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SUBSIDIARY AREA
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MEASUREMENT AND EVALUATION

The coach or physical education teacher must be skilled in the evaluation process. Every coach or a physical education teacher will always have to keep in mind the aim and objectives to be achieved in the progress and to determine the extent of attainment of aim and objectives; they will have to be thorough with the process of evaluation. For evaluation they will have to use various tests and measurements.

Definition of Test

A Test is a form of questioning and/or measuring used to assess retention of knowledge and ability, or to measure ability in some physical Endeavour e.g. standing broad jump to measure leg strength, a questionnaire to measure knowledge of students in Health Education.

Definition of Measurement

It is an old to the evaluation process and in this various tools and techniques are used in the collection of data e.g. in the above example of standing broad jump, the horizontal distance jumped by the subject in meters the measurement.

Definition of Evaluation

It is the process to determine the extent to which the objective is accomplished.

Need for Measurement and Evaluation

1. Motivation: of students and sustaining of interest in the instructional/training process.
2. Helps the coach/teacher to assess student's performance.
3. Helps students to evaluate their own knowledge and skill.
4. Helps coacher/teachers to objectively measure improvement by testing before and after teaching/coaching.
5. Assists in finding out strong and weak points of students and also the programmers.
6. Aids in determining effectiveness of teaching/coaching programmers.
7. Helps in identifying potential of younger population.
8. Helps in classification of students in ability groups.
9. Assists in judging the relative value.
10. Helps in collection of data for research.
11. Assists in judging the relative value of different activities in achieving objective.
12. Assists in determining needs of students.

PRINCIPAL OF EVALUATION

For effective evaluation, the following principles should be kept in mind:

1. Determining the product:
If evaluation is to be effective, it must be related to the values that society has selected as desirable. The first responsibility of the coach is to determine the product. This desired product has already been defined in a general sense as students who have the qualities and characteristics to become a good sportsperson.

2. Formulating Objectives:
The place of evaluation cannot be fixed in the coaching process until significant goals and purpose have been defined and direction has been established. Objectives are formulated as guides to the attainment of the envisioned product. The objectives enable the coach to know. What to teach and enable the sportspersons to know what to learn and alcove. Without objectives valuation is meaningless because it is like and unguided missile-out of control and without target.

3. Establishing the process:
Just as the place of evaluation cannot be fixed in coaching until values are selected and objectives are formulated, neither can it be defined completely until the coaching process itself is established. Process of development occurs in the light of 2 things the needs of the product that have been determined and the points of reference (goals) that have been established. Measurement technique is closely related to the procedures of the process. A good process is necessary if effective evaluation is to be expected.

4. Gathering data from both the product and the process:
Measurement is a technique employed to gather data to be used to evaluate both the product and the process. This principal implies that both subjective and objective techniques are used to collect both quantitative and qualitative data. It suggests that all traits, qualities, or characteristics possessed by the product and the process exist in some amounts or to some degree and can be measured.

5. Broad Scope of evaluation:
There is more to evolution than measurement. Measurement merely collects data and identifies statues, whereas evaluation assimilates those data and uses them to make comparisons with previously established criteria. Evaluation is important because after comparisons are made, there is a follow-up if the restudy and reappraisal show a need for revision reform, or redirection. Objective may be ravished, programmers replanted, personas and families improved, and methodology. All of these changes are brought about chilly to create a better teaching and learning situation.

6. Necessity for advancement in scientific education:
Evaluation and measurement are necessary for advancement in scientific education. Any part of education without some form of viable evaluation procedures is like a ship at sea without a chart of compass.

7. Subjective measurement:
All measurement is not objective. Much of measurement is not as simple as simple as the tests that give results that can be recorded in distance, time and numbers. Many characteristic cannot be expressed in quantitative terms. This sometimes leads to subjective results that are less reliable than objectively determined results.

8. An Aid to Teaching, not a Replacement:
Testing should not take the place of teaching but should be used as a technique to help make teaching more effective. The basic function of the coach is training and this function, like all phases of the process, should serve the needs of the sportspersons. Majority if the coach's time should be devoted to this function. After testing of course time must always be left in the process for the follow-up, or testing loses much of its educational significance. Measurement and evaluation are valuable teaching techniques when they are related to instruction in this manner and when they provide feedback, reinforcement and motivation for the students to learn more readily.

9. use for a specific purpose:
Testing is for the sake of testing wastes energy and time for both the coach and the sportsperson. Measurement is definitely a means to an end not an end in itself. There for, it must be used for a specific purpose. If coaching is to be most effective, coaches must have access to practical, scientific techniques of measurement that have been carefully selected for specific purpose.

10. Administration by Qualified personnel:
Measurement is most effective when qualified personnel who have training in its principles and techniques conduct it. Some other persons namely sportspersons, sports scientists, administrators, parents etc. may help in some phase of the evaluation process. In the final analysis, however, it is the specialist who must carry the load in planning and conducting an effective evaluation programmer.

Criteria of test selection

Selection of appropriate tests is necessary if wise application of results is to the realized. The little time allotted for measurement activities should be spent wisely. The choices of tests should be made in light of the objectives sought. The teacher is just as concerned about the accuracy and honesty of the results, but needs to find a test that is easy to use and appropriate to the group situation.

While selecting a test for use, the following criteria should be kept in mind.
1. Scientific Authenticity
2. Administrative Feasibility
3. Educational Application

1. Scientific Authenticity The following technical standards much be kept in mind.

(a) Reliability: - A test is a said to be reliable if it is dependable: if similar result occur when the test us repeated by same group under like conditions. The tester is the same, the students are the same, and the test is the same. Assume that the test is administered and then read ministered. If the students' scores fall in the same positions, the test is reliable. The student who performed best the first time is still best, the poorest performer is still poorest, and all in between are approximately in the same order,
The following factors affect reliability:
(i) Equipment
(ii) Instruments
(iii) Number of trials
(iv) Test instructions

(b) Objectivity:
It is the degree of uniformity with which various persons the same test it refers to the lack of any personal influence of the scorer on the test results, if a test is scored by two instructors, concurrently and independently, the results should be similar, objectivity is increased by clean test direction, Precise scoring methods and adherence to these factors.

(c) Validity:
It is the most important of the technical standards because it tests the honesty a test. The teacher wants to have confidence that a test selected to use as a measure of the tennis serve e.g. is indeed just that and not a test of shoulder girdle strength or general motor ability. A test is valid if is measuring, as accurately as passable what it is described as measuring.

(d) Norms
A norm is a scale that permits conversion from a raw score to a score capable of comparisons and interpretations. A raw score of 16 is quite meaningless, but if that 16 falls at the 78^{th} percentile it become capable of comparisons and interpretations.

2. Administrative Feasibility:
The following administrative consideration should be kept in mind:
(i) Equipment: it should be available and inexpensive.
(ii) Time: it should be less time consuming
(iii) Money: It should be economical
(iv) Utility: The test results should be usable.

3. Education Application:
The test should censure physical, mental and social development of the students. It must contribute to development of educational. Values and develop qualities of good citizenship.

TYPES OF TESTS

1. Standardized Tests.
Those tests that have been scientifically constructed and that may be accompanied by norms are called standardized tests. The validity and reliability of standardized tests have been established. Standardized tests are carefully developed and usually can be made available. Very few knowledge tests in sports and physical education are available commercially. But this is one area in which, undoubtedly, measurement progress will be made. Standardized tests have several characteristics:

(i) They provide valid and reliable measures.
(ii) They show the content areas and cognitive levels reflected in the test as well as the degree of difficulty applied to various groups.
(iii) They provide good tests when teachers do not have the time or skill to can. Teachers do not have the time or skill to construct them.
(iv) They provide tests for a great variety of activities
(v) They serve as examples for format and content balance.
(vi) They are available in printed from so that they can be utilized by those interested in assessing the knowledge of the students.
2. Teacher – make tests more prevalent are teacher-made tests. They are the work of teachers/coachers for their local purpose. They also have certain characteristics.
(i) They fir the unit which they are planned in content and difficulty.
(ii) They may or may not be scientifically constructed, depending on which the teacher has ascertained their reliability and validity.
(iii) They may or not be accompanied by local norms, depending on whether the teacher/coach has collected the scores years after year and prepared norms.

(iv) They usually are prepared quickly and consequently, probably are not as well constructed as standardized tests.
(v) They generally are not available to others. They are used only locally.

Subjective tests (Essay Tests)

These tests require a written answer that in involves the organization of information to be presented in logical paragraph from. Subjective questions are usually general and tests and the ability of the student to write the material to be covered. The characteristics of subjective are.

