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Some effects of variation in testing procedure on physical fitness test scores

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SOME EFFECTS OF VARIATION IN TESTING PROCEDURE ON PHYSICAL FITNESS TEST SCORES

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APPROVAL SHEET

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CHAPTER I

INTRODUCTION

For the past five years physical education programs in Richmond area secondary schools have placed considerable emphasis upon physical fitness testing. The majority of the schools are utilizing a test battery published by the American Association for Health, Physical Education, and Recreation.[1] Results of these tests are utilized to compare one student with another and to compare one school with another. These comparisons are made known to the students and to the public. The basis for comparison is a set of national norms developed by the AAHPER.

It has recently come to the attention of some physical education instructors in this area that particular tests in the AAHPER battery are not being administered in the same way by all testers. Thus, there is some doubt as to whether the results from the comparisons are, in fact, valid ones.

A. THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to determine what variations existed in testing procedure in five Richmond area secondary schools; and (2) to

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[1]Hereinafter referred to as AAHPER.

ascertain, through an experiment with a group of students, the effect such variations would have upon test scores. The investigator was not, at any time, concerned with the validity of the tests. It was assumed that the tests are valid measures of physical fitness.

Importance of the Study. For many years physical education was criticized for lack of demonstrable outcomes of its programs. The physical fitness testing movement provided some solution to this problem, because the test score could be used as a tangible record of success or failure in terms of objectives.

It is obviously essential that such a record must be accurate if it is to be of value. The use of unreliable estimates of fitness can have the following consequences:

1. An individual can be categorized as being "unfit" physically when his fitness level might actually be high, if it were measured accurately.
2. An individual can be erroneously classified as "excellent" in certain aspects of fitness, yet have weaknesses in those areas. These weaknesses, which need to be identified and improved upon, will go unnoticed.

In this study an effort was made to point out some of the inaccuracies in regard to testing procedure, in the hope

that those responsible for the administration of tests might alter their procedure, and thus obtain more precise measurements of their students' physical fitness.

B. DEFINITION OF TERMS

Physical fitness. The term, "physical fitness," has been defined by various writers. Mathews states that:

> In order to ascertain how the leading authorities in medicine as well as physical education defined physical fitness, a number of definitions during a sixteen year period were analyzed. The analysis revealed that the term fitness was most generally interpreted in its broadest concept, that of total fitness.[2]

Morehouse and Miller categorize and define aspects of physical fitness as follows:[3]

1. Anatomical fitness: all organs and body parts are in good condition and function well enough to perform the task at hand.
2. Physiological fitness: There is sufficient muscular strength and motor skill to perform the task well and to recover quickly from fatigue.
3. Psychological fitness: Desire is combined with

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[2]Donald K. Mathews, Measurement in Physical Education (Philadelphia: W. B. Saunders Co., 1958), p. 4.

[3]Edward B. Johns, Wilfred C. Sutton, and Lloyd E. Webster, Health for Effective Living (New York: McGraw-Hill Co., 1962), p. 179, citing Laurence E. Morehouse and Augustus T. Miller, Jr., Physiology of Exercise (St. Louis: The C. V. Mosby Co., 1959).

intelligence, educability, and emotional stability in performing the task.

Mathews[4] would add a fourth aspect to these, that of physical anthropometric fitness, which is reflected in body contour. This, in turn, is a result of good muscular tonus and proper body weight.

It is appropriate to include the statement prepared by the AAHPER, the publication of which precluded the great national drive to interest schools in utilizing the physical fitness tests with which this thesis is concerned.

> Fitness is that state which characterizes the degree to which the person is able to function. Fitness is an individual matter. 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.[5]

In this report the term, "physical fitness," shall be interpreted in accordance with the AAHPER definition.

Physical Fitness Test. Throughout the report of this investigation, the term, "physical fitness test," shall be interpreted as meaning a measure of one particular aspect of fitness. Examples are (1) a measure of arm and shoulder

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[4]Mathews, loc. cit., p. 5.

[5]Delbert Oberteuffer, School Health Education (New York: Harper and Brothers, 1960), p. 493.

strength and (2) a measure of agility. Seven of these individual tests comprise the AAHPER Youth Fitness Test Battery.

C. A SURVEY OF LITERATURE IN THE FIELD

A survey of literature failed to disclose any studies which relate specifically to the topic under discussion in this thesis. However, a few have been done on reliability of various fitness tests. Wilgoose, Askew, and Askew[6] tested a group of eighth graders on the six hundred yard run-walk on two occasions. The facility used and the persons who timed were the same; weather conditions were similar. Scores of trial one correlated with scores of trial two .92.

Fox[7] tested the reliability of the Washington Fitness Test, using high school girls. In the pull-ups, correlating trial one with trial two yielded a correlation coefficient in the eighties for all groups. In testing curl-ups, Fox found that two trials produced only moderately high correlations. Hence, she administered two additional trials, then correlated the sum of trials one and two with the sum of trials

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[6]Carl E. Wilgoose, Nathaniel R. Askew, and Mildred P. Askew, "Reliability of the Six Hundred Yard Walk-Run," Research Quarterly of the American Association for Health, Physical Education, and Recreation, 32:264, May, 1961.

[7]Katherine Fox, "Reliability and Validity of Selected Physical Fitness Tests for High School Girls," Research Quarterly of the American Association for Health, Physical Education, and Recreation, 30:430, December, 1959.

three and four. From this she obtained reliability ranging from .71 among juniors to .92 among freshmen. Her conclusion was that for some tests it is probably necessary to allow more than one trial.

In a comparison of the effect of experienced testers on the scores of students on the Physical Fitness Index Tests, Mathews[8] first engaged persons to administer the test who were unfamiliar with that particular testing instrument. In a second situation, experienced testers administered the test to the same subjects. The mean scores obtained the second time were significantly better than those obtained in the first situation. Mathews concluded that the better scores were due to the capabilities of the testers.

Slater-Hammel,[9] in commenting upon Mathews' findings, hypothesized that higher means on the second attempt could have been a result of (1) capabilities of the testers, (2) practice or learning on the part of the subjects, or (3) a combination of both factors.

To summarize, these studies were concerned with

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[8]Donald K. Mathews, "Comparison of Testers and Subjects in Administering Physical Fitness Index Tests," Research Quarterly of the American Association for Health, Physical Education, and Recreation, 24:442, December, 1953.

[9]Arthur T. Slater-Hammel, "Comments on the Article by Donald K. Mathews on the Comparison of Testers and Subjects in Administering Physical Fitness Index Tests," Research Quarterly of the American Association for Health, Physical Education, and Recreation, 25:487, December, 1954.

reliability of the tests throughout several repetitions. Only one investigation considered the variable of a difference in test conditions.

D. BACKGROUND OF CURRENT FITNESS TESTING

Although fitness testing had its genesis more than one hundred years ago, the particular tests about which this study is written were formulated within the last decade.

Interest in fitness had been stirred following the rejection of vast numbers of men by the armed forces in World Wars I and II. Then, in 1953, Dr. Hans Kraus and Ruth Hirshland released the report on the now famous Kraus-Weber Tests. In a study of 4,264 American and 2, 870 European children, 57.9 per cent of the Americans failed tests of strength and flexibility, while failure occurred in only 8.7 per cent of the European cases.[10]

This disturbing fact motivated President Eisenhower to call the National Conference on Physical Fitness of American Youth in 1956, and from the Conference came the National Council on Youth Fitness.[11]

One week later the AAHPER called a conference on youth fitness. As a result, selected members of the AAHPER

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[10]Arthur Weston, The Making of American Physical Education (New York: Appleton-Century Crofts, 1963), p. 98

[11]Ibid.

Research Council were commissioned to select specific fitness tests which should be used in elementary and secondary schools throughout the nation. Prior to this time many fitness tests had been devised, but according to Carl A. Troester, Executive Secretary of the AAHPER, "None of them seemed to be an adequate measure of physical fitness in all its aspects."[12]

In two days, members of the Council had agreed upon these seven tests:

1. Pull-ups, (modified when used with girls)
2. Sit-ups
3. Shuttle run
4. Standing broad jump
5. Fifty yard dash
6. Six hundred yard run-walk
7. Softball throw for distance

In order to establish norms for the tests, the AAHPER enlisted the aid of the University of Michigan's Survey Research Center.[13] The Center drew the sample schools and determined which students in the schools would be used.

