AN INVESTIGATION DETERMINING THE EFFECTIVENESS OF PHYSICAL FITNESS TEST SCORES AS INDICATORS OF ACHIEVEMENT IN PHYSICAL EDUCATION CLASS ACTIVITIES THROUGH THE USE OF SKILL TESTS

by

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A THESIS

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by

William Michael Bobo, 1943-

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Purpose

It was the purpose of this thesis to (1) administer a physical fitness test to seventh grade boys at Deer Park Junior High School; (2) administer three sports skill tests to the same group of boys; (3) calculate the correlation coefficient between the two test results; and (4) establish multiple regression equations for those factors found to be significantly correlated.

Methods

The methods used to obtain data for this thesis were (1) testing seventh grade boys at Deer Park Junior High School; (2) examining and studying books and journals concerning the topic; and (3) using a digital computer to calculate the numerous findings in the study.

Findings

From the evidence presented in this thesis the following findings were obtained:

1. The physical fitness test item, 50-yard dash, was significantly correlated to more skill test items than any other physical fitness test item by being significantly correlated to seven of the nine dependent variables.

2. The physical fitness test item, sit-up, was the second most significantly correlated variable. The sit-up was significantly correlated to five of the nine skill test items.

3. The push-up was significantly correlated to three of the nine skill test items.

4. The standing broad jump was significantly correlated to one of the nine skill test items.

5. The pull-up was not significantly correlated to any of the skill test items.

6. The physical fitness items--push-up, standing broad jump, and 50-yard dash--can best predict success in the football throw when applied to the multiple regression equation.

7. An individual's time on the 50-yard dash and the number of sit-ups he completes can be used to predict

how far a person can kick a football when applied to the multiple regression equation.

8. The number of sit-ups a person does can be used to predict how fast an individual can run 50 yards with a football when applied to the multiple regression equation.

9. Of the fitness test items used, none can predict success on a total football skill test score.

10. The time on the 50-yard dash and the number of sit-ups an individual does can be used to predict the number of basketball field goals an individual will make when applied to the multiple regression equation.

11. The total points from the basketball accuracy throw test can be predicted from the number of push-ups a person does and his time on the 50-yard dash when applied to the multiple regression equation.

12. An individual's score on a certain basketball dribble test can be predicted by using the number of sit-ups he does and his time on the 50-yard dash when applied to the multiple regression equation.

13. The distance an individual can throw a softball can be predicted by using his time on the 50-yard dash and

the number of sit-ups he completes when applied to the multiple regression equation.

Approved:

Supervising Professor

TABLE OF CONTENTS

CHAPTER PAGE

CHAPTER PAGE

CHAPTER PAGE

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Since 1954, the year in which the Kraus-Weber Test resulted in data which showed the poor physical condition of American children as compared to European children, there has been an ever increasing concern for the physical status of our school age children. This is shown, in part, by the formation of the President's Council on Youth Fitness, the emergence of national fitness tests norms, and an increase in the research in the area of physical fitness.

Such factors as agility, balance, flexibility, strength, and endurance, which contribute to the physical aspect of total fitness, are measured with a high degree of reliability and accuracy by the various physical fitness tests.[1] How the combination of these components affect the individual's achievement in various sport skills is a question not yet solved. This paper is an effort to discover if the fitness of an individual, measured by physical fitness tests available today, can be used to predict a high level of achievement in a specific sport's skill.

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[1]M. Gladys Scott and Ester French, Measurement and Evaluation in Physical Education (Iowa: Wm. C. Brown Company, 1959), pp. 288-322.

I. THE PROBLEM

Statement of the problem. It is the purpose of this paper to determine the effectiveness of physical fitness test scores as indicators of achievement in physical education class activities through the use of the skill tests.

Importance of the study. The efforts of physical educators to evaluate, classify, and rank individuals have been many and varied. To determine if one individual is better than another is a difficult job. But it is a necessary procedure, whether used in chosing the best group for a team or assigning grades. Work is carried on continually in an effort to establish norms, or guidelines by which we might gauge the achievement of an individual. To establish such a procedure would certainly be desirable. Even more desirable would be a procedure to predict this achievement. With the increasing availability of new measurement and evaluation techniques, it is possible in some areas to take a known test score and predict achievement on a future test. If one test of physical ability can be proven to indicate a desired correlation to another test of physical skill, this would certainly take much of the guess work out of evaluation.

Such a test would also aid the physical education

teacher, who so often is critized for his methods of grading and evaluation, and it would also upgrade the standards of the teacher and his profession.

II. DEFINITIONS OF TERMS USED

Correlation. Correlation refers to the degree of correspondence or relationship between two sets of test scores or other variable quantities. This degree of correspondence is expressed by the coefficient of correlation (called r) along a scale which extends from 1.00 through zero to -1.00.[2]

Median. The mid-point in a distribution of scores, that point above and below which lie fifty per cent of the scores, is the median.[3]

Mean. The arithmetic average is used to represent the mean.[4]

Range. The difference between the highest and lowest

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[2]Henry E. Garrett, Elementary Statistics (New York: David McKay Company, Inc., 1962), p. 88.

[3]Henry H. Clark, Application of Measurement to Health and Physical Education (New Jersey: Prentice-Hall, Inc., 1959), p. 426.

[4]Ibid., p. 428.

score in a set of scores is the range of scores.[5]

Standard deviation. The standard deviation is a measure of central tendency which indicates the scatter or spread of the middle 68.26 per cent of the scores taken from the mean of the distribution.[6]

T-score. The t-score is the equivalent score found by converting the distribution of raw scores into a common normal distribution, with a mean of fifty and a standard deviation of ten.[7]

Physical fitness. Physical fitness is that state which characterizes the degree to which the person is able to function.[8]

Regression equation. The regression equation is a technique used to predict the most likely measurement in

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[5]Robert Thorndike and Elizabeth Hagen, Measurement and Evaluation in Phychology and Education (New York: John Wiley and Sons, Inc., 1961), p. 110.

[6]Clark, op. cit., p. 435.

[7]Garrett, op. cit., p. 165.

[8]Harold Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia: Lea and Febiger, 1964), p. 124.

one variable from the known measurement in another. The general formula used is P equals AX plus K, where P is the prediction, A is the coefficient, X is the variable, and K is the constant.[9]

Sports skill test. A series of test items which indicate the level of proficiency of a specific task or limited group of tasks.[10]

III. SUB-PROBLEMS AND PROCEDURE TO BE USED

Sub-problems. In attempting to solve the stated problem, the following sub-problems will occur: (1) administering a physical fitness test composed of five specific test items; (2) administering three skill tests in softball, basketball, and touch football; (3) calculating the mean value and standard deviation for the fitness test scores and the skill test scores; and (5) determining the possibility of predicting success from one set of scores.

Procedure. A physical fitness test consisting of sit-ups, pull-ups, 50-yard dash, push-ups, and standing broad jump, will be given to one-hundred-and-fifty seventh

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[9]Ibid., p. 551.

[10]Edwin A. Flushman, The Structure and Measurement of Physical Fitness (New Jersey: Prentice-Hall, Inc., 1964), p. 9.

grade boys at Deer Park Junior High School.

Scores will be recorded for each boy and tabulated. Norm tables from the Youth Fitness Test Manual of the American Association for Health, Physical Education, and Recreation will be used for evaluating purposes. This manual has the various norms divided into age groups.

Three skill tests taken from Barrow and McGee's A Practical Approach to Measurement in Physical Education, Research Quarterly for the American Association of Health, Physical Education, and Recreation, and Clarke's Application of Measurement to Health and Physical Education in softball, football, and basketball, respectively, will be given to the same group of boys. The scores from these tests will be tabulated in the same manner as the fitness test results.[11]

These two sets of scores will then be applied to the correlation of coefficient formula calculated by a digital computer. Multiple regression equations will be established for those items found to be significantly correlated.

IV. LIMITATIONS OF THE STUDY

The following limitations should be stated in reference to this study:

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[11]A full description of these tests is given in Chapter IV and the results are given in Chapter V.

1.) The term "fitness" as used in this paper, unless otherwise stated, will pertain to the physical aspects of total fitness.

2.) Concurrent with all testing conditions, the skill testing and fitness testing conditions had numerous limitations: (a) different days, (b) testing large groups, (c) inadequate supervision at certain times, and (d) less than complete effort on the part of some individual participants.

3.) The number of subjects used could have been larger in order to give more valid results. However, due to facilities it was not possible in this investigation.

4.) The skill test items given were, in the opinion of the researcher, sufficient for the study. Other skill tests would possibly give different results.

CHAPTER II

REVIEW OF THE LITERATURE

A substantial volume of literature has been written concerning the importance of physical fitness, fitness tests, and sports skill tests. The importance of these items and their effects on the human body have also been explored. The following are the studies which closely relate to or contribute to the present study.

I. LITERATURE ON PHYSICAL FITNESS AND PHYSICAL FITNESS TESTS

Hackensmith, in discussing the history of physical education, attributes the birth of the term "physical fitness" to World War II and the social changes brought about by these war years. By December, 1941, approximately two million registrants between the ages of 21 and 35 years had been examined under the National Service Act of 1940. Of this number, 900,000 were rejected because of mental and physical defects and 100,000 for educational deficiencies.[1]

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[1] C. W. Hackensmith, History of Physical Education (New York: Harper and Row Publishers, 1966), p. 466.

The circumstances which reduced the available manpower by fifty per cent because of physical defects and educational deficiencies became a national concern.[2]

> The War Production Board knew that millions of man-hours were lost to war industries through sickness and disabilities that might have been avoided had the average citizen followed a sensible regime of health practices and physical recreation. All signs indicated the need for a national effort to improve the health and physical fitness of the American citizen.[3]

By executive order in April, 1943, a Committee of Physical Fitness was established in the office of the Administration, Federal Security Agency, whose purpose was to gather information and study the problems of physical fitness.[4]

This approximate period of time, during which there was a rise in concern for fitness, is also agreed with by Scott and French. They propose "it was during the war years of the early 1940's that the terms physical fitness and total fitness became generally used."[5] While the term "fitness" and its usage were relatively new, the concept and its meaning to physical education were not new.[6]

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[2] Ibid., p. 467.

[3] Ibid., p. 468.

[4] Ibid., pp. 469-70.

[5] M. G. Scott and Esther French, Measurement and Evaluation in Physical Education (Iowa: William C. Brown Company, 1959), p. 276.

[6] Ibid.

In the years following this sudden emphasis on fitness, there was a decline in general interest. However, this was soon changed as a result of several important studies conducted evaluating the fitness of American children. In 1956 the results of a study directed by Hans Kraus and Ruth Hirschland, were published. In prior studies carried on by these two, the muscular fitness of American school children in northeastern urban and suburban communities was studied. Kraus and Hirschland reported that 56.6 per cent of those tested between the ages of six and nineteen failed to meet even a minimum standard required for health.[7]

Kraus and Hirschland then decided to compare school age children in countries other than America. The test was administered to 1,987 European children from Italy and Austria and some disquieting facts were discovered. The summation of these facts indicated that American children, at no time, approached the fitness levels of the Europeans. Figure 1 on page 11 shows the findings on children of elementary school ages (6-13). Figure 2 on page 12 discloses the distressing fact that the children coming into the first grades of the school systems are seriously deficient as pointed out by the test reports.

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[7]Hans Kraus and Ruth P. Hirschland, "Muscular Fitness and Orthopedic Disability," (Paper delivered before Medical Society of the State of New York, May 8, 1953, Buffalo, New York), Research Quarterly, 24 (December, 1953), pp. 18-19.

