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Development of Ability Testing Instruments Based on Sensor Technology

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Abstract

This study aims to develop a sensor technology based agility test instrument. The research method used is research and development (research and development). Development research subjects were divided into two groups. Small-scale group trials consist of 10 students and large-scale group trials consist of 21 students. The results showed that the sensor technology-based push-up test instrument had a 94% validity test and sports measurement expert level and 75% IT expert validity so that it could be used appropriately. The level of reliability in small group trials amounted to 0.994 and small groups of women amounted to 0.988 with the High category. While the large group trials amounted to 0.998 and the large group of women 0.946 with a high category so that it can be held accountable for the tools carried out in large group trials and small groups have a High reliability category. The implication of this research is the development of test instruments based on sensor technology that can be used as a valid, effective, and practical test aid.

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INTRODUCTION

Sport is a form of systematic activity aimed at shaping, fostering, and developing physical and spiritual as well as social potential. Sport is a necessity to keep the body healthy, sport can also play a role in fostering and developing individuals in a planned, tiered, and sustainable way through competition to achieve achievement. Sports tests and measurements are a process of collecting information from something that is being measured, the results can be in the form of data or measurement results that are used as material for evaluating sports coaching. The physical condition test reflects the ability of each athlete so that the initial ability level of the athlete in the sport can be known.

Performing sports tests and measurements, coaches use tools to facilitate the process of monitoring the development of the athlete's physical components, take notes and serve as the basis for diagnosing athlete's weaknesses, and can determine training programs applied to certain sports. Manufacturers of testing aids for physical conditions are currently still controlled by foreign countries. To bring in aids from outside the country requires a lot of money and becomes an obstacle. Limited funds have resulted in carrying out tests and measurements currently still applying the manual recording method with a stopwatch and human resources. Knowing the level of agility athletes need to do tests and measurements, one of which is an agility test. Agility is a physical condition that also plays a role in sports skills, even in certain sports, such as football, futsal, volleyball, badminton, martial arts, and others, so that the agility factor becomes dominant in sports. As a physical component, agility is an element of speed, strength and coordination of motion, which includes elements of strength and endurance (Suharno, in Sinta.UNUD, 2018). Agility is a skill that is needed by every athlete in sports and is an important factor to improve athlete achievement. According to Harsono in Sinta UNUD (2018), agility tests can be carried out in various ways, namely: running back and forth (zig-zag run), squart trust, running obstacles and running back and forth (shutlle run), side-step test and according to the journal. Advances in Health Sciences Research, volume 23 (2019) Various agility instruments have been created such as Side Step Test, Illinois Agility Run, Shuttle Run Test, Zig Zag Test, TTest, Agility Cone Drill, Arrowhead Drill, 20 Yard Agility, Balsom Agility Test, and others. The shuttle run is a type of exercise that emphasizes speed, endurance, and accuracy. The shuttle run exercise is also intended to train agility, body control and acceleration when running by changing direction or position. The shuttle run exercise is running back and forth at the same predetermined distance or you can change the distance according to your type of exercise. This shuttle run test can be used as a test for agility in several sports. Tools for conducting shuttle run tests are very few and are produced by foreign countries. The implementation of this test is also still using the conventional shuttlerun test or carried out by the manual method.

Problems that have occurred in the implementation of the conventional Shuttle run test are often errors in the process of calculating the Shuttle run obtained. The process of calculating the conventional shuttle run test is done manually through the observations of each test companion. This can lead to errors in the calculation process caused by subjective supervision, meaning that it can be influenced by the opinions or views of each test companion. The use of a conventional shuttle run test is prone to differences in the calculation of the number of shuttle runs performed by more than one test supervisor. Instrument is a tool used to collect, examine, investigate a problem. Research instrument can also be interpreted as a tool to collect, process, analyze and present data systematically and objectively with the aim of solving a problem or testing a hypothesis. According to Arikunto (2000:134), he argues that research instruments are tools that are selected and used by researchers in carrying out activities to collect data so that these activities become systematic and facilitated by them. The research instrument is a measuring instrument used to obtain quantitative information about characteristic and objective variables. In line with this, Widoyoko (2012: 51) argues that the instrument is a tool used by researchers to collect data by taking measurements. In the Journal of Educational Research and Evaluation Volume 21, (2017:118) An instrument is a tool that meets academic requirements as a tool to measure a measuring object or collect data about a variable. These instruments can be used to collect research data.

The test is one of the tools used to measure and collect information on the characteristics of an object (Widoyoko, 2012: 50). Characteristics of objects can be in the form of skills, knowledge, talents and interests both owned by individuals or groups. This is in line with the opinion of Ismaryati (2011: 1) which states that the test is a tool used to obtain information about individuals or objects. As a means of gathering information or data, the test must be specially designed. The spe-

cificity of the test can be seen from the form of the test used, which must be in accordance with the established criteria. These specificities differ from one test to another. This test can be in the form of written questions, interviews, observations about physical performance, checklists, and others. According to Riduan in the Journal of Sports volume 3 (2017) The test is a process of collecting information to obtain data, where the data can be used for evaluation. The test as data collection is a series of questions/exercises used to measure the knowledge skills, intelligence, abilities, or talents of individuals. Physical fitness is defined as the ability of a person's body to perform daily work tasks without causing significant fatigue (Journal of Education and Culture Volume 20, 2014: 224). Physical fitness is very important in supporting activities of daily life. Everyone's level of physical fitness is different. Physical fitness is a person's condition at a certain time. Physical fitness is the body's ability to adapt (adaptation) to physical loading without experiencing significant fatigue (Agus, 2018: 85). Physical fitness is a reflection of the ability to function systems in the body that can realize an increase in the quality of life in every activity (Bafirman, 2010: 7).

