over the years have convinced us that there is a minimum of muscular strength and flexibility below which the individual must not drop if normal healthful living is to be enjoyed (46:Ch.VIII).

According to Clark, physical education has a special responsibility for boys and girls who are physically unfit. He maintained that physically unfit students are not capable of ". . . prolonged physical effort, are unable readily to learn and apply skills and are awkward and lacking in poise." He went on to say that pupils at all levels of intelligence have a great deal of difficulty in maintaining mental effort and alertness. The unfit also experience difficulty in day by day personal adjustment with others and in developing active social habits and attitudes (9:105).

Smith said that students need sufficient strength to maintain good posture at rest and in motion and to do with ease tasks of the day (13:29).

In summation, physical fitness seems to effect the performance of the pupil in other aspects of the educational program. By improving a person's physical fitness, authorities believe that the child will also improve in other ways as well.

The principal must provide some positive leadership toward eliminating many misconceptions about the values of a carefully planned, organized physical education program.

Physical education must not be considered an end in itself, but a means to an end. A good physical education program will provide many good pupil experiences.

The following factors should serve as guidelines for improving this aspect of the school program:

> All pupils participate in a wide range of teacher-pupil planned instructional activities which are directed toward meeting individual and group needs of children at various stages of growth and development.
>
> There is long and short-range planning. Pupils should assist in this planning. Such planning includes provision for handicapped children, activities for the classroom or limited indoor space, use of available facilities, and the like.
>
> All phases of the instructional offerings are guided by the teacher who encourages leadership and individual growth, and recognizes individual ability and inability.
>
> In all grades, boys and girls participate in many activities together, with provision for separation of sexes among the larger children for the more vigorous types of activities.
>
> Some report or evaluation of the progress and achievement of the child is made continuously; this evaluation is based on the individual's innate ability, physical make-up, and progress, and is used as a guide to further planning. In measuring achievement, consideration must be given to such factors as advancement in the development of physical skills, desirable social traits, and sound mental attitudes (51:262).

Limitations of the Study

The study was limited to the following:

1. To the sixth grades in three elementary schools in Yakima, Washington.

2. To the number of students in each sixth grade.
3. To the variations of the training of the students by their teachers as to what constituted "proper" execution of an exercise.
4. To the source of information concerning the factors used in this study which was the cumulative record.

III. DEFINITION OF TERMS USED

Physical Fitness

Physical fitness denotes the development and maintenance of a strong physique and sound functioning organs, to the end that the individual realizes his capacity for physical activity, unhampered by physical drains or by a body lacking in strength and vitality (9:24).

Family Size

The total number of people living within one household constitutes the family size.

Health History

Health history refers to the history of total days absent due to illness in five years of school as reported on the health card in cumulative records.

Absences

Absences refer to total days absent in the first

one-hundred thirty-five days of 1964-1965 without regard for reason for illness.

Intelligence

Intelligence refers to the mental ability of students based on the Iowa Basic Skills Test administered to all sixth grade students in Yakima, Washington.

Economic Level of School

Upon the recommendation of the elementary coordinator of Yakima Public Schools, three schools were selected to represent the economic level of the neighborhood in which it was located.

Physical Fitness Index

This is referred to in several studies and is obtained by dividing the obtained strength index by a norm based on sex, age and weight. Strength index is the sum of the following tests: arm strength from push-ups and pull-ups, back and leg lift strength, right and left hand grip strengths and lung capacity.

IV. ORGANIZATION OF THE REMAINDER OF THE STUDY

1. Chapter II will contain a review of previous studies of physical fitness that are related to this study.
2. Chapter III will contain the procedure for collecting

data pertinent to this study and will discuss the Washington State Physical Fitness Test.

3. Chapter IV will present an analysis of the data and the statistical results.
4. Chapter V will contain a summary, conclusions and recommendations for further study.

CHAPTER II

REVIEW OF THE LITERATURE

The importance of physical activities, which includes fitness, has been maintained by many people in history. Fraley quoted some of these people:

> Socrates (420 B. C.)
> Our children from their earliest years must take part in all the more lawful forms of play, for if they are not surrounded with such an atmosphere they can never grow up to be well conducted and virtuous citizens.
>
> Plato (380 B. C.)
> Lack of activity destroys the good condition of every human being, while movement and methodical physical exercise save it and preserve it.
>
> Comenius (1650)
> Intellectual progress is conditioned at every step by body vigor. To attain the best results, physical exercise must accompany and condition mental training.
>
> Horace Mann (1845)
> One of the most important items in a nation's wealth consists in the healthfulness and vigor enjoyed by its people.
>
> The educated man understands the relation of mental cultivation to physical health and vigor.
>
> John Dewey (1915)
> If we have reverence for childhood, our first specific rule is to make sure of a healthy bodily development. Even apart from this intrinsic value as a source of efficient action and of happiness, the proper development of the mind directly depends upon the proper use of the muscles and the senses (17:4-10).

John F. Kennedy stated that although the young people of today are healthier than previous generations, most of

them have not developed physically. He said:

> We must take immediate steps to insure that every American child be given the opportunity to make and keep himself physically fit, fit to learn, fit to understand, to grow in grace and stature, to fully live (33:i).

Charles "Bud" Wilkinson, past consultant to the President on youth fitness, stated that physical fitness cannot be achieved and then forgotten. In order for your body to serve you well, you must get enough exercise to maintain a minimum amount of physical fitness (57:144-145).

One definition of physical fitness as expressed by Bucher is that it is the ". . . state which characterizes the degree to which the person is able to function," and that it implies " . . . such abilities as that of resisting fatigue, performing with an acceptable degree of motor ability, and being able to adapt to muscular stress" (5:31).