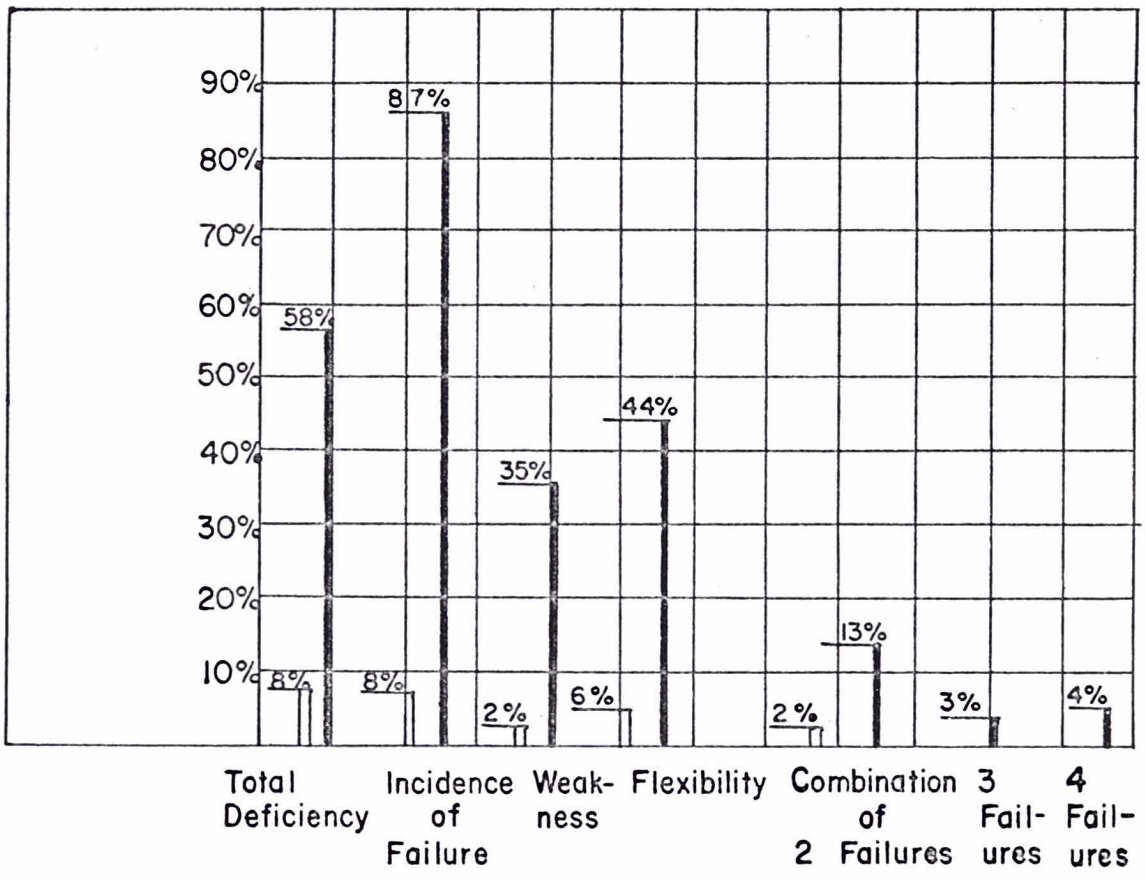

FIGURE 1

BREAKDOWN OF FAILURES AND COMBINATION OF FAILURES OF AMERICAN AND EUROPEAN CHILDREN OF ELEMENTARY-SCHOOL AGE (6-13). AMERICAN = ▬▬▬ EUROPEAN = ═══

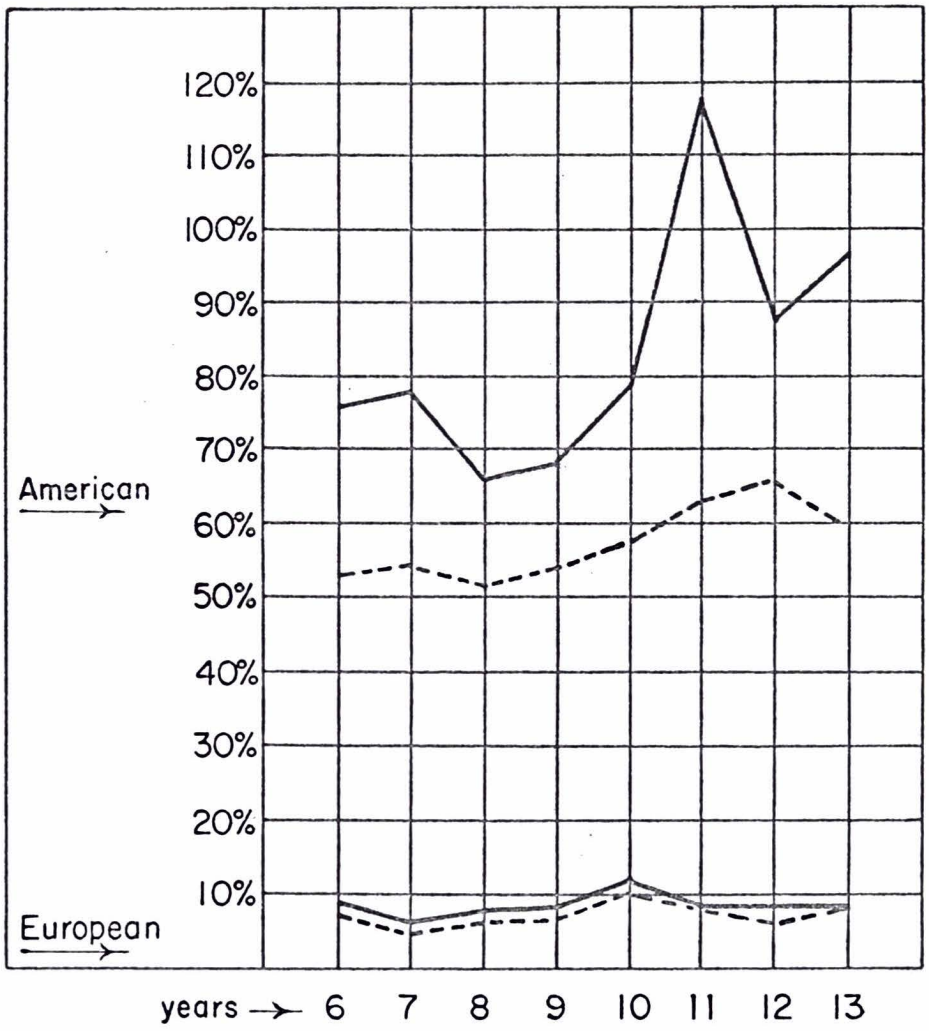

FIGURE 2

COMPARISONS OF FAILURE AND INCIDENCE OF FAILURE OF AMERICAN AND EUROPEAN CHILDREN OF ELEMENTARY-SCHOOL AGE (6-13). INCIDENCE OF FAILURE = ———. CHILDREN FAILING = ----------.

Figure 3 on page 14 shows the total weakness as well as flexibility failures of American and European children.[8]

The Kraus-Weber Test, which was used by Kraus and Hirschland in their study, received praise from various areas, but it also received some criticisms. One was that it employed movements that were quite similar to those found in the activities of the gymnastically-oriented European physical education and sports programs.[9]

President Eisenhower, after examining the results of the Kraus-Weber Test, called the first peace time conference on fitness ever held on June 18-19, 1956.[10]

Vice President Richard Nixon in the keynote address to the Conference said:

> The need for the conference is shown by such facts as these:
> Forty per cent of those persons entering the Armed Forces in World War II were unable to swim as far as fifty feet.
> Drownings between the ages of 5-44 are second only to motor vehicles in accidental deaths.

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[8]Hans Kraus and Ruth P. Hirschland, "Muscular Fitness and Health," Journal of Health, Physical Education and Recreation, 24 (December, 1953), p. 18.

[9]Howard Knuttgen, "Comparison of Fitness of Danish and American School Children," Research Quarterly for the American Association of Health, Physical Education and Recreation, 32 (May, 1961), p. 190.

[10]_____, "The President's Conference on Fitness of American Youth," Journal of Health, Physical Education and Recreation, 27 (September, 1956), p. 8.

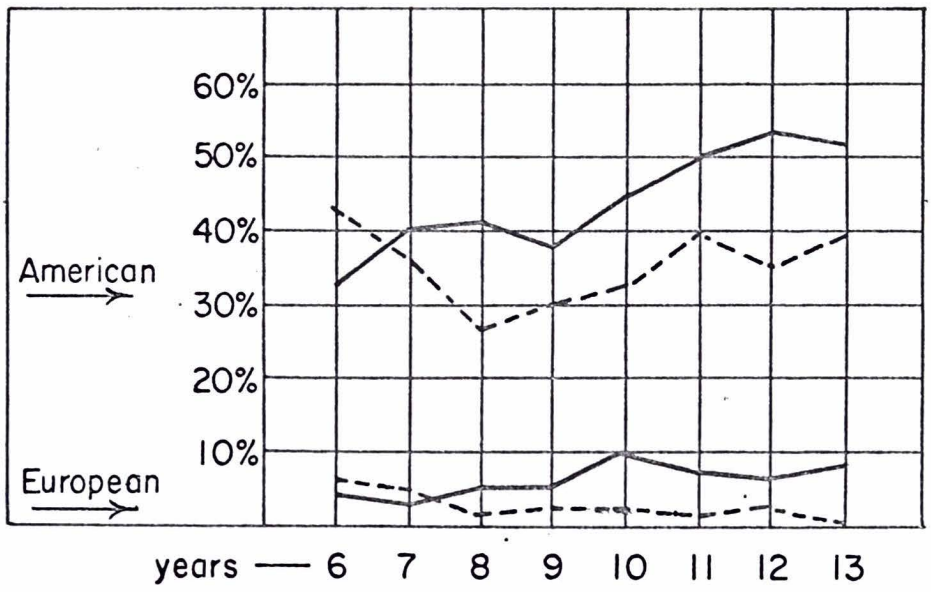

FIGURE 3

TOTAL WEAKNESS AS WELL AS FLEXIBILITY FAILURES OF AMERICAN AND EUROPEAN GIRLS AND BOYS (6-13). FLEXIBILITY = ————; WEAKNESS = ---------.

> Most drownings occur within 15-20 yards of some point of safety.
> Less than five per cent of our youth have had the opportunity to enjoy the experience of camping and outdoor living.
> Ninety per cent of the nation's elementary schools have less than the recommended five acres of land necessary for essential play areas.[11]

The President's Conference on Youth Fitness "awakened the need for a totally fit youth and pointed the way toward achieving this objective."[12]

Following the Kraus-Weber Test results and the President's Commission on Youth Fitness, the American Association for Health, Physical Education, and Recreation, held a conference on physical fitness in September, 1956. A Youth Fitness Project, headed by Paul A. Hunsicker, was begun with the purpose of undertaking four basic tasks: (1) To identify the major aspects of fitness; (2) To evaluate tests now available to measure these aspects identified and, when no suitable tests exist, to develop valid, reliable, objective and economical tests; (3) Using the tests developed, to establish norms for the sexes and different age levels for the various aspects of fitness, and (4) To give consideration to the formations of a fitness profile.[13]

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[11] Ibid., p. 9.

[12] Ibid., p. 30.

[13] Paul Hunsicker, "AAHPER's Youth Fitness Project," JOHPER, 28 (November, 1957), p. 17.

The test battery, devised by the Association of Health, Physical Education, and Recreation, and given to 8,500 boys and girls from grades 5 through 12, consisted of the following items:

1.) Softball throw for distance
2.) Standing broad jump
3.) 50-yard dash
4.) Pull-ups or modified pull-ups for girls
5.) Sit-ups
6.) Shuttle-run
7.) Run or walk 600 yards
8.) Swimming (15 feet, jump in water over head, swim 15 yards, turn around, swim back 1/2 distance, turn on back, rest for 1/2 minute, swim 100 yards for time)[14]

The scores from this test battery established very low averages for American youth.[15] These results led many authorities to make statements such as, "In the AAHPER Youth Fitness Test the stress should be on minimum norms, for they may appear too easy for children to meet in certain areas of the United States."[16]

The AAHPER Fitness Tests were then administered to over 10,000 boys and girls in England, Scotland, Wales, and Cyprus. By 1959 this survey was complete. The British boys were far superior to the American boys in all the fitness

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[14] Ibid., p. 24.

[15] Ibid., p. 25. See Appendix A for the norms established by the AAHPER Test.

[16] Carl E. Wilgoose, Evaluation in Health Education and Physical Education (New York: McGraw-Hill Book Company, Inc., 1961), p. 164.

tests (pull-ups, sit-ups, shuttle-run, 50-yard dash, standing broad jump, softball throw, and 600-yard run-walk) exclusive of the softball throw. They had greater shoulder girdle strength, superior agility, greater abdominal endurance, leg explosive power, and circulation endurance. The British girls paralleled the British boys in their superiority over their counterparts in the United States. Additionally, they showed at specific ages, superiority in performance over United States boys at ages 10, 11, 12, and 13 on their mean scores in five of the seven tests.[17]

The AAHPER Youth Fitness Test presented the opportunity for using an American test developed and used by American physical educators. The published standards also made it easy to compare other groups with the results of the 8,500 American children who participated in the establishment of the norms.[18]

Knuttgen administered the AAHPER Test to 2,162 Danish boys and 792 Danish girls in grades 7 through 12 between September, 1959, and May, 1960.[19]

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[17]William Campbell and Richard Pohnderf, "Physical Fitness of British and United States Children," Health and Fitness in the Modern World, (A collection of papers presented at the Institute of Normal Human Anatomy, Rome, Italy, The American Institute, 1961), p. 8. See Appendix B for specific results.

[18]Knuttgen, op. cit., p. 190.

[19]Ibid., p. 191.

