Innovation in Reactive Agility Test Measurement of Basketball Performance: Content Validity and Inter-Rater Reliability

SeptianaWijayanti[a], Tomoliyus[b], IrmantaraSubagio[c],Fauzi[d]

[a,b,d]Department of Sport Science, Yogyakarta State University, Indonesia
[c]Department of Sport Science, Surabaya State University, Indonesia
[a] septianawijayanti.2020@student.uny.ac.id, [b] tomoliyus@uny.ac.id,[c] irmantarasubagio@unesa.ac.id, [d] fauzi@uny.ac.id
Corresponding author:
Tomoliyus[b]
Yogyakarta State University, Indonesia Faculty of Sport Science
email: tomoliyus@uny.ac.id

Abstract: Basketball performances can be maximized if the athletes have good reactive agility abilities. So far, assessment using the reactive agility test could only be applied to volleyball, table tennis, rugby, and football, while basketball is still using the general agility test. The reactive agility itself is defined as the body's ability to change direction at high speed after receiving a stimulus. To assess the results of reactive basketball agility, a valid and reliable measuring instrument was needed. Therefore, this study aimed to test the content validity and inter-rater reliability of the basketball agility reactive test instruments that had been made.The methods used in this research were qualitative and quantitative, with several documents and seven experts as the participants. The first stage of the study was a qualitative method in the form of literature reviews. The second stage was data collection using the Delphi technique. A rating scale that ranged from 1 to 4 was applied in this study. The data analysis formula for this study was Aiken's, which aimed to test the content validity of the basketball performance reactive test instrument. Meanwhile, to test the inter-rater reliability, the study applied Alpha Cronbach's formula.This study produced a reactive agility test instrument for basketball performance with Aiken's coefficient of each aspect above 0.76 and reliability of 0.944. Therefore, it can be concluded that all aspects of the test instrument were valid, and the instrument has remarkable stability.

Keywords: inter-rater reliability, content validity, reactive agility, basketball performance

1. Introduction

Basketball is a sport that requires complex and fast performance (Raiola, 2017, Raiola Di Tore, 2017, Raiola, 2013, Gaetano, 2012, D 'elia et al, 2018, Altavilla, Raiola, 2019, 2015, 2014, Altavilla et al., 2018). Various components such as agility, speed, strength, and coordination are needed to overcome this complex performance (Sumaryanti, 2019). Agility is one of the essential bio motor components that must be mastered in basketball, which aims to initiate body movements, direction changes, and rapid acceleration/decelerations movements (Henry, G., Dawson, B., 2011; Lloyd RS, Read P & Olivier JL, 2013).

Almost all sport performances require agility (Haj-Sassi et al., 2011; Young et al., 2015), because it helps the body to move in all directions without losing balance (IssamMakhlouf et al., 2018; K Azmi and NW Kusnanik. 2018; Warren B. Young, at all., 2015). Over the years, agility has only emphasized motor work in general and not combining perceptual and decision-making processes when athletes change motions (Ooi et al., 2009; Young et al., 2002). Therefore, a combination of agility, perception, and decision making, which is called reactive agility, needed to be improved in training and assessment. The agility test is a test to assess open skills in sports that require dexterity and speed movements (QianGu, 2019)

Reactive agility is defined as the whole body's movement in changing its speed or direction after responding to a stimulus (Sheppard & Young, 2006). In other words, a reactive agility test is a combination of changes in directional velocity and stimulative components that involve information processing. The reactive agility test also consists of the perception component of the stimulus and decision returns in response to the movement of the tester.

2. Literature Review

Based on a journal review, the results of previous research indicate that the reactive agility test measuring instrument for table tennis has high validity and reliability (Tomoliyus et al., 2020). In addition, a sufficient validity was also found in the measuring instrument for the rugby reactive agility test (Gabbett& Benton, 2009) and the reactive football test (Veale et al., 2010). Likewise, the journal review results show that the reactive agility test was valid and reliable compared to traditional agility tests planned before (Inglis& Bird, 2016). It has been found that a valid agility test must adjust the stimulus according to its sports performance (Pojskic et al., 2019). Based on the research review results above, it was necessary to add more new findings regarding the agility test combined with the reaction after the stimulus in basketball. The urgency of this development was because the previous research on reactive agility tests for soccer and rugby performance showed that their

performances were different from the basketball and the table tennis performances. In addition, the football and basketball's width are also other, so that the speed changes the motion is also different.

