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CONTENT VALIDITY OF ANDROID-BASED SPORT TRAINING PROGRAM MONITOR FOR TENNIS PLAYERS

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Merytoryczna trafność monitorującego programu treningu sportowego opartego na Androidzie dla tenisistów

Streszczenie

Śledzenie programu treningowego sportowca jest kluczowe dla obiektywnego monitorowania jego aktywności treningowej, rozwoju fizycznego, nabywania umiejętności i możliwości dostosowania tegoż programu. Niniejsze badanie ma na celu opracowanie aplikacji opartej na Androidzie przeznaczonej do monitorowania programów treningu sportowego dedykowanych tenisistom. Badanie wykorzystuje zarówno ilościowe, jak i jakościowe metody badawcze, analizowane przy użyciu formuły V Aikena. W badaniu wzięło udział 5 licencjonowanych trenerów tenisa, 5 ekspertów ds. siły i kondycji oraz 3 specjalistów ds. technologii. Wyniki pokazują wartości współczynnika V w zakresie od 0,90 do 1,00, ze średnią wartością wynoszącą 0,97, co, według ekspertów-trenerów tenisa, wskazuje na wysoką trafność. Ocena kondycji fizycznej tenisistów dała wartości współ-

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czynnika V pomiędzy 0,90 a 1,00, ze średnią wartością wynoszącą 0,96, odzwierciedlając wysoką wartość wszystkich pozycji. Co więcej, oceny ekspertów z zakresu technologii i informatyki przyniosły wartości współczynnika V pomiędzy 0,83 a 1,00, ze średnią wartością 0,93, wskazując na wysoką wartość wszystkich pozycji. W związku z powyższym, badanie potwierdza, że wszystkie testowane pozycje cieszą się wysokim poziomem trafności merytorycznej. Biorąc pod uwagę tę wysoką trafność, aplikacja może być efektywnie użytkowana przez trenerów w celu zarządzania programami treningowymi i czynnościami codziennymi tenisistów.

Słowa kluczowe*:* monitorowanie, program treningowy, Android, tenis.

Abstract

Tracking an athlete's training program is crucial for objectively monitoring training activities, physical development, skill acquisition, and program adjustments. This research aims to develop an Android-based application for monitoring sports training programs tailored for tennis players. The study employs both quantitative and qualitative research methods, analyzed using Aiken's V formula. Participants included 5 licensed tennis trainers, 5 strength and conditioning experts, and 3 technology specialists. The results show V coefficient values ranging from 0.90 to 1.00, with a mean value of 0.97, indicating high validity according to tennis coaching experts. Evaluation of the physical condition of tennis players yielded V coefficient values between 0.90 and 1.00, with a mean of 0.96, reflecting high validity of all items. Furthermore, expert assessments in technology and informatics produced V coefficient values from 0.83 to 1.00, with a mean of 0.93, indicating high validity of all items. Therefore, this research confirms that all test items have a high level of content validity. With this high validity, the application can be effectively used by coaches to manage the training programs and daily activities of tennis players.

Keywords: monitoring, training program, Android, tennis.

Introduction

Monitoring an athlete's training involves gathering and analyzing data on the athlete's training activities, skills, physical development, and other factors that impact their performance, with the ultimate goal of tracking progress and adjusting the training program to optimize performance (West et al., 2019). Exercise monitoring also enables coaches to evaluate how performance was achieved and to reconcile planned training activities with actual achievements (Saw et al., 2016). The exercise program necessitates a monitoring system capable of recording all data to analyze any changes based on incoming data (Hidayah, Saghita Pratama, et al., 2024). Many youths have expressed the view that health should be customized to the individual, recognizing that different individuals have unique physical activity behaviors (Hidayah, Pratama, et al., 2024; Santosa et al., 2024). The younger generation has also scrutinized the usefulness of health technology in their lifestyle and education, regarding skill acquisition. This was evident in how they questioned the capability of self-tracking devices in regulating individual physical activity behaviors and the accuracy of device

measurements (Goodyear et al., 2019). Monitoring program activities is essential to ensure athletes adhere to the compiled coach's training program (Hidayah, Saghita Pratama, et al., 2024).