The Danish girls exceeded the American averages in all seven of the tests. In the 50-yard dash, 71 per cent of the Danish girls equalled or exceeded the American average (50th percentile) score. It is also interesting to note that in each of five of the tests (broad jump, pull-up, sit-up, shuttle-run, and 600 yard run-walk) over one-third of the Danish girls obtained results that equalled or exceeded the American norms for the 90th percentile.[20]

More than 50 per cent of the Danish boys' scores exceeded the American averages in six of the seven events. The only event which the Danish boys fell short in was the softball throw. In this event 68 per cent of the Danish scores were lower than the 50th percentiles.[21]

Leaders and physical educators across the country began to examine, define, and study physical fitness after these studies. The critics of physical education both within the profession and from outside, have accused physical educators of not understanding fitness, and of doing nothing about it in the programs for which they are responsible.[22]

A statement prepared by the AAHPER Fitness Conference says,

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[20] Ibid., p. 193.

[21] Ibid., p. 194. See Appendix C for test results.

[22] Scott and French, op. cit., p. 277.

> Fitness is that state which characterizes the degree to which a person is able to function. It implies the ability of each person to live most effectively within his potentialities. Ability to function depends upon the physical, mental, emotional, social, and spiritual components of fitness, all of which are related to each other and are mutually interdependent.[23]

The article further stated that each person in order to satisfy his own needs and, at the same time, contribute his share to the welfare of society must possess:

1.) Optimum organic health, consistent with heredity and the application of present health knowledge;
2.) Sufficient co-ordination, strength and vitality to meet emergencies, as well as the requirements of daily living;
3.) Emotional stability to meet the stresses and strains of modern life;
4.) Social consciousness and adaptability with respect to the requirements of group living;
5.) Sufficient knowledge and insight to make suitable decisions and arrive at feasible solutions to problems;
6.) Attitudes, values, and skills that stimulate satisfactory participation in a full range of daily activities;
7.) Spiritual and moral qualities that contribute the fullest measure to living in a democratic society.[24]

Scott and French define fitness as follows:

> The basic concept of fitness is that of an effective total response to work or activity of whatever intensity may be required....In short, the fit person is one who

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[23]Gene Kidder, "All-Around Fitness For All," JOPHER, 28 (September, 1957), p. 8.

[24]Ibid.

> is free of limiting and debilitating ailments, who has the stamina and skill to do the day's work, and who has sufficient reserve of energy not only to meet emergencies but to provide a zest for leisure time living.[25]

Still another definition is given by Vannier and Fait.

> Physical fitness has been described as the development of the body to a condition which enables one to work and play with maximum physical efficiency and without undue fatigue and with sufficient reserve to meet any reasonable physical emergency.[26]

Wilgoose states that physical fitness is the capacity for activity.[27] He goes on to list the characteristics which a physically fit person should possess:

1.) Strength to be ready for tasks encountered in everyday routine and in emergencies.
2.) Stamina (endurance) to continue necessary tasks without undue fatigue, and energy enough to participate in recreational activities after a day's work.
3.) Cardiorespiratory endurance for sustained effort in activities involving motion of the entire body.
4.) Agility to be able to make a wide range of movement easily.
5.) Speed to be able to move rapidly when personal safety demands it.
6.) Control to coordinate body movements skillfully.[28]

In discussing the problems in physical education, Neilson and Bronson have stated:

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[25]Scott and French, op. cit., p. 277.

[26]Maryhelen Vannier and Hollis Fait, Teaching Physical Education in Secondary Schools (Philadelphia: W. B. Saunders Company, 1957), p. 124.

[27]Wilgoose, op. cit., p. 16.

[28]Ibid.

> An individual is said to be fit when his body is free from defects and disease, when he has intellectual ability, emotional stability and maturity, muscular strength, skill and endurance, when he enjoys work and relaxation and when he is in possession of those qualities which are necessary to adequately cope with each situation as it arises.[29]

Although the exact definition of physical fitness varies, the components of physical fitness are generally agreed upon. Scott and French list agility, balance, endurance, flexibility, and strength as the major components.[30]

Cureton explains that "motor fitness is the major part of physical fitness and it includes endurance, power, strength, flexibility, and balance."[31]

Clark purposes the basic physical fitness elements to be muscular strength, muscular endurance, and circulatory endurance; muscular power, agility, speed, and body balance are added to compose motor fitness; then arm-eye, and kinesthetic foot-eye coordinations are needed for general motor ability. Clark offers the following chart to explain his idea.[32]

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[29]N. P. Neilson and Alice Bronson, Problems in Physical Education (New Jersey: Prentice-Hall, Inc., 1965), p. 69.

[30]Scott and French, op. cit., p. 490.

[31]Thomas K. Cureton, "What is Physical Fitness?" Background Readings for Physical Education (New York: Holt, Rinehart and Winston, 1966), p. 382.

[32]H. Harrison Clark, Application of Measurement to Health and Physical Education (New Jersey: Prentice-Hall, Inc., 1959), p. 221.

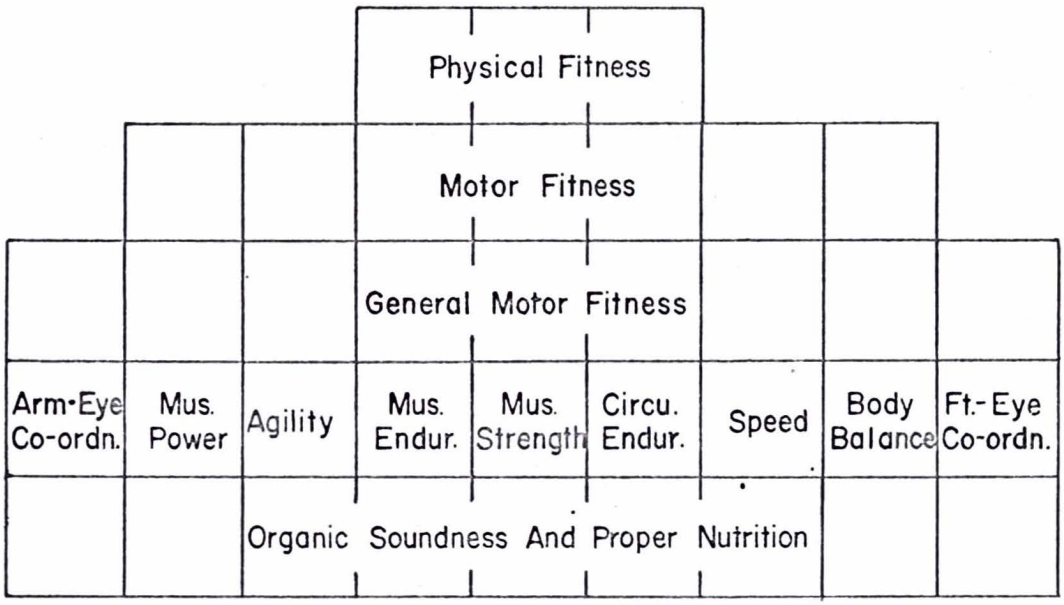

FIGURE 4

CLARK'S BASIC
PHYSICAL FITNESS ELEMENTS

In attempting to measure the elements of physical fitness, local, national, and military organizations developed and put into use various fitness tests.

The Indiana Motor Fitness Test, a very popular test in high schools, was designed to measure the various aspects of physical fitness. The test included straddle chins, squat-thrusts, push-ups, and vertical jump.[33]

The Oregon Motor Fitness Test is derived from research conducted separately for boys and girls at the elementary, junior high, and senior high levels. The test items for boys are pull-ups, jump and reach, and 160-yard potato race. The motor fitness items for the girls are hanging-in arm-flexed position, standing broad jump, and crossed-arm curl-ups.[34]

The Army devised a five item test battery consisting of pull-ups, squat-jumps, push-ups, sit-ups, and a 300-yard shuttle run.[35] These items were validated by selecting from a number of tests those items that showed the greatest differences between conditioned and non-conditioned troops.[36]

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[33] Ibid., p. 230.

[34] Ibid., p. 233.

[35] Donald Mathews, Measurement in Physical Education, (Philadelphia: W. B. Saunders Co., 1963), p. 120.

[36] Ibid.

The Navy's Standard Physical Fitness Test consists of five items, as follows: squat-thrust, sit-ups, push-ups, squat-jumps, and pull-ups. This test has greater application to civilian populations because it does not include a competitive run (300-yard shuttle run) as do the Army and Air Force tests.[37]

The United States Air Force motor fitness test was designed to measure cardiorespiratory endurance, muscular strength, speed, coordination, and power. The test items are unlimited sit-ups, pull-ups, and 300-yard shuttle run.[38]

All of these tests have been used in their respective fields or areas but the AAHPER Fitness Test has been the most widely used.[39]

The next area of concern encountered was the reliability of physical fitness tests. Julian Stein tested the reliability of the individual test items of the Youth Fitness Test, during a study in July, 1963.[40] The findings show that five of the seven test items (pull-ups, broad jump,

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[37]Clark, op. cit., pp. 223-224.

[38]Ibid., p. 226.

[39]Harold Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia: Lea and Feliger, 1964), p. 126.

[40]Julian Stein, "The Reliability of the Youth Fitness Test," Research Quarterly, 35 (October, 1964), pp. 328-29.

sit-ups, 50-yard dash, and softball throw) have very high and dependable reliability coefficients, ranging between .90 and .98. The other two items (shuttle run and 600-yard run and walk) show average to high relationships, ranging between .74 and .83. In all cases reliability coefficients are significant for beyond .001.[41] The table below illustrates the exact coefficients.

TABLE I

CORRELATION COEFFICIENTS OF TEST-RETEST RELIABILITY OF YOUTH FITNESS TEST

Pull-ups	.981
Broad jump	.900
Shuttle run	.832
Sit-up	.958
50-yard dash	.924
Softball throw	.931
600-yard run and walk	.740

In attempting to determine the best method for administering three fitness strength tests (push-ups, sit-ups, and pull-ups) McGraw and McClenney found that there is seemingly very little difference between the use of the better of two trials and that of the average of two trials. They also found the coefficients of correlation ranged from .90 to .94 on push-ups, .80 to .90 on sit-ups, and .95 to

[41] Ibid.

.97 on pull-ups.[42] Table II on the following page contains information on the coefficients of correlation of the McCraw and McClenney study.

The relationship between physical fitness and other factors has been reviewed and studied by numerous persons. Several positive correlations have been found as well as several low correlations.

Hart and Shay found 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 the academic index in the general education of college students.[43]

The relation between race and physical fitness was studied by Ponthieux and Barker who concluded that Negro boys exceeded white boys in five of seven items on the AAHPER Fitness Test. No difference was found in the other two items. Negro girls surpassed the white girls on four measures; the white girls were superior in two fields; and there was no difference on one.[44]

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[42]Lynn McCraw and Byron McClenney, "Reliability of Fitness Strength Tests," Research Quarterly, 36 (October, 1965), pp. 289-94.

[43]Marcia Hart and Clayton Shay, "Relationship Between Physical Fitness and Academic Success," Research Quarterly, 35:2 (October, 1965), pp. 443-45.

[44]N. A. Ponthieux and D. G. Barker, "Relationship Between Race and Fitness," Research Quarterly, 36 (December, 1965), pp. 464-67.

TABLE II

COEFFICIENTS OF CORRELATION OF
THREE FITNESS STRENGTH TESTS

		Push-ups	Sit-ups	Pull-ups
Trial 1 vs. 2	Elementary	.69	.80	.89
	Jr. High	.86	.78	.95
	Sr. High	.90	.80	.98
	Total	.90	.83	.97
Trial 2 vs. 3	Elementary	.72	.80	.92
	Jr. High	.83	.85	.95
	Sr. High	.91	.62	.95
	Total	.90	.81	.97
Trial 3 vs. 4	Elementary	.71	.70	.93
	Jr. High	.85	.81	.96
	Sr. High	.97	.83	.89
	Total	.92	.80	.95
Better 1 & 2 vs. better 3 & 4	Elementary	.75	.86	.93
	Jr. High	.93	.90	.97
	Sr. High	.93	.89	.96
	Total	.92	.90	.97
Average 1 & 2 vs. average 3 & 4	Elementary	.75	.85	.92
	Jr. High	.91	.88	.96
	Sr. High	.95	.78	.95
	Total	.94	.87	.96

Ponthieux and Barker carried out a second study. The relationship between socioeconomic status and physical fitness was examined in four areas. These areas included the occupation of the parents, the education of the parents, the type of house the students lived in, and the community. The AAHPER Fitness Test was used and each rating ranged from one to seven points with one as highest and seven as lowest. Lower status girls were faster, better coordinated (softball throw) and had more endurance (600-yard walk-run). Upper status girls were stronger in the arm-shoulder girdle strength (pull-ups) and in abdominal and hip flexor muscles (sit-ups). Lower status boys were faster and better coordinated. Higher status boys were more agile and had greater speed (40-yard shuttle-run). They also had more strength of abdominal and hip flexor muscles (sit-ups).[45]

Kenneth Tillman conducted research on the relation between physical fitness and selected personality traits. The top 15 per cent of 386 junior and senior high school boys that scored high on Tillman's personality index also scored high on a physical fitness test and exhibited more dominance than the group that finished in the lower 15

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[45]N. A. Ponthieux and D. G. Barker, "Relationship Between Socioeconomic Status and Physical Fitness Measures," Research Quarterly, 36 (December, 1965), pp. 464-67.

per cent. The top 15 per cent were also extroverts and revealed more personality traits that were also more socially oriented than were those of the lower group. There was more group interaction and more interest in people in the top 15 per cent.[46]

II. LITERATURE ON SPORTS SKILLS AND SKILL TESTS

The development of skill has long been recognized as one of the most important objectives of physical education, and it is often accepted as a desirable objective of some recreational situations.[47] Mohr says, "skill learning is defined as progress toward better performance in motor activity as a result of instruction and/or practice."[48]

Barrow and McGee state "these specialized skills may be defined as those physical activities constituting each sport which are distinctive to that sport."[49] They

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[46]Kenneth Tillman, "Relationship Between Physical Fitness and Selected Personality Traits," Research Quarterly, 36 (December, 1965), pp. 483-89.