Prudden's definition of physical fitness included four elements:

1. A healthy balance between the emotional and physical states.
2. The ability to mobilize the necessary reserve within one's self to meet an emergency.
3. A motor ability adequate to the demands of everyday living.
4. The capacity to reproduce and rear effectively a generation that will be a credit rather than a liability or a dead loss to the nation (46:12).

Duncan said "Physical fitness means total body fitness." This implies that one must have an understanding

of fitness to the individual's social and mental well being, a knowledge of how to develop it and a desire to maintain it (15:20).

One cannot study physical fitness without discussing its relationship to physical education. Physical fitness is a basic objective of physical education. It is essential that all students learn to attain and appreciate a high level of physical development so that sports and other activities can be engaged in with confidence and pleasure (45:5).

Weiss pointed out three ways that physical fitness is useful in a physical education program (55:17):

1. Fitness helps us to enjoy activities without becoming tired quickly.
2. Fitness sustains skill learning. A person who tires quickly will not learn rapidly or as effectively as a physically fit person.
3. Fitness enhances excellence in performance on the athletic field.

Physical education is an integral part of the total education program that has as its aim the development of physically, mentally, emotionally and socially fit citizens through physical activities (5:31). The modern aim is not to develop great muscular strength, but to develop wholesome, energetic, and vitally strong human beings capable of withstanding the ordinary strains of life and successfully coping with competition in their chosen field (27:114). A well balanced school physical education program should be

instrumental in helping the child gain strength, endurance, agility, and coordination required to meet the needs of life (24:23).

Physical fitness cannot be achieved by the physical education program of sports and exercise alone. Nutrition, sleep, work habits, study habits, and emotional balance are necessary in physical fitness as well (8:32). Brownell defined physical education as ". . . the accumulation of wholesome experiences through participation in large muscle activities that promote optimum growth and development" (3:17).

Athletics are also a part of the education program which affects physical fitness. Those who participate regularly in athletics and recreational sports of moderate or high levels of intensity and frequency probably will develop levels of fitness that will meet the normal demands of daily life with something left over for emergencies. Sports are limited, however, in the amount of physical fitness that they can develop. It is questionable whether sports, alone, develop the level of physical fitness we want our youth to attain throughout their school years (54:21).

Even with all of the emphasis on physical fitness in the past decade many of our young people are not physically fit. Less than one half of the schools in the United States

follow the minimum recommendations of the President's Council on Youth and Fitness. There was no fitness program at all in twenty per cent of the public school pupils in grades four through twelve (10:95). Four of every seven pupils between the ages of six to sixteen are unable to measure up to the simplest basic standards of muscular strength and flexibility. They even lack the minimum physical fitness demands for normal living (46:1).

Physical fitness demands constant attention, regular participation, and the opportunity to progress in skill development. Physical fitness is not a "sometimes thing." It means a constant state of awareness of the individual needs of the individual child (13:29).

> When every American is as concerned about the fitness of all youth as he is about his favorite football team, we will be on our way to solving the youth physical fitness program (57:78).

I. STUDIES IN PHYSICAL FITNESS

In 1954, Kraus and Weber administered a series of six test movements appraising strength and flexibility of trunk and leg muscles. This minimum fitness test was administered to Americans on the Eastern Seaboard, Italians, Austrians and the Swedish. One or more of the six tests were failed by 57.9 per cent of the 4,264 Americans, while only 8.7 per cent of the 2,870 Europeans failed (38:178).

The following year, Fox and Atwood administered the Kraus-Weber Minimum Fitness Test to 575 children, grades one through six, in Iowa City, Iowa. When the data were collected, 66.1 per cent of the children failed because of lack of flexibility and 34.8 per cent were failed because of weakness in one or more of the remaining tests (16:20).

In another study, the American Association of Health, Physical Education and Recreation Fitness Test was administered to a group of children from England, Japan, Denmark and the United States. The results showed the United States to again be physically inferior. American boys and girls exceeded the means of the Japanese only on the test involving abdominal endurance (36:1).

In the 600 yard run-walk, 98 per cent of the Danish boys and 99 per cent of the Danish girls exceeded the American averages for boys and girls. British boys on the average for all the tests were at the 64 percentile for United States performance scores (36:1).

The Army Air Force Fitness Test was administered to 4,172 enlisted men ranging from eighteen to forty and found the mean scores for all ages range from 34.0 to 47.4 with a grand mean score that fills in the upper end of the "poor" classification (32:192).

Hutinger attempted to find the effects of horizontal ladder exercise upon the body strength of third graders by providing ten minutes daily exercise on the ladder. He found significant gains in five of the six tests of strength at the end of a three month period (25:159).

Appleton found the physical fitness scores to be a useful predictor of non-academic aspects of military success in the United States Military Academy. He found that of every ten applicants in the bottom one per cent on the Academy's fitness tests, nine were below average cadets (1:99).

In a study to determine the effects of elementary school physical education upon some aspects of physical traits of twelve year old boys, Whittle compared two groups of eighty-one boys. One group had participated in physical education for at least three years; the other group had little or no physical education background. He found the means on the Roger's Physical Fitness Index Test for the boys in good and poor physical education programs were 121 and 103, respectively. The median for the test was 100. The boys in the good programs also scored higher on several other fitness tests as well (56:78).

Landiss tested 1,031 incoming freshmen at Pennsylvania State College to compare eight physical education

activities in their development of physical fitness to motor ability. Courses in body conditioning and tumbling-gymnastics produced the highest physical fitness scores; swimming, tennis and boxing were least apt to develop physical fitness (40:102).