(i) They usually involve only 5 or 8 question and thus a limited sample of the subject content.
(ii) They may be constructed quickly
(iii) They are difficult to grade objectively and reliably
(iv) They usually require more time to answer than objective tests.
(v) They may test general explanations, interpretations, and problem-solving concepts that may be difficult to measure in isolated questions of objective tests.
(vi) They are usually good for creative testing
(vii) They are more efficient for small scale testing
(viii) They favor the verbally inclined student
(ix) They promote good study habits
(x) Traditionally they have been considered more scholarly that objective tests.
(xi) They enable the students to focus and elaborate on a particulars question thus promoting critical thinking and development.
(xii) The student's time is spent thinking and then writing the response.

Objective tests

These tests require a brief response to question encompassing smaller pieces of information. They certain characteristics:

(i) Good objective tests are difficult and time consuming to prepare
(ii) They may be quickly, efficiently, and objectively graded.
(iii) They can be validated and revised.
(iv) They are reliable.
(v) They may test for several types of information, such as rules , strategy. Techniques, terminology. And history of any activity.
(vi) They lend themselves to follow-up lessons to correct errors and misconceptions.
(vii) They too frequently measure only superficial and trivial facts.
(viii) They rank the students accurately according to their overall knowledge of the activity.
(ix) They encourage guessing.
(x) They usually cover an extensive amount of the subject content.
(xi) They criminate bluffing

(xii) They clearly define the task to be done.
(xiii) The answer must be selected by the student from those given on the test.
(xiv) The student's time is spent reading, thinking and then selecting the desired response.

Content balance

Sports and physical education knowledge tests are rare in the literature, so they must be developed locally. The coach is charged with the responsibility developing knowledge tests that are valid and reliable. Once such professional skills are squired, the teacher will build a collection of good knowledge tests. The following points should be kept in main while constructing objective knowledge tests.

1. Content balance:

The constructor of the test should itemize the areas of information to be covered and assign them certain proportional weightings in the overall content. These weightings should parallel the weightings each area received in the instructional work.

2. Sources of Items:

Good tests question can be gleaned from several sources. The teacher should be alert for such question and collect them as they appear. The ideas for the questions must come first and then be developed. The teachers own creativeness and intellectual endeavors provide many question. Text books, Rule books, and sports books, are good sources. The questions that the students ask during classes can also be good sources. Help of professional colleagues can also be taken.

3. Types of Items:

Questions for objective tests are of several types. They each have certain and some rules for construction.

(i) Alternate –Response The example of alternate response questions are true false, yes or no and right –wrong,

(ii) Multiple –Choice the multiple –choice style of question is held in English esteem by rest constructors. They consider it capable of measuring the application of facts and the higher cognitive levels that the teacher hopes to assess. They are difficult to construct and avoid guessing. Matching statements are applicable for definitions, personality identifications, and rules.

(iii) Final Format The test should be typed carefully, proofread and duplicated. Directions for answering the questions should be stared carefully and thoroughly o the test paper. A double space should be provided in between question. All parts of the question should be on the same page of the test. The test should be titled.

(iv) Length the number of question in a test should be sufficient of assures some degree of reliability, but not so many that few students are able to complete it. Fifty questions is a good "rule of thumb" especially if most of them are multiple- choice items.

(v) Answer sheets and keys. The use of answer sheets and keys is recommended for several reasons:
1. They permit the reuse of the test papers.
2. They facilitate scoring the papers.
3. They permit a mark showing the correct answer for later study of the test by the students.
4. They are economical in time and in money.
5. They are convenient to use when doing an item analysis of the test.

Construction of Essay "Knowledge (subjective) tests:

Subjective tests are criticized for their low reliability and more amount of time necessary for reading and grading. These disadvantages can be minimized if steps are taken to prepare the subjective test carefully.
Content:
The content balance of a subjective test should be similar to that for an objective test. It should parallel the emphasis given to various aspects of the content during instruction.

Types of Item
Three types of times are related to the objective test format, each varying in the length of the response the student needs to write.

1. Completion:
The completion question requires a response of either I word or perhaps 2 to 3 words at the most. Long response result is less objective and more time – consuming grading.

2. Short answer:
This format is used for answers to question requiring only 1 or 2 sentence. It is useful when a restatement of a rule or a brief explanation of some point is desired.

3. Long answer (essay)
The response to the essay item, traditionally titled, can vary in length from a paragraph to several pages.
References:

1. Clarke H. David and Clarke Harrison H. Application of measurement to physical Education (Englewood Cliffs: Prentice Hall. Inc)
2. Mathew, Donald K. measurement in physical Education (London: W.V Saunders co)

PHYSICAL FITNESS, MOTOR FITNESS AND GENERAL MOTOR ABILITY

Definition of physical fitness:
It is the ability to carry out daily tasks with vigor and alertness without undue fatigue, and with ample energy to engage in leisure pursuits and to meet emergency situation.

PHYSICAL FITNESS, MOTOR FITNESS AND GENERAL MOTOR ABILITY

Definition of Physical Fitness
It is the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to engage in leisure pursuits and to meet emergency situation.

Definition of Motors Fitness
It is defined as a readiness or preparedness of performance with special regard for big muscle activity without undue fatigue. It concerns the capacity to move the body efficiently with force over a reasonable length of time.

Definition of General Motor
It is defined as a readiness or preparedness of performance with special motor skills of a general or fundamental nature, exclusive of highly specialized sports.

COMPONENTS OF PHYSICAL FITNESS, MOTOR FITNESS AND GENERAL MOTOR ABILITY

			PHYSICAL FITNESS					
			GENERAL MOTOR ABILITY					
			GENERL MOTOR ABILITY					
Arm-eye Coordination	Muscular Power	Agility	Muscular Strength	Muscular Endurance	Circulo-respiratory Endurance	Flexibility	Speed	Foot-eye Coordination

Definition of Motor Components

Arm-eye Coordination
Ability to effectively perform skills involving arm-eye coordination

Muscular Power
It is the ability to release maximum muscular force in the shortest possible time.

Agility
Speed in changing body positions or in changing directions.

Muscular Endurance
Ability of muscles to carry motor tasks for a prolonged period

Circular-Respiratory Endurance
It is characterized by moderate contractions of large muscle groups for relatively long periods of time, during which maximal adjustments of dilatory respiratory system to the activity are necessary.

Speed
Rapidity with which a movement or successive government of the same kind may be performed.

Flexibility
It is the range of movement in a joint or sequence of joints.

Foot-eye Coordination
Ability to effectively perform skills involving foot-eye coordination

CIRCULATORY-RESPIRATORY ENDURANCE

Circularity-respiratory (C-R) endurance (also known as cardio-vascular endurance) is a basic component of physical fitness. This form of endurance is characterized by moderate contractions of large-muscle groups for relatively long periods of time, during which maximum adjustments of the circulatory-respiratory system are necessary, as in sustained running, swimming, climbing, bicycling and the like. This physical fitness component is very complex. The elements of the C-R system affected include the heart and lungs, the vassals supplying blood to all parts of the body, the oxygen. Other body systems are also affected by endurance exercise, including the muscles the digestion-absorption-elimination processes the various internal secretion glands, the bones the bone marrow's production of red blood corpuscles, and the brain.

Cooper's 12 Min-Run/Walk Test

Purpose: To measure cardiovascular fitness. A 400 track is preferable. If none is available, distance can be measured on a football field, a play field, or any open area. Flags are placed around the track at 50m intervals.

Procedure: The group running can be divided into 2 sections for testing purposes. Each student's works is with a partner. While one student is running, the other partner checks the distance covered in 12 minutes. The instructor should talk about pace and the time a student should be running at the end of each lap. The partner is instanced to count the number of laps that are run within the allotted time when 11 minutes have elapsed, the instructor calls out the time left to run. At the end of 12 minutes, the instructor blows a blast on his whistle and the partner notes the flag him /her as just passed. After they have finished the run, students are instructed to continue walking or jogging for at least a lap in order to regain normal breasting.

Instructions: You should begin to run on the signal "Go" as you cross the finish line following each lap, listen for your elapsed time. When you have finished, continue to walk or jog for one more lap in order to regain normal breathing, but stay on the outside of the track so you will not interfere with late finishers.

Scoring: The observing partner records the number of completed laps plus the number of flags passed on the last lap and informs that to the to the instructor so that the same could be recorded.
Testing Personnel: One trained instructor can administer the test as he serves as timer, calls out times, and records results.

References: 1. Clarke R. David and Clarke Harrison H. Application of Measurement to Physical.

OREGON MOTOR FITNESS TEST

This test was established for realization of the following functions.
1. To determine physical fitness status according to grade level.
2. To identify those below standard so that programs can be introduced to improve fitness.
3. To determine effectiveness of the physical education programmed in regard to fitness objective.
4. To motivate youngsters to improve their fitness.

Test groups and respective batteries are as follows.