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[12]American Association for Health, Physical Education, and Recreation, Youth Fitness Test Manual (Washington: American Association for Health, Physical Education, and Recreation, 1962), p. 1.

[13]Ibid., p. 2.

During the school year 1957-58, representatives of the AAHPER held meetings with persons who would be in charge of the testing in order to describe and demonstrate proper procedures to be used in conducting the tests.

Scores were subsequently turned in to the Center and norms and percentile tables were set up. The first edition of the AAHPER Youth Fitness Test Manual, including the norms, appeared in October, 1958.[14]

President John F. Kennedy came to the support of physical fitness, citing it as a responsibility of the Department of Health, Education, and Welfare. Next he called the National Conference on Physical Fitness of Youth to determine how the federal government could work most effectively with state and local groups. In 1961, he appointed Charles "Bud" Wilkinson as personal consultant and asked that he aid the formulation of a youth fitness program.[15]

A document explaining President Kennedy's physical fitness program is now being used in schools throughout the United States.[16] This document is Youth Physical Fitness:

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[14] Ibid., p. 3.

[15] Weston, loc. cit., p. 103.

[16] American Association for Health, Physical Education, and Recreation, loc. cit., p. 4.

Suggested Elements of a School-Centered Program, Parts I and II. In regard to this publication, the following is quoted from the AAHPER Youth Fitness Manual:

> The AAHPER has worked closely with Mr. Wilkinson and his staff in developing the program presented by the President's Council on Youth Fitness. The Council has officially adopted the AAHPER Youth Fitness Test and recommends its use.[17]

In order that a distinction be made, the tests, described in the booklet, Youth Fitness: Suggested Elements of a School Centered Program, will hereafter be referred to as the "President's Council Tests," and the tests described in the AAPER Youth Fitness Test Manual will be referred to as the "AAHPER Tests." This differentiation is necessary because, although the two books are supposed to contain exactly the same test battery, there are, nevertheless, differences in the descriptions. This fact is explained in detail in Chapter II.

E. PROCEDURES

It was decided that the best way to begin the investigation was to select five secondary schools in the Richmond area where the AAHPER tests were being used, and to attempt to ascertain all various ways in which the tests were being

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[17] Ibid., p. 4.

administered in these schools. The list consisted of the following:

1. School A, a public co-educational secondary school with a total enrollment of 1,370, including 660 girls.
2. School B, a public co-educational secondary school with a total enrollment of 1,630, including 814 girls.
3. School C, a public co-educational secondary school with a total enrollment of 1,742, including 892 girls.
4. School D, a parochial girls' secondary school with a total enrollment of 140.
5. School E, an independent co-ordinate school, including grades five through twelve in the upper level. There are 350 girls enrolled.

The second step was to review the printed instructions for administering all tests in order to make a subjective analysis of the variations in testing procedure which might result from a misinterpretation of these. These possible variations, coupled with the knowledge of differences in test administration which had already been discovered through hearsay formed the basis for a questionnaire. A copy of the questionnaire appears in Appendix A. The questionnaire was then submitted to at least one teacher in each of the five

schools. In order to obtain accurate information, questions were asked and answered verbally.

A visual check was then made of all facilities and equipment which were used in the testing programs. Other variations in procedure were discovered by examining score sheets in all of the schools. At this point a list of the individual tests, outlining various ways of administering each, was prepared.

The next step in the investigation was an experiment which would disclose the effect which the various ways of administering the tests would have upon the scores. Five tests from the AAHPER battery were administered to twenty-eight college women. Each test was given under at least four conditions. An analysis of variance, repeated measures, was then conducted in order to determine whether the scores obtained under one condition were significantly different from those obtained under the other conditions. A Newman-Keuls procedure for testing differences between ordered means was conducted in all instances where the analysis of variance revealed a significant F ratio.

F. BRIEF SUMMARY OF RESULTS

The results of the analysis of variance and the Newman-Keuls test disclosed the fact that with three of the five tests, scores significantly increased or decreased,

depending upon the way in which the test was administered. Those results indicate that the ranking of a student against national norms and classifying certain aspects of her physical fitness as "poor" is not a sound practice, when, in fact, she may have taken the test under more difficult conditions than did the subjects whose scores make up the norms. The same applies to categorizing a student as "excellent," when the degree of difficulty might be less.

CHAPTER II

RESULTS OF THE SURVEY OF THE ADMINISTRATION OF TESTING PROGRAMS

It was discovered that the instructions for administering the AAHPER Test listed in the AAHPER Test Manual are not identical to those listed in the President's Council booklet, although they are supposedly exactly the same test battery.

Copies of the instructions are printed in Appendix B and Appendix C. The following discrepancies are evident:

1. The picture of the sit-up in the President's Council Test implies that it is done with a straight back, a feat which can be performed only if the elbows are kept back, pointing out to the sides. In the AAHPER instructions, it is clearly stated that the back should be rounded and elbows brought forward as the performer sits up.
2. The AAHPER instructions for the shuttle run state that the pupil <u>starts</u> from behind the line. This could mean either from a stand or a crouch. The President's Council Test instructions state that she <u>stands</u>.
3. The AAHPER instructions for the fifty yard dash

state that the runner takes a position behind the line, while the President's Council instructions state that she stands behind the line.

4. The AAHPER instructions for the softball throw state that the pupil should throw the ball while remaining within two parallel lines, six feet apart. The President's Council instructions state that she starts several feet behind the line, moves forward, and throws without going over the line.

5. The AAHPER instructions state that the maximum number of pull-ups that any high school girl should attempt is forty, and that the maximum number of sit-ups is fifty. The President's Council instructions state that the performer should execute as many as she can, up to, but not exceeding the number in the excellent category. The excellent levels for all ages in pull-ups are at forty-five. In sit-ups, the levels are:

1. age thirteen: fifty
2. age fourteen: forty-nine
3. age fifteen: thirty-seven
4. age sixteen: forty

5. age seventeen: forty-two

The survey of testing programs at the five schools revealed several variations in test administration. Each specific test and the various methods of administering it are enumerated in the following pages.

Modified Pull-ups

School A. A standard horizontal bar was used. Students were grouped according to height, and three of the same height performed at once, with the bar adjusted to the level of their arm pits. The teacher supervised the placing of the feet so that the line of the body was congruent with the diagram in the booklet. Another student braced the performer's feet with her feet. The grasp was with palms turned toward the face, (undergrasp). Students were told to do as many as they could up to, but not exceeding the number listed under "Excellent" on the score sheet. Each student was given three tries.

School B. The parallel bar, adjusted with one notch showing, was used for all students except a few who are exceptionally tall. In these cases, it was raised slightly. They grasped the bar with palms turned away from the face, and placed the feet on the far side of the metal base, where an assistant braced the feet with her own feet. They were

allowed one try, and were told to do as many as they could up to, but not exceeding, the number printed on the score sheet under the word, "Excellent."

School C. The standard horizontal bar was used and the tests were administered exactly like those at School D, except that the bar was not adjusted for each individual. Girls of similar height were divided into groups, and the bar was adjusted for each group.

School D. The test was administered on a standard horizontal bar, and procedures were like those at School A, with the following exceptions:

1. Only one girl performed at a time, and the bar was adjusted to the arm pit level of each individual.
2. The palms were turned away from the face, (overgrasp).
3. Only one try was given.

School E. Many students were tested on a bar fastened in a doorway with suction cups. It was adjusted to armpit level of each individual. Students were instructed to place feet on the floor, then walk forward until the body was suspended at a forty-five degree angle. Classes were divided into four groups, each group working on a different test.

The two teachers rotated from one group to another. They felt that because they were not able to be at the bar constantly, some of the girls did not align their bodies properly.

Some of the students were tested on the parallel bar because the doorway bar broke before testing was completed. It was adjusted to arm pit level of each student, and students were instructed to extend feet beyond the far side of the metal base and walk forward until the body formed a forty-five degree angle with the floor.

They were given one try, then told that if they had time and could find a partner to assist and count the number of pull-ups, they could have subsequent tries. Some did take additional tries.

Sit-ups

Four of the five schools had students lie on back, clasp fingers behind neck, have a partner hold feet, sit up, and touch right elbow to left knee, then repeat, touching left elbow to right knee. The exception was School E, where touching elbows to knees was not required.

At Schools A, B, D, and E students lay on the floor, while at School C they lay on gym mats.

