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VBSPT Application of basketball measurement for adolescent
VBSPT Aplicación de la medida del baloncesto para adolescentes

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Abstract. Van Basketball Skill and Performance Test (VBSPT) is designed to assist basketball athletes and basketball coaches in assessing their performance based on the test results and adhering to the training guidelines derived from the application's recommendations. The development goal of the VBSPT is to directly view their performance statistics based on the test results, which will benefit not only basketball coaches but also physical education teachers. These apps are designed to operate on smartphones and tablets; the adaptive applied software undergoes continuous enhancements and serves as the central component of the computer. The two elements (15 items) of the web-based application of the van basketball skill and performance test (VBSPT) were evaluated by a group of 10 experts. The study involved the participation of five experts in information technology and five basketball coach experts. The Delphi approach and test-retest methods were employed for data collection, while Aiken's formula, intraclass correlation coefficients (ICC), and Cronbach's alpha were utilized for data analysis. The expert assessment technique indicates that the content validity of the aspect is good, as evidenced by the results with a value of 0.80. The reliability of each feature of the basketball skill and performance test instrument was assessed using Cronbach's alpha, yielding a coefficient of 0.723. The ICC score agreement between raters is 0.723, with a consistency of 0.148 for one rater. Based on the results, the reliability and usability standards were met. VBSPT is a valuable tool for checking a web-based application's technical quality and usability.
Key words: web-based, application, basketball, adolescent

Resumen. Van Basketball Skill and Performance Test (VBSPT) está diseñado para ayudar a los deportistas y entrenadores de baloncesto a evaluar su rendimiento basándose en los resultados del test y siguiendo las pautas de entrenamiento derivadas de las recomendaciones de la aplicación. El objetivo de desarrollo del VBSPT es visualizar directamente sus estadísticas de rendimiento basadas en los resultados de la prueba, lo que beneficiará no sólo a los entrenadores de baloncesto, sino también a los profesores de educación física. Estas aplicaciones están diseñadas para funcionar en teléfonos inteligentes y tabletas; el software aplicado adaptativo experimenta mejoras continuas y sirve como componente central del equipo. Un grupo de 10 expertos evaluó los dos elementos (15 ítems) de la aplicación web del test de habilidades y rendimiento en baloncesto (VBSPT). En el estudio participaron cinco expertos en informática y cinco expertos entrenadores de baloncesto. Para la recogida de datos se empleó el enfoque Delphi y métodos test-retest, mientras que para el análisis de datos se utilizaron la fórmula de Aiken, los coeficientes de correlación intraclase (CCI) y el alfa de Cronbach. La técnica de evaluación por expertos indica que la validez de contenido del aspecto es buena, como demuestran los resultados con un valor de 0,80. La fiabilidad de cada aspecto del instrumento del test de habilidad y rendimiento en baloncesto se evaluó mediante el alfa de Cronbach, arrojando un coeficiente de 0,723. La concordancia en la puntuación ICC entre evaluadores es de 0,723, con una consistencia de 0,148 para un evaluador. Según los resultados, se cumplieron las normas de fiabilidad y usabilidad. El VBSPT es una herramienta valiosa para comprobar la calidad técnica y la usabilidad de una aplicación web.
Palabras clave: basado en la web, aplicación, baloncesto, adolescente Fauzi.

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Introduction

Technological advancements have led to increased digitization within healthcare and sports (Bhavnani et al., 2016; Cardinale & Varley, 2017). The use of technology is still being explored, but there is potential for technology to influence the implementation of training programs and athlete techniques positively (Adesida et al., 2019). The use of apps to collect data has also drawn widespread attention among sports professionals and exercise scientists. In fact, some apps have already been developed to collect physiological, kinanthropometric, and sports performance data (Peart et al., 2018). The use of apps for data collection is likely the most popular in recreational sporting activities, although they are also utilized in a higher-performance sporting context (Thompson, 2018). In high-performance sports, the expertise required to quantify an athlete's physical performance with traditional methods is often expensive and non-user-friendly, especially for trainers (Peart et al., 2018). However, apps hold great potential by making physical performance measurements for coaches and trainers more affordable in field conditions. Likewise, in a competitive sporting context, there are already validated apps aimed at coaches for assessing sports performance data (Romero-Franco et al., 2017; Muntaner-Mas et al., 2019).

Various web-based applications are generally made to have the ability to be accessed by hundreds to millions of people at one time (Musthafawi et al., 2020). The web has had a significant impact on all aspects of our society, from business, education, government, entertainment sectors, industry, to our personal lives (Dogan et al, 2014). The main advantages of adopting the web for developing software products include (1) no installation costs, (2) automatic upgrade with new features for all users, (3) universal access from any machine connected to the Internet, and (4) being independent of the operating system of clients (Dogan et al., 2014). The utilization of the Internet for software development offers several notable advantages. Firstly, it eliminates the need for any installation charges.