Test Group	Test Battery
Boys (grades 4-6)	Standing broad jump, push-ups, sit-ups
Boys (grades 7-12)	Jump and reach, push-ups, potato race
Girls (grades 4-12)	Hanging in arm flexed position, standing broad jump, crossed arm curl-ups.

Test items are administered in the following manner:

Standing Broad Jump: Mat or floor is marked with parallel lines two inches apart. Student test take-off line with both feet; crouching and swinging arms to ad in jump he takes off from both feet, jumping as far as possible. He must land on both feet and searing is the accords inch from take-off line to line nearest heel position.

Push-ups : A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angles to the body. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended. This action is repeated, and test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.

Scoring: Record the number of correctly completed push-ups.

<u>Sit-ups</u>
Student supine, knees straight, feet approximately 12 inches apart and hands clasped behind head: Scored kneels of hour and holds subject's soles against his knees. Subject sits up touching right elbow to tell knee (knee may fix slightly) and returns to supine position; he repeats the exercise alternating by touching left elbow to right knee. Scoring is one point for each complete movement of touching elbow to knee.

Hanging in arm-flexed position

Pupil stands on support to grasp I inch horizontal bar; hands are a shoulder width apart; elbow are flexed so that chin can be level with bar. Support is removed and the pupil maintains some flexion in acres; legs and thighs should remain extended throughout test. Score is the length of time (in scolds) that a degree of flexion at elbow is maintained.

Crossed arm curl ups

Pupil on back, knee bent at about 90^0 angle; feet flat on floor, arm tolled across chest; partner holds feet on the ankles. Scoring is the number of times pupil comes to sitting position.

Jump and reach Pupil stands with right side (left if left-hand) against smooth wild, It reaches up and places a mark on the wall with chalk as high as he can reach. Them, crouching, he jumps as high as possible, making a second mark. Distance measured to the nearest $\frac{1}{2}$ inch between the first and second marks is the core. Three trials are allowed, with the best of three being recorded.

Potato race

The following figure contains a diagram of this agility course. Three circles, one foot in diameter are placed on the floor, with their centers forming a straight line. Circle 1 is behind and tangent to the starting lines; the centers of circles 2 and 3 are 50 and $69\frac{1}{2}$ feet respectively from starting line. Careless 2 and 3 each contain a wooden block 3x2x4 inches (two-blackboard crasser may be substituted). Assuring a standing start positron me foot on starting line, at command “Go” student times to circle 2, pick up the block and brings it to circle 1. He them runs to circle 3 and brings that block to circle 1. He then picks up the first block from circle 1 and returns it to circle 2, picks up the second block from circle 1 and returns it to circle 3 returning to staring line as rapidly as possible. Pupil must place the blocks in the circles, not toss or drop them. Score is the clasped time in seconds.

JCR Test

The JCR is a three item test using the vertical jump, chinning, and a 100 yard shuttle run in which the subject runs a 10-yard course ten times. Backboards, set at an angle of approximately 40 degrees with the floor, are used to assist the subject in making the 180-degree turn. The test was designed to measure total ability in the performance of fundamental motor skills including jumping, running, and dodging, which in Tura contain such basic elements of power as strength, speed, agility, and endurance.

The reliability of the test items, according to data collected on two groups of 138 men is as follows:

	JUMP	CHIN	RUN	JCR SCORE
Group A	.89	.92	.80	.94
Group B	.89	.95	.81	.94

Validity of the test was first determined by obtaining a multiple correlation of .81 with a 25-variable criterion; a second evidence of its validity was the multiple R of .90 obtained between it and a 19-variable criterion of physical literacy, consisting of vertical jump, chins, doodling run, sit-ups (sped), softball throw, 300 yard run, dips, standing broad jump, rope climb, vault, Burped, total sit-ups, medicine ball put, push-ups, three broad jump, flexion, extension, a 50-yard dash, and an endurance index. A third study of validity was completed between the JCR and the AAF motor fitness test that resulted in a corrected of .78 also and r of .66 was obtained between the JCR and a 17-obstacle, 670-yard obstacle course. On the basis of the validity studies and the high reliably of the items contained in the JCR, this test can contribute much in the way of motor flatness testing in the public school.

Administration of test items

Vertical Jump: Pupil stands with right side (left if left-hand) against smooth wild, It reaches up and places a mark on the wall with chalk as high as he can reach. Them, crouching, he jumps as high as possible, making a second mark. Distance measured to the nearest $\frac{1}{2}$ inch between the first and second marks is the core. Three trials are allowed, with the best of three being recorded.

Chinning: The chins should be performed with either a palms forward grip of palms-backward grip.

Although the test direction allow the pupil to select any grip, the palms backward method results on the average in two to two and one half more chins. Whichever grip is selected, it should be consistent for all pupils.

When possible, the use of adjustable rings attached to the chinning bar may prove advantageous. Rings permit the wrists to rotate naturally in the execution of the chin, and they may be adjusted for convenience when measuring elementary and junior and senior high school pupils. Swimming or kicking is not permitted; the tester may and should steady the legs of the chinned. Half credits are not permitted and the exercise should be continuous. It is prudent to place a man beneath the rings are chinning bar.

Shuttle run: The subject runs 100 yards over a 10-yard course; he runs 10 yards makes a 180-degree turn and continues for five complete round trips. Runners start and finish at the same line. They start " inside" the starting line with one foot on or touching the bank board and are started by the conventional "On your mark, get set, go" Runners may turn in either direction, but must touch the bank board in making the turn.

Apparatus: Running lanes are approximately 6 feet wide and exactly 10 yards long. Bank boards, which are used to help the subject make the run, are placed at both ends of the lanes so that their bottom Indies edges are flush with the ends of the lanes. They are approximately 12 inches wide and are set at an angle of 40 degrees with the floor. Running is done on a hard and level surface that assures good footing. Proactive lengths are permitted before the run for time. The examiner should watch to see that runners stay in their own lanes and are encouraged to go "all-out" for the complete distance, that backboards are used from which to "spring" and not to bounce, and that runners are given a few lengths in practice before running for time.

Tuttle Pulse-Ration Test

Tuttle's pulse ration is interpreted as the ration of the resting pulse rate to the rate after exercise. This ration is computed by dividing the total number of pulse beats for two minutes after a standard exercise by the number of resting pulse beats canted for one minute. The cardiovascular efficiency of a person is determined by the amount of exercise required to obtain a 2.5 pulse ration.

Test administration:
1. The resting pulse with the subject in the sitting position is taken for one minute and recorded.
2. The subject exercises by stepping up and sown on a 13-inch bench for one minute. (Twenty steps for males and fifteen steps for females).
3. The subject, after cessation of exercise, is seated and the pulse counted for two minutes. The total number of pulse heats for two minutes is divided by the resting rate. This is the first pulse-ration.
4. The subject remains seated until the pulse has returned to normal. The number of steps should be increased to thirty-five or forty. The number of steps is recorded.
5. Again the subject exercises on the 13-inch bench for one minute. The number of steps should be increased to thirty-five or forty. The number of steps is recorded.
6. After cessation of exercise the pulse is again courted for two minutes. The two-minute total is divided by the resting pulse rate to obtain the second pulse-ration.

To compute the number of steps required to obtain a 2.5 ratio, Karpovich caps
Suggested use of the following formula:

$$S_0=S_1+\frac{(s_{2-1})(2.5-r)}{r_2-r_1}$$

S_0=Number of steps required to produce 2.5 ratio.
S_1=Number of steps in first test.
S_2=Pulse-ration for S_1

Obtained by: $[\frac{\text{Total 2}-\text{minute pulse following first exercise}}{\text{Total resting pulse for one minute}}]$

The following sample values may be substituted in the Karpovice formula to show the method of calculation:
Number of steps in first test =20
Normal sitting pulse rate=70
Heart rate after first test =157
Pulse-ration for first test=$\frac{157}{70} = 2.24$
Number of steps in second test=40

heart rate after second test=196

Pulse-Ration for second test= $\frac{196}{70} = 2.80$

Calculation:

S_0=20+$\frac{(40-20)(2.5-2.24)}{2.8-2.24} = \frac{20+5.2}{0.56} = 20 + 9.3$

S_0=29.3

Percent efficiency ratio= $\frac{29.3\times100}{50} = 58.6\%$

The norms established for the Tuttle pulse-ration are: boys, ages ten to twelve year-33 steps; boys, ages thirteen to eighteen years-30 steps; adult males-29 steps; adult females-25 steps.

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*50 steps for one minute represent the amount of exercise to produce a pulse ration of 2.5 in highly efficient individual. This number was selected to compute% age of efficiency as it falls far above the requirements for a 2.5 pulse-ration of the fit individuals in Tuttle's laboratory.

Harvard step Test

Lucien Brouha and Associates originally constructed the Harvard step test for college men. This test measures cardiovascular endurance of a person. Following are the instructions for its administration.

