Development of Physical Fitness Measurement on Senior High School Students

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Abstract

AIM: This study aims to provide another alternative for physical education teachers in measuring the physical fitness of high school students by measuring the tests of jumping, push-ups, and sit-ups and determining the correlation between the three activities as a condition for determining physical fitness.

MATERIALS AND METHODS: The random sampling method used to select respondents, and as a result, as many as fifty-two students chose as respondents. The device included a leaping test, push-ups, sit-ups, and a 2400 m run test.

RESULTS: The results showed that the validity coefficient between X1 and Y is r = -0.352. The push-up meets the requirement to measure the endurance of blood circulation and breathing with the acquisition of r = -0.007. Sit-ups measured the endurance of blood circulation and respiration with the acquisition of r = -0.714. The relationship between the combined degree of ability X1, X2, and X3 with a run of 2400 m obtained r = 0.47. The reliability coefficient for X1 was r = 0.82, X2 was r = 0.83, and X3 was r = 0.85.

CONCLUSION: It concluded that the jump test, push-ups, and sit-ups together could be used as another alternative to measure high school students’ physical fitness through facilities and infrastructure compared to the 2400 m running test.

Introduction

Sports activities endeavor to improve one’s health and physical fitness and develop a quality Indonesian society. Physical activity is a vital requirement for every human being to preserve their physical condition and health (Mubarok et al., 2014) [1]. It is not only the government’s responsibility but also the community’s.

Physical fitness is a person’s ability to carry out daily activities with optimal results without fatigue and still has energy reserves to carry out other activities. Muscle strength, endurance, flexibility, explosive power, balance, strength, coordination, and accuracy are all components of fitness. The body will surely be more comfortable carrying out an activity if these elements fulfilled in every human being’s physique (Mukhils et al., 2020) [2]. Physical fitness affects one’s cognitive abilities, such as cognitive flexibility, working memory, and decision-making, advantageous to daily activities, motor development, and social connections (Bile and Suharharjana, 2019) [3].

At present, sports knowledge and skills included in the education curriculum, even in school activities. Sport, physical, and medical education (Penjasorokes) provide the senior high school students with the knowledge about physical movement in sports and health factors that influence it, skills in carrying out physical movements in exercising, and maintaining their health. Penjasorokes referred to the aspect of an overall educational process that uses activity encouragement to develop fitness, organic, neuromuscular, strength, intellectual, and emotional control (Depdiknas, 2003) [4]. It functioned to educate through physical movement (Prayoga et al., 2020) [5] and assist students in improving their freshness and health by introducing inculcating positive attitudes and health and basic movement abilities from physical activity (Radifan and Aziz, 2019) [6]. Penjasorokes has an essential role in students’ daily activities, because good physical fitness needed in the learning process at school and to accomplish achievements outside of school (Sari, 2020) [7]. Physical education is needed to develop students’ potential by doing physical activities that impact the development of student’s critical thinking and knowledge.

Measurement of physical fitness is one of the efforts to increase stamina and health status by doing physical activity and physical exercise or sports Ervina et al. (2020) [8]. This measurement aims to make it easier for a coach, teacher, and all sports players to classify someone in making a program made when they want to determine the achievements obtained by each coach and teacher (Gumantan, 2020) [9]. It is a science and technology developed in sports to...
evaluate the performance of athletes then be treated with specific treatments to develop sports performance. In the educational process, tests defined as a data-gathering instrument and a basis for evaluation in the form of tasks that students must complete providing values regarding behaviour. Strength tests, speed tests, balance tests, VO2 max testing, flexibility tests, hand and foot-eye coordination tests, endurance tests, power tests, response tests, and agility tests are some of the physical condition tests or assessments done through sports (Gumantan, 2020) [9]. Through tests, teachers can obtain accurate information about the condition of their students, if they are at low, medium, or high physical abilities. Teachers can use tests to get reliable information about their student's physical abilities, whether low, medium, or high level. As a result, tests and measurements used as an entire discussion unit. In physical education and sports, the term measuring has a variety of meanings and applications.