School D's students had only one try. School E's had one try, but if, on subsequent days, they wished to find a

partner to assist, they were allowed several more tries.

At School C, students were allowed to try every day for a week. If a girl achieved an excellent score on the first day, she did not continue to take the test, and a similar procedure was followed with those who achieved an excellent score up to the last day. School A followed procedure.

At School B, if they did not achieve a score which fell in either the good or the excellent category on the first try, they were allowed additional tries.

Shuttle Run

There was very little variation in the conducting of this test. Every school conducted it exactly as outlined in the instructions. Every school tested on the gym floor except School B, and they tested on a grassy field.

Standing Broad Jump

Students at all schools were given three tries. The jump itself was done in the same manner by all students. At School A and School D they jumped on the gym floor, while at School B they jumped on grass. At School C the fall tests were conducted inside, but some of the spring tests were given on an asphalt area. School E used the gym floor for some of the students and a place on the athletic field where dirt is packed hard for others. All students were measured from the

heel which landed closest to the take-off point except those at School A. All of their tenth grade students were measured from the ball of the foot on the fall tests, and from the heel on the spring tests.

Fifty Yard Dash

Students at Schools B, D, and E ran on grass. Those at School A ran on a black-top area. At School C some ran on grass and others ran on the black-top.

At Schools A and D students assumed a crouched track man's starting position. At Schools B and C they simply stood behind the line. At School E some assumed the crouch and some stood up.

At Schools A and B every girl had three tries. At Schools C and D all had only one try. At School E one test was conducted, but anyone who requested additional tries was given several.

Softball Throw for Distance

Students at all schools except School C took running starts. All had three tries except those at School D, and they were allowed only one.

At no school did the girls have sufficient warm-up prior to throwing for distance. School B was the only one where a warm-up of any sort was done, and those students simply formed groups, took one ball to a group, and tossed

it around for approximately five minutes.

Six-hundred Yard Run-Walk

The only major difference found in the administration of this test was the facility on which it was run. School A and School C students ran on an oval track. School E students ran on an unfinished oval track with a macadam surface. At School B a one hundred yard straight-away was measured off on a grassy field. Each student ran the one hundred yards, turned around and ran back to the starting point, and repeated this action three times. The facility used by the School D students was a football field one hundred yards long and fifty yards wide. They ran around it twice.

It is significant to note that practically no variations were found in methods of scoring. In almost all instances one of the teachers was present at the test point, supervising measurement, clocking, counting, etc. Teachers also did all the recording of scores and this was done shortly after a girl had finished a test. Generally, teachers stated that opportunities for students to cheat were negligible. The only exception occurred at School E, where four tests were administered simultaneously, and the two teachers could not cover each test point constantly. The teachers there felt that there could have been some

cheating on reporting of scores of pull-ups and sit-ups.

All schools which utilized this particular test battery used the results, in one way or another, as a basis for grades. At School A scores of both the fall and the spring tests made up part of the six weeks grade. This was also true at School C. At School B the fall test scores were not used in grading, but spring scores were. School E was the only school which used the test scores as the entire physical education grade for a six weeks marking period, and this they did with the spring scores. At all four of these schools students were aware, prior to taking the tests, that they would be graded on their performance on the tests. At School D the teachers took the scores into consideration when giving the six weeks grade in the fall, but it was done in a subjective way rather than actually averaging the scores in with other marks. Students at School D were not aware that their grades were being influenced by the test scores.

CHAPTER III

EXPERIMENTATION: METHODS AND RESULTS

A. PREPARATION

A study was conducted to determine just how much variance the difference in testing procedure would produce. Five test items from the AAHPER battery were given to twenty-eight subjects. Each test was administered under as many of the conditions delineated on pages 16-22 as was deemed practical. In addition, sit-ups were administered exactly as pictured in the instruction booklet, as well as under the conditions on pages 18-19.

Selecting the Subjects

The subjects were selected from among thirty-three college women who comprised the entire enrollment of two physical education service classes at Richmond Professional Institute. All thirty-three students volunteered for the experiment; however, because of injury, sickness and the like, only twenty-eight were able to complete the tests.

Although the entire student body was not randomly sampled for this study, the testees composed a good cross-section because all levels from freshman to senior were represented, as well as seven different departments.

Eliminating Factors Other Than Differences in Test Administration

An attempt was made to screen out the influence of factors other than differences in testing procedures.

Factor 1: Increasing practice. Instead of having all twenty-eight subjects taking the test under condition #1, then all twenty-eight taking it under condition #2, #3, etc., the group was divided into as many segments as there were conditions. For example, there were five segments for the broad jump. The testing schedule was similar to this:

First Day

1. Group 1 jumped on grass
2. Group 2 jumped on dirt
3. Group 3 jumped on blacktop
4. Group 4 jumped on gym floor
5. Group 5 jumped on gym floor, measuring from balls of feet

The groups were then rotated from one surface to another, until every girl had jumped on every surface, but all groups started and finished on a different surface. This eliminated the possibility that high scores obtained under one condition could be attributed to the fact that it was the last surface on which all twenty-eight jumped.

Similar procedure was followed with all tests.

Factor 2: Overexertion. The testing was scheduled so that a student would not have to perform two strenuous tests in consecutive order. For example, no one was allowed to do sit-ups under more than one condition on any one day. A typical schedule was as follows:

First day	Second day	Third day
Broad jump	Shuttle run	Fifty yard dash
Pull-ups	Sit-ups	Broad jump

Factor 3: Sickness. Students were informed that they did not have to participate when they were not feeling well. Many of them sat out at various times.

Factor 4: Tests not administered exactly as stated: scores incorrectly recorded. The investigator personally supervised all testing. Scores were recorded on the spot; thus, the chance of students falsifying scores was negligible.

Factor 5: Motivation. Students were informed that a study on fitness would be conducted, and they were asked to perform to the best of their ability so that the results would be accurate.

They were told from the beginning that they would not be given a mark on physical fitness. Although all secondary schools which used this particular test battery did use

scores as a basis for grades, the investigator felt that to do so in this situation would be educationally unsound.

The investigator did not want motivation to become a major factor, as it does when scores are graded. Motivation in this experiment was augmented by a plea for making the best score possible so that the research would be valid. It is assumed that among a group of volunteers, this type of motivation is fairly evenly distributed. That is, one does not find a few who will do sit-ups until they virtually pass out, as they would if they knew that such action would be rewarded with an "A." Of course, there are always a few who strive to be better than the rest of the class, but this factor was kept to a minimum because there were so many tests being administered and with so many various groups, that many could not remember the score that they made under certain conditions. Moreover, there were no individual score sheets for students to peruse. There were only master sheets, held by the investigator.

Participants were not apprized of the norms. Neither were they congratulated for making scores which would be classified as excellent.

B. ADMINISTERING THE TESTS

An experiment was conducted with five of the seven fitness tests. The six hundred yard run-walk was omitted

because of lack of proper facilities. The softball throw for distance was not used because throwing without adequate warm-up could be injurious. The tests which were included are discussed below.

Modified pull-ups. Under all conditions the student's body and arms were aligned as closely as possible to the drawing in Figure 4, Appendix B. A partner braced her feet. The body was kept straight and the chest touched to the bar. Conditions under which pull-ups were administered were:

1. on horizontal bar adjusted to armpit level, overgrasp,
2. on horizontal bar, adjusted to armpit level, undergrasp,
3. on parallel bar, adjusted to armpit level, overgrasp,
4. on parallel bar, adjusted with one notch showing, overgrasp.

The bar suspended in the doorway was not used because it is not entirely safe. The investigator has had personal experience with the suction cups coming loose.

Sit-ups. Each student had a partner hold her feet, as indicated in the instructions in Appendix B. When doing the sit-ups in which the elbows must be kept straight back, each girl was carefully watched and told to stop as soon as she

allowed her elbows to move forward the least bit. The conditions under which sit-ups were administered were:

1. on floor, keeping elbows straight back, touching elbow to opposite knee,
2. on mat, keeping elbows straight back, touching elbow to opposite knee,
3. on floor, not attempting to keep elbows straight back, touching elbow to opposite knee,
4. on mat, not attempting to keep elbows straight back, touching elbow to opposite knee,
5. on floor, not attempting to keep elbows straight back, not touching elbow to opposite knee.

Shuttle run. This test was conducted exactly as indicated in the instructions, except that the testees ran under the following conditions:

1. On grass, starting from a stand.
2. On grass, starting from a crouch.
3. On the gym floor, starting from a stand.
4. On the gym floor, starting from a crouch.