1. The subject steps up and 30 times a minute on a bench 20 inches high. Each time the subject should step all the way up on the bench with the body erect. The stepping process is performed in four counts, as follows; (i) one foot is placed on floor. The tested may lead off with the same foot each time or may change feet, as he desires, so long as the four-count step is maintained. The steps may be timed with a metronome. If a metronome is not available, count the cadence as "up, up, down, down."

2. The stepping exercise continues for exactly five minutes, unless the subject is forced to stop sooner due to exhaustion. In either case, the duration of the exercise in seconds is recorded; the maximum number of seconds is 300 for the full five minute period.

3. Immediately after completing the exercise, the subject sites on a chair. The pulse is counted1- $\frac{1}{2}$, 2-2$\frac{1}{2}$ and 3-3$\frac{1}{2}$ minutes after the stepping ceases.

4. A physical Efficiency Index (PEI) is computed, utilizing the following formula;

$$\text{PEI}=\frac{\text{Duration of exerise in seconds X 100}}{\text{2X sum of pulse counts in reconvery}}$$

To illustrate: The subject completed the exercise period, 300 seconds; his recovery-period pulse counts were: 75 for 1$\frac{1}{2}$ minutes, 50 for 2-2$\frac{1}{2}$ minutes, and 35 for 3-3$\frac{1}{2}$ minutes (the sum is 160).

Substituting in the formula.

$$\text{PEI}=\frac{30{,}000}{2\times 160}=94$$

Grading can be done using the following norms:
Excellent 90 and above
Good 80 to 89
High average 65 to 79
Low average 55 to 64
Poor 54 and below

RAID FORM

A rapid form of the Harvard step test was proposed by Johnson and Robinson. The exercise phase is the same the same as for the regular test, however, the pulse is counted once between the first and the sum of the three pulse counts of the original test.

The score is obtained from the obtained from the formula:

$$PEI=\frac{\text{Duration of exercise in seconds X 100}}{\text{5.5 X pulse count in recovery}}$$

The norms for the short from are below 50, poor; 50-80 average; above 80 good.

GIRLS AND WOMEN

Skubic and Hodgkins proposed a three-munity step test for girls and women. The rate of stepping is 24 steps per minute; the height of the bench is 18inches. Following exercise, the subjects rested for one minute in a sitting position; the pulse was then counted for thirty seconds at the artery by palpating. For those who were unable to complete three minutes of stepping, the total time was recorded and their recovery pulse was counted after one minute for the usual 30 seconds. A cardiovascular efficiency Score (CES) is computed in a manner similar to the short from of the Harvard step test.

The formula is as follows:

$$PES=\frac{\text{Duration of exercise in seconds X 100}}{\text{5.6 X pulse conut recovery}}$$

The following norms are used for grading:

Rating	Junior H.S Girls	Junior H.S Girls	Junior H.S Girls
Excellent	72-100	71-100	71-100
Very Good	62-71	60-70	60-70
Good	51-61	49-59	49-59
Fair	41-50	40-48	39-48
Poor	31-40	31-39	28-38
Very Poor	0-30	02-30	0-27

COLLEGE WOMEN

The Queens Step test for college women was presented by Mc Ardle and associate. For this test, the women steps up and down on a bleacher step for three minutes at a cadence of 22 steps per minute. A the end of the stepping, the subject remains standing while a partner counts her pulse fate by palpation at the carotid artery for 15 seconds, from 5 to 20 seconds after exercise.

Harvey and Scott proposed the Kent state University step test for college women. This test cosmists or stepping on a bench 18 inches high at a cadence of 30 steps per minute for one minute; pulse rate is counted for 30 seconds, from 1 to $1\frac{1}{2}$ minutes after steping. Further women athletes obtained significantly better scores on the test than did non athletes.

Clarke studied the use of the step test with Redcliff College women as subjects, She used a bench 18 inches high; the exercise consisted of 30 steps per minute for four minutes. The pulse counts and scoring was the same as for the Harvard step Test. Based on the Harvard men's norms, the distribution of scores for these women was as slows: excellent, 20 percent; good, 15 percent; high average, 31 percent; low average, 9 percent; poor 43 percent.

HYMEN'S CARDIO-PULMONARY INDEX (CPI)

Blood Pressure measurements are mad with mercury or dial type sphygmomanometer; a stethoscope is also needed. The cuff is wrapped snugly around the upper part of the left arm just above the elbow joint. The stethoscope camphene is placed in the tester's ears; the stethoscope bell is placed firmly over the brachial artery just above the elbow slightly toward the indeed of the arm. The cuff is pumped up with the instrument bulb until no pulse beat can be heard, The tester, then, slowly releases the pressure, watching the mercury column or the needle on the dial, as he does so. When the first pulse sound is heard, the mercury column or the position of the needle on the dial is read. This is the systolic pressure, recorded in millimeters of mercury (mm. Hg.) the tester continues slowly to release the pressure in the cuff, when a dull, fireless beat is noted, the pressure on the mercy column or the position of the needle on the dial is again read, This is the diastolic pressure, Blood pressure is recorded with the systole reading first. Thus, a recording of 122/72 means a systolic pressure of 122 and a diastolic pressure measurement accurately.

Lung Capacity

1. The pyrometer should be equipped with an extra-length rubber hose (36 to 42 inches), filled with water to within one inch of the top, and placed at such a eight that all subjects can stand creed when beginning the test. A good arrangement for the majority of students is to place the base frame four to four and one-half feet from the floor.

2. An individual wooden mouthpiece, the most hygienic, is used for each subject. The mouthpieces should not be handled by the tester, but should be inserted into the tube by the subject being tested. The wooden mouthpiece may be used repeat if thoroughly sterilized by boiling, steaming, or soaking for half an hour in an antiseptic solution, such as zephiran aqueous solution, 1/100, A glass mouthpiece is not recommended unless some method can he devised for instantaneous sterilization.

3. The subject should take one or two deep breaths before the test. Then, after the fullest possible inhalation, be should exhale slowly and steadily while bending forward over the hose until all the air within his control is expelled. Care should be taken to prevent air from escaping either through the nose or around the edges of the mouthpiece, and to see that the subject during the test does not take a second breath.

4. The tester should water the indicator closely to note when it reaches the highest point.

5. The rubber plug at the base of the spirometer should be removed when lowing the inner can after a test has been administered. (Some sprirometers, as in the illustration, have an air-release valve on the top of the inner can rather than a plug at the base). Care should be taken in lowering this can so that the water is not spilled. If at any

time the inner can should “bobble” and refuse to raise higher weigh continued blowing into the hats, additional water is required. This situation will occur if there is an insufficient amount of water in the can, which may happen if the water level has been lowered through spilling.

III. Maximum Breadth Holding Time

The Maximum Breadth Holding is recorded in seconds. After one or two deep breadths the student is asked to fully inhale and then hold the breadth by closing the mouth. Simultaneously a clipper is applied on the nose so that breathing through the nose can be prevented. With the holding of breadth, a stop watch is started and as soon as the student fails to hold the breadth is recorded in seconds as the score of the student.

IV. Pulse Rate

The normal pulse rate of the student is recorded in number of beats per minute. The tester feels the pulse at the carotid/radial artery with the fingers of one had and holds a stop watch in the other. He then correctly counts number of pulse beats for one minute and records that as the score of the student.

V. Maximum Expiratory pressure

The Maximum expiratory pressure is recorded in mm. Hg.

The rubber tube of the sphygmomanometer is separated from the pump. After one two hyperventilation, the student will fully inhale and then forcefully expires in to the tube, ensuring that air does not leak out from the sides of the mouth. A clipper is applied on the nose before the student blows into the tube. The level to which the mercury rises in the column/or the needle moves on the dial, the reading is recorded in mm. Hg.

VI. Age

The age of student is recorded in completed years.

For computing cardio-pulmonary index, the following formula is used.

$$CPI=\frac{VC+MBH+MEP+AGE}{PR+SP+DP}$$

AAHPER (American Association for Health, Physical Education and Recreation) Youth Fitness Test

AAHPER Youth Fitness Test is a battery of six test items designed to give a measure of physical fitness for boys and girls in grades 5-12. The tests were selected to evaluate specific aspects of physical status which, taken together, give of fitness

Test Description

Item No.1 Pull-up (for boys)

Facilities and equipment: A metal or wooden bar approximately 1.5 inches in diameter is placed at a convenient height. However, for the lower age levels a doorway gym bar can be used, At times it may be necessary to improvise by using such equipment as a basketball goal support or a ladder.

Procedure: The bar is adjusted to such height that the students can hang free of the floor. The student should grasp the bar with his pains facing away from his body (overhand grasp). The student should then raise his body until his chin is over the bar and then lower it again to the starting position with his arms fully extended.