Bucher and Taddonio compared the physical fitness ratings of a group of aviation cadets and certain early life experiences which included items such as:

1. Attendance in public, private, or parochial schools.
2. Did or did not have required physical education program in elementary school.
3. Preference of favorite activity in elementary school.
4. Did or did not participate in varsity sports.
5. Lived in various geographical areas of United States.
6. Lived in rural or urban environment.

The study found no apparent difference in factors except in area of elementary school activities and participation in varsity athletics. No cause and effect relationship was determined (6:136).

Physical Fitness Related to Intelligence

Many studies have been made on the relationship of physical fitness to intelligence with results showing a relationship on one hand and no relationship on the other.

On the basis of the random selection of the studies in this paper, a majority of the studies seem to contend that there is a positive relationship between physical fitness and intelligence. Let us first consider those papers.

Ray, in a study of five groups of high school boys in Palo Alto, California, found a constantly positive correlation of intelligence quotient and physical achievement (47:136).

In a study comparing intelligence of high school athletes and non-athletes, Jones found that:

1. High school athletes were more intelligent than non-athletes.
2. There is a smaller percentage of athletes than non-athletes in the lower level of intelligence.
3. There is a lower percentage of athletes than non-athletes in the normal and superior groups of intelligence.
4. In the superior and near genius groups of intelligence, the percentage is about the same (31:416).

Bucher compared 442 selected students who ranked in the upper forty per cent in physical performance with two-hundred students selected at random. The data found showed the select group to score significantly higher than the random group (5:119).

When comparing the academic achievement of boys, ages nine, twelve, and fifteen years of age with their physical performance on several different fitness tests,

Jarman found that generally the boys with high scores on the various tests had significantly higher means on standard scholastic achievement tests (26:27).

In a case study of four students who participated in a special program of gross motor activities designed as therapy to facilitate academic school achievement, Godfrey reported that all participants improved in school subject grades and achievement test scores. A matched group of non-participants did not show comparable results (19:65).

Weber investigated the relationship between physical fitness and success as measured by academic grades of 246 male freshmen at the State University of Iowa. The coefficient of multiple correlation of +.666 between fitness scores and composite test scores of entrance exams in relation to grade point average was significant at the .01 per cent level of confidence (53:102).

Hart and Shay also found a significant correlation beyond .01 per cent level when they compared their physical fitness scores with academic success of sixty sophomore women at Springfield College. They concluded:

> Although physical fitness is not a general prediction of academic success, it is high enough to be a necessary factor for the improvement of academic index in general education of the college student (21:444).

During the academic year of 1939-1940, 80 per cent of the freshmen males dismissed from Syracuse University because of low grades had physical fitness indices below one-hundred. These same students' scholastic aptitude scores were above average, the median being at 72 percentile (43:21).

Many studies have shown no relationship between physical fitness and intelligence, although the number of such studies are smaller than those studies showing a relationship.

In a study of four-hundred athletes and one-hundred non-athletes, Slusher found that intelligence was significantly lower for all athletes than non-athletes. Wrestlers were found to have the lowest scores while football players had the highest scores (52:538).

Reales and Reiss compared high school lettermen with non-lettermen and found that:

1. Athletes have slightly lower intelligence than non-athletes.
2. Track athletes have higher intelligence than other groups.
3. Baseball players have the lowest intelligence of all groups (48:539).

They concluded that with intelligence held constant, scholarship of athletes was below scholarship of non-athletes (48:539).

Johnson concluded that there was no significant relationship between physical skills and general intelligence and that there was no significant relationship between physical fitness and academic grades when the results of the scores of 310 college freshmen men and women were compared (28:59).

Burley and Anderson compared the relation of jump and reach measure of power to intelligence scores and found no significant relationship in the scores of 1,013 secondary school boys (7:31).

In summation, it may be contended 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 (9:106).

Rogers contended that physically unfit boys and girls at all levels of intelligence have greater difficulty in maintaining mental effort and alertness. He explained:

> The dependence of learning upon muscular strength is better comprehended when it is recalled that the brain and mind do not tire easily; what tires is the body. Thus, the bloodstream, clogged with waste produces of muscular activity consequence upon all waking life, whether primarily physical or mental, interferes with synaptic changes (49:1).

Physical Fitness as Related to Health

Man's health is partly determined by the general type and level of his culture, and by factors such as

economic status, occupation, family, social class, level of education, personal motivation, and medical and dental care (14:507).

A healthy person is defined by Hogman as:

> One with optimal physical fitness who can carry out his usual everyday tasks without undue fatigue and have enough reserve energy left over to enjoy his leisure; to meet emergencies such as an accident, illness, an operation, or a disaster; to engage in activities requiring reasonably prolonged, vigorous physical effort when necessary or desired (23:253).

Jones maintained that boys who are low in strength show a tendency toward asthenic physiques, poor health, social difficulties and lack of social status, feelings of inferiority and personal maladjustments in other ways. Conversely, boys high in strength tend to have good physiques, good health, be physically fit, and to enjoy favored social status (30:45).

Cureton presented evidence that personality itself is responsive to physical training in view of the changes that can be made in the nervous system and in the cardiovascular state. He concluded that men are more energetic, more bouyant, and optimistic, more action minded, more playful, more aggressive--in general they appear more extroverted and more healthful when they are trained than when they are untrained (11:6).

Kraus and Hirschland found that patients who failed to meet minimum standards of physical fitness give evidence of being ill from undue tensions and often showed signs of emotional instability. Tensions tend to remain when persons are prevented from ridding themselves of surplus energies which in turn are apt to result in physical discomfort (39:215).