Based on the importance of reactive agility in basketball and the research journal reviews, it showed that there was no reactive agility test for basketball. Therefore, it was necessary to develop a valid and reliable reactive agility measuring instrument for that sport. Validity is a central issue in the instrument development process, especially if it used to measure concepts/constructs that are still ambiguous, abstract, and cannot be directly observed (Hendryadi, 2017). This explains how far the accuracy the measurement tool would be made or developed to produce accurate data. There are three types of validity: content validity, criterion validity, and construct validity (Embretson, 2007). In the early stages, the development process of measuring instruments used content validity. This content validity is critical to aid the construct validity and give the readers and the researchers confidence in the measurement tools used.

Inter-rater reliability was used to test the agreement between two experts or observers. Besides, it is also used to show the consistency of the assessors so that the quality of measurement tools increases (Widhiarso, 2010). Testing the content validity and inter-rater reliability of the basketball performance reactive agility test was the aim of this study.

3. Material and Methods

3.1 Sampling and Data Attaiment

This research used a mixed quantitative and qualitative approach proposed by Borrego et al. (2009), with several documents and seven experts as the participants. The research procedure was divided into two stages as follows: The first stage included reviewing journal articles and assessing theories related to the existing agility test measurement tools to develop the conceptual and operational definitions of the reactive agility. In this stage, the approach used by the researcher was qualitative with the literature reviews method using narrative review (Ferrari, 2015; Perry, 2002). The second stage was when the researcher designed a basketball reactive agility test measuring instrument and arranged a basketball reactive agility test measuring instrument indicator. In this stage, the content validity test was conducted by collecting data using the Delphi technique (Cox et al., 2016; Green, 2014), where each expert did not meet in assessing the construction of reactive test measuring instruments agility that was specifically designed for basketball (Landeta, 2006, Yudhistira, 2020). The results of the several expert judgments in the first step were collected and analyzed qualitatively. The feedback was then returned to the experts to be assessed again until all the experts received it without any improvement needed (Fraenkel, 2011). The construction of a basketball reactive agility test measuring instrument was entirely accepted when the experts gave a mark.

As the instrument in this study, the questionnaire was distributed to the experts by which consisted of four lecturers of the Physical Condition of Yogyakarta State University and three regional level basketball coaches who at least have a bachelor's education. The expert judgment was carried out on April 7^{th} – 9^{th} 2021. The questionnaire used in this study was a structured questionnaire using a rating scale of 1 to 4. The research instruments were in the form of material expert assessment sheets and sports evaluation experts. The expert assessment sheet was used to find out how relevant are 1) the conceptual definition of reactive agility, (2) the stimulus aspect for respondents, (3) the distance aspect, (4) the movement aspect, (5) the test procedure aspect, and (6) the construction image aspect test.

4. Analysis of Data

The data from expert judgment were analyzed using Aiken's formula (**Aiken, 1980,1985**), where each aspect was calculated to find the content validity index using the following calculation:

$V = \Sigma s / [n (C-1)]$
$S = r - lo$
Lo = the lowest score
C = the highest score
R = number given by the assessor.

The results of the calculations and analysis using Aiken's formula approach would later be used to conclude the category of the validity. The categorization of content validity refers to Table V of Aiken's classification.

The inter-rater reliability test was used to see the agreement among experts or ratters in assessing every aspect of the instrument, using Cronbach's Alpha in SPSS Apps and Intraclass Correlation Coefficients (ICC). The results of Alpha Cronbach's and ICC calculations later would be used to classify the level of reliability into four categories according to Fleiss (1975), namely: Kappa <0.4: bad; Kappa 0.4-0.60: fair; Kappa 0.60-0.75: satisfactory/good; and Kappa> 0.75: excellent.

5. Result

Based on research published by the Journal of Science and Medicine in Sport (Sheppard et al., 2006) entitled "An evaluation of a new test of reactive agility and its relationship to sprint speed and change of direction speed," it is explained that the reactive agility test was designed for soccer, but this reactive test can also be used for sports in general. However, the application of this test to basketball would be less practical and less valid. This reactive test from Sheppard has a reliability of 0.878, inter-rater reliability of 0.904, and its validity has a statistical effect of 1.13. Within that research, a reactive agility instrument for basketball with content validity of 0.75, an average of 0.873, and reliability between ratters of 0.944 have been found. When compared to traditional agility tests for basketball, it was generally less valid for basketball performance because a stimulus does not precede conventional agility. Basketball requires an erratic stimulus and then moves quickly (Lockie et al., 2014)

If the test produced in this study was compared to the reactive agility test in football, it would be less valid, especially in the vast area of the field. The basketball court has a size of ± 28 x 15 meters while the size of the soccer field is ± 105 × 68 meters, which means that the reactive agility test distance for soccer (10 meters) is too long when applied to basketball. Therefore, modifications were made to the test distance of 8 meters.