Standing broad jump. Students jumped on the following surfaces:

1. Grass
2. Dirt
3. Blacktop

4. Gym floor

5. Gym floor, measuring from the ball of the foot.

Fifty yard dash. Each participant ran on the following surfaces:

1. On grass, starting from a stand.

2. On grass, starting from a crouch.

3. On blacktop, starting from a stand.

4. On blacktop, starting from a crouch.

No attempt was made to test whether a student who was allowed three tries under one condition might score higher than one who received only one try under the same condition. It was not possible to test this factor. As an illustration, the schedule for the broad jump could be set up as follows:

First Day

1. Group 1 jumps on grass.

2. Group 2 jumps on dirt.

3. Group 3 jumps on gym floor.

4. Group 4 jumps on blacktop.

5. Group 5 jumps on gym floor, measuring from balls of feet.

Now, if each group were tested under only one condition, it would be possible to determine whether three tries would produce a better score than one try. For example, all in Group 1 could jump one time on grass, record the scores,

and then make two more attempts. The score obtained on the third set of jumps could then be compared with the scores made on the first series. This comparison will not yield a true picture when Group 1 begins jumping under condition #2, however, for the first jump under condition #2 will, in fact, be the fourth attempt for the girls in that group. As the tests progress, the ensuing results would be less and less accurate, as the first jump under condition #5 would be the thirteenth attempt for Group 1.

C. RESULTS OF THE TESTING

An analysis of variance, repeated measures, was conducted in order to determine the existence of any significant differences in scores obtained under various conditions. This adaptation of the analysis of variance was taken from B. J. Winer, Statistical Principles in Experimental Design. The hypothesis of no effect was postulated. The five per cent level of confidence was chosen.

Significant F values were found in the modified pull-ups, sit-ups and broad jump. Therefore, a Newman-Keuls procedure for testing differences between ordered means was done on each of these three in order to determine wherein the differences lay. The adaptation of the Newman-Keuls test was taken from B. J. Winer, Statistical Principles in Experimental Design.

The mean scores of students executing modified pull-ups on the horizontal bar were 27 and 27.93, while the same students taking the tests on the parallel bar achieved means of only 13.14 and 11.68. The figures in Table I produced an F ratio of 24.90, exceeding the critical value of F at the five per cent level of confidence. Hence, the null hypothesis was rejected.

TABLE I

ANALYSIS OF VARIANCE, MODIFIED PULL-UPS

Source	SS	df	MS	F
Between People	4,832.21	27		
Within People	3,295.25	84		
Treatments	6,837.17	3	2,129.05	24.90*
Interaction	6,908.08	81	85.28	
Total	8,127.46	111		

*$F_{.95}(3,81) = 2.72$

The Newman-Keuls test, which utilizes the q statistic, revealed that there is no significant difference between mean scores obtained with the parallel bar, (means 1 and 2 in Table II), and that there is no significant difference between means obtained with the horizontal bar, (means 3 and 4). However, means 3 and 4 do differ significantly from means 1 and 2.

In the sit-ups tests, when elbows were allowed to come forward, mean scores were 21.25, 22.46, and 22.57. When

elbows were kept straight back, the mean scores were 8.07 and 8.32. The figures in Table III produced an F ratio of 35.36, exceeding the critical value of F at the five per cent level of confidence. Hence, the null hypothesis was rejected.

TABLE II

RESULTS OF NEWMAN-KEULS TEST ON MODIFIED PULL-UPS

Ordered Differences		(2)	(3)	(4)
	(1)	1.46	15.32*	16.25*
	(2)		13.86*	14.79*
	(3)			.93

*Exceeding critical value of $q_{.95}(k,81)$, where k = number of steps apart for any pair of means.

TABLE III

ANALYSIS OF VARIANCE, SIT-UPS

Source	SS	df	MS	F
Between People	9,098.02	27		
Within People	11,500.80	112		
Treatments	6,521.01	4	1,630.25	35.36*
Interaction	4,979.79	108	46.11	
Total	11,500.80	139		

*$F_{.95}(4,108) = 2.45$

The Newman-Keuls test revealed that mean scores obtained when elbows were kept straight back, (means 1 and 2 in Table IV), were not significantly different, and that mean scores obtained when elbows were allowed to come forward, (means 3, 4, and 5), were not significantly different, but that means 3, 4, and 5 differed significantly from means 1 and 2.

TABLE IV

RESULTS OF NEWMAN-KEULS TEST ON SIT-UPS

Ordered Differences		(2)	(3)	(4)	(5)
	(1)	.25	13.18*	14.39*	14.50*
	(2)		12.93*	13.14*	14.25*
	(3)			1.21	1.32
	(4)				.11

*Exceeding critical value of $q_{.95}$ (k,108), where k = number of steps apart for any pair of means.

Means scores obtained by students executing the broad jump under various conditions were as follows:

1. On dirt, 61.67 inches.
2. On the gym floor, 63.13 inches.
3. On the grass, 64.38 inches.
4. On the blacktop, 64.94 inches.
5. On the gym floor, measuring from ball of foot, 67.54 inches.

The figures in Table V produced an F ratio of 14.13, exceeding the critical value of F at the five per cent level of confidence. Hence, the null hypothesis was rejected.

TABLE V

ANALYSIS OF VARIANCE, BROAD JUMP

Source	SS	df	MS	F
Between People	7,062.53	27		
Within People	1,561.72	112		
Treatments	536.36	4	134.09	14.13*
Interaction	1,025.36	108	9.49	
Total	1,561.72	112		

*$F_{.95}$ (4,108) = 3.50

The Newman-Keuls test revealed that the mean obtained when measuring from the ball of the foot is significantly different from each of the other means. It also showed that the mean obtained on dirt differs significantly from the means obtained on blacktop and grass.

TABLE VI

RESULTS OF NEWMAN-KEULS TEST ON BROAD JUMP

		(2)	(3)	(4)	(5)
Ordered Differences	(1)	1.46	2.71*	3.27*	5.87*
	(2)		1.25	1.81	4.41*
	(3)			.56	3.16*
	(4)				2.60*

*Exceeding critical value of $q_{.95}$ (k,108), where k = number of steps apart for any pair of means.

In the fifty yard dash tests, no significant difference was found. The mean scores were as follows:

1. On grass, starting from a stand, 8.41 seconds.
2. On grass, starting from a crouch, 8.54 seconds.
3. On blacktop, starting from a stand, 8.46 seconds.
4. On blacktop, starting from a crouch, 8.43 seconds.

The figures presented in Table VII produced an F ratio of 1.44, which is below the critical value of F at the five per cent level of confidence. This indicated that no significant difference existed.

TABLE VII

ANALYSIS OF VARIANCE, FIFTY YARD DASH

Source	SS	df	MS	F
Between People	36.03	27		
Within People	7.47	84		
Treatment	.38	3	.126	1.44
Interaction	7.09	81	.087	
Total	7.47	84		

Results obtained from executing the shuttle run under various conditions indicated no significant differences between means. Mean scores were as follows:

1. In gym, starting from a stand, 11.47 seconds.

2. In gym, starting from a crouch, 11.55 seconds.

3. On grass, starting from a stand, 11.70 seconds.

4. On grass, starting from a crouch, 11.67 seconds.

TABLE VIII

ANALYSIS OF VARIANCE, SHUTTLE RUN

Source	SS	df	MS	F
Between People	65.23			
Within People	2.21			
Treatment	.92	3	.31	.19
Interaction	1.29	81	1.59	
Total	2.21	84		

CHAPTER IV

SUMMARY AND CONCLUSIONS

A. SUMMARY

The investigation pointed up the fact that variations in testing procedure definitely affect scores on some fitness tests, but have no effect upon others.

The most significant differences appeared in the sit-ups tests. The reader will recall that under the three conditions where subjects were allowed to bring elbows forward as they sat up, the mean scores were 21.25, 22.46, and 22.57. When instructed to keep elbows back, mean scores were 8.07 and 8.32. According to these results, a girl should be able to execute two and one-half times as many rounded back sit-ups as straight back sit-ups.