Studies of the health habits of adults who have suffered heart attacks showed that sedentary living and poor health habits were responsible and not hard work, over exercise or occupational stress. The author contended that proper health habits, including nutrition and exercise, should be carried on into middle age (41:1021-1024).

Kraus lists several ailments as the result of inactivity. He reported:

1. Coronary heart disease is twice as frequent in the sedentary as in the active.
2. Other diseases more frequent in the sedentary than the active are diabetes, duodenal ulcer, and other internal and surgical conditions.
3. Lack of adequate physical activity caused 80 per cent of low back pain.
4. Lack of physical fitness goes parallel with emotional difficulties.

He concludes, "The physically active show better adaptability to stress, less neuromuscular tension and less fatiguability" (37:62).

In an analysis of the relationship between health practice, adjustment, and physical performance of 141 freshmen women, Powell found a correlation significant at the .05 level of confidence (44:35).

Literature concerned primarily with this relationship was not found to be plentiful, possibly because it appears too obvious to warrent extended study. A physically fit person would naturally be expected to be healthy.

Physical Fitness as Related to Economics and to Family Size

Information in these two areas is extremely limited. Economics is such a broad area that it is usually broken down into more specific areas affecting or effected by it. Family size has not been discussed to any great extent, possibly because it is generally not considered to be relevant to physical fitness.

One conclusion that could be drawn in relationship of physical fitness to economics would be that many people could not afford to participate in various fitness activities such as Y.M.C.A. or camping trips. This might be a valid explanation in some cases but in a study of the parents of highly active students and those of low activities, there does not seem to be any major difference between the income levels of the activity groups (50:183).

Wrightstone found only a slight relationship between social and economic factors with a physical fitness index. He did find that participation in certain sports rather than others developed pupils in physical fitness. Those with camping experience, for example, were found to have a higher level of physical fitness than non-campers (59:35).

Hendel, Burk and Lund found that the adequacy of vitamins A and C intake in the diet of 302 Ohio school children showed a direct correlation with the family income level. Only about fifty-six per cent were getting the recommended amount of vitamins A and C. The rest were considered to be "borderline" cases for nutritional safety. One might surmise that a child with malnutrition could not be expected to be physically fit. This study also found that children from large families were less apt to consume diets adequate in vitamins A and C (22:207).

Ruffer found that the highly active students had more siblings, more brothers and less older brothers than the inactive ones, but the differences were not significant. He did find that the highly active older students had more highly active brothers than the inactive student. The differences were significant at the .05 level of confidence (50:183).

These studies seem to indicate that physical fitness has a positive relationship with a student's success in school. The school administrator has a responsibility to ascertain whether this is true with the students under his charge. If such a relationship does indeed exist, every effort must be made to provide the students with the opportunity to improve their physical fitness and thus improve their success in school.

CHAPTER III

PROCEDURES

The purpose of this study was to determine if there was a relationship between physical fitness and several selected factors. During the month of May, the sixth grade boys and girls from three Yakima, Washington elementary schools were tested for physical fitness. Their fitness scores were compared with the selected information found in each pupil's cumulative record.

I. INSTRUMENT OF MEASUREMENT

Washington State Elementary Physical Fitness Test

The Washington State Elementary Physical Fitness Test was selected because this test was familiar to all the students involved in this study and because the norms established by boys and girls from Washington State were considered more reliable and valid than those taken elsewhere.

This test was developed by Glenn Kirschner, Associate Professor of Physical Education at Eastern Washington State College for the Washington State Association for Health, Physical Education and Recreation. It was designed to measure strength, endurance, power, and speed, which are considered to be basic elements of physical fitness. The

tests described below, can be found in detail in the examiner's manual (34:5-10).

Standing broad jump. The purpose of this test was to measure power. The pupil assumes a squat position and jumps as far forward as possible. A tape measure is used to measure the distance to the nearest inch from the take-off line to the nearest heel position.

Bench push-up. The purpose of this test was to measure the strength of the forearm, the arm, and the shoulder muscles. The pupil assumes regular push-up position with the hands on the nearest corners of a chair rather than the floor. The pupil lowered and raised her body as many times as possible. The score depended on the number of complete push-ups.

Curl-ups. The purpose of this test was to measure the strength and endurance of the trunk flexor muscles. The pupil assumes a back lying position with knees bent, feet flat on floor and hands behind the head. The pupil sit up to a vertical position and returns to the starting position. A scorer or partner assists the pupil to maintain the starting position by holding feet down and keeping them close to the body.

Squat jump. The purpose of this test was to measure the strength and endurance of the trunk and leg extensor

muscles. The pupils assume a crouched position with the arms at the side and the fingers resting on the mat. The pupil jumps to a height at which his feet are approximately four to six inches above the mat. The pupil returns to the starting position and continues the exercise.

Thirty-yard dash. The purpose of this test was to measure speed. The pupil ran a thirty yard distance and was timed to the nearest one-tenth of a second.

II. ORGANIZATION OF THE TEST SITUATION

In order to administer the test with ease and efficiency, Kirschner suggested these preliminary preparations (34:1).

Health Status

Only those children who were physically able to participate in the regular physical education program were tested.

Pupil Orientation

Each child was familiar with the test items, consequently only a reminder of certain aspects of each test item was necessary. Each pupil was encouraged to "do his best" on each test item. A score of fifty was set as the maximum that anyone was required to do on any of the strength and endurance test items.

Equipment

The equipment necessary for administering this test included a stop watch, several mats and chairs, measuring tape, and class score sheets.