Performance analysis of sports aims to evaluate athletes'

improvements as a consequence of training over an extended period, as well as the degree of physical condition or technical expertise (Pueo & Jimenez-Olmedo, 2017). Coaches looking for optimal performance and technique develop a tailored training plan and monitor outcomes by means of different tools (Southgate et al., 2016). There has been a rapid evolution of the technologies available in the field of sports performance, and the consequences of this evolution are revolutionizing decision-making, training prescription, and injury management (Torres-Ronda & Schelling, 2017; Hidayah et al., 2024). Several sports have implemented technology as a supporting element in improving athlete performance (Thatcher et al., 2021). Competitive performance analysis has gained importance in recent decades, becoming the primary way to measure and evaluate the performance of athletes (Valero, 2018).

Basketball is a sport that continues to develop at any time, along with the development of technology, and many sports use technology in its development. Basketball is one of the most-played team sports worldwide (Wierike et al., 2015), but surprisingly, it has a limited set of tests available for its practitioner's evaluation. In various fields, the development of science and technology has a very important influence on the emergence of new applications that people widely use to facilitate testing and measurement activities (Hartati et al., 2020). The emergence of novel devices measuring athletic performance is quickly gaining momentum as these devices increase in popularity as potential alternatives to expensive laboratory equipment (Sharp et al., 2019; Silva et al., 2021). Their main advantage is that these novel devices are easily portable (especially in the case of software applications that are integrated into tablets and smartphones)(Turan et al., 2022); the potential to offer an excellent solution to the problems of many laboratory-based measurement methods such as the high cost of laboratory equipment, the difficulties of transporting the devices to the field, or people to the laboratory, and the need for periodic maintenance and complex interfaces (Brooks et al, 2018; Ulupinar and Ozbay, 2020). However, to take advantage of all these facilitating aspects, it is necessary to ensure that the measurements made with these methods give valid and reliable outputs.

Several programming skill assessment models have been created, such as the Aspiring coding test website (Wang et al., 2012) and the coding test simulator (Glider, 2020). Another model was developed (De Souza et al., 2015; Grover, 2015); the assessment model analyzes programming skills, especially in branching code, by detecting coding plagiarism when there is copy and paste (Ngo, 2016). Online assessment can utilize modern network technology to quickly transfer and analyze large amounts of data, resulting in ease and effectiveness of test distribution assessment and reporting (Panyahuti et al., 2022). This model assessment will save time, human labour, expenses, and other costs in various aspects when compared to traditional assessments (Andry & Stefanus, 2020). However, whatever the form, the ultimate goal of an assessment must be to realize better and more effective learning (Su, 2020).

Van Basketball Skill and Performance Test (VBSPT) is designed to assist basketball athletes and basketball coaches in assessing their performance based on the test results and adhering to the training guidelines derived from the application's recommendations. The development goal of the VBSPT is to directly view their performance statistics based on the test results, which will benefit not only basketball coaches but also physical education teachers (Salafi et al., 2023). These apps are designed to operate on smartphones and tablets (Salafi et al., 2023); the adaptive applied software undergoes continuous enhancements and serves as the central component of the computer (Xu & Wei, 2013). The importance of research and development of skills test instruments and basketball performance for players aged 14-16 years is to (a) shorten test time, (b) reduce waiting time for results, (c) be comprehensive enough to reflect actual abilities, (d) be accessible, and (e) serve as a benchmark for coaches when selecting.

Method

The BSPT test is evaluated using process-based assessment techniques, including layups, free throws, passing, shooting, dribbling variations, and speed dribbling. Use the following metrics for outcome-based results measurement: (a) completion time, (b) penalty time, and (c) performance time (completion time + penalty time).

The test begins with two free throws, followed by dribbling the ball (crossover- between the leg – behind the back), then passing (chest pass and one-hand side bounce pass), shooting (three-point shoot, medium shoot, and under-basket) speed dribble ending with a lay-up. The assessment from the BSPT test combines the performance assessment method (process-based) using the free throw, dribbling, passing, shooting, slide defense, and lay-up performance rubric in web apllication. Meanwhile, for outcome-based measurement, it uses (a) completion time; (b) penalty or reward time; (c) performance time (completion time + penalty time) (Salafi et al., 2023).