Instruction: Your must not lift your knees or assist your pull-up by kicking. You must return to the hang position with the arms fully straight. Your will not be permitted to swing or snap your way up.

Scoring: One point is scored each time the student completes a pull-up. Part scores do not count, and only I trial is permitted unless it is obvious the student did not have a fair chance on is first trial.

Testing personnel: One trained tester can administer this Item. Count the scores, and record results.

Item No. 2 Flexed-Arm hangs (for girls)

Purpose: To measure arm and shoulder strength.

Facilities and equipment: A metal or wooden bar approximately 1.5 inches in diameter is placed at the subject's height. A doorway gym bar adjusted at the desired height in a doorway works very well. If these items are not available, it is necessary to improve by using some kind of pole or pipe across bleachers or ladders. A stopwatch is needed.

Procedure: The height of the bar should be adjusted to approximately the standing height of subject. The student should grasp the bar with an overhand grasp. She then raise her body off the floor with the help of assistants to a position where the chin is above the bar, The elbows should be flexed and the chest should be close to the bar, Two setters, I in front and I in back of the subject, are recommended for assistance in

getting to the hang position. The subject holds the hang position as long as possible. The stopwatch is started as soon as the subject assumes the staring potation and is topped when the chin touches the bar falls below the bar, or when the subjects head is titled back to keep the china above the bar.

Instruction: Grasp the bar with palms facing away from your body. Your will be litter by assistants to a position with your chin just above the bar. Hang in this position as long as possible. It is a violation for your chin to touch the bar or fall below the bar, or for you to tilt your head backward to keep your chin from touching the bar.

Scoring: The score is the elapsed time to the nearest second that the subject maintained the proper hanging position.

Testing Personnel: One trained tester can administer this test and record the score.

Item No. 3 Sit-up
Purpose: To measure abdominal strength and endurance.

Facilities and Equipment: Mats may be used if they are available: otherwise the floor is satisfactory.

Procedure: The student lays flat on the back with knees bent and feet on the floor with the heels no more than I foot from the buttocks. The knee angle should be no less than 90 degree. The fingers are interlocked and placed behind the meek with the elbows roughing the floor. The feet are held securely be a partner, the students then curls up to a sitting position and touch the elbows to the knees. This exercise is repeated as many times responsible in the time requirement.

Instruction: Your fingers must remain interlocked and in contact with the back of your meek at all times. You curl up from the starting position, but you may not push off the floor with elbow. When you return to the starting position, your elbows must be flat on the floor or mat.

Scoring: One point is scored for each correct sit-up. The score is the maximum number of sit-ups competed in 60 seconds.

Testing personnel: One trained tester can administer this item and count and record the score.

Item No. 4 Shuttle Run
Purpose: To measure speed and agility
.
Facilities and Equipment: Two lines parallel to each other are placed on the floor 30 feet apart. Since the student must overrun both these lines. It is necessary to have 4 inches and stopwatch is needed.

Procedures: The student stands at one of the lines with the 2 blocks at the other line. On the signal to start, the student's runs to the blocks, take one, and returns to the starting line, and places the block behind that line. He/ She then return to the second block, which is carried across the starting line on the way back. Two students can run at the same time if 2 timers are available, or if I test administrator has a split-second timer, and of course, if there are 2 sets of blocks. Two trials are permitted. It is not necessary to return the blocks after each race. Sneakers should be worn or the students may run barefooted.

Instruction: On the signal to go run fast as you can to the nest line and pick up a block. You should return the block over the second line where you place if on the floor. Do not throw it. Return for the second block, and this time you may run across the starting line as fast you can without placing the blocks on the floor.

Scoring: The score is the clasped time recorded in seconds and tenths or seconds for the better of 2 trials.

Testing personnel: One trained tester can administer this and time and record the score. If he has a split-second timer, he may have 2 students running at the same time. If 2 regular stopwatches are available, 2 timers can be used.

Item No.5.Standing broad jump

Procedure: The subject stands with feet slightly apart, toes behind the take - off line. Hips, knees and ankle are slightly bent. The subject pushes forward vigorously with the lags and swings the arms to jump as far forward as possible. The distance from the take - off line to the spot where the heels touch is measured.

Item No.6. 600-yard run-walk (with optional runs of one mile or 9 minutes for ages 10-12,
Procedure: Starting from a standing or crouch position, the subject runs 600 yards. The elapsed time from the starting signal to the passage of the runner's chest across the finish line is counted.

THE CANADA FITNESS TEST (CAHPER)

The Canada fitness test was designed to motivate Canadian youth seven to 17 years of age to participate in physical in physical activates and to change the state of passive interest in to that of active involvement. The objectives of the Canada fitness test are as follows:

1. To promote the development of health and fitness in Canadian youth so that they may achieve a state of well being, states in which they will function most effectively while at home, work and play.

2. To offer Canadian youth seven to seventeen years of age an opportunity to participate in continuing Canada fitness youth programmer to strive for excellent and reach higher levels of fitness which will pay dividends it them and Canada in the future.

3. To challenge youth and recognize and honor their outstanding physical achievement through a series of Canadian tests.

(a) 50 yard run for speed.

(b) Bent knee speed sits - ups for strength and endurance of abdominal muscles.

(c) Flex darn hangs for arm and shoulder girdle strength.

(d) Shuttle run for speed and agility.

(e) Standing long jump for explosive muscle power of leg extensor.

(f) 300 – yard run for cardiovascular efficiency.

<u>50– Yard run</u>

Start from a crouch or standing position. Measure theme time it takes to run 50 yard.

<u>Bent knee speed sit- ups</u>

The subject lies on his back on a flat surface, fingers interlaced behind the head, knees bent. The partner holds legs to prevent him from sliding. The subject sit-up and touches both elbows to the knees and returns to the starting position. He repeats the movement as possible for one minute.

<u>Flexed arm hang</u>

The subject grasps a horizontal bar with toward the face. He gets into the position where the eyes are level with the bar and hangs from this position for as long time as possible. Timing stops when the head drops blew the level of the bar.

Shuttle run

The course is 30 feet long a line at each end. Blocks are place behind the line opposition the starting line. The subject line face down behind the starting line, hand at the side of the chest, forehead on the starting line, facing in the direction of the blocks. On the starting signal, he jumps up and runs the 30 feet to the blocks. He picks up one block and returns to the starting line and place this block behind this line. He then returns for the second block and races back across the original line, still holding the block. The elapsed time from start to the passage of the runner chest across the finish line is counted.

Standing long jump

The subject stands with feet slightly apart, toes behind the take - off line. Hips, knees and ankle are slightly bent. The subject pushes forward vigorously with the lags and swings the arms to jump as far forward as possible. The distance from the take - off line to the spot where the heels touch is measured.

300 - Yard run

Starting from a standing or crouch position, the subject runs 300 yards. The elapsed time from the starting signal to the passage of the runner's chest across the finish line is counted.

Norms are divided into three levels of difficulty, with crest being awarded to those participants who-excel. For example: (1) each participant, regardless of success receives a participation pin: (2) those achieving level one or higher in four test items receive a silver; participants scoring at level three of higher in four test items receive a gold crest; and finally, the individuals who score at level three or higher on each of the six items receive an award of excellence along with an attractive certificate.

References:

1. Clarke H. David and Clarke Harrison H. Application of Measurement to Physical Education (Englewood Cliffs: Prentice Hall. Inc)

2. Mathew, Donald K. Measurement in Physical Education (London: W. B. Saunders Co.)

INDIANA MOTOR FITNESS TEST

Using a twelve-item standard, involving at least two measures each strength, velocity, motor ability, and endurance. Book water constructed a practical test of motor fitness. The following four indices have been developed and validated for high school and college age men:

Motor Fitness Index I = (Chins + Push-ups). (Vertical Jump)

Motor Fitness Index II = (Chins + Push - ups). (Standing Broad Jump)

Motor Fitness Index III = (Straddle Chins + Push-ups). (Vertical Jump)

Motor Fitness Index IV = (Straddle Chins + Push-ups). (Standing Broad Jump)

The validities of the above indices with a twelve-item criterion are as follows: Index I- 850, Index II- 818, Index III- 841, and Index IV-812. As these coefficients of validity are of approximate size the instructor may selected the index most applicable to his program and facilities. Indices I and III are preferable became of their validity coefficients.

Administration of test item

Chins: The chins should be performed with either a palms forward grip of palms-backward grip.

Although the test direction allow the pupil to select any grip, the palms backward method results on the average in two to two and one half more chins. Whichever grip is selected, it should be consistent for all pupils.

When possible, the use of adjustable rings attached to the chinning bar may prove advantageous. Rings permit the wrists to rotate naturally in the execution of the chin, and they may be adjusted for convenience when measuring elementary and junior and senior high school pupils. Swimming or kicking is not permitted; the tester may and should steady the legs of the chinned. Half credits are not permitted and the exercise should be continuous. It is prudent to place a man beneath the rings are chinning bar.