III. COLLECTION OF PHYSICAL FITNESS DATA

During the month of May, the sixth grade boys and girls of the three schools selected for this study were tested by the writer and one teacher from each school, who was familiar with the testing procedures.

The procedure used for testing each room involved the following steps:

1. The class was divided into two groups--boys and girls.

2. Each pupil was paired with one approximately his own size to work together for duration of the test. One partner did the exercise while the other one counted the exercise and aided by holding the feet, in the case of the curl-up, and by holding the chair, in the case of the bench push-up.

3. The standing broad jump was administered to the boys while the teacher-assistant administered the thirty-yard dash to the girls. At the completion of the testing of the boys, the girls were tested in the standing broad jump and the boys ran the thirty-yard dash.

4. The remainder of the tests were administered in the following order: (1) curl-up, (2) squat jump, and (3) bench push-up.

5. At the completion of each test item, the pupil reported his score to an assistant at a scorer's

> table. Each pupil was instructed to carefully give his name, the test activity, and his score to insure accuracy in scoring.

Once all the pupils were tested and the raw scores recorded, it was necessary to convert them into points. This was done by using the norms provided in the test manual.

The McCall T-scale was used to transfer a child's raw score on each test item into equivalent points in a normal distribution. Kirschner reported:

> This common scale permits the performance on any test item to be compared with the performance on any of the other four tests of the battery. The points can also be added to give a total physical fitness score. A teacher simply has to look at the rating which corresponds to the points a child receives to estimate his level of physical fitness (34:10).

The individual's raw score, points, total points, and physical fitness rating was recorded on a score sheet as shown in the Appendix.

The ratings used in this test were superior, good, average, below average, and poor. According to Kirschner approximatley 6 per cent of any group will rank superior, 25 per cent will rank good, 39 per cent will rank average, 23 per cent will rank below average and 7 per cent will rank poor (35:10).

IV. COLLECTION OF THE DATA CONCERNING THE FACTORS SELECTED FOR THIS STUDY

Economic Factor

This factor was previously discussed in Chapter I

and will not be discussed further except to say that three schools were chosen to represent the economic levels of the neighborhood in which it is located. The scores of five, ten, and fifteen were arbitrarily given to low, medium, and high economic levels respectively.

Absenteeism

The days absent were taken from the teacher's offical attendance register and covered the first 135 days of the year. All pupils who entered during the year had the days prorated to 135 days. No attempt was made to determine why the pupils were absent.

Intelligence

The composite score on the Iowa Basic Skills Test was used to determine intelligence.

Health History

This involves the health history of the pupil for the previous five years of school. Pupils who missed less than five days of school each year because of illness were considered to be infrequently ill; those who missed five to eight days were considered to be occassionally ill and those who were absent more than eight days per year or had a disability because of chronic disease were considered to be chronically ill.

The scores of five, ten, and fifteen were arbitrarily given to infrequently ill, occasionally ill and chronically ill, respectively.

Family Size

This was simply a matter of counting the number of people living in the home as recorded in the cumulative record.

The above data plus the physical fitness score and rank was recorded in an information sheet as shown in the Appendix.

At the time the three schools were selected for this study, 203 boys and girls were enrolled in the seven classrooms involved. Due to incomplete cumulative records and to absences on the day the test was administered, the actual number involved in the study was 160--76 girls and 84 boys.

CHAPTER IV

ANALYSIS OF DATA

The statistical computations of this study were in the form of intercorrelations, multiple correlations and regression equations. The means and standard deviations were computed as was a percentage analysis of physical fitness rating scores.

In most computations the boys and girls were considered separately. The following formulas were used to compute some of the elements of statistics.

Number = N

Sum of = Σ

Mean = $\frac{\Sigma X}{N}$

$$\sigma = \sqrt{\frac{\Sigma X^2}{N} - M^2}$$

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

FIGURE 1

FORMULAS FOR THE COMPUTING OF SOME OF THE ELEMENTS OF STATISTICS

I. A PERCENTAGE ANALYSIS OF PHYSICAL FITNESS RATING SCORES

Expected Percentage Scores

Kirschner asserted that approximately 6 per cent of any group will rate superior, 25 per cent will rate good, 39 per cent will rate average, 23 per cent will rate below average and 7 per cent will rate poor (34:10).

Obtained Percentage Scores for Boys

From the raw scores the writer determined the percentage of boys who rated superior, good, average, below average, and poor. Table I, located on page 37, illustrates the results obtained.

The percentage of boys who rated superior was 3.6 per cent. The school representing the low and medium economic neighborhoods had no one who rated superior. The school representing the high economic neighborhood had 9.7 per cent who rated superior.

The percentage of boys who rated good was 32.1 per cent. The percentages for the schools representing the low, medium and high economic neighborhoods were 11.1 per cent, 35.6 per cent and 45.2 per cent, respectively.

TABLE I

OBTAINED PERCENTAGE SCORES FOR BOYS

	High	Medium	Low	Total	Expected
Superior	9.7	.0	.0	3.6	6.0
Good	45.2	35.6	11.1	32.1	25.0
Average	35.5	51.3	66.7	50.0	39.0
Below Average	6.4	10.5	22.2	11.9	23.0
Poor	3.2	2.6	.0	2.4	7.0
Total	100.0	100.0	100.0	100.0	100.0

The percentage of boys who rated average was 50.0 per cent. The percentages for the schools representing the low, medium, and high economic neighborhoods were 66.7 per cent, 51.3 per cent, and 35.5 per cent respectively.

