

Mathematical Measurement, Evaluation and Test in Physical Education**Dr. Sandeep Sharma****Govt. College Alewa****Abstract**

Everybody is interested in knowing about what, how and why the things and activities near their surroundings are happening. Because, our day-to-day life is largely associated with all these terms to know the status or level, attitude or skill, cause or effect of someone's effort. To know the answer of any query or assumption, we use test, measurement and evaluation. Any idea or thought cannot take constructive shape without evaluation and it is based on measurement which cannot start without using an appropriate test. Basically test, measurement and evaluation are interrelated, interdependent and follow a continuous process. Test is a tool to obtain information to determine the specific characteristics or qualities of an individual regarding knowledge, physical abilities, skill abilities, etc. For example, unit test, annual examinations, physical fitness or body measurement (height, weight). Measurement can be quantitative, qualitative or both. It is a score or data in numerical/grading values, indicating the capacity or ability of an individual, which is obtained on the basis of applied test. Students score in their test and examination either on the field or in the classroom is called measurement.

Evaluation is the process of interpreting the collected data to measure and make the professional judgment of value or worth. After giving the test, everyone wants to know the feedback or effectiveness of the measures, which can be gathered through evaluation. Evaluation may be formative or summative evaluative process used three steps- process education, objectives, learning experiences and change of behavior. These steps are performed in sequence.

Measurement and Evaluation programme is very useful for teachers, students and parents in the field of health and physical education, either to check academics as well as the level of fitness. TME process is useful for achievement, diagnosis, prescription, improvement, classification, and grading, motivational purpose and also helpful for the prediction of performance.

Measurement and Evaluation of Selected Physical Fitness Components

Measurement and evaluation of the major components of physical fitness:

- (i) Muscular Strength: Push-ups, Abdominal Curls and Squat Thrust
- (ii) Muscular Endurance: 1000 meter run/walk test
- (iii) Flexibility: Sit and Reach Test
- (iv) Assessment of Body Mass Index (BMI)
- (v) The Waist-Hip Ratio or Waist-to-Hip Ratio (WHR)

Muscular Strength

Muscular strength refers to the ability of the muscle or group of muscles of an individual to overcome or to act against the resistance. It largely depends upon a few things such as physiological factors like cross-section of the muscle, ratio of slow and fast twitch fibers in muscle, coordination between muscles (agonist and antagonist), ATP and CP store, which plays an important role in providing energy to the active muscle or group of muscles. The psychic factors or the present state of mind such as anger, aggression, motivation, emotional state, etc., have positive as well as negative correlation in muscular strength.

For measuring the strength of the muscle or group of muscles, we must have the knowledge of muscles and also of the particular exercise for particular muscle and supportive muscles. For example, while performing the pull ups, an individual lifts his body, the deltoid, latissimus dorsi, trapezius and biceps contract and produce power whereas the triceps stretch and play the supportive role.

If we want to measure the strength of upper limb (arms), then pull-ups can be one of the test items, but if we want to measure the strength of lower limbs (legs), then we have to think of other exercises.

Muscular strength can be measured with the help of one's own body weight or with the help of equipment such as dynamometer, tensiometer, weight plates and barbell, etc.

Tests related to Muscular Strength

There are different types of tests to measure muscular strength.

Push-up

The push-up or press up fitness test measures the upper limb muscular strength and muscular endurance.

There are many variations of the push-up test, such as different placement of the hands, how far to dip, the duration of the test and the method of counting the number of completed push-ups.

This helps in identifying and assessing muscular strength and endurance of the upper body.

Depending on which protocol is to be used, you may need a floor mat, metronome, beat drum, audio tape, clapping or stopwatch.

Procedure

A standard push-up begins with the hands and toes touching the floor, the upper body and legs should be in a straight line, feet slightly apart, the arms at shoulder width apart extended and at a right angle to the body. Push-ups can be started from a plank position. Align your body with your hands on the floor. Keeping the back and knees straight, lower the body to a predetermined point, to touch some other object, or until there is a 90 degree angle at the elbows, then return back to the starting position with the arms extended. This action is repeated, and the test

continues until the exhaustion or until individual is unable to perform it in rhythm or have reached the target number of push-ups. Body should be in straight line from head to ankles.

As you are going down, elbows should come to 90 degrees. Hold this position and go up, hold the upward position.

Scoring

Maximum number of correct push-ups done by the participants at a specific given rate or time will be the score.

Abdominal Curl

Abdominal curl test helps to identify and assess muscular strength and endurance of abdominal muscles. For this test, floor mat and stopwatch are required.

Procedure

The individual has to lie in a supine position with flexed knees and elbows. Fingers of both the hands are clubbed with each other and are kept behind the head. Individual is asked to raise his or her upper body and then come back to his initial position repeatedly till the given set of time duration ends.

Score

Number of curl ups done by the participants at a specified rate or in specific time will be their score.

Squat thrust

This test enables an individual to identify and assess muscular strength and endurance of the lower body.

Procedure

For this test, follow the given steps—

- (a) Start from a standing position.
- (b) Go down achieving low squat position and place both palms on the floor.
- (c) Take both legs back quickly as shown in the figure and achieve plank position. Quickly come back to the original standing position.