If the reader inspects the raw scores on the modified pull-ups in Table IX of the Appendix, he will observe that, in all but four cases, the subject's scores on the horizontal bar were better than on the parallel bar. In most instances, they were considerably higher. Both bars were horizontally suspended. Both were placed at similar distances above the floor, and position of subjects in relation to each bar was the same. This leads one to conclude that the size of the circumference of a bar correlates with the degree of

difficulty of the test, and that it is more difficult to execute modified pull-ups on a bar with a larger circumference.

The results of the broad jump test show that measuring from the ball of the foot gave a mean score which is significantly higher than when the jump is measured from the heel. Also, the mean score achieved when jumping on dirt was significantly lower than when the jump was executed on either the blacktop surface or the grass.

In regard to the shuttle run and fifty yard dash, the statistical evidence of this study points to the fact that neither the surface upon which the test is conducted, nor the position the subject assumes at the start, has any appreciable effect upon the score.

Although no attempt was made to test the six hundred yard run-walk under various conditions, several observations warrant consideration. First, the AAHPER suggests that the test can be conducted on an oval track, a football field, or a diamond shaped area. The investigator observed students at School D being tested on a football field, and noticed that they did not run to the end of the field and then make a sharp turn to run down the goal line. Instead, they made a curved turn, thereby eliminating a portion of the distance. Although the eliminated distance was not measured, it was gauged to be at least eight feet at each corner of the field.

This would probably occur if students were tested on a diamond shaped field.

Also, the AAHPER recommends that one dozen students be tested simultaneously. If this could be done on a straight stretch of field, on which the runner proceeded to a designated line, turned around, and ran back to the starting point, it would be possible to insure the fact that each would run exactly six hundred yards. However, if this test is conducted on any of the three suggested areas, it is possible for only one student to run on the inside measurement. Thus, the other eleven would not be running exactly six hundred yards.

These findings lead one to question whether the testing movement was pushed into action too swiftly, before truly standardized procedures for testing had been developed. If this is the case, it appears that haphazard testing has resulted.

The fact that the fitness testing programs have been a boon to the field of physical education cannot be denied. The focus of attention of those in the profession has been turned toward the primary objective of physical education, the improvement of body. This came in a time when American physical education was so cluttered with group games and social recreation activities that this objective was all but submerged. Certainly Operation Fitness has been successful

in this regard.

Since the entry of physical education into the public school curriculum one hundred years ago, the controversy has continued as to whether it should be accepted on a level with academic subjects. The ranking of individuals against perhaps invalid norms, and erroneous reporting of progress on the basis of such ranking is bound to invoke the criticism of those in other fields of education. Therefore, the immediate and all-important responsibility of every person in the profession should be to make certain that physical education is founded upon sound scientific principles, in its measurement phase as well as in its instructional aspect.

B. CONCLUSIONS AND RECOMMENDATIONS

The fact that there are differences among schools in the testing procedure that they follow can be attributed to three factors:

1. The two sets of test instructions are not identical.
2. The instructions, in some cases, are nebulous.
3. It is virtually impossible to run large numbers of students through the seven tests in a short period of time without using short cuts at the expense of accuracy.

The only way to insure valid comparisons of individuals

and of testing programs, on either a local or a national level is to make certain that all students are taking precisely the same tests. Therefore, the AAHPER should revise its test instructions and should see to it that all booklets containing tests entitled AAHPER Youth Fitness Test include identical instructions. The following specific suggestions for revision are offered:

1. State that a bar one and one-half inches in diameter is <u>required</u> for modified pull-ups. In schools which do not have a horizontal bar, a bar placed in a doorway could be used. For those who are adverse to using the bar which adheres by means of suction cups, it is suggested that two pieces of pipe be obtained. In order to secure the pipe in the doorway, the tester could fasten plywood braces to the door jamb with screws, as shown in Figure I. Using two doorways can enable the tester to place the bar at various heights. In the first doorway, braces could be placed at three and one-half feet, at four feet, and at four and one-half feet. In the second doorway, they could be placed at three feet, nine inches, four feet, three inches, etc. The bar simply rests on these braces.

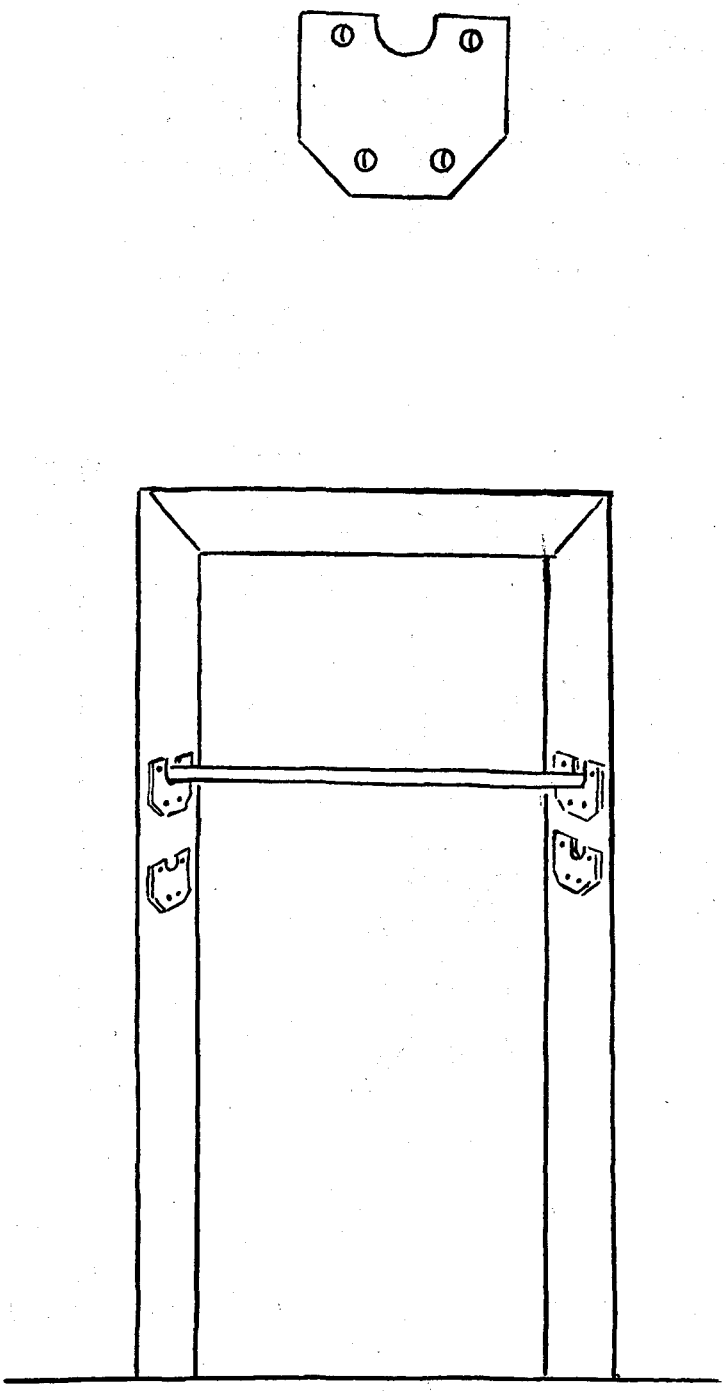

FIGURE 1

THE DOORWAY BRACES

In order to be positive that the body is aligned on an exact forty-five degree angle, a line can be painted along the wall adjacent to the horizontal bar, as shown in Figure 2.[18]

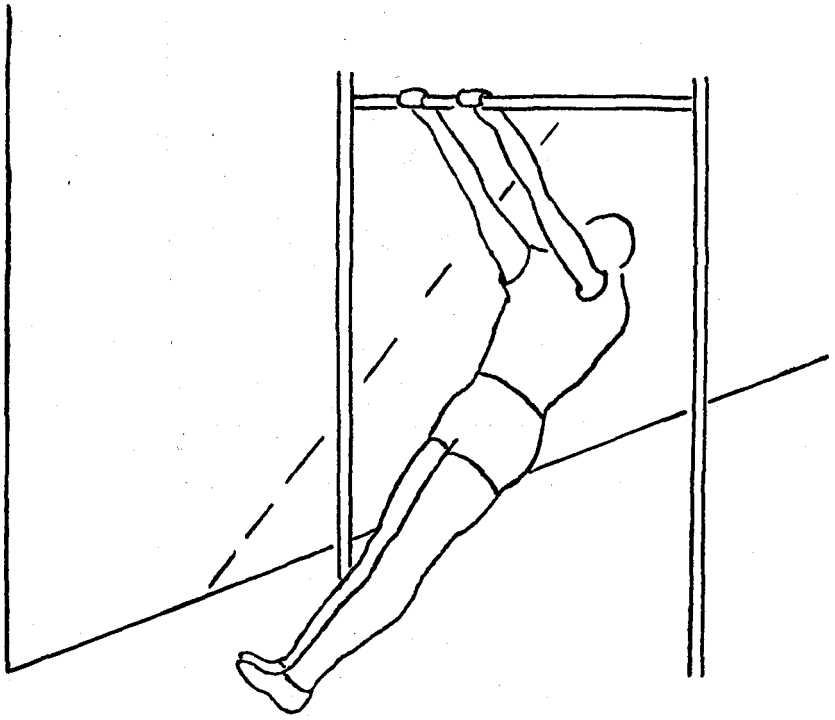

FIGURE 2

ALIGNING THE BODY WITH THE LINE PAINTED ON THE WALL

[18]State Board of Education, Virginia Physical Fitness Test for Junior and Senior High Schools (Richmond, Virginia: State Board of Education, 1962), p. 8.