The formulation of a specialized product specifically designed for the complexities of sports science was guided by the research and development (R&D) approach (Amran, 2023; Firdausi et al., 2023; Shchokin et al., 2023). This process prioritizes innovation, aiming to provide a product that adheres to industry norms and challenges conventional offerings' limitations. The incorporation of the DevOps development model enhances the complexity of the technique (Amaro et.al., 2023; Cifuentes et.al., 2023; Venanzi et.al., 2023).

According to Thiagarajan (1974), the 4D research and development paradigm encompasses four primary steps, namely (a) Define, (b) Design, (c) Develop, and (d) Disseminate.

a) Define

The following phase was a literature review to collect

materials supporting the application. The obtained resources encompassed many forms of literature, such as books, the Internet, and journals, including texts, images, and symbols. At this step, a survey was conducted on the general population. A fifteen-question questionnaire is designed to assess the societal need for web-based applications in measuring VanBasketball Skill and Performance Test.

b) Design

The basic product design was developed by the researcher at this stage. The initial phase involved creating an app flowchart. The flowchart facilitated our understanding of the app's functionality. Collected materials substantiated the statement. The initial product of the VBSPT app was developed by utilizing maker software and a computer programming language to construct the flowchart and app contents. The initial product obtained expert validation.

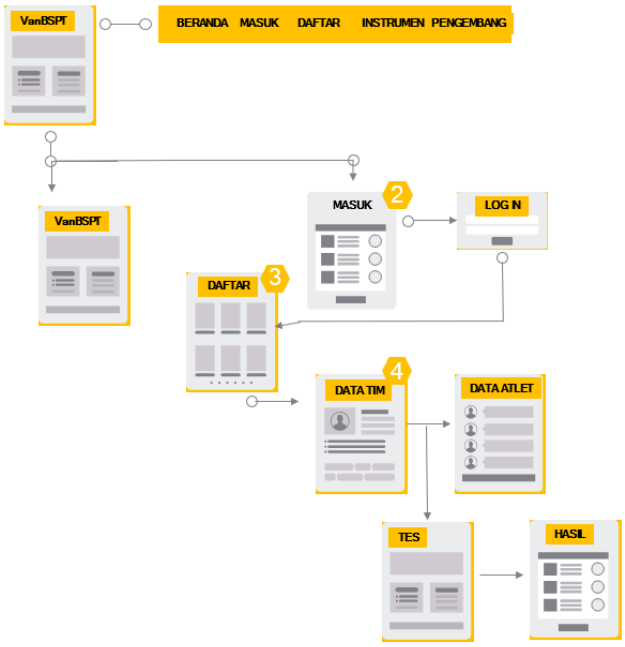

Figure 1. VBSPT Flowchart

Table 1.
Indicator aspect of expert

Aspect	Assessment Indicator
App view	Text suitability in terms of layout, font, and size
	Text suitability in terms of layout, font, and size
	Suitability of the video with the instrument made
	The attractiveness of the video presentation
	Consistency of button display
	Attractive interface
Usability Aspect	Can be operated using a computer/laptop/smartphone
	Simplicity of registration
	Ease of selecting the program menu
	Easy to operate media in assessment
	Media can store complete test results
	Media is practical and flexible to use
	Media can perform its function well
	This media meets the objectives of assessment/evaluation
	The media makes it easier for coaches to process basketball skill and performance test data

c) Develop

Developing a product in the form of an initial web form design for BSPT, the author conducted a content validity test with ten experts using the Delphi method, namely meeting several experts directly to collect points of similarity and summarising for agreement on opinions by hiding the identity of the expert, which the next step was to improve according to expert advice and reliability to trainers and media experts.

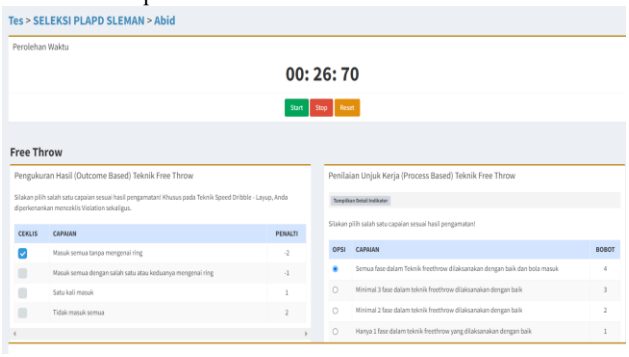

Figure 2. Homepage VBSPT

d) Disseminate

Contains activities to disseminate products found to have content validity, and reliability of the developed applications.