Quality training is determined by objective factors such as training facilities, infrastructure, competition, coach abilities, and athlete abilities, including talent, motivation, and nutrition fulfillment (Ratna et al., 2018). Resting activities, including sleep, are necessary for athletes to recover their physical condition. Sleep deprivation can negatively impact athletes' physical, mental, and medical health (Charest & Grandner, 2022). It is important to maintain a balanced approach by avoiding bias and using precise technical terminology while adhering to formal language, conventional structure, and grammatical correctness standards. Athletes frequently provide inaccurate estimates of their duration of sleep when asked how long they sleep. Research on self-perceived sleep activity and activity monitored sleep activity in athletes has shown that subjective sleep duration overestimates sleep activity by an average of 19.8 minutes (Caia et al., 2018). During the interview with the Chairperson of the Provincial Management of the Indonesian Lawn Tennis Association (PELTI), the research team discovered factual data regarding problems that arose within the sport of tennis. Specifically, at the 2021 National Sports Week (PON) XX event in Papua Province, the Jawa Tengah tennis team failed to obtain a medal. The research team interviewed the tennis coach of the Central Java team, who reported that the team had conducted extensive training sessions. However, the team lacked a monitoring system to implement their training program effectively.

Monitoring athletes' daily activities outside of training has not been detected. Additionally, the monitoring of the quality of athletes' rest and players' nutrition is not available. Reliable tracking of player location during play or matches is crucial in many sports (Umek et al., 2019). Monitoring training programs is essential for coaches to understand the difficulties athletes face in the field. Athletes can give feedback on their training and recovery status, which can be used to monitor their readiness to train or compete (Coyne et al., 2022). However, some coaches are unable to monitor the activities of athletes who train independently at home, resulting in a decrease in performance and achievements. Several tennis clubs have implemented independent training programs at home during the pandemic season. However, the implementation of these programs, including their intensity, volume, and training intervals, has not been adequately monitored. Athletes who fail to follow these programs could face a variety of risks, such as poor performance, overreaching, and overtraining (Perrey, 2022). This situation may impact the athlete's performance and increase the likelihood of injury (Bourdon et al., 2017).

The lumbar spine and shoulders are commonly at risk of injury (Gescheit et al., 2019). Monitoring exercise plays a crucial role in improving athlete perfor-

mance, minimizing injury risk, and ensuring adequate stress management and recovery (Saw et al., 2016). This results in athletes achieving maximum performance while minimizing the risk of injury (Bourdon et al., 2017). Additionally, effective monitoring of an athlete's training can detect their reaction to stressors, enabling coaches to identify possible mental health issues and adapt the training regimen (Nässi et al., 2017). The interview results with the physical trainer of the Indonesian national team reported that technical, physical, and tactical training for national players did not undergo thorough recording. This has resulted in manual training records and observational-based evaluation materials that lack data, which is worrisome. According to the trainer, training results must have comprehensive data displayed for each session. The recording must be done for every exercise, both exercises carried out online, and exercises carried out offline.

To enable the monitoring of training and daily activities of tennis athletes, a research team will develop software to record data. This will be presented in real-time to coaches, athletes, and related organizations. The research team conducted this research with the title "Content validity of Android-based Sport Training Program Monitor for Tennis Athletes".

Materials and Methods

This study used the research and development method (Borg, W.R. & Gall, 1983). The study utilized both qualitative and quantitative data analysis approaches (Yudhistira & Tomoliyus, 2020) to obtain more valid data. A development research methodology combining both quantitative and qualitative approaches was utilized to strengthen the rigor of the study (Sugiyono, 2019). This mixed methods approach combines quantitative data, qualitative data collection from expert interviews and analysis techniques for in-depth analysis (Saparudin, Kurniawan, 2022). The study included three experts in tennis coaching, three experts in physical conditioning for tennis, and two experts in technology and informatics. Data collection involved utilizing a questionnaire. Afterwards, the results would undergo analysis using Aiken's V formula in order to assess the content validity of the sports training program monitoring application intended for tennis athletes. Content Validity is a test of validity conducted by experts to assess the feasibility of the test content designed in the questionnaire. Its purpose is to ensure that the test material is consistent with the objectives that need to be measured (Budiastuti, 2018). Aiken's (1985) formula for Aiken's V content validity is utilized to determine the content-validity coefficient by evaluating n experts' results on an item's extent of measured construct (Hendryadi, 2017).