[47]Dorothy Mohr, "The Contributions of Physical Activity to Skill Learning," Research Quarterly, 31 (May, 1960), p. 321.

[48]Ibid., p. 322.

[49]Barrow and McGee, op. cit., p. 126.

elaborate further by giving the importance of these skills.

> Sport skills are the heart of the physical education program and the key to future participation. Most of the objectives of physical education, remote and immediate, are dependent on the development of skill. Without skill there can be little if any satisfying participation in physical activities, and without participation, the lasting values--organic, neuromuscular, mental and social--sought through a comprehensive physical education program are impossible to achieve. In the final analysis, skill provides the medium through which all the objectives of physical education can more nearly be attained.[50]

Clark discusses physical education skills and explains that physical education has a history that extends back many centuries, beginning with early Greek civilization. The basis for this form of education is the learning and practice of skills in order to achieve worthwhile objectives..."The true basis of all physical education is to learn skills essential for physical fitness, for building character, and for use during leisure time."[51]

Skill tests are available in all sports areas. As is shown below, these include tests for speed, accuracy, power, agility, and balance:

1.) The fundamental body movements (running, walking, throwing, jumping, leaping, hanging, climbing, and carrying).

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[50] Ibid., p. 127.

[51] Clark, op. cit., p. 127.

2.) Body mechanics.
3.) Individual, dual and team sport skills.
4.) Rhythms and dance skills (singing games, basic movement patterns, folk, social, acrobatic, tap, and modern dance).
5.) Aquatics (swimming, diving, life saving, boating).
6.) Self-testing activities (rope climbing, weight lifting, etc.).
7.) Track and field events.[52]

The check list, rating scale, and skill test are all of equal importance and very necessary in the proper evaluation of skills in sports, dance, and aquatics according to Latchaw and Brown.

> Evaluation of movement skills using standards for performance in the activity may be done by using objective skill tests which measure the degree of proficiency in hitting the target, striking the ball or running the bases....Evaluation of movement skills in sports, dance, and aquatics should include all three types of assessment if the student is to have a clear picture of where he is in the activity he wishes to learn.[53]

Skill tests reflect the ability of the pupil to perform in a specified sport such as badminton, handball, or basketball. By knowing the level of ability of a youngster in a particular sport, it becomes possible to use his ability score for purposes of classification, determining progress, and marking.[54]

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[52]Vannier and Fait, op. cit., p. 322.

[53]Marjorie Latchaw and Camille Brown, The Evaluation Process in Health Education, Physical Education and Recreation (New Jersey: Prentice-Hall, 1962). p. 190.

[54]Mathews, op. cit., p. 161.

Scott and French indicated that, "the measurement of sports skills (have) become an integral part of a well-coordinated program."[55] Teachers are interested in determining the skill abilities of each student in order to place students in groups of like ability and thus facilitate teaching.[56] Skill improvement, grading, and instruction evaluation can be enhanced with the use of skill tests.[57]

The validity and reliability of a skill test, just as with any test, needs consideration. Mathews says, "a word of caution should be injected as to the amount of confidence that can be placed in the results of the skill test, particularly in respect to marking."[58] He lists the following general outline in establishing and using a skill test:

> 1.) Critically examine the sport to determine the skills most essential for successful performance in the activity. In basketball, skills such as shooting, passing, dribbling, and pivoting would be highly important to playing ability. Therefore, you might select these skills as variables to be measured in making up a basketball skill test.

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[55]Scott and French, op. cit., p. 139.

[56]Ibid.

[57]Ibid., p. 140.

[58]Mathews, op. cit., p. 162.

2.) The variables selected for measurement are administered as a test to a large sample of the group of subjects to whom the results are to be applied, say, for example, junior varsity and varsity high school basketball players.
3.) The final step is to ascertain whether those who score high on the test were also the better basketball players. This may be done by having the coaches (board of experts) rank each player in regard to his playing ability. If there is a close relationship--that is, a high correlation between the experts' rating and the test scores--you may then conclude the test is valid, as it measures what it purports to measure.[59]

Latchaw and Brown concur when writing about the statistical validity of a skill test. "A criterion or standard for ability in basketball for instance must first be determined. The scores obtained on a basketball wall pass are correlated with the criterion scores. If the correlation results are satisfactory, the test is considered to be valid."[60]

Skill test reliability can be determined by the test-retest method or by the split-half method, however the statistical technique used for computing reliability, as well as validity, is the correlation technique.[61]

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[59] Ibid., p. 163.

[60] Latchaw and Brown, op. cit., p. 205.

[61] Ibid., p. 201.

Broer lays emphasis on the number of trials on a skill test in determining reliability.

> It cannot be stated that a particular number of trials is necessary for reliability since the number needed depends upon the ability being tested and the age and/or the level of skill of the student.[62]

Although the proper development of a valid, reliable skill test is achieved, it should be remembered that all skill tests contain isolated skill techniques. Therefore teachers should realize that even though a student may score highly on such a test he may fail miserably as a team member in a game situation.[63]

Several studies have been developed concerning the relationship of skill to other areas and the effect of numerous factors on skill. Eunice Way found laterality seemed to be more important in activities stressing accuracy of direction toward a fixed target (archery and bowling) than in activities which do not. "There is no indication that homolaterial preference results in a higher degree of skill than does contralateral preference."[64]

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[62]Marion R. Broer, "Evaluating Skill," Journal of Health, Physical Education, and Recreation, 33 (November, 1962), p. 22.

[63]Vannier and Fait, op. cit., p. 377.

[64]Eunice Way, "Relationship of Lateral Dominance to Scores of Motor Ability and Selected Skill Tests," Research Quarterly, 29 (October, 1958), p. 369.

Distributed practice (24-hour rest intervals) was found to be more effective than massed practice and relatively massed practice (5-minute rest intervals) at the .01 level of confidence, in the immediate acquisition of a novel basketball skill.[65]

Trussell studied the prediction of a success in a motor skill and revealed that the prediction could be based on the amount of early learning achievement.[66]

The relationship between ability and motor skill learning has been shown by Anderson and McClay who measured 155 high school girls with a series of motor ability tests. The authors found high correlations between the tests and the ratings of the girls' playing ability.[67]

A study dealing with the reaction time and speed of movement in skilled and non-skilled sports performers points out the contributions of skill possession to athletics. The skilled athletes were found to be superior in studies by Burpee and Stroll.[68]

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[65]Robert Singer, "Massed and Distributed Practice Effects on the Acquisition and Retention of a Novel Basketball Skill," Research Quarterly, 36 (March, 1965), pp. 68-77.

[66]Ella Trussell, "Prediction of Success in a Motor Skill on the Basis of Early Learning Achievement," Research Quarterly, 36 (October, 1965), pp. 342-47.

[67]Theresa Anderson and C. H. McClay, "The Measurement of Sports Ability in High School Girls," Research Quarterly, 18 (March, 1947), pp. 2-11.

[68]R. H. Burpee and W. Stroll, "Measuring the Reaction Time of Athletes," Research Quarterly, 7 (March, 1936), pp. 110-18.

CHAPTER III

THE DEER PARK PHYSICAL FITNESS TEST

The Deer Park Independent School District has established a physical fitness test to be used in the Deer Park School System. This test is composed of seven items: push-ups, sit-ups, standing broad jump, 50-yard dash, 300-yard shuttle run, pull-ups, and an agility run. This test has not been standardized and therefore norms are not available. Only five of these seven items are used frequently enough on other fitness tests to warrant norm tables. The agility run and 300-yard shuttle run are peculiar to Deer Park.

Research has shown that such activities as pull-ups, push-ups, sit-ups, and a jumping event are valuable items in fitness tests.[1] Due to this, only five items, push-ups, sit-ups, standing broad jump, 50-yard dash, and pull-ups were used in this study. The norms for these items can easily be found in several test booklets and measurement textbooks.[2]

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[1]Carl F. Wilgoose, Evaluation in Health, Education, and Physical Education (New York: McGraw-Hill Book Company, Inc., 1961), p. 168.

[2]_____, American Association Youth Fitness Test Manual (Washington, 1962); Indiana Motor Fitness Test (Indiana: Department of Public Instruction, 1944).

The five test items chosen were administered to 150 seventh grade boys at Deer Park Junior High School, Deer Park, Texas. The test was given during the last two weeks of the Spring Semester, 1967. Due to special programs, short class schedules, and the end of school this length of time was required to test all classes in an acceptable manner.

Two instructors supervised the actual testing and recording of scores. The items were given to four classes of 40, 35, 46, and 44 students respectively. The items were administered by the following schedule: first day-push-ups and sit-ups; second day-pull-ups and 50-yard dash; third day-standing broad jump.

Complete instructions were given to the students for each item. Instructions and item description for the pull-up, sit-up, standing broad jump, and 50-yard dash were obtained from the AAHPER Youth Fitness Test Manual. Description and instructions for administering the push-up were obtained from Barrow and McGee's text.[3]

The remainder of this chapter will be devoted to explaining the test items and how they were administered.

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[3] _____, AAHPER Youth Fitness Test Manual, (Washington, D.C.: American Association for Health, Physical Education, and Recreation, 1961); Harold Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia: Lea and Feliger, 1964).

The Push-up Test

Purpose. The purpose of the push-up was to measure arm and shoulder girdle strength and endurance.

Facilities and equipment. Facilities and equipment would include ample space on a clean floor.

Procedures and description. The student assumed as a starting position the front leaning rest. In this position the arms were straight with the hands resting on the floor, shoulder width apart. The back and legs were straight with the feet together and the weight was supported on the hands and feet. As the arms were bent, the student lowered himself until his chest touched the hand of his partner. The partner assumed a prone position with his fist clinched and placed on the floor straight in front of him with his little finger on the floor and thumb on the top. He placed his fist in such a position that the individual doing the push-up would touch the fist with his chest when coming down. The fist was always left on the floor. He then pushed back up to the starting position. The complete procedure counted as one push-up.

Rules. Throughout the push-up the student maintained a straight line body position with the head up and back straight. The body could not rest on the floor at the

conclusion of the first part of the exercise. The chest lightly touched the clinched fist, and the body pushed away at once. If any part of the body, except hands or toes touched the floor, the trial was not counted.

Instructions. The instructor told the student to start in the up position in push-ups. On "Ready, go" he instructed him to do as many push-ups as he could by touching the partner's fist with his chest and going back up. The students could not rest either in the up position or on the floor. He further instructed the students to do the push-ups without any body sag or arch.

Scoring. The number of successful completions of the complete exercise was the number of correct push-ups and no part scores were credited.[4]

The Sit-up Test

Purpose. The purpose of the sit-up was to measure abdominal strength, endurance, and speed.

Facilities and equipment. If enough mats were available, they were used; otherwise, the floor was satisfactory.

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[4] Ibid., p. 220.

The timer needed a watch with a second hand or a stop-watch.

Procedures and description. The pupil doing the exercise began by lying on his back with legs extended and feet about two feet apart. His hands were placed on the back of his neck with the fingers interlaced. The elbows were brought almost vertical to the floor. A partner held the ankles down, the heels being in contact with the mat or floor at all times. The legs were held just tight enough to allow the knees to flex slightly when doing the exercise. The student sat up, turned his trunk to the left, and touched his right elbow to his left knee. He returned to the starting position and then sat up, turned his trunk to the right, and touched his left elbow to his right knee. He repeated the exercise, alternating sides.

Rules. The fingers remained in contact behind the neck throughout the exercise. The knees were on the floor during the sit-up but could be slightly bent when touching elbow to knee. The back was rounded and the head and elbows were brought forward when sitting up as a "curl" up. When returning to starting position, elbows were flat on the mat before sitting up again.