The development of sports science begins from the sciences that study humans. This scientific development aims to develop physical education teaching materials for physical fitness using skipping movement tests, push-ups, and sit-ups with a 2400 m run. The steps of development are the actions taken to tackle a research challenge so that the problem may be solved and a product created (Mukhls et al., 2020) [2]. The aim of this study to examine if skipping, push-ups, and sit-ups use to predict the level of physical fitness for a 2400 m run. Furthermore, this research aims to learn more about the relationship between physical education tests and a 2400 m running test by employing skipping, push-ups, and sit-ups as the foundation for producing test material.

Materials and Methods

The development research design utilized in Penjasorkes to answer challenges in the education and learning process. The inferential approach applied in this research, which resulted in a correlation. The research conducted on first-grade senior high school (SMA) students in Bukittinggi City, West Sumatra Province, Indonesia. In this study, 469 people separated into 18 groups and came from three senior high schools. Purposive random sampling used to select a sample of up to 10% from each class. The instruments used to 2400 m running test, skipping, push-ups, and sit-ups test. The 2400 m run test was held in the Lapangan Ateh Bukittinggi, while the skipping, push-up, and sit-up tests carried out at their respective schools in each Penjasorkes lesson. The data analyzed with regression.

Furthermore, the data analyzed using both simple and multiple regression with a significance level of 0.05. To determine the validity of the test, concurrent validity used by correlating the results of the skipping, push-ups, and sit-ups tests with the results of the 2400 m run test. Meanwhile, reliability carried out using the test re-test technique, where the calculation uses the product-moment correlation formula.

Results and Discussion

Results

Based on the data obtained for each variable:

a. 2400 m run test, the highest score 1,419 s, and the lowest score 851 s. It also showed that the average value 1084.37, with a standard deviation of 131.242. The median obtained 946.96, and the modus 1016.

b. Skipping test measured in units of the number of successes with the highest score 83.83 and the lowest score 33.33. The average value 58.46 with a standard deviation of 16.66, for the median of 64.44, and the modus 49.17.

c. Push-Up test measured in units of the number of successes with the highest score 28.16 and the lowest score 11.16. The average value is 18.74 with a standard deviation of 4.68, with a median of 17.80, and the modus 16.5 and 16.67.

d. Sit-Up test measured in units of the number of successes with the highest score 22 and the lowest score 7.16. The average value 14.76 with a standard deviation of 3.79, with a median of 15.69, and the modus 13.83 and 20.67.

Normality test (liliefors test)
The analyse showed that the data distributed normally. It showed in Table 1.

| Variables | L_0 | L_1 | Distribution |
|-----------|-----|-----|--------------|
| X1        | 0.0520 | 0.123 | Normal |
| X2        | 0.0728 | 0.123 | Normal |
| X3        | 0.0841 | 0.123 | Normal |
| Y         | 0.1123 | 0.123 | Normal |

Homoscedasticity test (bartlett's test)
The result showed, all variables homogeneous. It showed in Table 2.

| Variables | X² Result | X² Table | Population variance |
|-----------|-----------|----------|---------------------|
| X1        | 0.75      | 5.59     | Homogeneous         |
| X2        | 1.06      | 5.59     | Homogeneous         |
| X3        | 0.75      | 5.59     | Homogeneous         |
| Y         | 2.77      | 5.59     | Homogeneous         |
Statistical hypothesis testing

a. Correlation and regression skipping test (X1) with 2400 m run test. The result of correlation is shown in Table 3, and the result of regression is shown in Table 4.

Table 3: The result of correlation skipping test (X1) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 61133267.77| 118321.93   | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21354       |         |
| Square error | 8                    | 21334      | 21334       |         |

The results showed that the skipping test (X1) obtained a negative value of −0.352 or the correlation between X1 and Y is an inverse correlation. The results contradicted, but the hypothesis can accepted due to the skipping movement score data taken by number of successes. In contrast, the 2400 m running score data taken by the time it takes.