The Aiken's V content validity formula is presented below:

$$V = \sum s / n\ (c - 1)$$

Description:
s = r – Lo
r = number given by rater
Lo = lowest rating
c = highest rating
n = number of raters

The value of Aiken's V coefficient ranges from 0-1. If the index is ≤ 0.4, it is said to have low validity, 0.4-0.8 is said to have moderate validity, and > 0.8 is said to be very valid (Retnawati, 2016).

Results

The results of the study were obtained from a questionnaire that was distributed to 5 professionals in tennis coaching, 5 specialists in the physical fitness of tennis, and 3 experts in technology and information. The questionnaire was tailored to each expert's role requirements, and the calculation of results is detailed in the table1.

Table 1
Results of Content Validity Using Aiken Formula on Tennis Coaching Field Experts

Item	Rater										∑S	n(c-1)	V
	A	S	B	S	C	S	D	S	E	S			
1	5	4	5	4	5	4	5	4	5	4	20	20	1.00
2	5	4	5	4	5	4	5	4	5	4	20	20	1.00
3	5	4	4	3	5	4	5	4	5	4	19	20	0.95
4	4	3	5	4	5	4	5	4	5	4	19	20	0.95
5	5	4	4	3	5	4	5	4	4	3	18	20	0.90
6	5	4	5	4	5	4	5	4	5	4	20	20	1.00
7	4	3	5	4	5	4	5	4	5	4	19	20	0.95
8	5	4	5	4	5	4	5	4	5	4	20	20	1.00
9	5	4	5	4	4	3	4	3	5	4	18	20	0.90
10	5	4	5	4	5	4	5	4	5	4	20	20	1.00
						Mean							0.97

Based on the results of Table 1, it is known that the tennis coaching expert's assessment of item 1 regarding the Availability of the Forehand Technique Com-

ponent Assessment Monitor Room obtained a V index value of 1. Item 2, Availability of the Backhand Technique Component Assessment Control Room obtained a V index value of 1. Item 3, Availability of the Serving Technique Component Assessment Control Room obtained a V index value of 0.95. Item 4, Availability of Volley Technique Component Assessment Control Room obtained a V index value of 0.95. Item 5, Availability of the Smash Technique Component Assessment Control Room obtained a V index value of 0.90. Item 6, Availability of the Monitor Room in Planning the Technique Training Program obtained a V index value of 1. Item 7, Availability of the Monitor Room in Organizing the Technique Training Program obtained a V index value of 0.95. Item 8, Availability of the Monitor Room in Implementing the Technique Training Program obtained a V index value of 1. Item 9, Availability of the Monitor Room in Evaluating the Technique Training Program obtained a V index value of 0.90. Item 10, The Monitor Room Can be Connected With a Physical Trainer Who is in Accordance With the Sport of Tennis, obtained a V index value of 1. The results of the overall assessment that has been given by experts in the field of tennis coaching obtained a mean V of 0.97.

Table 2
Results of Content Validity Using Aiken Formula on Tennis Physical Condition Field Experts

Item	Rater										∑S	n(c-1)	V
	A	S	B	S	C	S	D	S	E	S			
1	4	3	5	4	5	4	5	4	5	4	19	20	0.95
2	5	4	4	3	4	3	5	4	5	4	18	20	0.90
3	5	4	5	4	5	4	5	4	5	4	20	20	1.00
4	5	4	5	4	5	4	5	4	5	4	20	20	1.00
5	4	3	5	4	5	4	4	3	5	4	18	20	0.90
6	5	4	5	4	5	4	5	4	5	4	20	20	1.00
7	4	3	5	4	5	4	5	4	5	4	19	20	0.95
8	5	4	5	4	5	4	5	4	5	4	20	20	1.00
9	5	4	4	3	5	4	5	4	4	3	18	20	0.90
10	5	4	5	4	5	4	5	4	5	4	20	20	1.00
Mean													0.96

Based on the results of Table 2, it is known that the tennis physical condition expert's assessment of item 1 regarding the Physical Condition Monitor Room is Available and Organized Systematically obtained a V index value of 0.95. Item 2, the Monitor Room of Each Athlete, Accessible to Physical and Technical Coaches obtained a V index value of 0,90. Item 3, the Required Physical Condition Components are Represented in the Monitor Room obtained a V index value of 1.