Instructions. The instructor told the student to lie on his back with his partner holding his feet. He told

the student to sit up and touch his right elbow to his left knee and return to the down position. The student then sat up and touched his left elbow to his right knee and returned to the down position. The student kept his hands locked behind his head at all times and touched his knee with his elbow. He had one minute to do as many as he could. On "Ready, begin" he began.

Scoring. One point was given for each time the student touched an elbow to a knee. If the fingers unlocked or if the student pushed off the floor with an elbow, the sit-up was not counted.[5]

The Standing Broad Jump Test

Purpose. The purpose of the standing broad jump was to measure power and leg strength.

Facilities and equipment. The equipment needed was a take-off mark on the floor and a tape measure.

Procedures and description. The student stood with his feet several inches apart and his toes just behind the

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[5] AAHPER Test Manual, op. cit., p. 8.

take-off line. Preparatory to jumping, the pupil swung the arms backward and bent the knees. The student attempted to jump forward as far as he could by simultaneously extending the knees and swinging forward the arms.

Rules. The toes were behind the take-off line prior to jumping. When jumping, if the student fell backward, the spot where his hands landed was marked as the distance jumped.

Instructions. The instructor told the student to stand with his toes behind the take-off line, bend his knees, swing his arms backward, and jump forward as far as he could. The best of three jumps was counted.

Scoring. The best of three trials in feet and inches, to the nearest inch was recorded. Measurement was made from the take-off line to the nearest point of body contact.[6]

The 50-yard Dash Test

Purpose. The purpose of the 50-yard dash was to measure speed.

Facilities and equipment. Equipment needed was two stopwatches or one with a split-second timer and a hard

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[6] Ibid., p. 10.

surface area of at least 75 yards long with sufficient width to permit two lanes of three feet width. The lanes were marked with a starting and finishing line 50 yards apart.

Procedures and description. Two students started at one time. Both students took positions behind the starting line. A starter used the commands "Are you ready?" and "Go!". The starter held his hand in the air and on "Go!" dropped it. At this time another person started recording the time for those running.

Rules. Students waited behind the starting line until they saw the starter's hand drop. If pupils were running in lanes, they were told to stay in their lanes.

Instructions. The students were instructed to group behind the starting line. Two students were asked to come forward and take their positions behind the starting line. They were told the starter would say, "Are you ready?" and raise his hand. The students were told to begin when they saw the starter's hand drop. They were instructed to run past the finish line at full speed.

Scoring. Each student's time was recorded in seconds to the nearest tenth of a second.[7]

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[7] Ibid., p. 11.

The Pull-up Test

Purpose. The purpose of the pull-up was to measure arm and shoulder girdle strength and endurance.

Facilities and equipment. A metal or wooden bar approximately 1-1/2 inches in diameter was preferred. A doorway gym bar could be used and, if no regular equipment is available, a piece of pipe or even the rungs of a ladder could also serve the purpose. The bar was secured to prevent rotation.

Procedures and description. The bar was high enough so the pupil could hang with his arms and legs fully extended and his feet free of the floor. The student jumped and grasped the bar placing his hands about shoulder width apart. He grasped the bar with the palms down. After assuming the hanging position, the pupil raised his body by his arms until his chin could be placed over the bar and then lowered his body to a full hang as in the starting position. The exercise was repeated as many times as possible.

Rules. The student's body could not swing during the execution of the movement. The pull could in no way be a snap movement nor could the pupil jump to the bar and continue into a pull-up. He started from a full hang. The

knees could not be raised and kicking of the legs was not permitted. If the student began swinging, an extended arm was held across the front of the thighs.

Instructions. The instructor told the student to jump to the bar with a palms down, full hang position. The student was told he must pull himself up and place his chin over the bar, and lower himself to the starting position. He was told not to swing, lift his knees, or kick to aid in the action of chinning. The chin was a continuous movement without a snap. He was also told not to rest between pull-ups.

Scoring. The number of completed pull-ups to the nearest whole number was recorded.[8]

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[8] Ibid., p. 5.

CHAPTER IV

THE SPORTS SKILL TEST

Three sports skill tests were administered to 150 boys at Deer Park Junior High School. The tests covered isolated skill techniques used in football, basketball, and softball.

Each test was given in two days, and the entire class period was devoted to the test. Under these conditions it was possible to finish the actual testing in six days.

In reviewing the various sports skill tests it was decided to use the Borleske Touch Football Test,[1] the Johnson Basketball Test,[2] and one item from the Fringer Softball Battery.[3] These tests were chosen on the basis of the following criteria:

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[1]Stanley E. Borleske, "A Study of Achievement of College Men in Touch Football," (unpublished Master's Thesis, The University of California, Berkeley, 1936). Research Quarterly, 8 (May, 1937), pp. 73-8.

[2]L. W. Johnson, "Objective Tests in Basketball for High School Boys," (unpublished Master's thesis, State University of Iowa, 1934). H. Harrison Clarke, Application of Measurement to Health and Physical Education (New Jersey: Prentice-Hall, Inc., 1959), pp. 331-32.

[3]Margaret Neal Fringer, "A Battery of Softball Skill Tests for Senior High School Girls," (unpublished Master's thesis, University of Michigan, Ann Arbor, 1961). Harold M. Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia: Lea and Febiger, 1964), pp. 302-06.

1.) These three activities were taught during the regular school year and it was felt this would give valid and reliable scores.
2.) The tests are easy to score, and are not open to the evaluator's subjective judgment.
3.) The test items contained a certain degree of challenging difficulty.
4.) The tests were of such a nature that they could be administered with the facilities available and in the time available.

Borleske Touch Football Test

Purpose. The purpose of the touch football test is to measure the basic skills in touch football--running, throwing, and kicking.

Evaluation. The three-item battery correlated .88 with the objective criterion of composite scores.

Level and Sex. This test battery was originally designed for college men. It has been used widely and adapted for use with secondary and junior high school boys.

Time allotment. The three items contained here are considered a valid measure of touch football performance. Two class lessons would be needed to give the three-item battery to a class of boys.

Facilities. One regulation size football field,

divided into three stations will accommodate the administration of this test.

Class organization. Three instructors administer and supervise this test. Each class is divided into three groups, with one group performing each of the test items simultaneously. Each student is given an individual score card. As he completed an item, his score is recorded and he proceeds to the next item.

General procedures. The plan of organization is explained to the students prior to actual testing. Assistants included students who are instructed to return balls in the punt and pass test items.

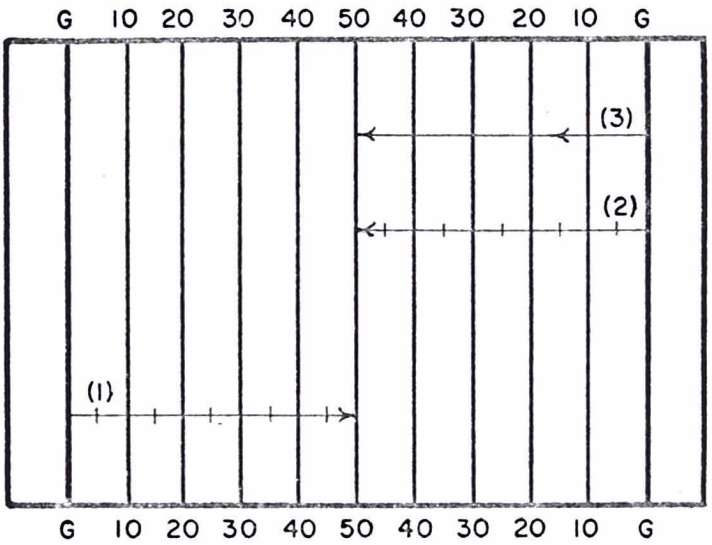

FIGURE 5

FIELD PLAN FOR THE BORLESKE TOUCH FOOTBALL TEST
(1) PUNT FOR DISTANCE. (2) PASS FOR DISTANCE. (3) SPRINT.

Item Number I - Forward Pass For Distance

Purpose. The purpose of this item was to measure the ability to pass far and straight.

Facilities and equipment. A football field was marked every five yards. Several footballs were used to speed the administration.

Procedures. As the students came on the field they began throwing and kicking the footballs. They were told they would be measured on a football throw and they would need to loosen up their arms. They were given approximately one minute for this warming-up period. At this point, the students were divided into three groups. The group designated to execute the football throw first was told to report to station two.

Instructions. The students were placed in single file behind the goal line. They were told they could take one step in throwing the football, but could not cross the goal line. (An instructor was stationed at the goal line to check that they did not cross the line in throwing. He also recorded the score and indicated when each student should throw.)[4] The students were told they would have

[4]It should be noted here that during two of the four classes tested, six instructors were available. During the other two classes, three instructors and three student assistants were used.

three trials and the best one would count as their score. They were told to throw the football as far and as straight as they could.

Scoring. Each score was measured to the nearest yard by an instructor in the field. The best of three trials was recorded.

Testing personnel. One instructor stood at the goal line and a second instructor was in the field to spot the distance. Students were used to retrieve the footballs.

Item Number II - Punt for Distance

Purpose. The purpose of this item was to measure the ability to punt for distance.

Facilities and equipment. A football field marked every five yards was necessary. Several footballs were also needed.

Procedures. The students were required to stretch their leg muscles as a warm-up exercise. One minute was allowed for this warm-up exercise. The kicker stood behind the goal line and punted the ball as far as he could.

Instructions. The students were instructed to stand behind the goal line and punt three footballs as far and

straight as they could. They were told the best of three trials would be recorded.

Scoring. An instructor in the field estimated, to the nearest yard, the distance of the punt. The best of three punts was recorded.

Testing personnel. One instructor supervising the punting was at the goal line. Another instructor was in the field measuring distance. Several students were used as ball retrievers.

Items Number III - Running-Straight-Away

Purpose. The purpose of this item was to measure the ability to make a fast take-off after receiving a football and to run for fifty yards.

Facilities and equipment. A fifty yard area of the football field, marked correctly was needed. Several footballs and a stopwatch were also required.

Procedures. The student stood behind the goal line, and after receiving a pass from the instructor immediately ran fifty yards, carrying the ball.

Instructions. The students were instructed to stand behind the goal line in single file. They were told that

an instructor, standing five yards away, would throw them a football. They were instructed to catch the ball behind the line and run full speed until they crossed the fifty yard line. If they dropped the ball, the trial was invalid and was repeated. Students were instructed that their time would begin when they caught the ball and end when they crossed the fifty yard line.

Scoring. The time was recorded in seconds to the nearest tenth of a second from the time the student caught the ball until he crossed the fifty yard line.

Testing personnel. Two instructors were needed. One was needed to time, the other was needed to throw footballs.[5]

Johnson Basketball Test

Purpose. The purpose of this test is to measure the basic skills of shooting, throwing, and dribbling in boys' basketball.

Evaluation. Johnson used nineteen tests to determine the best ones to measure basketball playing ability. He found the reliability coefficients ranged from .73 to .93 and the validity coefficients reported were .84 and .88.

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[5]Borleske, op. cit., pp. 73-78.

Level and sex. The Johnson Basketball Test is designed for use with high school and junior high school boys.

Time allotment. Two class periods can be used for the administration of this test.

Facilities. A regulation basketball court and a wall area are needed for this test.

Class organization. The station plan is used in the administration of this test. Due to the fact that the throw for accuracy caused a bottleneck, two students alternately throw at the same target.

General procedures. The three raw scores for the test items are added to obtain a battery score.

Item Number I - Field Goal Speed Test

Purpose. The purpose of this item was to measure the ability to make successive field goals under the stress of time.

Facilities and equipment. The equipment needed was one basketball, one basketball goal, and one stopwatch.

Procedures. The student started close under the basket in any position he desired and threw as many baskets as he could in thirty seconds.

Instructions. The students were told they could take any position under the basket they wished. They were instructed that they had thirty seconds to make as many baskets as they could. They were told to start on "Ready, Go!"

Scoring. One thirty second trial was given to each student. One point was scored for every basket made during this time.

Testing personnel. One instructor was used to score and time.

Item Number II - Basketball Throw For Accuracy

Purpose. The purpose of this item was to measure the strength of the shoulders and the ability to throw accurately with consistency.

Facilities and equipment. For this test item a target area, a space about 50 feet, and a basketball were needed.

Procedure. The student stood behind a line thirty-five feet from a target which was a series of rectangles of various sizes, arranged one inside of the other. The dimensions of these rectangles were as follows: 60 inches by 40 inches, 40 inches by 25 inches, and 20 inches by 10

inches. The student threw a basketball using either the baseball or the hook pass form of throwing.

Instructions. The students were instructed to stand behind the thirty-five foot restraining line and throw the basketball to the target area. They were told they would have ten throws to make as many points as possible.

