Original Article

A volleyball skills test instrument for advanced-level students

ALNEDRAL¹, GARRI ZONIFA², YENDRIZAL³

^{1,2,3}Coaching Department, Faculty of Sport Science, Universitas Negeri Padang, INDONESIA

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Abstract:

Volleyball is one sports that is played in various world major competitions, such as the Asian Games and the Olympics. A measuring the performance and skills of players in volleyball is necessary. Various studies continue to develop volleyball and improve the performance of its players. Inspection of the performance and improvement of volleyball skills requires a valid and reliable test instrument. In this paper, the development of a volleyball skills test instrument for advanced-level students is presented. This work had a research and development design. The research step consists of need analysis, design, development, trial and validation. Advanced-level students in the coaching department (n=40) were recruited for this study. A series of measurements in volleyball skills, including overhand serve, underarm pass, forearm pass, smash, and blocking, were assessed. The validity and reliability of the instrument for advanced-level students were investigated. The instrument's validity and reliability were measured in two ways, namely, via a scoring system and by technical assessment from judges. The product-moment of the Pearson and Wherry-Doolittle methods was adopted in the data analysis. Based on the experimental results, the validity and reliability of the test in terms of the underarm pass, forearm pass, serve, smash, and blocking were high and very high, respectively. Moreover, based on the score of each skill test and the judges' assessments, the validity and reliability of the volleyball skill tests were very high (0.837 and 0.973, respectively). In short, the experimental results show that the volleyball skills test instrument is suitable for advanced-level students.

Key Words: - Performance of Players, Research and Development, Validity and Reliability Test, Undergraduate Students

Introduction

Sports activities have become a cultural phenomenon and a potential industry. Almost everyone is involved in sports in various roles and degrees of participation. A sport is no longer just for health; it has become a profession, and sporting achievement is a national pride. Volleyball is one sports that is played in various world major competitions, such as the Asian Games and the Olympics. Volleyball is also growing in other areas, including beach volleyball (Seweryniak, Mroczek, & Gryguć, 2020; Šimac, Grgantov, & Milić, 2017). In addition, various studies continue to develop volleyball and improve the performance of its players (Alnedral, 2014; Ramos, Coutinho, Silva, Davids, & Mesquita, 2017; Zahradnik, Jandacka, Farana, Uchytíl, & Hamill, 2017). Several studies related to this sport include the use of robot technology in training (Sato et al., 2017), the measurement of the efficiency in attacking, receiving, and servicing (Zhang, 2018) and of the effect of warm-up (Kubota, Sugino, No, Ishizuka, & Gamada, 2011), and the development of various technical capabilities (Kitsiou, Sotiropoulos, Drikos, Barzouka, & Malousaris, 2020; Zahradnik et al., 2018). The performance of volleyball players is determined by parameters such as endurance, flexibility and power (Taware, Bhutkar, & Surdi, 2013). Moreover, various training models have also been developed to improve volleyball skills (Oğuzhan & Hunuk, 2018). Therefore, measuring the performance and skills of players in volleyball is necessary.

Inspection of the performance and improvement of volleyball skills requires a valid and reliable test instrument. However, few studies have discussed or developed an instrument to test volleyball skills. In previous works, several volleyball skills test instruments have been developed (Bartlett, Smith, Davis, & Peel, 1991; Gabbett & Georgieff, 2006). However, these tests are limited to three basic volleyball skills: set, forearm pass and service. These tests are unable to measure the player's overall performance. In other works, the developed test instrument was designed to be used by junior volleyball players, who have different characteristics from senior players and advanced-level students. In fact, maturity and age greatly influence the skill and performance of sports players (Hancock, Adler, & Côté, 2013; Hollings, Hume, & Hopkins, 2014). Furthermore, the student level greatly affect skills, psychology, intelligence, and motivation (Kajbafnezhad, Ahadi, Heidarie, Askari, & Enayati, 2011). Therefore, appropriate skills test instruments for advanced-level students are needed. To date, no instrument for advanced-level students has been developed that can test all aspects of volleyball skills. Without a valid and reliable test instrument, it is very difficult to measure a student's ability and the progress of his performance.

To overcome these problems, an instrument was developed in this study to test various aspects of volleyball skills for advanced-level students. Tested capabilities include overhand service, underarm passes, forearm passes, blocks and smashes. The skills test instrument developed was designed to correctly distinguish advanced-level students from more beginner-level students. For this reason, the skills test instrument must have high validity and reliability. The reliability and validity of instruments in sports performance assessment are important for measuring the performance of the players (Carmines & Zeller, 2012; Currell & Jeukendrup, 2008; Hopkins, 2000; Stevens & Dascombe, 2015). In addition, a valid instrument can be used to quantify the strength and weakness of the players in a short time. Test data must be useful and interpreted correctly and can be used in the measurement of players' skills. The instrument design and skills test results are presented in the results and discussion sessions.