In situations where the doorway bar is necessary, it is possible to construct a wooden device on which is painted a diagonal line. This can be placed in the doorway, and the pupil can then align her body with it.

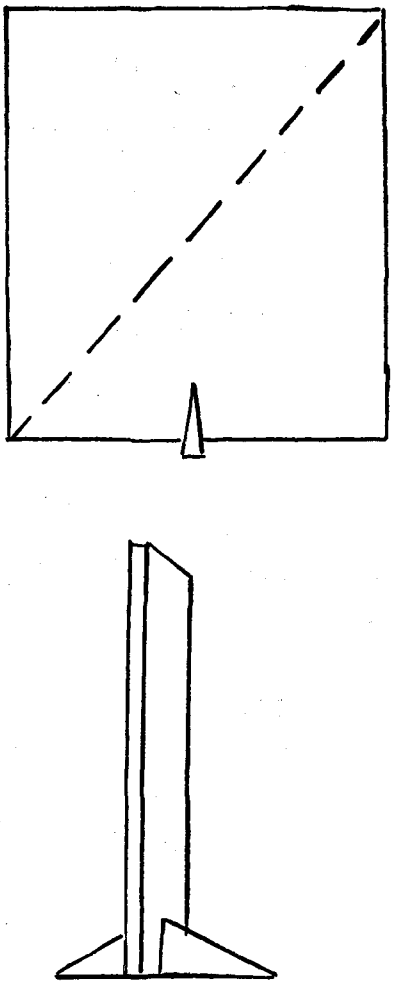

FIGURE 3

THE DOORWAY STRUCTURE, FRONT AND SIDE VIEW

2. The AAHPER could determine whether the curl sit-up, in which the elbows are brought forward, or the straight back sit-up, in which the elbows are kept straight, should be used. If the straight back type is selected, insertion of a foam rubber padded rod behind the neck and between the elbows will make it impossible for the student to bring the arms forward.[19] If the curl type is chosen, there need be no revision of the instructions in the AAHPER Test Manual. Those in the President's Council Booklet should be revised so as to read precisely as the AAHPER instructions.

3. The instructions in both manuals should be revised to indicate that only a one hundred yard straight-away can be used for the six hundred yard run-walk.

If these suggestions are followed, it will then be necessary to revise the norms.

In reference to the broad jump, the practice of measuring from the balls of the feet is deplorable. Universally, the broad jump has always been measured from the heel, and it is not the prerogative of any testor to alter

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[19] Ibid., p. 10.

standard procedure. It is conceivable that such measuring could increase the recorded length of the jump by as much as six inches. Probably, the reason why the length of the jump showed an increase of only two to three inches in this study is that the subjects were not accustomed to landing on the balls of their feet, and the majority of them had difficulty with balance. The students at School A had had several weeks of practice prior to their tests, and had probably learned to retain their balance well.

The findings of this investigation indicate that further studies are needed. Specifically, the fifty yard dash and the shuttle run should be explored in a different manner. The subjects of this study had not been trained in the rudiments of making a quick start from a crouch, and many of them stated that they found it difficult to start from such a position. Perhaps if the students were schooled in starting from a crouch, a more valid comparison of the influence of the two starts upon scores could be made.

An investigation of the six hundred yard run-walk might reveal that it takes longer to perform the test on a straight stretch of ground than on an oval area. Having to turn completely around at the end of a straight-away may involve more time. If the course were one hundred yards long, the runner would be obliged to make five such turns.

In the five years that the AAHPER Test has been in use

it has probably been the most significant factor in creating nationwide enthusiasm for physical fitness. It is the investigator's hope that this study will point up the need for reliability in utilizing the test, so that it may become increasingly more valuable as an instrument of measurement in education.

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APPENDICES

APPENDIX A

QUESTIONNAIRE

Pull-ups

1. What type of bar did you use?
2. To what height was it adjusted?
3. Did the student grasp the bar with the palms of the hands turned away from her face or toward her face?
4. Did you make certain that her body was aligned at a forty-five degree angle and that her arms formed a ninety degree angle with the bar? How?
5. Were her feet braced?
6. Did she pull up until her chest touched the bar?
7. Did she keep her body straight?
8. How many tries did she have?
9. Who recorded the score and under what circumstances?

Sit-ups

1. Was she told to keep her elbows straight back?
2. Did she touch elbow to opposite knee?
3. Did someone hold her ankles?
4. Did she lie on a mat or on the floor?
5. How many tries did she have?
6. Who recorded scores and under what circumstances?

Broad Jump

1. On what surface did she jump?

2. Was she measured from the heel or the ball of the feet?
3. How many tries did she have?
4. Who recorded scores and under what circumstances?

Shuttle Run

1. Was the exact distance marked, or was it estimated?
2. Were the blocks placed directly in front of the girl as she stood or crouched, ready to run?
3. What type of surface did she run on?
4. Did she start from a crouch or a stand?
5. How many tries did she get?
6. Who recorded scores and under what circumstances?

Six Hundred Yard Run-Walk

1. Was the exact distance measured off, or was it estimated?
2. Did she run on a track, a field, a straight-away, or what?
3. Of what surface was this facility?
4. Did she start from a crouch or a stand?
5. Did several students run simultaneously?
6. How many tries did she have?
7. Who recorded scores and under what circumstances?

Fifty Yard Dash

1. Was exact distance measured off, or was it estimated?
2. On what surface did she run?
3. Did she start from a crouch or a stand?

4. How many tries did she have?

5. Who recorded scores and under what circumstances?

Softball Throw for Distance

1. Did she have sufficient time to warm up her arm?

2. Did she take a running start? If so, how long?

3. How many tries did she have?

4. Who recorded scores and under what circumstances?

APPENDIX B

PRESIDENT'S COUNCIL ON YOUTH FITNESS TEST

MODIFIED PULLUPS (GIRLS)

Equipment: Any bar adjustable in height and comfortable to grip. A piece of pipe, placed between two stepladders and held securely, may be used.

Starting Position: Adjust height of bar to chest level. Grasp bar with palms facing out. Extend the legs under the bar, keeping the body and knees straight. The heels are on the floor. Fully extend the arms so they form an angle of 90 degrees with the body line. The partner braces the pupil's heels to prevent slipping.

Action:

1. Pull body up with the arms until the chest touches the bar.
2. Lower body until elbows are fully extended.
3. Repeat the exercise attempting to achieve the "Excellent" score for her age, but not exceeding that number.

Rules:

1. The body must be kept straight.
2. The chest must touch the bar and the arms must then be fully extended.
3. No resting is permitted.
4. One pullup is counted each time the chest touches the bar.

[Refer to Figure 4, page 57.]

SITUPS

Starting Position: Pupil lies on his back with legs extended, feet about 1 foot apart. The hands, with fingers interlaced, are grasped behind the neck. The other pupil holds his partner's ankles and keeps his heels in contact with the floor while counting each successful situp.

Action:

1. Sit up and turn the trunk to the left. Touch the right elbow to the left knee.
2. Return to starting position.
3. Sit up and turn the trunk to the right, touching the left elbow to the right knee.
4. Return to the starting position.
5. Pupil should do as many situps as he can, but not exceed the number shown below in the "Excellent" category for his age and sex.
6. One complete situp is counted each time the pupil returns to starting position.

[Refer to Figure 5.]