The superiority of this study results with the previous existing tests lies in the suitability of the test material with the basketball performance. However, this test needed to be tested directly to determine the reliability of the test. Below is the construction of the reactive basketball agility test that has been made:

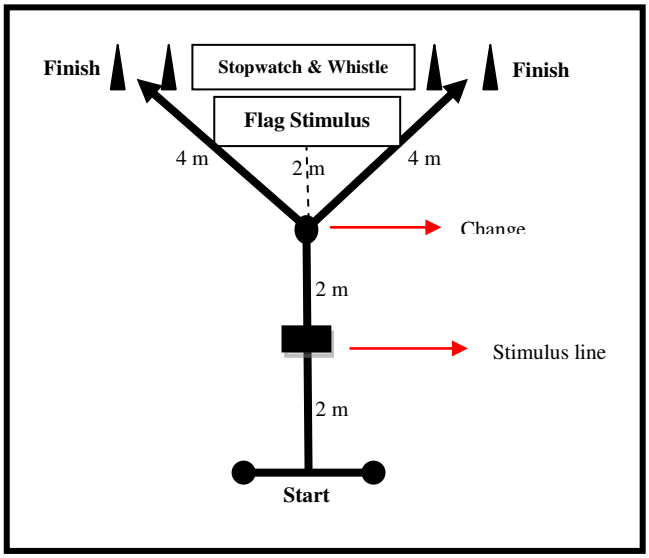

Figure 1. Construction of the Basketball Agility Reactive Test

Test Procedure
Tools:
- Cone
- Stopwatch
- Flag
- Blank and stationery

The procedures for implementing the reactive agility test for basketball performance are as follows:

1. The testee does a sufficient warm up.
2. The tester provides examples of implementation.
3. The testee is allowed to try once.
4. After the testee understands, the test begins with the testee standing behind the start line, waiting for the whistle as a signal to start the test.
5. When the whistle is sounded (at the same time the tester turns on the stopwatch), the testee runs as fast as possible across the stimulus line (the first 2 meters) and continues running until the line changes direction (the next 2 meters) in response to the stimulus given.
6. After the testee enters the stimulus line, the testers provide the stimulus by raising the flag to the left or right.
7. When the testee sees the stimulus, the testee changes direction (in front of the line changing direction) according to the direction of the flag.
8. The testee continues running (the next 4 meters) as fast as possible to the finish line (simultaneously, the testers turn off the stopwatch).

9. Time is recorded per second.
10. The test is carried out four times (2 to the right, 2 to the left), and the average time of the test will be taken.

Scoring
The test will fail if:
1. The test begins before the signal starts or before the sound of a whistle from the tester.
2. The testee does not run to the finish line.
3. The testee is wrong in responding to the stimulus.

5.1Aiken's Validity Test Results

Six essential aspects were assessed from the basketball reactive agility test measuring instrument by experts: (1) the conceptual definition of reactive agility, (2) stimulus for respondent, (3) distance, (4) movement, (5) test procedures, and (6) the clarity of the test construction image. If the assessment given is getting bigger, the tests arranged would be more relevant. On the other hand, if the score given is decreasing, the tests set are increasingly irrelevant. The scores given by the expert judgment were collected to be analyzed quantitatively using Aiken's formula. The following results from Aiken's validity test are presented in Table 1.

Table 1. Aiken's validity test results

Assessor	Aspect 1		Aspect 2		Aspect 3		Aspect 4		Aspect 5		Aspect 6	
	Score	s	Score	s	Score	s	Score	s	Score	s	Score	s
A	4	3	4	3	4	3	4	3	4	3	4	3
B	3	2	3	2	3	2	3	2	3	2	3	2
C	4	3	4	3	4	3	4	3	4	3	4	3
D	4	3	4	3	4	3	4	2	3	2	4	3
E	3	2	3	2	3	2	3	2	3	2	3	2
F	4	3	4	3	4	3	4	2	3	2	4	3
G	4	3	3	2	4	3	4	3	4	3	4	3
ΣS	19		18		19		18		17		19	
V	0.905		0.857		0,905		0,857		0,809		0,905	

The Aiken validity test in the first aspect, namely the conceptual definition, shows the Aiken's V coefficient value of 0.905. The second aspect, the stimulus aspect for Aiken's coefficient test, was 0.857. The third aspect was the distance aspect with Aiken's coefficient values of 0.905. The fourth aspect was the motion aspect, with Aiken's coefficient value of 0.857. 0.857. The fifth aspect was the procedure for implementing, with Aiken's coefficient test of 0.809. The last aspect, the aspects of image construction, with Aiken's coefficient value of 0.905. The magnitude of Aiken's V coefficient was between 0 - 1. Based on the results of the Aiken coefficient value of the basketball performance reactive agility test instrument, all the products exceed the standard, namely 0.76, so it can be concluded that all aspects of this instrument were valid.