Scoring. The student scored three points for every ball which hit in the center of the target or on the inner line. He scored two points for balls which hit in the middle rectangle or line. The student scored one point for balls landing in the outer rectangle or line. A total of thirty points was possible.

Testing personnel. Two instructors were used to score the test. One instructor was with each of the boys throwing alternately at the target. Those students not participating kept balls available to the floor.

Item Number III - Dribble

Purpose. The purpose of this item was to measure ball handling ability and agility of the players.

Equipment and facilities. An area at least forty feet in length was needed to set up the test. School desks

were placed back to back and used as obstacles in this test. A ball and a stopwatch were also needed.

Procedures. The test was started behind a line six feet long and twelve feet from the first obstacle. The student was to dribble the ball in figure eight fashion around the obstacles for thirty seconds.

Instructions. Each student was told to stand behind the restraining line and on the signal "Ready, Go," dribble in and out the obstacles in a figure eight pattern, passing as many obstacles as the pupil could in thirty seconds.

Scoring. The student was given one point each time he passed the end of an obstacle.

Testing personnel. An instructor was used to score and a student was used to time.[6]

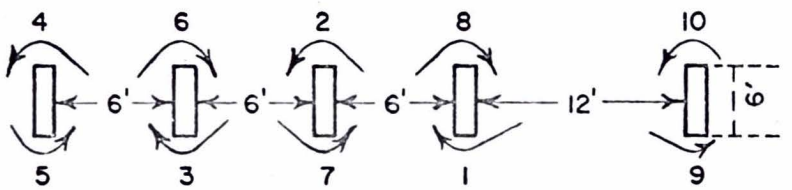

FIGURE 6

SPECIFICATIONS FOR THE DRIBBLE TEST

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[6]Johnson, op. cit., pp. 331-32.

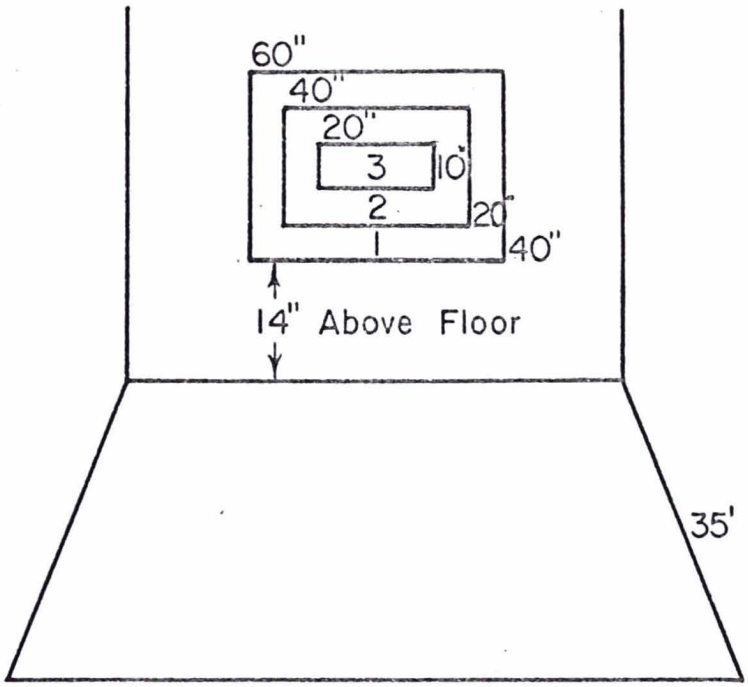

FIGURE 7

SPECIFICATIONS FOR THE BASKET-BALL THROW FOR ACCURACY TEST.

Fringer Softball Battery

Purpose. The purpose of this test is to measure the important aspects of softball playing ability--catching, fielding, and throwing.

Evaluation. The fly ball test item had a reliability coefficient of .87 and a validity coefficient of .76. The fielding test item had reliability and validity coefficients of .72 and .70 respectively. The softball throw test item had .90 and .72 reliability and validity coefficients, respectively.

Level and sex. This battery was designed for high school girls but the items are appropriate for boys.

Time allotment. The softball throw for distance test requires 1-1/2 minutes per person. The fielding test requires 2 minutes per person and a minute rest period between trials. The fly ball test requires 1-1/2 minutes per person plus a minute rest period between trials.

Facilities. For the fielding and fly ball test only indoor floor and wall space is needed. The softball throw for distance requires outdoor space.

Class organization. The station system is recommended.

General procedures. Warm-up exercises are suggested for the items in this test and rest periods can be scheduled if the students rotate after each trial.

Item Number I - Softball Throw For Distance[7]

Purpose. The purpose of this test item was to measure the ability to throw long distances.

Facilities and equipment. Several softballs were needed for this test. An outdoor marked area was also needed.

Procedures. The students were required to stand behind the goal line and were allowed to take one step into a throw for distance. Three successive throws were made and the best one counted. The students engaged in a warm-up period before the test began.

Instructions. The students were instructed to stand behind the goal line, allowing themselves enough room to take one step into a throw for distance without stepping over the line. They were told they would throw three times and the longest throw would be recorded as their score.

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[7]Only the softball throw item was used in this study due to administrative schedule changes.

Scoring. Each student's throw was measured to the nearest foot and the best of three trials was recorded.

Testing personnel. Two instructors were needed. One was stationed at the restraining line, the other was in the field.[8]

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[8]Barrow and McGee, op. cit., p. 306.

CHAPTER V

TABULATION AND RESULTS OF TEST DATA

The data obtained from the skill tests and the physical fitness test was tabulated and arranged for programming into a digital computer. The following items were determined by the computer, using the Stepwise Regression Analysis Program:

1.) The mean and standard deviation for each independent variable;
2.) The mean and standard deviation for each dependent variable;
3.) The correlation coefficients between each of the independent variables and between the independent and dependent variables;
4.) The most significantly correlated variable;
5.) The multiple regression equations;
6.) The standard error of measurement.[1]

The independent variable with the most significant correlation coefficient was entered into Step 1. In this step the variable was correlated with the particular dependent variable being tested. The significance of each correlation was tested by an F ratio test. If the F value was 4.0 or greater, the correlation was significant at the 95 per cent level of confidence and a regression equation was established for the variables.

The computer then selected the second best

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[1]A. R. Colville and L. S. Holmes, "A Stepwise Regression Analysis," (Texas: IBM Publications), January 15, 1962.

correlation coefficient. This began Step 2.

The significance of the multiple correlation was then determined by the F ratio test. If the significance was found to be above the 4.0 (95 per cent) level, a multiple regression equation was established.

The computer carried out this selection process for each significant variable. The computer tested the significance of each correlation, determined the possible error of measurement, and calculated the pure constant or the constant number needed to complete the regression equation.

Multiple regression equations used as predictive formulas were established for all significant correlations. Only those correlations with F values of 4.0 or above were considered in this study.

The five physical fitness items were labeled independent variables and the sport skill test items were labeled dependent variables. The specific numbering, the mean values, and standard deviations for the variables are illustrated in Table III on page 64.

Only those independent variables found to be significant are discussed with each dependent variable. A complete list of correlation coefficients can be found in Appendix D.

The dependent variable DV6 (football throw) was

TABLE III

MEAN VALUES AND STANDARD DEVIATIONS
OF THE VARIABLES

Independent Variables		Mean Values	Std. Deviations
IV1	Push-ups	29.3	11.2
IV2	Sit-ups	55.3	13.3
IV3	Std. Bd. jump	73.2	7.6
IV4	50-yd. dash	7.2	.580
IV5	Pull-ups	4.8	3.8
Dependent Variables			
DV6	Ftb. throw	27.7	5.8
DV7	Ftb. kick	28.3	6.9
DV8	Ftb. run	8.0	6.6
DV9	Ftb. total	155.3	11.4
DV10	Bsktb. field goal	8.7	3.8
DV11	Bsktb. accuracy throw	9.8	3.8
DV12	Bsktb. dribble	15.9	3.6
DV13	Bsktb. total	155.8	.509
DV14	Sftb. throw	145.1	26.3

considered first. Three independent variables were significantly correlated. The multiple regression equation for the prediction of DV6 (football throw) can be determined by using the following equation:

DV6 equals 25.8 plus .11 (IV1) plus .18 (IV3) minus 2.0 (IV4).

The standard error of measurement is 5.1 yards.

The football kick (DV7) had significant correlation with two independent variables. The multiple regression equation for the prediction of DV7 (football kick) can be determined by using the following equation:

DV7 equals 43.2 plus .126 (IV2) minus 3.0 (IV4).

The standard error of measurement is 6.4 yards.

The football run (DV8) was only significantly correlated with one independent variable. The multiple regression equation for the prediction of DV8 (football run) can be determined by using the following equation:

DV8 equals 17.8 minus .178 (IV2).

The standard error of measurement is 6 seconds.

None of the five independent variables had a significant correlation with a football skill test total score (DV9). From the variables used in this investigation, there is no way to predict an individual's total point score on the football test battery. However, as shown in

the preceeding paragraphs, it is possible to predict achievement in individual football skill activities.

Collectively the basketball test battery yielded a better correlation with the independent variables. The basketball field goal test (DV10) can be predicted by using two independent variables. The multiple regression equation for the prediction of DV10 (basketball field goal) can be determined by the following equation:

DV10 equals 25.9 plus .05 (IV2) minus 2.8 (IV4).

The standard error of measurement is 3 points.

The basketball accuracy throw (DV11) was significantly correlated to two variables. The regression equation for the prediction of DV11 (basketball accuracy test) can be determined by the following equation:

DV11 equals 17.9 plus .09 (IV1) minus 1.5 (IV4).

The standard error of measurement is 3 points.

The basketball dribble (DV12) was significantly correlated to two independent variables. The multiple regression equation for the prediction of DV12 (basketball dribble) can be determined by the following equation:

DV12 equals 22.9 plus .07 (IV2) minus 1.5 (IV4).

The standard error of measurement is 3 points.

On the total basketball score (DV13) significant correlations were found to exist with two independent

variables. The multiple regression equation for the prediction of DV13 (basketball total) can be determined by the following equation:

DV13 equals 158.0 plus .01 (IV1) minus .34 (IV4).

The standard error of measurement is .43 points.

The softball throw for distance (DV14) was significantly correlated with two independent variables. The multiple regression equation for the prediction of DV13 (softball throw for distance) can be determined by the following equation:

DV14 equals 253.9 plus .47 (IV2) minus 18.6 (IV4).

The standard error of measurement is 2 feet.

The significant correlations illustrated graphically can be found in Figure 8 on page 68.

Examples were taken from the actual scores of three individuals involved in the study. The regression equations illustrated on the preceding pages were applied to the following scores to predict a football kick, basketball throw for accuracy points, and softball throw.

The actual scores on the football kick test for individual case number 30 were: sit-ups--71 and 50-yard dash time--7.7. The multiple regression equation for DV7 equals 43.2 plus .126 (IV2) minus 3.0, with a standard error of measurement of 6 yards. By substituting the numerical values, the equation becomes: 43.2 plus .126

Independent Variables

Dependent Variables	FtB. Throw	FtB. Kick	FtB. Run	FtB. Total	BsktB. Field Goal	BsktB. Accur. Throw	BsktB. Dribble	BsktB. Total	SftB. Throw
Push Ups	X					X		X	
Sit Ups		X	X		X		X		X
Std. Bd. Jump	X								
50-yd. Dash	X	X			X	X	X	X	X
Pull Ups									

FIGURE 8

SIGNIFICANT CORRELATIONS AT THE 95% LEVEL OF CONFIDENCE

(71) minus 3.0 (7.7). The results indicate that individual case number 30 should kick the football between 23 and 35 yards, 68 per cent of the time and between 17 and 41 yards, 95 per cent of the time.[2] His actual score was 25 yards.

In predicting the basketball throw for accuracy, the following scores were taken from individual case number 96: pull-ups--20 and 50-yard dash time--8.1. The multiple regression equation for DV11 equals 17.9 plus .09 (IV1) minus 1.5 (IV4), with a standard error of measurement of 3.0 points. By substituting the numerical values, the equation becomes: 17.9 plus .09 (20) minus 1.5 (8.1). The results indicate that individual case number 96 should score between 4 and 10 points, 68 per cent of the time and between 1 and 13 points, 95 per cent of the time. His actual score was 11.

In predicting the softball throw, the following scores were taken from the scores on the physical fitness test of individual case number 13: sit-ups--42 and 50-yard dash time--6.5. The multiple regression equation for DV14 equals 253.9 plus .47 (IV2) minus 18.6 (IV4), with a standard error of measurement of 22 feet. By substituting the

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[2]These percentages are based on the normal curve distribution where 68 per cent of all cases fall between plus and minus one deviation and 95 per cent of all cases fall between plus and minus two standard deviations. N. P. Neilson, Statistics, Tests, and Measurements in Physical Education (California: N-P Publications, 1960), pp. 12-17.

numerical values, the equation becomes: 253.9 plus .47 (42) minus 18.6 (6.5). The results indicate that individual case number 13 should throw the softball between 130 and 174 feet, 68 per cent of the time and between 108 and 196 feet, 95 per cent of the time. His actual throwing distance was 135 feet.