Item 4, the Ease of the Coach in Providing Physical Exercise Doses to Athletes obtained a V index value of 1. Item 5, the Ease With Which Athletes Can Receive Notifications of Training Tasks Given by Physical Trainers obtained a V index value of 0.90. Item 6, the Coach Can Make a Physical Training Plan obtained a V index value of 1. Item 7, the Physical Trainer Can Organize the Training Components Systematically obtained a V index value of 0.95. Item 8, the Coach Can Monitor the Implementation of Athlete Training obtained a V index value of 1. Item 9, the Physical Trainer Can Evaluate Descriptively Quantitatively and Qualitatively obtained a V index value of 0.90. Item 10, Athletes Can Report All Training Activities in Real Time and Completely obtained a V index value of 1. The results of the overall assessment that has been given by experts in the field of physical condition of tennis sports obtained a mean V of 0.96.

Table 3
Results of Content Validity Using Aiken's Formula on Experts in the Field of Technology and Informatics

Item	Rater						∑S	n(c-1)	V
	A	S	B	S	B	S			
1	4	3	5	4	5	4	11	12	0.92
2	5	4	5	4	5	4	12	12	1.00
3	5	4	4	3	5	4	11	12	0.92
4	4	3	5	4	4	3	10	12	0.83
5	5	4	5	4	5	4	12	12	1.00
6	5	4	5	4	5	4	12	12	1.00
7	5	4	4	3	5	4	11	12	0.92
8	5	4	4	3	4	3	10	12	0.83
9	5	4	5	4	4	3	11	12	0.92
10	5	4	5	4	5	4	12	12	1.00
				Mean					0.93

Based on the results of table 3, it is known that the assessment of experts in the field of technology and informatics on item 1 regarding the Outdoor Display of Coaches and Athletes obtained a V index value of 0.92. Item 2, the Display of the Sport Training Monitor Logo obtained a V index value of 1. Item 3, the Trainer Data Security System and Athlete Data obtained a V index value of 0.92. Item 4, Notification of the Location of the Athlete's Whereabouts obtained a V index value of 0.83. Item 5, Color Selection That is Friendly and Safe for the Eyes obtained a V index value of 1. Item 6, the Font is Easy to Read obtained a V index value of 1. Item 7, Ease of Use obtained a V index value of 0.92. Item 8, Notification Messages are Well-conveyed and Easy to Read obtained a V index

value of 0.83. Item 9, the Menu in the Application Can be Easily Understood obtained a V index value of 0.92. Item 10, GPS Access Only for Trainers obtained a V index value of 1. The results of the overall assessment given by experts in the field of Technology and Informatics obtained a mean V of 0.93.

Discussion

Based on the results of Aiken's V calculations in Table 1, the expert assessment in the field of tennis coaching obtained a coefficient value range V 0.90 – 1.00, with a mean of 0.97, which means that all items have high validity. Based on the results of Aiken's V calculations in Table 2, the expert assessment in the field of physical condition of tennis resulted in a coefficient value range of V 0.90-1.00, with a mean of 0.96, indicating high validity for all items. Based on the results from the Aiken's V calculations presented in Table 3, the expert appraisal in the field of technology and informatics yielded a coefficient value range of V 0.83 - 1.00, with a mean of 0.93, suggesting that all items have high validity. A coefficient value of V index ≤ 0.4 indicates low validity, while a coefficient value between 0.4-0.8 indicates moderate validity, and a value >0.8 indicates very high validity (Retnawati, 2016).