The success to achieve fitness is determined by the quality of the exercise including the training objectives, the selection of the exercise model, the training facilities and the dose of the concept exercise. In sports science, physical fitness means having a level of physical ability and health to carry out activities well (Zaccagni, et.al., 2014: 2). According to Syahara (2011:162), physical fitness is defined as the body's ability to carry out physical and psychological activities without experiencing extreme fatigue and still having energy for other physical activities to fill spare time. Ciptadi in the Epidemiology Periodic Journal, Vol 4 (2016), explains that excellent physical fitness will have a positive impact on increasing the ability of blood circulation and heart work, increasing strength, flexibility, endurance, coordination, balance, speed, and body agility. will have an impact on increasing the ability to move efficiently and increasing the ability to recover organs after exercise as well as increasing the ability of the body's responsiveness. Agility is one aspect of physical fitness that is used as a benchmark in measurement tests in the implementation of athlete tests and various other tests. for the timer (Journal of Sports Window, 2017).

Agility is a physical condition that also plays a role in sports skills, even in certain sports, such as football, futsal, volleyball, badminton, martial arts, and others, so that the agility factor becomes dominant in sports. As a physical component, agility is an element of speed, strength and coordination of motion, which includes elements of strength and endurance (Suharno, 1993). Agility is often equated with the ability to coordinate movements, skills, the ability to direct muscles or the speed of movement. Agility is a person's ability to be able to change direction quickly and precisely when moving without losing balance (Jurnal Keolahragaan, 2014).

METHODS

This study uses research and development methods. Research and development method or (Research and Development) is a research method used to produce certain products and test the effectiveness of these products. A certain product is produced through needs analysis research and to test the effectiveness of the product so that it can function in the wider community, research is needed to test the effectiveness of the product.

RESULTS AND DISCUSSION

The product is a shuttle run test instrument based on sensor technology for large group subjects. Large group scale trials were conducted on 21 PB fostered children. Sungai Tenang Junior and PB's fostered children. Arham Junior. The small-scale trial consisted of 12 boys and 9 girls. The data obtained is then processed so that its reliability is obtained by looking at the correlation between the test and retest. The reliability test data on this tool can be seen in the appendix and the reliability of this tool is used to see the level of reliability of the tool using the small group test method and product moment statistical calculations, the following results are obtained:

Table 1. Frequency Distribution of Boys' Small Group Children

Kelas Interval	f. absolute	f. relatif	Kategori
< 12.10	0	0%	Sangat baik
12.11 – 13.53	2	17%	Baik
13.54 – 14.56	10	83%	Sedang
14.58 – 16.39	0	0%	Kurang
16.40 >	0	0%	Sangat Kurang
Jumlah	12		100 %

The results of the men's small-scale trial showed that there were no children who got a shuttle run score between <12.10 minutes in the

very good category, as many as 2 children got a shuttle run score between 12.11 – 13.53 minutes in a good category, as many as 10 children got a shuttle run score. between 13.54 – 14.56 minutes in the medium category, no child got a shuttle run score between 14.58 – 16.39 minutes in the less category, and no child got a shuttle run score between 16.40 > in the very poor category.

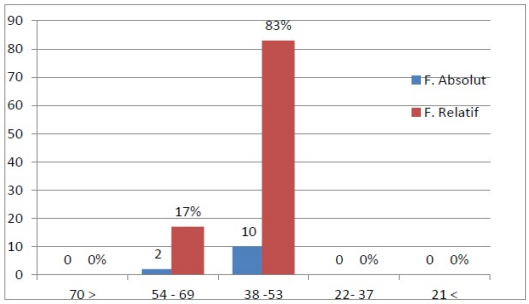

Figure 1. Histogram of Frequency Distribution of Tests Shuttle run for Men's Large Group.

Table 2. SPSS Processed Table for Normality of Test Data for Large Groups of Men

Descriptive Statistic					
Tes shuttle run	N	Maen	Std. Deviation	Minimum	Maximum
	12	14,005	0,4698	14,51	13,12

This Research and Development produces a shuttle run test instrument product based on sensor technology. This tool is named shuttlerun multimode prototype 1 which has a working system by combining two ultrasonic sensors integrated on the microcontroller chip. The first sensor is placed on a 50cm high support pole which functions to detect movement when the tester passes the sensor to know that the tester passes through the post as the shuttlerun test is carried out. The data obtained from the sensor capture will later be processed into the results of the shuttle run calculation through the program application display and stored in the form of an excel file format. This tool has 2 modes of shuttle run test, the first mode is the shuttle run test with a distance of 5-10-5 and the second mode is the shuttle run test with a distance of 5 meters back and forth up to 4x rounds. Based on the test results that have been processed and analyzed, it can be concluded that the sensor technology-based shuttle run test instrument can be used as a tool for calculating the shuttle run test that is valid, effective in its use, and helps the practicality of managing the shuttle run measurement results.

CONCLUSION

Based on the results of research on the development of a shuttle run test instrument based on sensor technology, a prototype of a digital-based shuttle run measuring instrument was obtained using an ultrasonic sensor integrated with the Arduino Uno microcontroller so that the shuttle run test data can be displayed on the LCD screen and laptop. The prototype results are intended as the starting material for the field of science on sports measurement tests that can be developed towards a digital-based industry 4.0.

This completed tool will be very useful for several parties, which can assist in the data collection process for PJOK trainers and teachers. This tool can be used in institutions that prepare achievements in the field of sports. If the tool is used within the scope of academics, especially schools and campuses, it will be able to assist in learning and increase scientific knowledge in the fields of evaluation, tests and sports measurement.

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