5.2Reliability Test Results Between Cronbach's Alpha Ratters

The results of Cronbach's Alpha analysis for inter-ratter reliability tests are as shown in Table 2 below:

Table 2. Reliability results of cronbach's alpha

Cronbach's Alpha	N of Items
0,944	6

The Cronbach's Alpha value of 0.944. So, it can be concluded that this instrument was reliable. This means that the instrument has special stability qualities.

5.3Test Results of Agreement Between Ratter Intraclass Correlation Coefficients (ICC)

The results of the inter-rater agreement or inter-rater reliability test using the ICC are as shown in Table 3 as follows:

Table 3. Results of the Intraclass Correlation Coefficient

IntraclassCorrelation[b]	95% Confidence Interval		F Test with True Value 0			
	Lower Bound	Upper Bound	Value	df1	df2	Sig

Single Measures	,738	,466	,937	17,857	6	30	,000
Average Measures	,944	,839	,989	17.857	6	30	,000

The results of the ICC analysis in Table 3 above show that the average agreement among ratters was 0.944, while for one ratter, the consistency was 0.738. So based on Fleiss' category, the values of 0.75 is in a special category. Therefore, it can be concluded that the agreement among ratters was special, and each assessor has special consistency.

6. Discussion

Agility is an essential component in basketball (Sekuli et al., 2017) and will produce maximum performance when combined with reactive training. It is necessary to develop exercises that specifically train agility and train the response of an athlete. Therefore, reactive agility training instruments for basketball performance were developed. The test instrument can be valid or fit for use if it meets the valid and reliable requirements (Widhiarso, 2010). The test instrument can be said to have high validity if the instrument created can carry out the function and achieve the goal of the test is made.

The approach used in this study combined quantitative and qualitative approaches to test the validity of the instrument content (Borrego et al., 2009). The result of this research qualitatively was a reactive agility test instrument for basketball performance. The results of the document analysis included (1) the purpose of the measurement instrument, (2) the conceptual and operational definition of reactive agility, which means the body's speed in stimulating the stimulus to change direction, and (3) the construction of the reactive agility test instrument for basketball performance.

The next stage was the second stage of the quantitative approach. In this stage, Aiken's validity test was conducted, which resulted: the first aspect, namely the conceptual definition, shows the Aiken's V coefficient value of 0.905. The second aspect, the stimulus aspect for Aiken's coefficient test, was 0.857. The third aspect was the distance aspect with Aiken's coefficient values of 0.905. The fourth aspect was the motion aspect, with Aiken's coefficient value of 0.857. 0.857. The fifth aspect was the procedure for implementing, with Aiken's coefficient test of 0.809. The last aspect, the aspects of image construction, with Aiken's coefficient value of 0.905. The magnitude of Aiken's V coefficient was between 0 - 1. Based on the Aiken coefficient value of the basketball performance reactive agility test instrument, all the results exceed the standard, which was 0.76. Therefore, it can be concluded that all aspects of this instrument were valid.

The next stage was still with the quantitative approach, namely testing the reliability of the reactive agility test instrument for basketball performance using Cronbach's Alpha. The value generated through the Cronbach's Alpha reliability analysis was 0.944. So, it can be concluded that this instrument was reliable. This means that the instrument has special stability qualities.

Furthermore, to test the inter-rater reliability and consistency between the ratters with more than two ratter numbers, the intraclass correlation coefficients (ICC) were used. The analysis shows that the average agreement between ratters was 0.944, while for one ratter, the consistency was 0.738. So, based on Fleiss's category, the value which shows more than 0.75 is in a special category. Therefore, it can be concluded that the agreement between ratter was special, and each assessor has special consistency.

Based on quantitative and qualitative analysis results, the conclusion said that the reactive agility test instrument for basketball performance was categorized as valid because it has good content validity and good inter-rater reliability.

7. Conclution

Based on the analysis results above, this study produced a reactive agility test instrument for basketball performance where the instrument made had good content validity using Aiken's, and the inter-rater reliability was quite good so that the reactive agility test instrument for basketball performance can be used or tested for senior basketball athletes.

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