SHUTTLE RUN

Equipment: Two blocks of wood, 2- by 2- by 4- inches (blackboard erasers may be used) and stopwatch. Mark two parallel lines 30 feet apart. Place the blocks of wood behind one of the lines.

Starting Position: Pupil stands behind the line opposite the blocks ready to run.

Action: On the signal, "Ready!--Go!" the pupil runs to the blocks, picks up one, returns and places it behind the starting line. (He does not throw or drop it.) He then runs and picks up the second block and carries it back across the starting line.

Rules:

1. Allow two trials
2. Disqualify any trial in which the block is dropped or thrown.
3. Record the better of the two trials in seconds to the nearest 10th.

STANDING BROAD JUMP

Equipment: Any level surface and tape measure.

Starting Position: Pupil stands with the feet comfortably apart, with toes just behind the takeoff line.

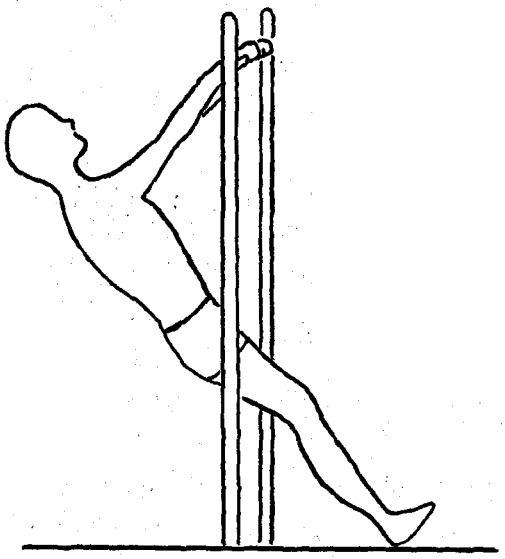

FIGURE 4

MODIFIED PULLUPS (GIRLS)

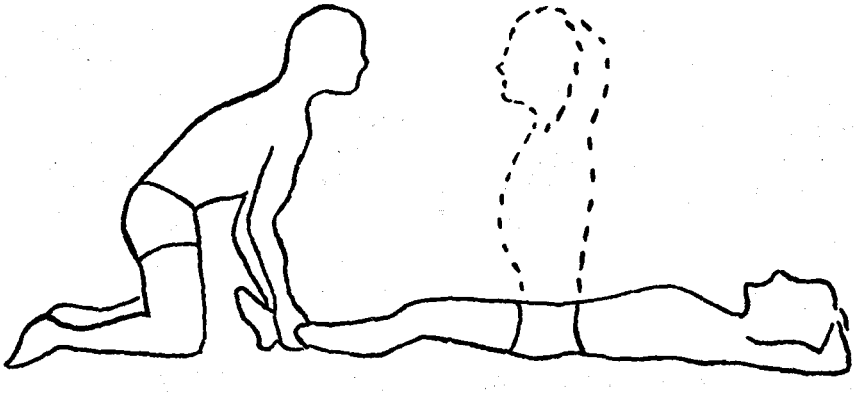

FIGURE 5

SITUPS

Preparatory to jumping, pupil should have knees flexed and should swing the arms backward and forward in a rhythmical motion.

Action: Jump, swinging arms forcefully forward and upward, taking off from the balls of the feet.

Rules:

1. Allow three trials.
2. Measure from the takeoff line to the heel or any part of body that touches the surface nearest the takeoff line.
3. Record best of three trials in feet and inches to the nearest inch.

FIFTY-YARD DASH

Equipment: Stopwatch.

Starting Position: Pupil stands behind the starting line. The starter takes a position at the finish line with a stopwatch. He raises one hand preparatory to giving the starting signal.

Action: When the starter brings his hand down quickly and hits his thigh, the pupil leaves his mark. As the pupil crosses the finish line, the time is noted and recorded.

Rules:

1. The score is the lapsed time between the starter's signal and the instant the pupil crosses the finish line.
2. Record the time in seconds to the nearest 10th.

SOFTBALL THROW FOR DISTANCE

Equipment: Softball (12-inch), tape measure, small metal or wooden stakes. Within the contestants' limitations, mark lines at 5-yard intervals parallel to a restraining line. A football field marked in conventional fashion makes an ideal area for the test.

Starting Position: Pupil stands several feet behind

the restraining line, ready to throw.

Action: Moving forward, the pupil throws the ball, overhand, from behind the restraining line, as far as he can.

Rules:

1. Only an overhand throw may be used.
2. Mark point where ball lands with one of the stakes.
3. Three throws are allowed.
4. Disqualify throw if pupil steps over restraining line.
5. Measure and record the best of the three throws to the nearest foot.

600-YARD RUN--WALK

Equipment: Stopwatch, and running area with designated starting and finish lines.

Starting Position: Pupil stands behind starting line.

Action: On the signal, "Ready!--Go!" the pupil starts running the 600-yard distance (walking only if necessary).

Rules:

1. Walking is permitted, but the subject is to cover the distance in the shortest possible time.
2. Record the time in minutes and seconds.[20]

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[20]President's Council on Youth Fitness, Youth Fitness: Elements of a School-Centered Program (Washington: Government Printing Office, 1961), pp. 46-54.

APPENDIX C

AAHPER YOUTH FITNESS TEST

MODIFIED PULL-UPS

Equipment. A metal or wooden bar approximately 1½ inches in diameter is preferred. A doorway gym bar can be used and, if no regular equipment is available, a piece of pipe can also serve the purpose. In some instances, it is possible to use the aisle between bleacher seats and have the bleachers support the pipe at the desired height . . .

Description. Adjust the height of the bar so it is approximately at nipple level. Use an overhand grasp. The pupil extends her legs under the bar and extends the arms fully. The arms should form an angle of 90 degrees with the body line, and the body line should form an angle of 45 degrees with the floor . . . The heels should be braced to prevent slipping; they can be resting on a mat or against an improvised rest, like the scorer's foot, to prevent slipping. From this position the pupil raises her body by her arms until the chest touches the bar, then lowers her body to a full hang. The exercise should be repeated.

Rules.
1. No resting is permitted.
2. No pull-up shall be counted in which the pupil fails to keep the body straight, come to a full extension of the arms, or touch the chest to the bar.
3. The maximum number is 40.

SIT-UPS

Equipment. Mat on floor.

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

contact with the mat or floor at all times . . .

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

Rules. 1. The fingers must remain in contact behind the neck throughout the exercise.
2. The knees must be on the floor during the sit-up but may be slightly bent when touching elbow to knee.
3. The back should be rounded and the head and elbows brought forward when sitting up as a "curl" up.
4. When returning to starting position, elbows must be flat on the mat before sitting up again.

SHUTTLE RUN

Equipment. Two blocks of wood, 2 in. x 2 in. x 4 in., and stopwatch. Pupils should wear sneakers or run barefooted.

Description. Two parallel lines are marked on the floor 30 feet apart. The width of a regulation volleyball court serves as a suitable area. Place the blocks of wood behind one of the lines as indicated in Figure 7. The pupil starts from behind the other line. On the signal "Ready! Go!" the pupil runs to the blocks, picks one up, runs back to the starting line and places the block behind the line; he then runs back and picks up the second block which he carries back across the starting line. If the scorer has two stopwatches or one with a split-second timer, it is preferable to have two people running at the same time. To eliminate the necessity of returning the blocks after each race, start the races alternately, first from behind one line and then from behind the other.

Rules. Allow two trials with some rest between.

STANDING BROAD JUMP

Equipment. Mat, floor, or outdoor jumping pit, and

tape measure.

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

Rules. 1. Allow three trials.
2. Measure from the take-off line to the heel or other part of the body that touches the floor nearest the take-off line.

FIFTY YARD DASH

Equipment. Two stopwatches or one with a split-second timer.

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

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

SOFTBALL THROW FOR DISTANCE

Equipment. Softball (12-inch), small metal or wooden stakes, and tape measure.

Description. A football field marked in conventional fashion (five yard intervals), makes an ideal area for this test. If this is not available, it is suggested that lines be drawn parallel to the restraining line, five yards apart. The pupil throws the ball while remaining within two parallel lines, six feet apart. Mark the point of landing with one of the small stakes. If his second or third throw is farther, move the stake accordingly so that, after three throws, the stake is at the point of the pupil's best throw. It was found expedient to have the pupil jog out to his stake and

stand there; and then, after five pupils have completed their throws, the measurements are taken.

