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Concurrent Validity and Reliability of Footwork Ability Test Based on The Internet of Things Technology for Badminton Player

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Abstract

The purpose of this study is to evaluate the device of footwork ability test based on the Internet of Things technology for badminton players, an online tool for testing badminton players' agility, for validity and reliability. The data collection method used is by testing two devices on samples. A side step test, an agility test kit, and a footwork ability test were used to evaluate several badminton players. Members of the student activity unit at Universitas Pendidikan Indonesia who play badminton make up the research sample. Each sample carried out the test 2 times, the first test with a side step test (Edgren) and the second test with a footwork device test. The footwork ability test is a valid and reliable way to gauge a badminton player's agility. Based on the test results of the two test tools (footwork ability test based on the Internet of things and side step test) conducted on 12 players, the validity level of the footwork ability test based on the Internet of things is 0.93 and a reliability of 0.98. So it can be concluded that the device of footwork ability test based on the Internet of Things technology for badminton players' validity and reliability falls into the good category, making it recommended as a footwork agility test tool for badminton players.

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INTRODUCTION

Badminton is one of the world's favourite sports in great demand (Williyanto et al., 2021). This sport is played using a racket and shuttlecock by two players for the singles category and four for the doubles category. Even though it is in great demand, becoming a reliable badminton player playing this sport is challenging. To become a reliable badminton player, one of the physical skill requirements that must be possessed is agility (Kusnadi et al., 2022). Agility is a very important element in most sports on the field (Sheppard et al., 2006). Almost all sports, including badminton, require agility as a benchmark between one player and another (Baskoro, 2020).

To find out the level of agility of badminton players, we need a tool to measure the agility of players. The test is one way that can be done to obtain information using measurement through a certain set of rules to achieve goals that can result in proper and correct follow-up and evaluation (Edmizal & Soniawan, 2020). The nimbleness test in badminton is exceptionally fundamental, considering that a player must promptly return to the center position after hitting the shuttlecock so that he isn't as well cleared out behind in pursuing the shuttlecock within the another shot (De França Bahia Loureiro & De Freitas, 2016).

A test tool must have validity if it is used to measure a certain object. Validity is the definition of how far the accuracy of a concept or tool is measured in quantitative studies (Heale & Twycross, 2015). So it is important to test whether the test kit is "valid" and "reliable" to explore the information you want, or not even according to what is intended. According to (Mohamad et al., 2015), the validity test is divided into three types: validity criteria, content, and constructs. Besides being valid, a measuring instrument must also have good reliability. Unwavering quality is an record that appears the degree to which a measuring gadget can be trusted or depended upon (Edmizal et al., 2019).

The Side Step Test is an agility measurement tool often used to determine a player's agility in sports (Brian T. McCormick, 2014). The purpose of the side step test is to measure the agility of the player's movement from the right side to the left side and so on repeatedly. Harry D. Edgren was the first to introduce the side step test to the general public in 1932 (Raya et al., 2013). Recently, a new innovative test tool has been developed to measure the agility level of a badminton player's footwork, namely the Footwork Ability Test.

The Web of things based footwork capacity test is an deftness device planned to degree the foot nimbleness of badminton players. This tool is equipped with a camera that can record the footwork of connected players in real time on a smartphone via an Internet of Things-based application platform (Setiawan, 2022). The purpose of this tool is to randomly measure the agility of the player's movement from the right side to the left side and so on, which is operated by humans.

Several related studies that are relevant to this research include (Edmizal & Haryanto, 2022), (Zulkapri et al., 2020), (Badruzaman et al., 2021), and (Kamuk, 2020). They have tested several instruments and test kits that have been developed before. However, from the studies above, there has yet to be any research on testing the validity and reliability of the IoT-based Footwork Ability Test. So analysts feel it is imperative to test the legitimacy and unwavering quality of the Web of Things-based Footwork Capacity Test. This inquire about is anticipated to be a reference for science, particularly in sports.

METHODS

The stage of this research is to do a test which consists of a side step test and then a footwork ability test. Previously the testees had been given instructions regarding the procedure and how to carry out the test and also given adequate rest time at intervals between the side step test and the footwork ability test. Then the results of the two tests are recorded to be used as material, which will later be used to determine the validity and reliability of the two measuring instruments. The population in this study were badminton players who were members of the Badminton Team Universitas Pendidikan Indonesia. The total sample of the research is 12 players using a cluster sampling technique.

This research is a quantitative descriptive study using test and measurement techniques. The research instrument used was the side-step agility test by Harry D. Edgren and the IoT-based footwork ability test.

Figure 1. Side Step Test Procedure

Starting from the testee's position in the middle line in a ready position and focused on receiving a signal. After the command starts, the tester moves the foot towards the right line until the right foot reaches the outer line. Then proceed with shifting as fast as possible towards the left line until it reaches the far left line. Do it repeatedly until the test officer sounds the "stop" command. One point is given if the testee succeeds in stepping to the right or left end of the line, then record the number of times the testee succeeds in doing so.

Then the next test is the Footwork Ability Test. In this test procedure, the player is prepared to wait for a signal displayed by a device designed to display commands. Command signals are displayed through the light instructions on the testee's right and left. As soon as the light is on, the testee must swing the racket over the light sensor to change the light to the other direction.