Subjects / Participants

The study involved the participation of ten experts. Half of the experts are academic specialists, while the remaining are professional basketball coaches. In this study, individuals who satisfy the established criteria for expertise are selected to participate in the sample. The criteria utilized in this study are derived from expert experience, reputation, availability, motivation to participate in research, confidentiality, and quality (Ibáñez et al., 2019; Skjong, 2001). The chosen specialists must satisfy a minimum of three out of the following six criteria: The requirements for eligibility include (i) possession of a PhD degree in Sports Science or expertise in IT; (ii) previous experience as a university lecturer; (iii) possession of the highest license granted by a sports federation; (iv) a minimum of five years of teaching experience as a faculty member; and (v) a minimum of five years of training experience. All specialists are sourced exclusively from Indonesia and do not communicate directly with the study team.

Statistic analysis

This research employed a developmental methodology, incorporating both qualitative and quantitative methodologies, to undertake a comprehensive study (Creswell, 2016; Harrison et al., 2020; Terwee et al., 2018). The validity of the basketball skill and performance test was assessed using empirical and content validity measures. Expert judgment is a commonly used approach to assess the content validity of a questionnaire. It involves determining which items should be included in the instrument to measure the intended construct accurately. Additionally, experts can evaluate the existing items using quantitative or qualitative cri-

teria, assigning scores, and make suggestions or modifications to their wording if necessary (Garrote & del Carman Rojas, 2015; Guillot-Valdés et al., 2022). Assessing content validity for newly developed instruments or modifying existing instruments is a commonly employed approach among researchers (Leyton-Román et al., 2021). Content validity can be assessed through a three-step process. The researchers collected pertinent scholarly materials, undertook an initial participatory observational study to formulate a test, and ultimately assessed the acquired data.

Furthermore, the researchers employed the Delphi technique (Wilpers et al., 2020). The Delphi technique obtains expert perspectives on a particular topic through a systematic and iterative approach (Hasson et al., 2000). Determining variable change or elimination criteria was conducted using Aiken's V coefficient (Aiken, 1985,; Torres-Luque et al., 2020).

The internal consistency and reliability of VBSPT were evaluated using Cronbach Alpha, with a value below 0.70 indicating satisfactory reliability (Rahayu & Arovah, 2022; Sharma, 2016). The one-week test and retest reliability of the VBSPT was assessed by calculating the intra-class correlation (ICC) for each item using a single one-way model, as described by Schreiber et al. (2006). The classification of reliability was determined using the ICC value, which was categorized as fair (0.5), good (0.5–0.75), very good (0.75-0.9), and exceptional (>0.9) (Koo & Li, 2016; Olaya-Cuartero et al., 2022).

Results

There is no doubt that professional team managers, coaches, and scouts are actively using the latest advances in information and communication technologies. This has led to an unprecedented increase in the amount of data generated during competitions or sports training, as well as a greater interest and motivation in developing models that allow the interpretation of such data and provide valuable information for each sport (Valero et al., 2018). The Delphi method is identified as one method that seeks to approach the consensus of a group of experts based on analysis and reflection of a defined problem (Varela-Ruiz et al., 2012; Puigarnau Coma et al, 2021)..

Content Validity

The measurement instrument employed in the study exhibits a high level of content validity, indicating its ability to accurately assess the target construct in accordance with the test's intended purpose (Alim et al., 2024).

Van basketball skill and performance test instruments specifically created for adolescent athletes are evaluated using expert opinion. The expert's assessment uses a numerical scale ranging from 1 to 5. The relevance of the evaluation criteria is contingent upon the proximity of the assessment to a value of one on a scale. The assessment criteria are more meaningful when they are closer to a five on a scale. The data from the expert assessment was subsequently subjected to quantitative analysis using Aiken's formula.