Score

Maximum number of successive squat thrusts performed by an individual in 1 minute will be the score

Muscular Endurance

Muscular endurance is the ability of your muscles to perform muscular activity over a period of time or it is the duration upto which you can apply your muscular strength. Muscular endurance is related with the time and duration of the activity. Slow twitch fiber in muscles is responsible for the activities of muscular endurance. Sometimes, the term stamina is also used in place of endurance.

Tests related to Muscular Endurance

There are many tests to measure muscular endurance. 1000 metre run or walk test is the most common test, which is discussed below.

1000 Metre Run or Walk Test

Through this test, one can identify and assess cardio-vascular endurance. For this test, one needs running track and a stopwatch.

Procedure

Participants or students should start running from the starting line on the command of teacher. They have to cover the distance of 1000 metre in shortest possible time. Walking is also allowed.

Scoring

The score of this test will be given on the basis of recorded time to cover 1000 meters (in a minute and second).

Flexibility

As discussed in the previous chapter, flexibility is the range of motion around the various joints. Flexibility is the ability of our joints and muscles to perform movements with greater range. Good flexibility helps to execute the movement with less muscle tension.

Test related to flexibility

Sit and Reach Test: Sit and reach test helps in the measurement of flexibility of the lower back muscles and hamstring muscle group. For this test, a sit and reach box, and mat are required.

Procedure

The person is asked to sit in a long sitting position placing both feet against the box with sole touching the box. The knees should be straight, legs should be grounded and palm facing downward on top of each other at same level above the box (Fig. 9.5).

The person is asked to bend forward sliding the hand on the scale without any jerky movement.

Scoring

Score is recorded in centimeters

Table 1: Measurement Table

Difference between Measurements				
Poor	Fair	Good	Very Good	Excellent
15 cm	25 cm	30 cm	35 cm	40 cm

Body Mass Index (BMI)

This assessment gives the information of an individual's level of obesity. BMI is calculated by dividing the weight of a person by the square of his/her height.

Measurement of Body Weight

It can be done with the help of a weighing machine.

Procedure

The individual is asked to stand on the weighing machine. The readings of the machine should be noted. While taking the weight, the individual should wear minimum garments. Reading of the weight should be noted down in Kilograms.

Measurement of Height

It can be done with the help of an Anthropometer or Stadiometer.

Procedure

The subject is asked to stand straight against the wall, with the back and head touching the wall, looking in forward direction. The measuring bar of anthropometric rod should be touched at the highest point of the subject's head (vertex point). The reading should be noted down in centimeters.

BMI Formula Calculator:
$$\frac{\text{Weight in Kg}}{(\text{Height in meters})^2}$$

BMI Calculation

BMI is a simple mathematical calculation which helps us to find out if an individual is normal weighted, over weighted or obese. BMI is calculated by dividing the weight of an individual by the square of the height which is expressed in kg/metre². World Health Organization (WHO) has recommended norms for categorizing an individual as normal weighted, under weighted or over weighted.

Table 2: BMI Calculation

Category	BMI(Kg/M ²)	
	From	To
Very severely underweight	-	15
Severely underweight	15	16
Underweight	16	18.5
Normal(Healthy Person)	18.5	24
Overweight	25	29.9
Obesity	30 and above	

In same way and with the same formula, but not judged on the basis of norms mentioned in the above table. Whatever the result comes after calculating the BMI is compared after preparing the percentile table of all the children falling under the same sex and age category.

Less than 5 percentile is under-weight, 5 to 85 percentile is normal, 85 to 95 percentile is over-weight and above 95 percentile is obese.

Waist-to-hip ratio (WHR)

The waist-to-hip ratio (WHR) helps us to find out the fat distribution by which we can help in evaluating the overall health of an individual. One who carries more weight around the middle than the hip may have higher risk of developing several health issues.

This is the ratio of the circumference of the waist and the circumference of the hip of an individual. This is calculated by dividing waist measurement with the hip measurement of an individual ($W \div H$). For example, if the measurement of the persons waist and hip is 76 cm and 97 cm respectively then his waist-hip ratio will be 0.78.

World Health Organization (WHO) has recommended the given norms for WHR:

Table 3: WHR Table

Men	Women	Health Risk Level
.95 or less	.80	Low Risk
.96 to 1.0	.81 to .85	Moderate Risk
1.0 or more	.85 or Higher	High Risk

Measurement procedure

While taking the measurement of an individual's waist, he/ she should be asked to stand straight and breathe out. Then place the tape around the waist just above his or her belly button and take the measurement in centimeters. In the same manner, place the tape around the hip of an individual, where his or her hip is widest then take the measurement.

Conclusion

Mathematical Measurement Evaluation and Test in Physical Education are more comprehensive measurement tools for testing the learner educational performance. It represents a continuous process and overall efforts for knowing about the progress of the learner. It provides quantitative as well as qualitative description of the outcomes of a Physical learning process. It helps knowing about the changes in the behavior related to the domains of the learner's behavior as a result of the process of Physical learning. It provides greater scope and flexibility for the use of variety of means and techniques rather than limiting itself to certain tests or conventional examinations. It represents a comprehensive pain of better testing and measurement for inquiring into the quality of the output in the light of the set of objectives.

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