Material & methods

The Research and Development method was adopted in this study (Bennett, Borg, & Gall, 1984). The research step consists of need analysis, design, development, and trial and validation, as presented in Fig. 1. Tests were developed to measure skills including the overhand serve, underarm pass, forearm pass, smash and blocking. The population of the study (test takers) consisted of the male students of the Coaching Department ($n=40$), selected by a purposive sampling technique.

Fig. 1. Research and development steps

The validity of the instrument was determined through data analysis from scoring the 5 skills tests and technical assessments by two judges. Then, the Wherry-Doolittle method was used to determine the validity (Battery Test) through the correlation coefficient (r_{xly}). The correlation between the results of the skills tests and the assessment of the two judges was determined with a significance level of 0.05% by comparing $r_{observed}$ with r_{table} . Meanwhile, the instrument reliability test was carried out after the validity criteria were obtained. The instrument reliability was determined by the test-retest method on different days, specifically the first day and the second day. The validity and reliability of the instrument were classified into several categories, as listed in Table 1.

Table 1. Validity and Reliability Criteria (Kirkendall, Gruber, & Johnson, 1987)

Validity Criteria		Reliability Criteria	
Interval Score	Category	Interval Score	Category
0.80 – 1.00	Very High	0.93 – 1.00	Very High
0.70 – 0.79	High	0.88 – 0.92	High
0.50 – 0.69	Adequate	0.68 – 0.87	Adequate
0.00 – 0.49	Unacceptable	0.00 – 0.67	Unacceptable

Results

An instrument was developed for each volleyball skill. A ball that goes into target areas A, B, C, D is given a score as listed in Table 2. On the other hand, a ball that goes out of bounds will be given a score of 0. Each test taker is given the chance to perform the skill five times.

Table 2. Scoring system for the volleyball skills test instrument

Target Area	Points awarded
A	4
B	3
C	2
D	1
Out of bounds	0

The overhand serve is performed five times in the serve area. After the serve, the ball is awarded points depending on where it lands as described in the aforementioned system. The test taker is given five chances to serve. The final score is the accumulations of points from the five servers. The developed volleyball skill test for overhand serve is illustrated in Fig. 2.

Fig. 2. Illustration of the volleyball skills test for the overhand serve.

The validity of the overhand serve skill test had a correlation coefficient (r_{xly}) of 0.718, which was categorized as high validity. In other words, the correlation between the overhand skills test and the judgment of two judges showed a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.718) was greater than r_{table} (0.312). Thus, this test can be recommended to measure the skills of the volleyball overhand serve for advanced-level students. Furthermore, the reliability of the overhand serve skill test had a correlation coefficient r_{xly} of 0.913. It can be said that the correlation between the overhand serve skill test on the first day (test I) and the overhand serve skill test on the second day (test II) demonstrates a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.913) was greater than r_{table} (0.312). In conclusion, the volleyball serve skills test for advanced-level students was reliable.

Fig. 3 presents an illustration of the developed volleyball skills test for the underarm pass. The underarm pass is performed five times. A bouncer is in the P area to bounce the ball to the test taker. The test taker himself determines the quality of the ball bounced. A ball that goes into target areas A, B, C, D or out of bounds is awarded points based on the previously described point system. The test taker is given five chances to perform an underarm pass. The final score is the accumulation of points from the five underarm passes (2 when the test taker is positioned at X, 1 at Y, and 2 at Z).

Fig. 3. Illustration of the volleyball skills test for the underarm pass. X, Y and Z are the passing test areas, and P is the bouncing area.

The validity of the underarm pass skill test had a correlation coefficient (r_{xly}) of 0.733, which was categorized as high validity. In other words, the correlation between the underarm pass test and the judgment of the two judges showed a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.733) was greater than r_{table} (0.312). Thus, this test can be recommended to measure the skills of the volleyball underarm pass for advanced-level students. Furthermore, the reliability of the underarm pass skill test had a correlation coefficient r_{xly} of 0.904. It can be said that the correlation between the underarm pass skill test on the first day (test I) and the underarm pass skill test on the second day (test II) demonstrates a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.904) was greater than r_{table} (0.312). In short, the volleyball underarm pass skills test for advanced-level students was reliable.

Fig. 4 illustrates the volleyball skills test developed for the forearm pass. The bouncer is in quarter half-circle area P and bounces the ball to the test taker. The quality of the bounced ball is determined by the test taker himself. A ball that goes into target areas A, B, C, D or out of bounds is awarded points based on the previously described point system. A test taker is given five chances to perform a forearm pass. The final score is the accumulation of points from the five forearm passes.

Fig. 4. Illustration of the volleyball skills test for forearm pass with P is the bouncing area.

The validity of the forearm pass skill test had a correlation coefficient (r_{xly}) of 0.724, which was categorized as high validity. In other words, the correlation between the forearm pass test and the judgment of two judges showed a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.724) was greater than r_{table} (0.312). Thus, this test can be recommended to measure the skills of the volleyball forearm pass for advanced-level students. Furthermore, the reliability of the forearm pass skill test had a correlation coefficient r_{xly} of 0.905. It can be said that the correlation between the forearm pass skill test on the first day (test I) and the forearm pass skill test on the second day (test II) demonstrates a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.905) was greater than r_{table} (0.312). In conclusion, the volleyball forearm pass skills test for advanced-level students was reliable.