Push-ups : A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angles to the body. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended. This action is repeated, and test continues

until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.

Scoring: Record the number of correctly completed push-ups.

Standing Broad Jump: Mat or floor is marked with parallel lines two inches apart. Student test take-off line with both feet; crouching and swinging arms to ad in jump he takes off from both feet, jumping as far as possible. He must land on both feet and searing is the accords inch from take-off line to line nearest heel position.

Vertical Jump: Pupil stands with right side (left if left-hand) against smooth wild, It reaches up and places a mark on the wall with chalk as high as he can reach. Them, crouching, he jumps as high as possible, making a second mark. Distance measured to the nearest $\frac{1}{2}$ inch between the first and second marks is the core. Three trials are allowed, with the best of three being recorded.

McCLOY'S GENERAL MOTOR ABLITY TEST

McCloy constructed a test of general motor ability composed of a simple test of strength and a number of track and field events. The elements are as follows.

For Boys: The strength test included is the pull-up or chinning test computed for arm strength, using McCloy's formula. The track and events may vary according to the age and experience of the group, the selection being made by the physical educator/coach, provided scoring tables are available for the event. However, the event selected should include one sprint (varying from 50 to 100 yards, one broad jump (either running or standing), the running high jump, and weight-throwing event (shot-put, basketball throw, or baseball throw). These four events are scored on McCloy's scoring tables, the sum of which is combined by special formula with chinning strength as follows.

General Motor Ability Score = 0.1022 (track and field point) + 0.3928 (chinning strength).

For Girls: The actual number of pushups, rather than pull-up strength, is used in the girls General Motor Ability Test. Three track and field event are included: a sprint, a broad jump, and a throw scored on McCloy's scoring tables. The formula for combining this element is:

General Motor Ability Score = 0.42 (track and field point)+ 9.6 (number of push-ups).

In the development of the General Motor Ability Tests, results on individual test elements were correlated with the total score on a large battery of achievement tests. The elements finally selected to form the test gave as high a prediction of general motor ability as was given by any other combination of events, Other item added to this battery gave significant additional predictive value.

McCloy correlated total track and field point with skill soccer and basketball of physical education professional students, as determined by student ratings, each student in the group rating each other individually. The resulting correlations were: with soccer 0.84; with basketball, 0.92.

McCloy developed the following formula for computation of chinning and dipping strength.

Boys: Chinning or dipping strength = 1.77 (weight) + (chins or dips) -46.

Chinning or dipping strength + 3.54 (weight) 3.42 (pull ups or push-ups) -92.

Girls: Chinning strength = .67 (weight) + 1.2 (chins)+52.

Dipping strength = .78 (weight) +101 (dips) +74.

METHENY - JOHNSON TEST

In 1982, Johnson proposed a test designed to measure “native neuro-muscular skill capacity”. The test consists of performing ten stunts down the length of a five by ten-foot gymnasium mat, specially marked for this purpose. Johnson reported a validity coefficient of 0.69, but did not indicate the criterion. Koob obtained a correlation of 0.95 between this test and the number of trials required for junior high school boys to learn a series of ten tumbling stunts. Johnson indicated a reliability coefficient of 0.97 with collage men as subjects. Other experiments, however, have not found the reliability of 0.61 with high school girls. Hatlestad concludes, after administering the test collage women, that greater objectivity is needed.

Metheny studied the Johnson Test and found that, with boys, four of tests alone correlated 0.98 with the total Johnson score, and 0.93 with a criterion of learning trembling, stunts. For girls, combination of three of Johnson items gave a correlation of 0.86 with the total Johnson score.

With the elimination of six the original Johnson items, Metheny was able to simplify the mat used in the performance of the test, as shown in Figure. A lane 2 feet wide is marked down the center of a 15- foot mat. This lane is divided into two equal narrow lanes by a center line, and into ten equal sections lengthwise by line place every 18 inches. These lines are alternately 3 inches wide and 3/4 inch wide, the 18- inch section being measured to the middle of the line in each case.

On this mat, the selected Johnson Test items are performed. The first three tests are used for both boys and girls; the fourth test “jumping full turns” is included for boys only.

The tests are described as following:

Front Roll: Perform rolls in the 2- foot lane. Start with feet outside of chart. Perform two front rolls, the first within the limits of the first half of the lane (not going beyond the middle 3-inch line); the second within the limits of the second half, never touching or overreaching the lanes.

Scoring: Count five points for each roll. Deduct two for overreaching side-line right of left

For each roll; one for overreaching end limit on each roll; and five for failure to perform a true roll.

Back Roll: Perform two back roll in entire 2-foot lane, one in each half of the lane. Start with feet outside of chart.

Scoring Score as for front roll.

Jumping Half-Turns, Right and Alternately: Start with feet on first 3-inch line. Jumping with both feet to second 3-line, executing a half turn either right or left; jump to third 3-inch, line, executing half-turn in opposite direction; continue the length of the mat, alternating direction of rotation.

Scoring: Deduct two points for each jump in which the subject does not land with both feet on the 3-inch line or turns the wrong way, or both.

Jumping full Turns: Start with the feet outside the chart at about the center of the lane. Jump with feet together to second rectangular space, executing a full turn with body right of left; continue across the mat, executing full turns, rotating in the same direction, landing on both feet in every second rectangular space.

Scoring: Score as for preceding test, deducting two points if the subject fails to lane on both feet, oversteps the square, turns too far or not far enough, or loses balance before starting the next jump.

References:

1. Clark H. David and Clarke Harrison H. Application of Measurement to Physical Education (Englewood Cliffs: Prentice Hall Inc)

2. Mathew, Donald K. Measurement in Physical Education (London: W. B. Saunders Co.)

ROGERS PHYSICAL FITNESS INDEX

In selecting the individual elements composing the PFI battery, Rogers included only tests that would measure most of the large muscles of the body. As a result, the complete test involves the following muscle groups: forearms, shoulder girdle, back, and legs. Most of the large muscles not tested are antagonistic to those tested-Rogers composite test of seven elements is a reduction from ten tests given by Sergeant.

With the construction of norm tables for many combination of sex, age, and weight, two major scores are possible - the Strength Index and Physical Fitness Index - each of which has a distinctly purpose. By the construction of these norm tables, Rogers created the PFI.

The Strength Index:

The Strength Index is the gross score obtained from the six strength tests plus lung capacity. It is proposed as a measure of general athletic ability and should be conceived neither as a measure of skill in any particular sport nor as a measure of physical fitness. It is with this measure, scored in kilograms and points rather than pounds and points that Sargent was familiar. The old Sargent test was an athletic ability test only.

The physical Fitness Index:

The physical Fitness Index is a score derive from comparing and achieved Strength Index with a norm based upon the individual's sex, weight, and age, It is a measure of basic physical fitness elements, including both muscular strength and muscular endurance.

ADMINISTRATION OF THE PFI TESTS

The physical Fitness Index Test may be used for boys and girls, the elements being the same for both sexes; however, the pull-up test for girls are less strenuous than described in detail here. In all tests, the subject should be encouraged to do best but should not strain. "Normal strains of effort" should be encouraged; "extreme strains" should be avoided.

Age Height, Weight;

The age, height, and weight of the individual should be recorded, according to the following instructions:

1. Age should be taken in years and months, as 15 years and 7 months.

2. Height and weight should be taken in gymnasium uniforms, and at the nearest half-inch and half-pound respectively.

Lung Capacity:

Lung capacity is measured in cubic with a wet Spiro meter.

1. The Spiro meter should be equipped with an extra-length rubber hose (36 to 42 inches), filled with water to within one inch of the top, and placed at such a height that all subjects can stand erect when beginning the test. A good arrangement for the majority of students is to place the base from four and one-half feet from the floor.

2. An individual wooden mouthpiece, the most hygienic, is used for each subject. The mouthpieces should not be handed by the tester, but should be inserted into the tube by the subject being tested. The wood mouthpiece may be used repeatedly if thoroughly sterilized by boiling steaming or soaking for half an hour in an antiseptic solution, such as zephiran aqueous solution, 1/1000. A glass mouthpiece is not recommended unless some method can he devised for instantaneous is sterilization.

3. The subject should take one or two deep breaths before the test. Then after the fullest possible inhalation, be should exhale slowly and steadily while bending forward over the hose until all the air control is expelled. Care should be taken to prevent air from escaping either through the test does not take a second breath.

4. The tester should watch the indicator closely to note when it reaches the height point.

5. The rubber plug at the base of the Spiro meter should be removed when lowering the inner can after a test has been administered. (Some Spiro meters, as in the illustration, have an air -release valve on the top the inner can rather than a plug at the base) Care should be taken in lowering this can so rise higher with continued blowing into the hose, additional water is required. This situation will occur if there is an insufficient amount of water in the can, which may happen if the water level has been lowered through spilling.