Exercise needs assessment is a continuous procedure of gathering data to identify the training requirements, which will enable the organization to attain its goals (Brown, 2002). Monitoring tools are vital to display data in real-time and offer recommendations for enhancing exercise intensity-based physical activity prescriptions (Han et al., 2020). Technology in the sport of tennis has produced a monitoring system capable of distinguishing different actions carried out during a match (Benages Pardo et al., 2019). These actions refer to the different strokes performed by each player. Moreover, sports technology can aid in the evaluation of fine and gross motor skills in children (Clark et al., 2021). Over the last two decades, rapid technological advancements and digitization have significantly transformed the role of technology in sports (Frevel et al., 2022).

Sports technology is advancing with the use of the Android system on smartphones (Galetsi et al., 2022). Specific applications have been developed to showcase data on smartphones or IMHOs that operate on the Android system (Jaitner et al., 2015). As technology becomes more popular, the demand for it increases, leading to a growing sports industry market (Mali & Kumar Dey, 2020). Research indicates that prolonged sitting can negatively affect physical fitness in adults, including muscle strength, cardiorespiratory fitness, and balance. Therefore, it is necessary to develop strategies that encourage behavior change (Silva et al., 2020).

The absence of technology implementation in the area of tennis training urges researchers to develop a monitoring technology for training programs and daily athlete activities. The researcher concluded, based on interview data, that tennis athletes in Central Java province require technology to monitor their activities. This study aims to examine the physiological changes that athletes undergo as a result of training and enhancement of athletic performance (Claus et al., 2017; Corrigan et al., 2022). The implemented monitoring system can detect early signs through athlete reports and measure self-reported levels of fatigue, sleep quality, and muscle soreness (Buchheit et al., 2013; Springham et al., 2021; Thorpe et al., 2015). This program monitoring application is useful for tracking athletes' progress in synchronizing their training programs with their daily activities, including school, hobbies, work, rest, and family. Such synchronization is necessary to prevent overlaps between the training program and the athlete's daily routine. What is more, it is necessary to track the athlete's rest pattern following the training program and inform the coach of its quality, which will impact the execution of the prepared program.

This application offers a private chat feature for athletes and coaches to discuss the implementation of the training program and any necessary adjustments. The chat feature enhances the communication quality between the two parties. It maintains the privacy of the athletes and coaches during communication. This application provides information on athlete location detection, which is crucial for maintaining discipline during their activities. Furthermore, the location detection helps prevent distractions, such as visits to places that do not support athletic performance. Additionally, it provides the coach with relevant information about the athlete's activities at any given time.

This research aims to promote the development of training programs, their monitoring, and evaluation, while also exploring the potential of technology-based programs. Previous research results can provide a theoretical foundation for addressing lack of technology usage in enhancing the performance of petanque athletes in Central Java province. This study's data identifies Central Java tennis athletes as the target group for monitoring applications in training programs. The solution involves an Android-based monitoring app designed to track all athlete activities, including training program implementation, quality of rest, and daily non-sporting activities.

Conclussions

The research concludes that all test items demonstrate high content validity. Thus, coaches can implement this application to monitor their athletes' daily activities and training programs. Moreover, the application enables coaches to as-

sess each training session. The positive impact of technology is evident in the sports field where maximum utilization is crucial. The exercise program monitoring application development is highly beneficial for coaches and athletes in designing and preparing workouts. Athletes can access the assigned exercise program through the application, while the coach can monitor the implementation of each program and evaluate training sessions. Additionally, coaches can track athlete's daily activities outside of training. This application maximizes the potential of athletes and monitors the implementation of their training programs and daily activities.

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STATEMENT OF ETHICS

This study was conducted in accordance with the World Medical Association Declaration of Helsinki. The study protocol was reviewed and approved by the / UPPM STKIP PGRI Bangkalan (Nomor: 025/C8/6/II/2023, Bangkalan, Indonesia).

DECLARATION OF CONFLICTING INTERESTS

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AUTHORS' CONTRIBUTIONS

Rivan Saghita Pratama: Conceptualization, Validation, Resources, Writing – Original Draft.
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Abdul Hafidz: Methodology, Investigation.
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Jaffry Bin Zakaria: Methodology, Visualization.
Teguh Santosa: Validation, Investigation, Project administration, Funding acquisition.
Sunanto: Validation, Funding acquisition.
Agus Himawan: Formal analysis, Project administration.
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Septyaningrum Putri Purwoto: Investigation, Resources, Writing – Review and Editing.

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