Table 2.
Result of VBSPT Aiken Validity

Aspect	Rater										S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	Σs	n(c-1)	V
	1	2	3	4	5	6	7	8	9	10													
1	5	5	4	4	5	3	4	5	3	3	4	4	3	3	4	2	3	4	2	2	31	40	0,78
2	4	5	4	5	3	3	4	5	4	4	3	4	3	4	2	2	3	4	3	3	31	40	0,78
3	5	5	4	5	4	5	4	5	4	5	4	4	3	4	3	4	3	4	3	4	36	40	0,9
4	5	5	5	4	3	5	3	3	4	5	4	4	4	3	2	4	2	2	3	4	32	40	0,8
5	4	5	5	4	5	4	5	4	5	5	3	4	4	3	4	3	4	3	4	4	36	40	0,9
6	4	4	4	5	4	3	4	3	4	5	3	3	3	4	3	2	3	2	3	4	30	40	0,75
7	5	5	4	5	5	4	5	5	5	5	4	4	3	4	4	3	4	4	4	4	38	40	0,95
8	4	4	5	4	4	4	4	4	4	4	3	3	4	3	3	3	3	3	3	3	31	40	0,78
9	5	5	5	4	5	5	5	5	4	5	4	4	4	3	4	4	4	4	3	4	38	40	0,95
10	4	5	4	5	3	3	4	3	4	3	3	4	3	4	2	2	3	2	3	2	28	40	0,7
11	4	4	4	5	4	3	4	3	4	4	3	3	3	4	3	2	3	2	3	3	29	40	0,73
12	4	5	4	3	3	3	4	4	5	4	3	4	3	2	2	2	3	3	4	3	29	40	0,73
13	4	5	4	3	4	3	4	5	4	4	3	4	3	2	3	2	3	4	3	3	30	40	0,75
14	4	5	4	5	4	4	3	5	3	4	3	4	3	4	3	3	2	4	2	3	31	40	0,78
15	4	5	4	5	4	3	3	3	4	4	3	4	3	4	3	2	2	2	3	3	29	40	0,73
																							0,80

The table of expert judgment results above shows that all items in the instrument have a calculation value > 0.70, so it can be interpreted that all items in this instrument are valid.

Reliability

Reliability testing is used in this study to determine the instrument's consistency level—reliability calculations using the SPSS program, as shown in the table below.

Table 3.
Result of Cronbach alpha analysis

Cronbach's Alpha	N of Items
0.723	15

In the reliability test, the Alpha Cronbach value is expected to be > 0.60 so that the data or instrument can be said to be reliable. From the reliability test results in this study, it was found that the Alpha Cronbach value was 0.723, so it can be concluded that the test instrument developed in this study is reliable.

The mean agreement across raters is 0.723, whereas the consistency for a single rater is 0.148. The ICC score findings fall under excellent reliability (Portney & Watkins,

2009). This suggests a high degree of agreement across raters and a relatively high level of consistency among each rater.

Table 4.
Intraclass Correlattion Coefficient analysis result

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.148	0.040	0.428	3.609	9	126	.000
Average Measures	0.723	0.386	0.918	3.609	9	126	.000

Discussion

The Delphi technique of expert judgment validation of VBSPT has enhanced the validity of its dimensions and categories, providing coherence and clarity to the items and the instrument's structure. By combining technology and basketball skills, the combined engagement of knowledgeable technologists and basketball coaches gave the instrument a unique dimension absent from earlier surveys that were primarily technocentric (Diaz-Barahona et al., 2023).

This study looked at the application of van basketball skill and performance instrument tests in terms of their content validity and reliability. According to this study, the VBSPT has strong content validity and may be used to assess the performance and skill of teenage basketball players. When assessing athletic performance, accurate data collection is necessary to test consistency across multiple trials (W.G. Hopkins, 2000; Lockie et al., 2013; Radman et al., 2016). The expert assessment tool obtains a value of 0.80, suggesting that the aspect has good content validity based on the Aikens analysis used to determine the content's validity. The reliability of each component of the basketball skill and performance test instrument was measured using Cronbach's Alpha, and the findings were 0.723. When an instrument's Cronbach's Alpha value is more than 0.7, it indicates high reliability (Tavakol & Dennick, 2011).

Since there are more than two raters in this study, the consistency and dependability of each rater were assessed using Intraclass Correlation Coefficients (ICC) analysis. It is possible to conclude that there is strong rater agreement and that each rater has a respectably high consistency level (moderate dependability) based on the ICC results (table 4). The web-based application that was produced was user-friendly. As a result, society could use it under any circumstances and was not dependent on the availability of signals. Additionally, this app facilitated access to public amenities for those still recovering from the pandemic. Creating distributable and reasonably priced application software solutions helps the public, making it a fortunate endeavor.

Conclusion

Based on the findings and subsequent analysis, it can be inferred that the web-based program known as the Van Basketball Skill and Performance Test (VBSPT) demonstrates both validity and reliability in evaluating the abilities of adolescent basketball athletes. Consequently, the VBSPT can evaluate adolescent basketball athletes' proficiency, thereby offering advantages not only to basketball coaches but also to physical education instructors. In subsequent undertakings, it is imperative to incorporate additional features that diverse approaches can assess. The complexity of application functionality increases, making the design of a user interface model more sophisticated. Furthermore, a user interface that possesses robust functionality has the potential to elicit a wide range of feedback from consumers. In conclusion, there remains a need for further investigation and evaluation of case studies that encompass diverse characteristics and approaches. In order to mitigate potential challenges during implementation, it is imperative to allocate significant focus toward evaluating this application throughout the first phases of design and development.

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