Grip Strength:

A manometer, or hand dynamometer, of the rectangular type, is to measure grip strength both and hands being tested.

1.The tester should take the right corner of the manometer between the thumb and bolding the hand to be tested with his left hand in such a manner that the convex edge of the manometer is between the first and second joints of the fingers and they should be placed face down in the hand.

2. In taking the test, the subject’s elbow should be slightly bent and hand should describe a sweeping are downward as he squeezes the manometer. The hands should not be allowed to touch the body, or any object, while the being administered. If they do, the score should not be read at all, and should be given after a shout rest period of 30 seconds.

3. The right hand should be tested first and then the left. Scores be read to the nearest pound.

4. A cake of magnesium carbonate should be available for dusting the hands if they should become moist and slippery.

5. The indicator should be returned to zero after each test.

Back and Leg Dynamometer:

The back and leg dynamometer is the instrument used in measuring of both back and leg muscles.

1. Several back and leg dynamometers are on the market, the better ones being rather expensive. The instrument selected be easy to read, should be calibrated in pounds, and should be capable of measuring a lift of at least 2500 pounds. The chain purchased with the dynamometer should be at least 24 inches in length, and the handle should be from 20 to 22 inches long.

2. Certain dynamometers are equipped to measure compression, or crushing strength. In testing for back and leg strength, the handles supplied for this purpose should be removed. The outer edge of the dynamometer carries the scale measuring the lifting strength.

3. Small pointers of white adhesive with the weight indicated on the ends may be placed at each hundred-pound interval on the dial to facilitate reading the lifts.

4. The dynamometer base should be placed on a small-elevated platform, such as a stall bar bench. It is very important that this base solid and steady so that the subject will have a feeling of security throughout the test. Stall-bar type benches may be purchased with the instrument. A runner should be to the supports of be bench platform, for maximal stability.

5. The subject should tape the handle or crossbar to facilitate firm handling; a block of magnesium carbonate or chalk should also be supplied with which to dust the hands if they are moist and slippery. Hinojosa and Berger studied the use of bare hands, a taped handle, and a strap to secure the hands to the lifting bar in performing the back lift. They found that a taped bar was essential for maximal lifts.

6. In all lifting tests, the feet should be placed parallel, about six inches apart, with the center of the foot opposite the chain. To save the tester’s time and energy, foot outlines should be painted on indicate the position of the feet.

Back Lift:

1. With the feet in the proper position on the base of the dynamometer, the subject should stand erect with the hands on the front of the things, fingers extended downward. The tester should then hook the chain so that the bar level is just below the fingertips. The subject should grasp the handle firmly at the ends of the bar, with thumb clenching fingers and with one palm forward and one palm backward. When the subject is position to lift, the back should be slightly bent at hips, so that he will not completely straighter when lifting, but the legs should be straight with no bend at the knees. The head should be up and eyes directed straight ahead.

It is highly important not to bend the back too much, as the resultant poor leverage is conducive to a poor lift as well as to the possibility of strain. With the back properly bent, however, there is very little likelihood of injury from lifting.

2. The tester should grasp the subject's hands firmly during the lift. Hinojosa and Berger found that grasping of the hands actually did not make a difference in back lift score of college men. The practice is recommended, however, if for no other reason than to give added stability of the subject and enhance his confidence in making a maximal lift.

3. The subject should lift steadily. Care should be taken to keep the knees straight. The feet should be flat on the platform. It is necessary to retest after shortening the chain, if attempts to lift result in rising on the toes. Any initial lateral sway should be immediately checked.

4. At the lifting of effort, they should be almost straight. If not, repeat the text. Singh and Ashton found that the back lift scores were obtained with back angles of 163 to 170 degrees, which verifies the usual practice for this test.

Leg Lift:

Two methods have been proposed for administering the leg lift on the back leg dynamometer. These methods may be characterized as "without the belt" and "with the belt" Everest and Hathaway perfected the technique in order to obtain

The belt technique is now objective advocated and has been generally adopted by physical educators as the standard technique in the administration of the test. Consequently, the leg lift only is described below.

A belt may be purchased or may be made from pliable, tightly woven canvas belting 5 feet 8 inches long, 4 inches wide and about 1/8 inch thick. A loop is formed at one end of a size to fit snugly over one end the lifting bar. The loop is formed by doubling back the last four inches of the belt and sewing firmly with double cross and diagonal stitching.

1. The subject should hold the bar with together in the center, both palms down, so that it rests at the junction of thighs and trunk. Care should be taken to maintain the position after the belt has been put in place and during the lift.

2. The loop end of the belt is slipped over one end of the handle or crossbar; the free end of the belt should be looped around the end of the bar, tucking it in under so that it rests next to the body. In this position, the pressure of the belt against the body and the resultant friction of free end against the standing part hold the bar securely. The belt should be placed as low as possible over the hips and glutei muscles.

3. The subject should stand with his feet in the same position as for the back lift. The knees should be slightly bent. Maximum lifts occur when the subject's legs are nearly straight at the end of the lifting effort. Experienced testers become adept at estimating the potential lift by noting the degree of muscularity of the subject's legs. As a consequence, they will start the stronger subjects at a lower chain link, to allow for the extra distention in the dynamometer. If too high a link is used, the tester can always anticipate such an occurrence and interrupt the performance.

4. Before the subject is instructed to lift, the tester should be sure that the arms and back are straight, the head erect, and the chest up. These details are of great importance to accurate testing. Beginners will err in results by from 100 to 300 or more pounds if the single detail of leg-angle is worn. Therefore, even experienced testers repeat leg lift tests for mot subjects immediately, changing slightly the length of chain - even twisting, if a link seems too great.

Pull-up Tests:

In Rogers's construction of his strength battery, he administered the pull-up tests for boys and girls from rings attached loosely to a bar in order to allow the wrists to twist been discarded and the tests are given with hands grasping the chinning bar.

Boys' Pull-up Test:

The bar should be located high enough so that feet of the tallest boy do not touch the floor when performing the test.

1. In taking the pull-up test, the subject hangs from the bar by his hands with forward baad grip and chins himself as many times as he can. In executing the movement, he should pull himself up until his chin is even with his hands, then lower himself until his chin is even with his hands then lower himself until his arms are straight. He should not be permitted to kick, jerk, or use a kip motion.

2. Half-counts are recorded if the subject does not pull all the way up, if he does not straighten his arms completely when lowering the body, or if he kicks, jerks, or kips in performing the movement. Only four half-counts are permitted.

Girls' pull-up Test:

For the girls' pull-up test, use either and adjustable horizontal bar or one bar of the parallel bars, which permits convenient raising and lower. A mat should be he lay on the floor to prevent the feet from slipping.

1. The bar should be adjusted to approximately the height of the apex of the sternum, thus requiring each girl to pull approximately the same proportion of her weight. Time may be saved in adjusting the bar if girls are arranged by height at the beginning of the test.

2. The girl should grasp the bar with palms outward and should slide her feet under the bar until the body and arms from approximately a right angle when the body is held straight. The weight should rest on the heels.

3. The test is to pull up to the bar with the body held perfectly straight as many times as possible. The girls should pull a dead weight, the exercise being performed by the muscles of the arms and shoulder girdle only.

4. If the body sags, if the hips rise, or if the knees bend in a kip motion, or if the subject does not pull completely up or go completely down, half-credit only is given up to four half-credits.

A. E. Gay formerly the Lockport, New York, public school, perfected a device that improves the procedure for administering the girls' pull-up test. This device consists of a platform with an adjustable heel rest which may be raised or lowered depending upon the height or the being tested, the bar remaining at a fixed height.

Push-up Tests:

Boy's push-up Test: The push-up test for boys may be administered either on the regular gymnasium parallel bars or on wall parallel (or "dipping bars"). The regulation parallel bars are preferred since their wide and height may be adjusted to the height of the subject.

1. The bars should be adjusted at approximately shoulder height.

2. The subject should stand at the end of the parallels bars, grasping one bar in each hand. He jumps to the front support with arms straight (this count one). He lowers his body until the angle of the upper arms and forearm is less than a right angle, then pushes up to the straight-arm position (this count two). This movement is repeated as many times as possible. The subject should not be jerk or kick or stop and rest when executing push-ups.

3. At the first dip for each subject, the tester should gauge the proper distance the body should be lowered by observing the elbow angle. He should then hold his first or fingers so that the subject's shoulder just touches it on repeated movements.

4. If the subject does not go down to the proper bent-arm angle or all the way up to a straight-arm position, half-credit only is given, up to four half-credits.