CHAPTER VI

SUMMARY AND CONCLUSIONS

It was the purpose of this study to determine the effectiveness of physical fitness test items as indicators of achievement in physical education class activities through the use of skill tests. This investigation was attempted by administering a five item physical fitness test and three sports skill tests in the areas of softball, football, and basketball, to 150 seventh grade boys at Deer Park Junior High School, Deer Park, Texas.

The results of these tests were tabulated for programming into a digital computer. Using a Stepwise Regression Analysis Program the computer calculated the mean, standard deviation, correlation coefficients, and data necessary for formulating multiple regression equations. Table III on page 64 lists the means and standard deviations of test items and the correlation coefficients can be found in Appendix D. A multiple regression equation was established for every item on the skill test excluding the football total test score. The basic formula for the regression equation is: P equals AX plus K, with P as the prediction,

A as the coefficient, X as the variable, and K as the constant.

The factors necessary for the completion of the multiple regression equation are the significantly correlated variables (tested to give an F value of 4.0 or above), the coefficients of the variables, the pure constant, and the standard error of measurement. Regression equations are given for the various skill test items found to be significantly correlated.

It is concluded from this study that:

1. The physical fitness test item, 50-yard dash, was significantly correlated to more skill test items than any other physical fitness test item by being significantly correlated to seven of the nine dependent variables.

2. The physical fitness test item, sit-up, was the second most significantly correlated variable. The sit-up was significantly correlated to five of the nine skill test items.

3. The push-up was significantly correlated to three of the nine skill test items.

4. The standing broad jump was significantly correlated to one of the nine skill test items.

5. The pull-up was not significantly correlated to any of the skill test items.

6. The physical fitness items--push-up, standing broad jump, and 50-yard dash--can best predict success in the football throw when applied to the multiple regression equation.

7. An individual's time on the 50-yard dash and the number of sit-ups he completes can be used to predict how far a person can kick a football when applied to the multiple regression equation.

8. The number of sit-ups a person does can be used to predict how fast an individual can run 50 yards with a football when applied to the multiple regression equation.

9. Of the fitness test items used, none can predict success on a total football skill test score.

10. The time on the 50-yard dash and the number of sit-ups an individual does can be used to predict the number of basketball field goals an individual will make when applied to the multiple regression equation.

11. The total points from the basketball accuracy throw test can be predicted from the number of push-ups a person does and his time on the 50-yard dash when applied to the multiple regression equation.

12. An individual's score on a certain basketball dribble test can be predicted by using the number of sit-ups he does and his time on the 50-yard dash when applied to the multiple regression equation.

13. The distance an individual can throw a softball can be predicted by using his time on the 50-yard dash and the number of sit-ups he completes when applied to the multiple regression equation.

The evidence presented above illustrates that the physical educator should be able to use the multiple regression equation and predict an individual's achievement on a skill item with a certain degree of accuracy. This could possibly aid in assigning grades and choosing individuals for specific teams.

BIBLIOGRAPHY

Books

Barrow, Harold, and Rosemary McGee. A Practical Approach to Measurement in Physical Education. Philadelphia: Lea and Febiger, 1964.

Clark, Henry H. Application of Measurement to Health and Physical Education. New Jersey: Prentice-Hall, Inc., 1959.

Flushman, Edwin A. The Structure and Measurement of Physical Fitness. New Jersey: Prentice-Hall, Inc., 1964.

Garrett, Henry H. Elementary Statistics. New York: David McKay Company, Inc., 1962.

Hackensmith, C. W. History of Physical Education. New York: Harper and Row, 1966.

Latchaw, Marjorie, and Camille Brown. The Evaluation Process in Health Education, Physical Education, and Recreation. New Jersey: Prentice-Hall, Inc., 1962.

Mathews, Donald. Measurement in Physical Education. Philadelphia: W. B. Saunders Company, 1963.

Neilson, N. P. Statistics, Tests, and Measurements in Physical Education. California: N-P Publications, 1960.

Neilson, N. P., and Alice Bronson. Problems in Physical Education. New York: Holt, Rinehart and Winston, 1966.

Scott, M. Gladys, and Ester French. Measurement and Evaluation in Physical Education. Iowa: William C. Brown Company, 1959.

Thorndike, Robert, and Elizabeth Hagen. Measurement and Evaluation in Psychology and Education. New York: John Wiley and Sons, Inc., 1961.

Wilgoose, Carl E. Evaluation in Health Education and Physical Education. New York: McGraw-Hill Book Company, Inc., 1961.

Vannier, Maryhelen, and Hollis Fait. Teaching Physical Education in Secondary Schools. Philadelphia: W. B. Saunders Company, 1957.

Publications of the Government and Learned Societies

American Association for Health, Physical Education, and Recreation. AAHPER Youth Fitness Test Manual. Washington: NEA Publication, 1965.

Periodicals

Anderson, Theresa, and C. H. McClay. "The Measurement of Sports Ability in High School Girls," Research Quarterly for the Association of Health, Physical Education, and Recreation, 18 (March, 1947), 2-11.

Borleske, Stanley E. "A Study of Achievement of College Men in Touch Football," Research Quarterly, 8 (May, 1937), 73-8.

Broer, Marion R. "Evaluating Skill," Journal of Health, Physical Education, and Recreation, 33 (November, 1962), 22-23.

Burpee, R. H., and W. Stroll. "Measuring the Reaction Time of Athletes," Research Quarterly, 7 (March, 1936), 110-18.

Colville, A. R., and L. S. Holmes. "A Stepwise Regression Analysis," IBM Publications (January, 1962).

Hart, Marcia, and Clayton Shay. "Relationship Between Physical Fitness and Academic Success," Research Quarterly, 35 (October, 1965), 443-45.

Hunsicker, Paul. "AAHPER's Youth Fitness Project," Journal of Health, Physical Education, and Recreation, 28 (November, 1957), 17-18.

Kidder, Gene. "All-Around Fitness For All," Journal of Health, Physical Education, and Recreation. 28 (September, 1957), 8-9.

Knuttgen, Howard. "Comparison of Fitness of Danish and American School Children," Research Quarterly, 32 (May, 1961), 230-34.

Kraus, Hans, and Ruth Hirschland. "Muscular Fitness and Health," Journal of Health, Physical Education, and Recreation, 24 (December, 1953), 17-19.

Kraus, Hans, and Ruth Hirschland. "Muscular Fitness and Orthopedic Disability," Research Quarterly, 24 (December, 1953), 18-19.

McGraw, Lynn and Byron McClenney. "Reliability of Fitness Strength Tests," Research Quarterly, 36 (October, 1965), 289-94.

Mohr, Dorothy. "The Contributions of Physical Activity to Skill Learning," Research Quarterly, 31 (May, 1960), 321-50.

Ponthieux, N. A., and D. G. Barker. "The Relationship Between Race and Fitness," Research Quarterly, 36 (December, 1965), 468-72.

Ponthieux, N. A., and D. G. Barker. "The Relationship Between Socioeconomic Status and Physical Fitness Measures," Research Quarterly, 36 (December, 1965), 464-67.

"President's Conference on Fitness of American Youth," The Journal of Health, Physical Education, and Recreation, 27 (September, 1956), 8-10.

Singer, Robert. "Massed and Distributed Practice Effects on the Acquisition and Retention of a Novel Basketball Skill," Research Quarterly, 36 (March, 1965), 66-77.

Stein, Julian. "The Reliability of the Youth Fitness Test," Research Quarterly, 35 (October, 1964), 328-29.

Tillman, Kenneth. "The Relationship Between Physical Fitness and Selected Personality Traits," Research Quarterly, 36 (December, 1965), 483-89.

Trussell, Ella. "Prediction of Success in a Motor Skill on the Basis of Early Learning Achievements," Research Quarterly, 36 (October, 1965), 342-47.

Way, Eunice. "The Relationship of Lateral Dominance to Scores of Motor Ability and Selected Skill Tests," Research Quarterly, 29 (October, 1958), 360-69.

Essays and Articles in Collection

Campbell, William, and Richard Pohnderf. "Physical Fitness of British and United States Children," Health and Fitness in the Modern World. Washington: The American Institute, 1961. Pp. 8-16.

APPENDIX A

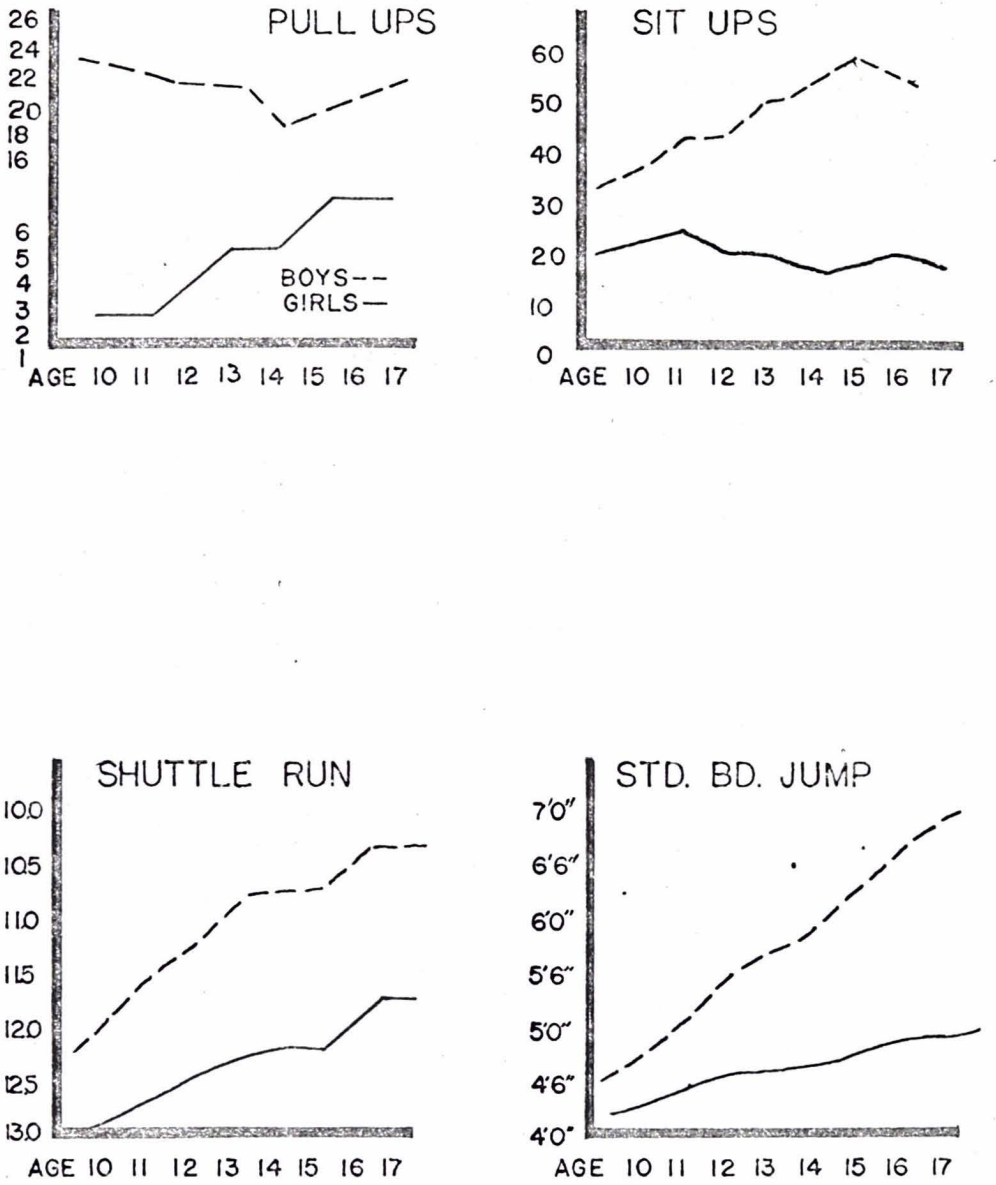
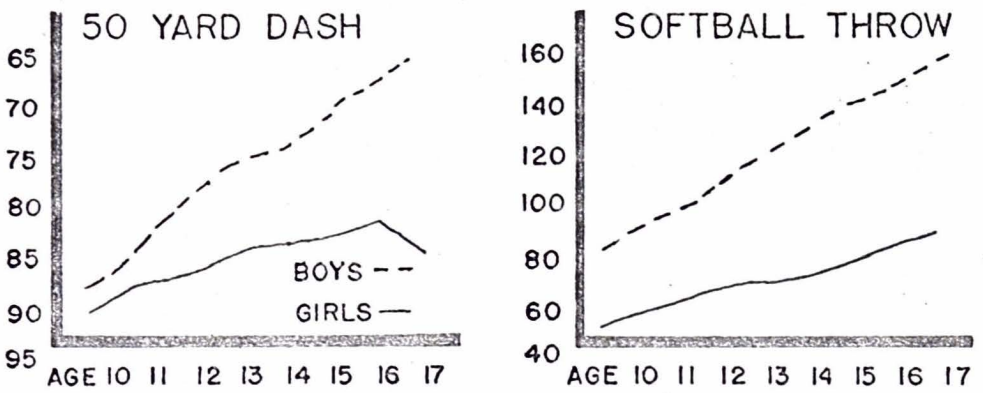