The percentage of boys who rated below average was 11.9 per cent. The percentages for the schools representing the low, medium, and high neighborhood were 22.2 per cent, 10.5 per cent, and 6.4 per cent, respectively.

The percentage of boys who rated poor was 2.4 per cent. The percentages for the schools representing the low, medium, and high economic neighborhoods were .0 per cent, 2.6 per cent, and 3.2 per cent, respectively.

Obtained Percentages Scores for Girls

From the raw scores the writer determined the percentage of the girls who rated superior, good, average, below average, and poor. Table II, located on page 39, illustrates the results obtained.

The percentage of the total girls who rated superior was 2.6 per cent. The schools representing the low and medium economic neighborhoods had no one who rated superior. The school representing the high economic neighborhood had 9.1 per cent who rated superior.

TABLE II

OBTAINED PERCENTAGE SCORES FOR GIRLS

	High	Medium	Low	Total	Expected
Superior	9.1	.0	.0	2.6	6.0
Good	40.9	26.3	14.8	27.6	25.0
Average	36.4	55.3	63.0	51.4	39.0
Below Average	13.6	11.5	22.2	14.5	23.0
Poor	.0	7.9	.0	3.9	7.0
Total	100.0	100.0	100.0	100.0	100.0

The percentage of the total girls who rated good was 27.6 per cent. The percentages for the schools representing the low, medium and high economic neighborhoods were 14.8 per cent, 26.3 per cent, and 40.9 per cent, respectively.

The percentage of the total girls who rated average was 51.4 per cent. The percentages for the schools representing the low, medium, and high economic neighborhoods were 63.0 per cent, 55.3 per cent, and 36.4 per cent, respectively.

The percentage of the total girls who rated below average was 14.5 per cent. The percentages for the schools representing the low, medium, and high economic neighborhoods were 22.2 per cent, 11.5 per cent, and 13.6 per cent, respectively.

The percentage of the total girls who rated poor was 3.9 per cent. The percentages for the schools representing the low, medium and high economic neighborhoods were .0 per cent, 7.9 per cent, and .0 per cent, respectively.

Obtained Percentage Scores for Each School

Table III, located on page 42, illustrates the results when the boys and girls were combined into their respective schools. The following results were obtained.

The schools representing the low and medium economic level had no one who rated superior. The school representing the high economic level had 9.4 per cent who rated superior.

The composite percentages for those who rated good were 13.0 per cent, 31.2 per cent and 43.4 per cent for the low, medium, and high economic levels, respectively.

The composite percentages for those who rated average were 64.8 per cent, 53.2 per cent, and 35.8 per cent for the low, medium, and high economic levels, respectively.

The composite percentages for those who rated below average were 22.2 per cent, 10.4 per cent, and 9.5 per cent for the low, medium and high economic levels, respectively.

The composite percentages for those who rated poor were .0 per cent, 5.2 per cent, and 1.9 per cent for the low, medium and high economic levels, respectively.

TABLE III

OBTAINED PERCENTAGE FOR EACH SCHOOL

	High	Medium	Low	Expected
Superior	9.4	.0	.0	6.0
Good	43.4	31.2	13.0	25.0
Average	35.8	53.2	64.8	39.0
Below Average	9.5	10.4	22.2	23.0
Poor	1.9	5.2	.0	7.0
Total	100.0	100.0	100.0	100.0

II. THE MEAN SCORE AND THE STANDARD DEVIATION OF EACH FACTOR IN THIS STUDY

Means and Standard Deviation for Boys

Table IV illustrates the results when the means and standard deviations were computed for the factors selected for this study.

The mean score of the physical fitness test was 263.8 with a standard deviation of 37.1. The mean score of the economic level of the neighborhood in which the school was located was 10.0 with a standard deviation of 3.9. The mean score of the absences was 4.4 with a standard deviation of 5.9. The mean score of the Iowa Basic Skills Test was 6.0 with a standard deviation of 1.4. The mean score of the health history was 6.8 with a standard deviation of 2.8. The mean score of the family size was 5.5 with a standard deviation of 1.6.

TABLE IV

MEANS AND STANDARD DEVIATION OF PHYSICAL FITNESS AND SELECTED FACTORS FOR BOYS

	Phys. Fitness	Econ. Level	Absence	Iowa Basic Skills Test	Health History	Family Size
Mean	263.8	10.0	4.4	6.0	6.8	5.5
σ	37.1	3.9	5.9	1.4	2.8	1.6

Means and Standard Deviations for Girls

Table V illustrates the results when the means and standard deviations were computed for the factors selected for this study.

The mean score of the physical fitness test was 256.3 with a standard deviation of 35.6. The mean score of the economic level of the neighborhood in which the school was located was 9.7 with a standard deviation of 3.8. The mean score of the absences was 4.9 with a standard deviation of 5.5. The mean score of the Iowa Basic Skills Test was 6.0 with a standard deviation of 1.2. The mean score of the health history was 6.6 with a standard deviation of 2.5. The mean score of the family size was 5.5 with a standard deviation of 1.7.

TABLE V

MEANS AND STANDARD DEVIATION OF PHYSICAL FITNESS AND SELECTED FACTORS FOR GIRLS

	Phys. Fitness	Econ. Level	Absence	Iowa Basic Skills Test	Health History	Family Size
Mean	256.3	9.7	4.9	6.0	6.6	5.5
σ	35.6	3.8	5.5	1.2	2.5	1.7

III. THE INTERCORRELATIONS OF THE FACTORS IN THIS STUDY

Intercorrelations for Boys

Table VI, located on page 46, illustrates the intercorrelations of the factors selected for this study for boys.