The volleyball skills test developed for the smash is illustrated in Fig. 5. The smash is performed five times by the test taker from position IV. The test taker directs the ball to a predetermined target. A ball that goes into target areas A, B, C, D or out of bounds is awarded points based on the previously described point system. If the test taker touches the net while performing the smash, the score is not counted and the smash can be redone. The test taker is given five chances to perform a smash. The final score is the accumulation of the points from the five smashes performed.

Fig. 5. Illustration of the volleyball skills test for smashes, where P is the bouncing area.

The validity of the smash skill test had a correlation coefficient (r_{xly}) of 0.724, which was categorized as high validity. In other words, the correlation between the smash test and the judgment of two judges showed a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.726) was greater than r_{table} (0.312). Thus, this test can be recommended to measure the skills of the volleyball smash for advanced-level students. Furthermore, the reliability of the smash skill test had a correlation coefficient r_{xly} of 0.906. It can be said that the correlation between the smash skill test on the first day (test I) and the smash skill test on the second day (test II) demonstrates a positive relationship. At a significance level of 0.05%, the results obtained $r_{observed}$ 0.906 > r_{table} 0.312. In conclusion, the volleyball smash skills test for advanced-level students was reliable.

The developed volleyball skills test for blocking is illustrated in Fig. 6. The test taker was allowed to position himself freely along the net. The block was performed five times. A ball that goes into target areas A, B, C, D or out of bounds is awarded points based on the previously described point system. The final score is the accumulation of the points from the five blocks performed.

Fig. 6. Illustration of the volleyball skills test for blocking.

The validity of the blocking skill test had a correlation coefficient (r_{xly}) of 0.709, which was categorized as high validity. In other words, the correlation between the block test and the judgment of two judges showed a positive relationship. At a significance level of 0.05%, the obtained $r_{observed}$ (0.790) was greater than r_{table} (0.312). Thus, this test can be recommended to measure the skills of the volleyball block for advanced-level students. Furthermore, the reliability of the blocking skill test had a correlation coefficient r_{xly} of 0.925. It can be said that the correlation between the block skill test on the first day (test I) and the block skill test on the second day (test II) demonstrates a positive relationship. At a significance level of 0.05%, the results obtained $r_{observed}$ 0.925 > r_{table} 0.312. In short, the volleyball blocking skills test for advanced-level students was reliable.

Discussion

This work was conducted due to the absence of an instrument to test the volleyball skills of advanced-level students. The results of this study provide a valid and reliable instrument to test these volleyball skills. The results of the validity and reliability analysis for the 5 skill tests are summarized in Fig. 7. As the figure demonstrates, the validity of the developed instrument in terms of overhand serve, underarm pass, forearm pass, smash, and blocking is classified as high. On the other hand, the reliability of the instrument is classified as very high.

Fig. 7. The validity and reliability of the developed volleyball skills test instrument

The validity of the test instrument indicates the high degree of conformity between the skills test and the judge's assessment. This means that the instrument can be used to measure what is supposed to be measured (Sugiyono, 2011). The validity of the instrument determines the level of trust in the data obtained as the material to be processed. For the five skill tests, the validity did not reach the very high category, which is likely due to the slight differences between the player's score and judge's score. The judges' assessment can be biased when the ball touches the target area boundary line. In contrast with other studies (Gjinovci, Idrizovic, Uljevic, & Sekulic, 2017; Kitsiou et al., 2020; Oğuzhan & Hunuk, 2018), the results of this study could be used to assess volleyball skills more completely and in accordance with the advanced-level student.

Reliability is a measure of the test consistency, which means that a reliable test should have roughly the same result regardless of the number of times it is administered (Miller, 2002). According to Fig. 7, the reliability of the volleyball skill test instrument for the five skills is very high. This shows the extent to which the

measurements can deliver relatively similar results when the measurements are made for the same subject. According to (Winarno, 2011), reliability is also interpreted as a consistency, that is, the similarity between the first measurement and subsequent measurements with the same data source. This means that the developed instrument is a reliable fit when the instrument can perform measurements with the same score repeatedly. According to (Winarno, 2011), the factors affecting the reliability of a test are (1) the length or duration of the test, (2) the nature of the test-taking, (3) the test time, and (4) the condition of the environment of the test.

Conclusions

The development of a volleyball skills test instrument for advanced-level students is presented in this paper. Based on the experimental results, the volleyball skills test instrument displayed very satisfactory validity and reliability. Furthermore, a high level of validity and reliability was obtained in all skills, including the overhand serve, underarm pass, forearm pass, smash, and blocking. In addition, the combination of player and judge scores showed that the volleyball skills test instrument has high validity and very high reliability. As a result, the volleyball skills test instrument is suitable for use for advanced-level students. In future work, the differences in the results of the skill test between student and professional volleyball players will be investigated.

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