Rules. 1. Only an overhand throw may be used.
2. Three throws are allowed.
3. The distance recorded is the distance from the point of landing to the nearest point on the restraining line.

SIX HUNDRED YARD RUN-WALK

Equipment. Track or area marked according to Figures 10-12, and stopwatch.

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

Rules. Walking is permitted, but the object is to cover the distance in the shortest possible time.[21]

[21]American Association for Health, Physical Education, and Recreation, AAHPER Youth Fitness Test Manual (Washington: [n.n.], 1961), pp. 6-12.

APPENDIX D

TABLES OF RAW SCORES

TABLE IX

RAW SCORES OF TWENTY-EIGHT SUBJECTS EXECUTING MODIFIED PULL-UPS UNDER VARIOUS CONDITIONS

SUBJECT	HORIZONTAL BAR, OVERGRASP	HORIZONTAL BAR, UNDERGRASP	PARALLEL BAR, ARMPIT LEVEL	PARALLEL BAR, ONE NOTCH SHOWING
1	33	23	11	5
2	25	25	7	10
3	25	22	10	6
4	50	40	20	17
5	50	32	20	17
6	21	20	10	7
7	32	17	12	7
8	33	18	11	12
9	25	41	15	9
10	30	15	10	11
11	25	15	14	15
12	46	30	20	10
13	24	15	20	8
14	16	20	9	10
15	30	25	6	20
16	21	40	20	16
17	25	65	13	15
18	25	20	15	20
19	31	101	15	8
20	15	15	7	10
21	12	20	14	10
22	10	10	10	20
23	30	40	22	15
24	20	21	15	9
25	11	17	12	0
26	40	15	12	15
27	31	30	10	15
28	20	30	8	9

TABLE X

RAW SCORES OF TWENTY-EIGHT SUBJECTS EXECUTING SIT-UPS UNDER VARIOUS CONDITIONS

SUBJECT	FLOOR; NOT TOUCHING ELBOW TO KNEE; ELBOWS NOT KEPT BACK	MAT; ELBOWS NOT KEPT BACK; TOUCH ELBOW TO KNEE	FLOOR; ELBOWS KEPT BACK; TOUCH ELBOW TO KNEE	MAT; ELBOWS STRAIGHT TOUCH ELBOW TO KNEE	FLOOR; ELBOWS NOT KEPT BACK; TOUCH ELBOW TO KNEE
1	12	26	1	2	25
2	12	19	6	1	16
3	25	25	9	9	21
4	50	60	10	7	50
5	30	51	6	9	50
6	21	14	10	9	14
7	20	25	2	5	20
8	25	25	13	9	15
9	10	10	1	0	11
10	20	20	14	15	20
11	10	10	1	0	10
12	29	20	8	11	10
13	12	14	4	7	11
14	35	30	19	23	40
15	31	15	1	10	25
16	16	20	8	11	20
17	20	25	18	15	32
18	20	20	5	7	15
19	33	40	5	22	30
20	15	15	10	5	20
21	11	12	8	8	20
22	10	20	11	6	20
23	12	10	7	5	15
24	50	33	16	20	60
25	26	30	22	5	31
26	10	10	6	1	6
27	15	15	4	9	15
28	15	15	1	2	10

TABLE XI

RAW SCORES OF TWENTY-EIGHT SUBJECTS EXECUTING THE SHUTTLE RUN UNDER VARIOUS CONDITIONS

(Scores Recorded in Seconds)

Subject	Gym; From a Stand	Gym; From a Crouch	Grass; From a Stand	Grass; From a Crouch
1	11.7	11.9	12.4	11.7
2	11	9.7	10.3	10.2
3	11	10.7	10.0	10.3
4	10.9	10.8	11	11
5	10.8	10.5	11.4	11.4
6	10.4	11.4	11.6	10.8
7	12.1	12.4	11.9	11.8
8	12.4	11.7	11.6	11.5
9	12	11.4	11.6	11.7
10	10.5	10.6	11.5	11.7
11	11	11.1	12.2	12.2
12	11.3	11.2	13.7	11.5
13	11	11.5	10.9	11.1
14	11.6	11.5	11	11.8
15	11.9	11.1	11.4	11
16	12.4	12.4	13.3	12.9
17	13	13	13.1	13
18	12.3	12.5	13	12.8
19	11.2	11	11.1	10.0
20	10.3	10.8	10.4	11.1
21	12.6	12.6	12.6	13.1
22	11.4	11.4	11	11.5
23	11	13.1	11.1	11.4
24	11.4	11.7	11.5	11.9
25	12	12.3	12.6	12.1
26	11.4	12.2	12	12.2
27	11.2	11.4	11.3	11.5
28	11.4	11.5	11.2	12.8

TABLE XII

RAW SCORES OF TWENTY-EIGHT SUBJECTS EXECUTING THE FIFTY-YARD DASH UNDER VARIOUS CONDITIONS

(Scores Recorded in Seconds)

Subject	On Grass; From a Stand	On Grass; From a Crouch	On Blacktop; From a Stand	On Blacktop From a Crouch
1	7.8	8	8.3	7.8
2	6.9	6.9	7.6	7.5
3	7.9	7.6	8.5	7.7
4	8.5	8.7	8.5	8.6
5	8.2	8.5	8.3	8.4
6	7.7	8.3	8.6	8.1
7	8.3	8.6	8	9.1
8	8.6	9.9	8.6	8.4
9	9.1	8.6	8.5	8.8
10	8.4	8.6	9	8.6
11	9.1	9.7	8	9.1
12	8.1	8.3	8.5	8.1
13	8.4	8.7	8.5	8.6
14	8.6	8.8	8.7	8.7
15	8.3	7.7	8.1	8.6
16	8.8	9.0	8.7	8.6
17	9.2	9	9.1	9.2
18	8.3	8.5	8.1	8
19	7.0	7.2	7.1	7.4
20	9.5	9.9	9.7	9.8
21	9.4	9.8	9.8	9.9
22	8.8	8.6	8.8	8.7
23	8.5	8.6	8.3	8.6
24	8.4	8.1	8.0	8.5
25	9.0	9.2	9.1	8.9
26	8.3	8.5	8	8.2
27	8.4	8.6	8.7	8.1
28	8.1	8.2	7.9	8.0

TABLE XIII

RAW SCORES OF TWENTY-EIGHT SUBJECTS EXECUTING THE STANDING BROAD JUMP UNDER VARIOUS CONDITIONS

Subject	On Floor	On Floor; Measuring From Balls of Feet	On Grass	On Blacktop	On Dirt
1	62	62.5	65	64.5	64.5
2	78	77.5	81.5	78.75	77.5
3	65.5	66.75	75.5	68	62
4	63.75	71.5	63.5	66	62
5	72	74	69	72.5	72
6	70.5	68.5	71	72	71.5
7	60.5	70	71.5	68.75	62.75
8	79.5	82.5	68.5	80	79
9	60.5	66	60.5	61	61
10	64	68	67.5	65.5	61
11	65	69	66	69	64
12	60	64.5	53.5	60	62
13	53	55.5	52.5	54	48
14	52.5	59	51.75	54	50
15	59	72	58.5	60.75	61
16	64	64.5	60	60	64
17	61	62	52	57.75	50
18	77	80.5	75.75	78.75	77
19	58	67	65	65	51
20	53.75	63	59	61	46.5
21	54	61	58	60	56
22	72	78.5	73	71	73.5
23	63.5	66	65	64	58.5
24	59	57	61	59	55.5
25	56	59.5	62	58	55
26	65	72	67	67	69
27	52	64.75	57	53	51.5
28	66.75	68	72	69	61

VITA

Nancy Shields Alexander was born March 18, 1931, in Richmond, Virginia, and is the daughter of Gladys Robinson Alexander and the late Samuel Midyette Alexander. She was graduated from Thomas Jefferson High School, and in 1952 received the Bachelor of Arts Degree from the College of William and Mary.

From 1952 to 1954, she was employed as physical education teacher at Newport News High School, and from 1954 until 1957, taught at Douglas Freeman High School, Henrico County. Since 1957, she has been employed at Richmond Professional Institute, and at the present time is Assistant Professor of Physical Education.

She is a member of the Virginia Association for Health, Physical Education, and Recreation, and for the past two years has served as Secretary of the R. P. I. Chapter of the Virginia Education Association. In 1962 she was elected to Kappa Delta Pi.