The correlation coefficient of physical fitness versus economic level, absences, Iowa Basic Skills Test, health history, and family size were .34, .02, .11, .01, and .06 respectively.

The correlation coefficient of economic level versus absences, Iowa Basic Skills Test, health history and family size were .09, .09, .06, and .21, respectively.

The correlation coefficient of absences versus Iowa Basic Skills Test, health history, and family size were .23, .42, and .19, respectively.

The correlation coefficient of Iowa Basic Skills Test versus health history and of Iowa Basic Skills Test versus family size were .12 and .08 respectively.

The correlation coefficient of health history versus family size was .23.

TABLE VI

INTERCORRELATION OF PHYSICAL FITNESS AND SELECTED FACTORS FOR BOYS

	1	2	3	4	5
C	.34	.02	.11	.01	.06
1		.09	.09	.06	.21
2			.23	.42	.19
3				.12	.08
4					.23
5					

NOTE: C = physical fitness, 1 = economic level, 2 = absences, 3 = Iowa Basic Skills Test score, 4 = health history, and 5 = family size.

The relationship between absences and health history had the highest correlation coefficient (.42) which indicated a moderate correlation, a substantial relationship.

The relationship between physical fitness and economic level, absences versus Iowa Basic Skills Test, health history versus family size and between economic level and family size had a correlation coefficient between .20 and .40 which indicated a low correlation, a definite but small relationship.

The relationship between the remaining factors were less than .20 which indicated a slight, almost negligible relationship.

Intercorrelations for Girls

Table VII, located on page 48, illustrates the intercorrelations of the factors selected for this study for girls.

The correlation coefficient of physical fitness versus economic level, absences, Iowa Basic Skills Test, health history, and family size were .32, .05, .12, .06, and .07 respectively.

The correlation coefficient of economic level versus absences, Iowa Basic Skills Test, health history and family size were .18, .03, .12, and .14, respectively.

TABLE VII

INTERCORRELATION OF PHYSICAL FITNESS AND SELECTED FACTORS FOR GIRLS

	1	2	3	4	5
C	.32	.05	.12	.06	.07
1		.18	.03	.12	.14
2			.17	.38	.00
3				.14	.01
4					.07
5					

NOTE: C = physical fitness, 1 = economic level, 2 = absences, 3 = Iowa Basic Skills Test, 4 = health history, and 5 = family size.

The correlation coefficient of absences versus Iowa Basic Skills Test, health history and family size were .17, .38, and .00, respectively.

The correlation coefficient of Iowa Basic Skills Test versus health history, and of Iowa Basic Skills Test versus family size were .14 and .01, respectively.

The correlation coefficient of health history versus family size was .07.

The relationship between absences and health history was once again the highest correlation coefficient (.38) which indicated a definite but small relationship.

The relationship between physical fitness and economic level also had a correlation coefficient which indicated a definite but small relationship.

The relationship between absences and family size had a correlation coefficient of .00 which indicated no relationship whatsoever.

The relationship between the remaining factors had a correlation coefficient less than .20 which indicated a slight, almost negligible relationship.

IV. THE MULTIPLE CORRELATIONS OF THE FACTORS IN THIS STUDY

The Wherry-Doolittle method was used to determine the multiple correlations of the factors in this study.

For a full description of the Wherry-Doolittle method, the reader is referred to Garrett (18:436-448).

> The coefficient of multiple correlation indicates the strength of relationship between one criterion and two or more variables taken together. The multiple correlation is not, however, merely the sums of the correlations of the independent variables and the various independent variables taken separately (20:392).

The process involves selecting the highest intercorrelation coefficient between physical fitness and one other factor and by using the Wherry-Doolittle method, attempt to increase that correlation coefficient when another factor is included. If the correlation does increase, then still another factor is included. If the correlation does not increase then no multiple correlation exists between the other factors.

The Multiple Correlations for Boys

The highest intercorrelation was found to be between physical fitness and the economic level of the neighborhood in which the school was located. The .340 correlation coefficient was then processed through the Wherry-Doolittle method of multiple correlation.

When the second factor, physical fitness versus Iowa Basic Skills Test was selected and processed through the Wherry-Doolittle method it caused the multiple correlation coefficient to decrease from .340 to .333.

Because of the decrease in the multiple correlation coefficient the writer concluded that there was no multiple correlation between physical fitness and the factors selected for this study.

The Multiple Correlation for Girls

The highest intercorrelation was again found to be between physical fitness and the economic level of the neighborhood in which the school was located. The .320 correlation coefficient was then processed through the Wherry-Doolittle methods of multiple correlations.

When the second factor, physical fitness versus the Iowa Basic Skills Test score, was selected and processed through the Wherry-Doolittle method it caused the multiple correlation coefficient to increase from .320 to .321. Because the multiple correlation increased, the writer concluded that the Iowa Basic Skills Test score did have a multiple correlation with the economic level factor and physical fitness. The increase was very slight, however.

When a third factor, physical fitness versus health history, was selected and processed through the Wherry-Doolittle method, it caused the multiple correlation coefficient to decrease from .321 to .303. Because the multiple correlation decreased, the writer concluded that there was no further multiple correlation between physical

fitness and the remaining factors selected for this study.

V. THE REGRESSION EQUATION OF THE MULTIPLE CORRELATIONS

Guilford stated the following in regard to a regression equation:

> The main use of a regression equation is to predict the most likely measurement in one variable from the known measurement in another. The higher the correlation, the greater is the accuracy of prediction and the smaller the errors of prediction (20:365).