Table 4: The result of regression skipping test (X1) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 820169.86  | 16003.39    | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

b. Correlation and regression push-up test (X2) with 2400 m run test The result of correlation for the push-up test (X2) with 2400 m run test is shown in Table 5 and result of regression is shown in Table 6.

c. Correlation and regression sit-up (X3) with 2400 m run test. The result of correlation for sit-up test (X3) with 2400 m run test is shown in Table 7 and result of regression is shown in Table 8: Correlation of each variables skipping test (X1), push-up (X2), sit-up (X3), and with 2400 m run test. A multiple regression correlation analysis conducted to determine the relationship between the skipping, push-up, sit-up, and the 2400 m run, which gives the following description (Table 9).

Table 5: The result of correlation push-up test (X2) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 170872.02  | 170872.02   | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

The relationship between skipping test, push-up, and sit-up with a 2400 m run obtained an r = 0.47. It means a significant correlation between X1, X2, and X3 with Y (Table 10).

Table 6: The result of regression push-up (X2) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 820169.86  | 16003.39    | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

Furthermore, the sit-up movement (X3) score obtained a negative value of −0.164 which means that the correlation between the sit-up movement and the 2400 m run is also inverse correlation. The result showed the push-up movement relatively lower, namely, r = −0.007. It showed a non-significant correlation between X2 and Y.

Table 7: The result of correlation sit-up (X3) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 170872.02  | 170872.02   | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

Table 8: The result of regression sit-up (X3) with 2400 m run test

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 820169.86  | 16003.39    | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

The relationship between skipping test, push-up, and sit-up with a 2400 m run obtained an r = 0.47. It means a significant correlation between X1, X2, and X3 with Y (Table 10).

Table 9: The result of correlation multivariat

| Variable | Degree of Freedom (df) | Sum square | Mean square | F-ratio |
|----------|------------------------|------------|-------------|---------|
| Total    | 52                     | 170872.02  | 170872.02   | 1.03    |
| Regression | 1                     | 61133267.77| 61133267.77|         |
| Residual  | 50                     | 903499.02  | 18069.98    |         |
| Non-Sig. | 8                      | 170872.02  | 21334       |         |
| Square error | 8                    | 21334      | 21334       |         |

It means that the 2400 m run could be the standard measure of endurance, blood circulation and breathing, predicted through skipping, push-ups, and sit-ups. These three movements can used as a test to measure circulatory and respiratory endurance.

Table 10: The result of correlation between each variable

| Variable | X1 | X2 | X3 | Y |
|----------|----|----|----|---|
| X1       | 0.256 | 0.352 | 0.288 | 0.007 |
| X2       | 0.256 | 0.007 | 0.288 | 0.007 |
| X3       | 0.288 | 0.288 | 0.288 | 0.47 |
| X1, X2, X3 | 0.288 | 0.288 | 0.288 | 0.47 |

However, one form of this test cannot measure endurance, and further, research needs to conduct practically.

Discussion

Product development has an element of interactivity so that the delivery of material can be appropriately conveyed and effectively and can achieve the maximum learning objectives (Arief et al., 2021) [10]. Development of physical fitness measurement using skipping, push-up, and sit-up by running 2400 m.

Table 10: The result of correlation between each variable

| Variable | X1 | X2 | X3 | Y |
|----------|----|----|----|---|
| X1       | 0.256 | 0.352 | 0.288 | 0.007 |
| X2       | 0.256 | 0.007 | 0.288 | 0.007 |
| X3       | 0.288 | 0.288 | 0.288 | 0.47 |
| X1, X2, X3 | 0.288 | 0.288 | 0.288 | 0.47 |

Conclusion

Based on the facts above, it concluded that the skipping test, push-up test, and sit-up test could be utilized as an alternative to the 2400 m running test to assess high school students’ physical fitness through the utilization of facilities and infrastructure.
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