FIGURE 9
AVERAGE SCORES ON AAHPER
FITNESS TEST



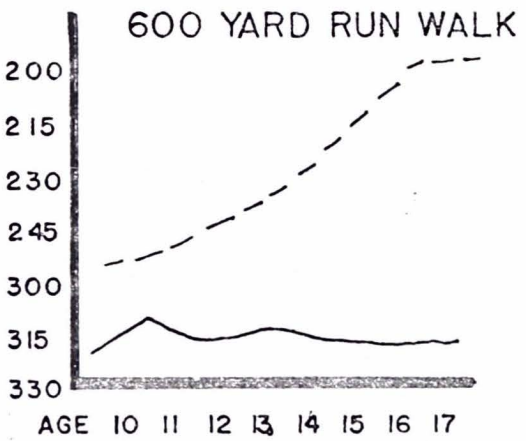


FIGURE 9 (CONTINUED)

APPENDIX B

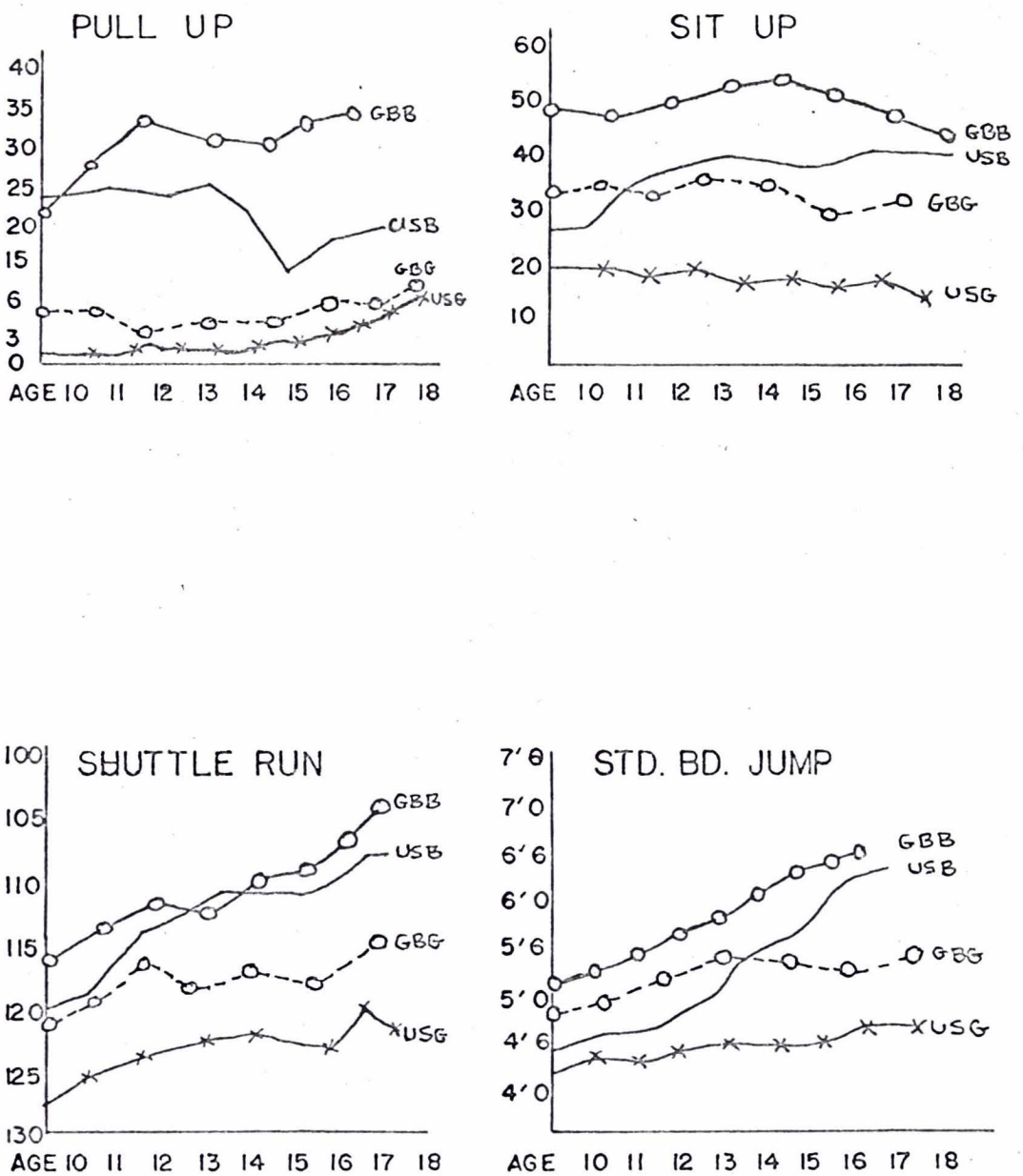
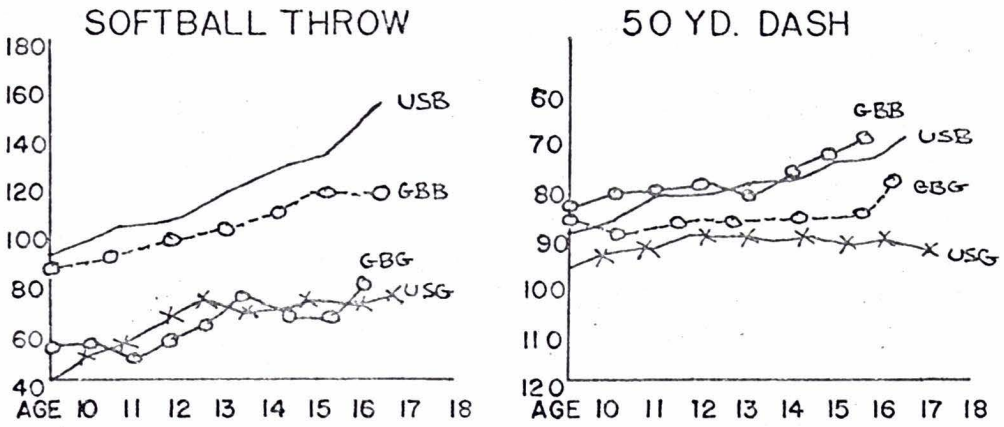


FIGURE 10
UNITED STATES AND GREAT BRITAIN BOYS AND GIRLS RESULTS ON AAHPER FITNESS TEST



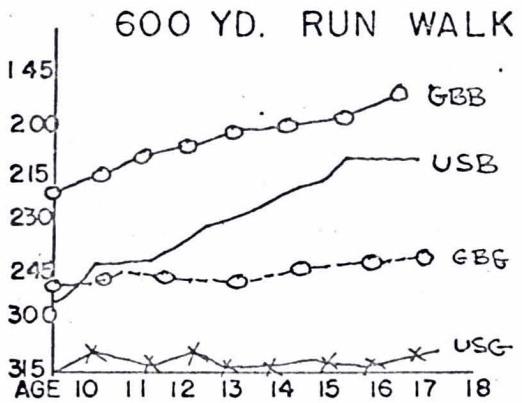


FIGURE 10 (CONTINUED)

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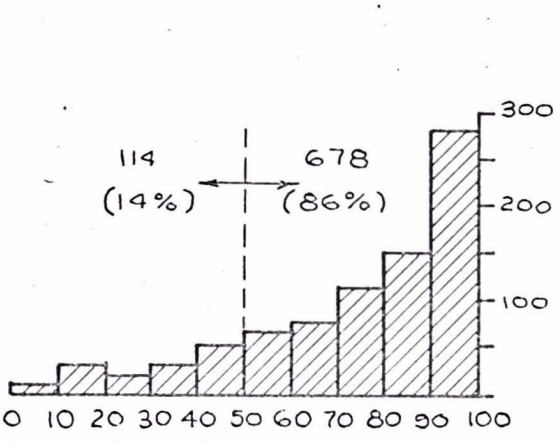

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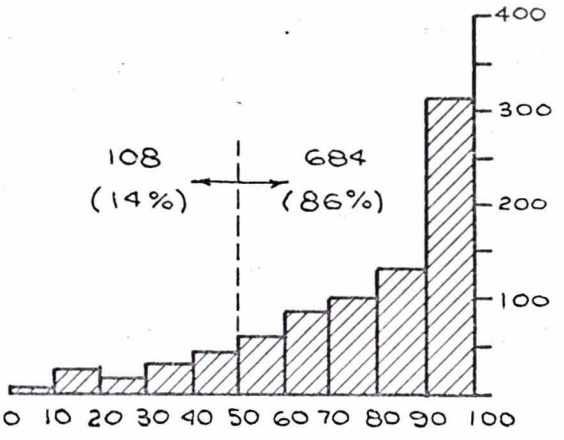
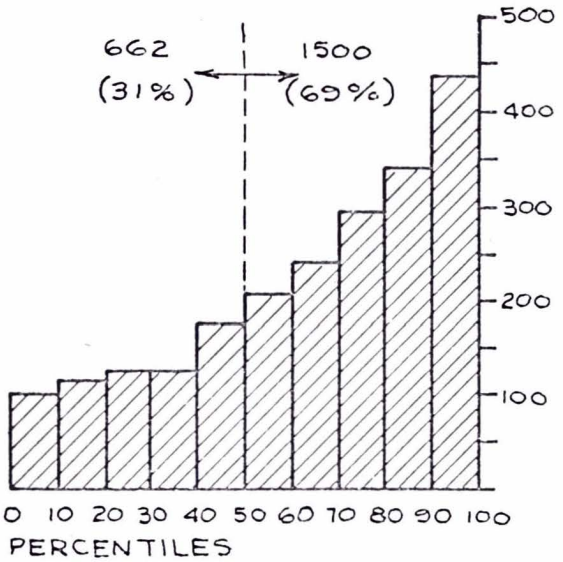


CLASSIFICATION INDEX NORMS.*

GIRLS



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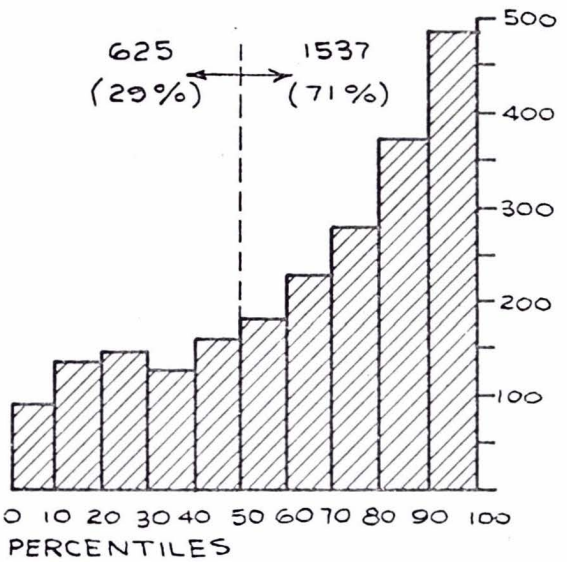

CLASSIFICATION INDEX NORMS*

BOYS

FIGURE II

RESULTS OF DANISH FITNESS TEST
(TOTAL PERFORMANCE*)

APPENDIX D

TABLE IV

CORRELATION COEFFICIENTS

	FtB. Throw	FtB. Kick	FtB. Run	FtB. Total	BsktB. Field Goal	BsktB. Accur. Throw	BsktB. Dribble	BsktB. Total	SftB. Throw
Push Ups	*.433	.291	-.162	-.002	.370	*.396	.293	*.416	.369
Sit Ups	*.336	*.323	*-.356	.057	*.335	.301	*.361	.351	*.373
Std. Bd. Jump	*-.485	.327	-.195	.015	.404	.305	.217	.444	.452
50-yd. Dash	*-.455	*-.329	.258	-.024	*-.486	*-.365	*-.336	*-.499	*-.488
Pull Ups	-.402	.242	-.141	-.042	.359	.345	.323	.324	.351

* Denotes Significant Correlations

Vita was removed during scanning