Because the correlations in this study were so low, only the highest correlations for boys and the highest correlations for girls will be considered. The formulas for computing the regression equation are located below.

$$Y = bX + c \qquad b = \frac{\Sigma xy}{\Sigma x^2} \qquad c = \overline{Y} - b\overline{X}$$

Y = physical fitness score X = economic level value

FIGURE 2

FORMULAS FOR COMPUTING THE REGRESSION EQUATION

b is a ratio and it tells how many units y is increasing for every increase of one unit in x (20:367).

c is a constant that must be added in order to assure that the mean of the predictions will equal the mean of the obtained values (20:367).

Regression Equation for Boys

When the regression equation was applied to the data for boys, the following results were obtained:

$$b = 3.20$$
$$c = 231.61$$
$$Y = 3.2\,x + 231.61$$

From this equation a physical fitness score can be predicted by multiplying 3.20 times the economic level value and adding 231.61. (The economic levels were arbitrarily given the values of 5, 10, and 15, for low, medium, and high economic levels respectively.) For example, a student from a medium economic level could have a predicted physical fitness score of 263.61 because $y = 3.20 \times 10 + 231.61$. This physical fitness score is very close to the mean which is 263.77.

The standard error of the prediction score was 34.9 and two-thirds of the cases should be within the limits of plus or minus 34.9 (20:373).

Regression Equation for Girls

When the regression equation was applied to the data for girls the following results were obtained:

$$b = 2.98$$
$$c = 227.45$$
$$Y = 2.98x + 227.45$$

From this equation a physical fitness score can be predicted by multiplying 2.98 times the economic level

value plus 227.45. For example, a student from a high economic level could have a predicted physical fitness score of 272.15 because $y = 2.98 \times 15 + 227.45 = 272.15$. This physical fitness score is considerably above the mean which is 256.3.

The standard error of the prediction score was 33.3 and two-thirds of the cases should be within the limits of plus or minus 33.3 (20:373).

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to determine the relationship between the scores achieved on the Washington Elementary School Physical Fitness Test and the following factors: (1) the economic level of the neighborhood in which the school was located; (2) family size; (3) achievement scores on the Iowa Basic Skills Test; (4) absenteeism of the student and (5) health history of the students.

In the spring of 1965, three schools from the Yakima, Washington school district were selected to represent the high, medium and low economic levels. A total of seventy-six girls and eighty-four boys took part in this study. Each pupil was administered the physical fitness test and the information concerning the factors was obtained from the cummulative records. Intercorrelations, multiple correlations and regression equations were obtained from the raw data as well as a percentage analysis of physical fitness rating scores.

The intercorrelations for both boys and girls were extremely small. Only physical fitness versus economic level and absences versus health history recorded a

correlation coefficient above .30.

No multiple correlation relationship was found between the factors for the boys. The girls' physical fitness, economic level, and Iowa Basic Skills Test scores had only a very slight multiple correlation relationship.

Because of the low correlation coefficient obtained, only the highest correlation was considered in the regression equation.

When the economic level value was multiplied by 3.20 and added to 231.61, the physical fitness score for boys could be predicted.

When the economic level value was multiplied by 2.98 and added to 227.45, the physical fitness score for girls could be predicted.

II. CONCLUSIONS

The statistical data indicated that the economic level factor had the greatest relationship with physical fitness test score for both boys and girls and that the other factors selected for this study had almost neglible relationships with physical fitness.

A multiple correlation was found to exist only between physical fitness, economic level and Iowa Basic Skills Test scores for girls. This multiple correlation was very slight, however. There was no multiple correlation

for boys whatsoever. The writer concluded that in this study only the economic level had a significant relationship with physical fitness.

The writer feels that a much higher correlation between health history and physical fitness could have been obtained had the health records been more complete and accurate.

The writer also feels that if the economic level factor and the health history could have been divided into more than three groups better correlations could have been obtained.

Due to the fact that such a large standard error of prediction was obtained for both boys and girls and that only a moderate correlation was found between physical fitness and economic level, the writer concluded that the economic level of the student would not be a good predictor of physical fitness.

This study seems to indicate that the administrator need not concern himself with physical fitness as related to the factors selected for this study. The correlations were not significant enough to have a real effect upon a child's success in school. One study such as this however, does not provide conclusive evidence one way or the other. Previous studies contend that a significant relationship does exist.

III. RECOMMENDATIONS

On the basis of this study, the writer suggests the following recommendations:

A more accurate measurement of the economic level of the student is necessary so that more than three categories can be obtained. One possibility would be to send out a questionnaire to the parents to indicate the average yearly income to the nearest one thousand dollars. This would, however, be a difficult task.

A more accurate measurement of the health history is also necessary. The cumulative health records were not always up to date or accurate. More than three levels of health status would also be desirable.

Future studies could also include other factors than the ones used in this study. One of these factors could be a nutritional factor based on caloric intake per day. Another might be an attitude factor based on a questionnaire given to the students regarding physical education activities.

A different instrument could also be used to measure physical fitness of the students.

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APPENDIX

APPENDIX A

INFORMATION SHEET

School_____

Name_____

Days absent in 1964-65 (Sept. to April 31)_____

Iowa Basic Skills Test score_____

Health History:

Infrequently ill_____

Occasionally ill_____

Chronically ill_____

Size of family_____

Total physical fitness score and rank_____

APPENDIX B

PHYSICAL FITNESS SCORE SHEET

Name_____

School_____ Age_____

Activity	Score	Points
Standing Broad Jump	_____	_____
Bench Push-Up	_____	_____
Curl-Up	_____	_____
Squat Jump	_____	_____
Thirty Yard Dash	_____	_____

Total Points_____

Rating_____