Push-Up Test for Girls:

The push-up test for girls is executed from a stall bar bench, or a stool, 13 inches high by 20 inches long by 14 inches wide. It should be placed on a mat about six inches from a wall so that subject will not take a position too far forward.

1. The girl should grasp the outer edges of the bench or stool at the nearest corners and assume the front-leaning rest position, with the balls of her feet resting on the matrons with her body and arms forming a right angle.

2. The test is to lower the body so that the upper chest touches the near edge of the stall bar bench, then raise it to a straight-arm position as many times as possible. In performing the test, the girl's body should be held straight throughout.

3. If the body sways or arches, or if the subject does not go completely down or does not push completely up, half-credit is give, up to four half-credits.

General Instructions for Pull-up and Push-up Tests: General instructions in administering pull-ups and push-ups tests follow.

1. After four half-credits have been recorded in the push-up and pull-up tests for both boys and girls, no more should be allowed for partial performance. The tester should give reasons for half count scores as they occur.

2. At the fifth incomplete exercise, it is advisable to stop the test and repeat after a rest period.

3. Counting should be audible to the subject, the count being made sharply at the end of each evolution.

4. The subject should rest five minutes between the pull-up and push-up tests unless fewer than three counts have been made. No rest periods are necessary between the other parts of the test.

Scoring:

Scoring of the physical Fitness Index tests in accomplished in the following manner.

Arm Strength: Arm strength is scored according to the following formula:

(Pull-ups+push-ups)($\frac{W}{10}$ +H-60)

in which Represents the weight in pounds, and H the height in inches. Fractions are corrected to nearest whole numbers.

For example, a boy pulls up 7 and pushes up 8 times. His weight is 155 pounds and big height 68 inches.

(7+8) ($\frac{155}{10}$ + 68-60)

or

(15) (16+8)

This gives arm strength of 360 ponds, if the subject is below 61 inches in height, height should be disregarded in the formula.

Strength Index: The strength Index, or SI, is the total score determined by adding together the scores made on each test item: lung capacity, right grip, left grip, back strength, leg strength, and arm strength.

The Norm: The norm charts are based upon sex, weight, and age, the normal score being changed of reach tow-pound increase in weight and for each half-year increase in age. Instead of interpolation to determine the norm for those individuals between points on the norm chart, the weight above and the age below should be taken. For example, if an individual weight 151 pounds, the norm at 152 should be taken; if he is 16 years and 5 months of age, the norm at 16 years should be taken.

As norm charts have been prepaid for PFI tests both when the belt is used in the leg lift and when it is not used, care should be taken to use the proper chart in scarring the tests.

Physical fitness Index: The physical Fitness Index is computed from the following formula:

$$\text{PFI}=\frac{Achieved\ SI}{Normal\ SI}\times 100$$

Reference:

1.Barrow M. Harold and Mc Ghee Rose many A. Practical Approach to Measurement in Physical Education (Philadelphia; Lea and Febiger)

2. Clarke H. David and Clarke Harrison H. Application of Measurement to Physical Education (Englewood Cliffs: Prentice Hall. Inc)

3. Larson L. A and Yocom R.C. Measurement and Evaluation in Physical. Health and Recreation Education (St. Louis: C.V. Mosby Co)

4. Mathew, Donald K. Measurement in Physical Education (London: W.B Saunders Co.)

KARUS-WEBER STRENGTH TESTS

Recognizing that the number of patients with low back disorders was increasing and that, as demonstrated through clinical experience, the majority of the disorders might have been prevented by maintaining a certain level of fitness, Kraus and Hirsch land examined 4458 American school children on a battery of six muscular strength tests. These tests, according to Kraus and Hirsch land, represented minimum-fitness that is they were tests that indicated a level of strength and flexibility in certain key muscular groups below which functioning of the whole body as a healthy organism seemed endangered Kraus and Hirsch land noted that the patients whose physical fitness level feel below these minimum requirements appeared to be “Sick people” individuals who bore all the earmarks of “constant” and who frequently manifested sings of emotional instability.

The Kraus-Weber tests were constructed over a period of eighteen years from clinical experience. The six tests selected for administration to the school children are purportedly the most valid out of a large battery administered in clinical situations.

Administration: Threefold not be any ware-up prior to take the test.

In the description of the six tests which follows the words “ Upper” and “lower” are used to indicate test movements rather than any specific arrears.

Test 1 in this test the strength of the abdominal and psoas muscles is determined.

Designation: “Abdominals plus poses” or A+

Position of person being tested: The subject is supine, with hands behind neck, the examiner holds the subjects feet down on the table.

Command: Keep your hands behind your neck and try to roll up into a sitting position”.

Precaution: If the person being tested is unable to perform this movement at first try, it may be because he has not understood the directions. Help him a little and then let him try again. Watch for a “stiff back sit up”. This may indicate that either the subject has not understood you and needs a further explanation with emphasis on “rolling up” or that he has very poor abdominal and is doing most of the work with his psoas.

Watch also for a twist of the upper body as the subject sits up. If one is noted it may be due to unequal development of the back muscles.

Marking: If the person being tested cannot raise his shoulders from the table the mark is 0. If unaided, he is able to reach a sitting position the mark would be 5. The distance from supine to sitting is marked from 0 to 10.

Test 2 this is a further test for abdominal muscles.

Designation: “Abdominals minus psoas” or A-

Position of Person being tested: The subject is supine, with hands behind neck and knees bent. The examiner holds the subject’s feet down on the table.

Command: “Keep your hands behind your neck and try to roll up into a sitting position”.

Precaution: The precautions are the same as fro Test 1, but at Test 2 are usually more difficult the tendency toward “stiff back sit-up” will be even more pronounced and to it is added the tendency to help with over or the other elbow.

Marking: Same as Test 1

Test 3. This test the strength of the psoas, and lower abdominals

Designation: “Psoas” of P.

Precautions: If the person tested has not understood your command, he may try to raise his chest when he raises his feet and will need further explanation. Watch for an extremely arched back, which may indicate very weak abdominal muscles or poor postural habits, contributing to way back or lordosis.

Marketing: Holding for ten full seconds is passing and is marked as 10. Any this less is recorded as that part of the ten seconds that was held: 4 for four seconds, 7 for seven.

Test 4 This tests the strength of the upper back muscles.

Designation: “Upper back” or UB.

Position of person being tested: The subject is prone with a pillow under his abdomen, but far enough down to give the body the feeling of being a seesaw, one end of which could be held in the air if the other end were weighted. The commands will aid in getting the subjects in the proper position.

Commands: “Roll over on to your stomach and lift up the middle so that I can slide this pillow under you”. (Be sure the pillow is large enough to easily support the subject) “Now I am going to hold down your feet while you put your hands behind your neck and rise up your chest, head, and shoulders. Hold up while I count” The count is chest, head, and shoulders. Hold them up while I count”. The count is ten seconds.

Precautions: Do not let the person being tested drop his chest onto that table our rest his elbows. Watch for pronounced muscular development on one side of the spring It

this condition is present, the back should be cheeked from time to time to guard against scholiasts (curvature of the spine).

Market: Holding for ten full seconds is passing and is marked as 10. Anything less than ten seconds is recorded as that part of the seconds that was held. For example a person staying for four seconds would get a mark of 4.

Test 5. Tests the strength of the lower back

Designation: “Lower back” of L.B.

Position of person being tested: The subject remains prone over the pillows, but removes his hands from behind his neck, places them down on the table, and rests his head on them.

Commands: “I am going to hold your chest down on the table, try to lift your legs up, but do not bend your knees”. There may be a tendency to bend the knees or even to support the legs by keeping the toes on the table. It may be necessary to assist the subject to the required position. “Now, hold this position while I count”. The count is ten.

Marking: Holding for ten full seconds is passing and is marked as 10. Anything less is recorded as that part of the ten seconds that was held, for example, four seconds would be scored as 4.

Test 6. This tests the length of back and heartstring muscles.

Designation: “Back and hamstrings”. or BH.

Position of person being tested: The subject stands erect in stocking or bare etc, with hands at his sides.

Commands: “Put your feet together. Keep your knees straight, now lean down slowly and see how close you can come to touching the floor with your fingertips. Sty down as far as you can for a count of three. Do not bounce”.

Precaution: Watch out for bouncily the farthest pint reached without bouncing and held for three counts is the marking point. The examiner should hold the knees of the person being tested in order to prevent any bend.

Marketing: Touch is designated by T Touch is only given when the floor-touch is held for three counts. Less than touch is market by the distance is inches between the floor and the fingertips. For example, if a person unable to touch the floor by 2 inches would be marked”-2”.

Reference:
1. Clarke H. David and Clarke Harrison H. Application of Measurement to physical Education (Englewood Cliffs: Prentice Hall. Inc)
2. Mathew, Donald K. Measurement in Physical Education (London: W.B Standers Co.)