Picture 2. Footwork Ability Test Procedure

The data collection technique uses action tests, while data analysis uses validity and reliability level testing. The steps taken can be seen in the **Figure 3.**

The validity of the research uses criteria-related validity. In this case, the Footwork Ability Test acts as a "predictor" and the Side Step Test as a "Criterion". Validity is obtained by correlating the predictor score with the criterion score, where the result is a correlation coefficient or correlation index with the product moment correlation technique (Fraenkel et al., 2012), with the formula:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

r xy = Correlation coefficient
N = Total of respondents
X = Score of each item on the instrument
Y = Score of each item on the criterion

The coefficient esteem over is called the legitimacy coefficient, where the legitimacy coefficient esteem changes from +1.00 to -1.00. The coefficient esteem of +1.00 demonstrates that the subject has moderately the same score on the instrument and basis tests. Be that as it may, in the event that the legitimacy coefficient is 0, there's no relationship between the instrument and the criteria (Syamsuryadin & Wahyuniati, 2017). The higher the esteem of the legitimacy coefficient of the instrument, the superior the instrument.

RESULTS AND DISCUSSION

The agility test results generally show that the average value of the test shows a different value from one another. As shown in the **Table 1.**

Table 1. Data Description

ITEM TEST	SCORE				
	Min	Mean	Max	SD	N
FAT	27	34	39	3.9	12
SSD	58	87.2	117	19.3	
FAT (Footwork Ability Test)					
SSD (Side Step Test)					

Based on the above data, it can be seen that the average values obtained from the 12 samples for the footwork ability test were 34, while for the side step test, the scores were 87.2. The minimum score for the footwork ability test is 27, while the side step test is 58. The maximum value for the footwork ability test is 39, while the side step test is 117. The standard deviation value for the

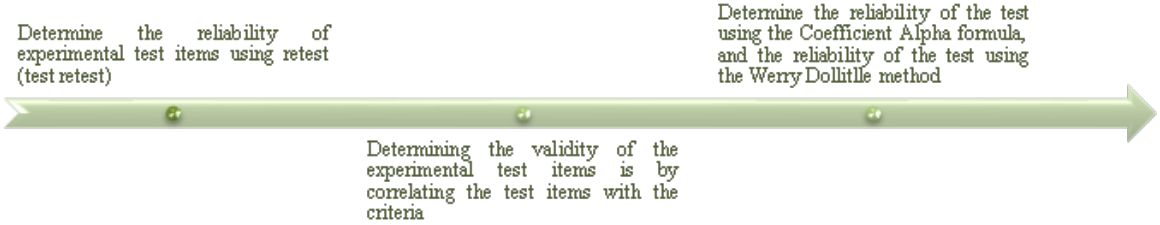

Figure 3. Channel Research

footwork ability test is 3.9, while the side step test scored 19.3.

The way to calculate the level of instrument validity is by concurrent validity, which is to correlate the scores of the test results using the Footwork Ability Test (FAT) measuring instrument with the test results using the Side Step Test (SST) measuring instrument as a criterion using the formula, with the correlation technique product moment. The following is the result of processing the footwork ability test validity data against the side-step test:

Table 2. Validity Test Results

Validity Score	Side Step Test
Footwork Ability Test	r = 0.93

From the **Table 2** above, the level of validity of the footwork ability test against the side step test tested is included in the very high category. According to (Wira Yudha Kusuma et al., 2015), if r count ≥ r table (2-sided test with sig. 0.01), then the instrument has a significant correlation (declared high validity). If r count ≤ r table (2-tailed test with sig. 0.01), then the instrument is not significantly correlated (declared invalid).

Meanwhile, based on the reliability test conducted using the Spearman-Brown formula, a reliability score of 0.98 was obtained. According to Sekaran, a reliability score of less than 0.6 is included in the poor category, while 0.7 is acceptable, and above 0.8 is included in the good category (Sekaran & Bougie, 2016).

The footwork ability test based on the internet of things technology for badminton players is an agility tool designed to measure the foot agility of badminton players. This tool is equipped with a camera that can record the footwork of connected players in real time on a smartphone via an Internet of Things-based application platform (Setiawan, 2022).

Based on the research results, the validity of the footwork test device reached the "very good" criterion. According to (Cureton, 1951), test validity is how well a test does the job it is supposed to do. The reliability criteria for the footwork test are also "good", therefore this test tool can measure well and specifically the player's abilities in that sport. So this statement answers the opinion of (Loureiro Jr et al., 2017) that existing agility tests are generally easy to use and their application is very simple, but often do not contain sport-specific movements that reflect the real actions contained in that sport. Because the instruments in research have a huge influence in determining the success of research, especially quantitative research (Anam, 2017).

Apart from validity, a measuring device must have reliability, and this reliability is related to the accuracy of the measurement results. A measuring device has a high reliability value or can be trusted if the measuring device is stable. Accuracy and reliability are absolute requirements that must be met in the validity of agility measuring devices. If you want to know the agility of a badminton player, then a valid test to measure agility is an agility test which includes elements or components of agility such as basic multilateral movements and main physical components (Rahman, 2016). Therefore, these basic movement components and physical components are the main references used in badminton player agility tests, including in the Footwork ability test.

CONCLUSION

The conclusion of this research is : Footwork ability test berbasis internet of things merupakan alat test kelincahan yang dibuat untuk mengukur kelincahan kaki pemain bulu tangkis. Alat ini dilengkapi kamera yang dapat merekam gerak kaki pemain yang terkoneksi secara real-time pada smartphone, melalui platform aplikasi berbasis internet of things (Setiawan, 2022) Based on the results of research that has been carried out, the footwork ability test has a good level of validity and reliability, so based on these results, this test device can be recommended as a footwork agility test tool for badminton players.

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