

Development of a Volleyball Spike Accuracy Training Model for Young Athletes at Tulung Selapan Club

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ABSTRACT

This study aimed to examine the effect of varied underhand passing exercises. This study aimed to develop a spike accuracy training model for young volleyball athletes at Tulung Selapan Club using the Research and Development (R&D) approach with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The motivation for the study arose from the observation that many athletes experienced difficulties in performing accurate spikes, mainly due to the monotonous and conventional training methods commonly used. The developed product consisted of three training models with nine variations of exercises designed to improve spike accuracy, coordination, strength, and reflexes. Validation was conducted by three experts—an instructional media specialist, a motion expert, and a volleyball practitioner—using the Content Validity Ratio (CVR) and Content Validity Index (CVI). The validation results showed that the training model met the criteria for validity. A small-scale trial involving 15 athletes and a large-scale trial involving 25 athletes indicated that the training model achieved feasibility percentages above 70%, with ratings ranging from “good” to “very good.” These findings suggest that the developed spike accuracy training model is both feasible and effective, and it may serve as a valuable reference for coaches in designing structured, engaging, and measurable volleyball training programs.

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- A. Conception and design of the study;
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INTRODUCTION

Volleyball is one of the most popular team sports worldwide, with a high level of participation across all age groups. It was first introduced by William G. Morgan in 1895 as “Mintonette” and has since evolved into a global sport played competitively at school, club, national, and international levels (Nugroho et al., 2021). In Indonesia, volleyball has grown rapidly due to its simple facilities, accessibility, and popularity among both men and women across urban and rural communities (Endang, 2020; Khamal & Sistiasih, 2023). The sport is also formally regulated under Indonesian Law No. 11 of 2022 on Sports,

which emphasizes the role of sports in education, physical fitness, and national development (Government of Indonesia, 2022).

Among the fundamental techniques in volleyball, the spike—or smash—is considered the most crucial offensive skill. A successful spike allows a team to directly score points and puts pressure on the opponent's defence (Asnaldi, 2020; Pokhrel, 2024). Effective spiking requires not only technical execution but also several physical attributes such as explosive power of the legs and arms, body flexibility, eye-hand coordination, reaction speed, and timing (Yulifri et al., 2018). Biomechanical studies have confirmed that joint torques and angular velocities in the shoulder and elbow significantly influence the accuracy and effectiveness of different types of spikes (Baena-Raya et al., 2021). Therefore, spike accuracy is an essential performance determinant in modern volleyball.

Despite its importance, many young athletes still face challenges in performing accurate spikes. Preliminary observations at Tulung Selapan Club revealed that nearly half of the athletes struggled with spike accuracy. This problem is partly due to the monotonous training models commonly applied, which usually consist of repetitive net spikes without variation. Such limited training approaches often reduce athlete motivation and fail to stimulate skill development effectively. Previous research has emphasized the significance of structured and varied training models in improving spike accuracy and overall volleyball performance (Mahfud et al., 2023; Iksal et al., 2023; Dahrial, 2018). For instance, hanging ball drills and targeted power training have been shown to improve the precision of volleyball spikes significantly.

To address these challenges, there is a need for innovative training models that are not only technically sound but also engaging for young athletes. The ADDIE instructional design model (Analysis, Design, Development, Implementation, and Evaluation) offers a systematic framework for developing training programs that are evidence-based, contextually relevant, and easily implemented in practical settings (Setiawan et al., 2021). Applying this framework to volleyball spike training can help design effective and measurable programs tailored to the needs of athletes and coaches.

This study aims to develop and validate an innovative and structured spike accuracy training model for young volleyball athletes. Specifically, this study is designed to identify fundamental problems in spike training that have been used by coaches and athletes, including technical, physical, and psychological aspects that are often overlooked (Muhammad Arkanul Arba, 2025; Siti Nurhalizah Mutia Aulria, 2025). Designed and developed an evidence-based practice training model that combines biomechanical approaches, exercise periodization, and sports psychology to comprehensively improve spike accuracy. Evaluate the effectiveness of training models developed through implementation and measurement in young volleyball athletes in a controlled setting. Provide practical and measurable guidance that can be applied by coaches in designing spike training programs tailored to the athlete's characteristics, ability level, and individual needs. With the achievement of these goals, this research is expected to make a significant contribution to improving the quality of volleyball training in Indonesia,

especially in the fundamental aspect of spike accuracy, which determines the success of the team in competitions.

The urgency of this research arises from the significant gap between the need to improve the performance of Indonesian volleyball athletes and the availability of a systematic and scientifically validated training model. Data shows that Indonesia's volleyball performance at the international level is still not optimal, with one of the contributing factors being the low level of spike accuracy in important matches (Rahmatullah, 2025; Rerung, 2025). This condition is exacerbated by the limited local research that develops training models based on the context and characteristics of Indonesian athletes. The majority of training programs that exist today still adopt conventional methods that lack consideration of modern biomechanical aspects, proper periodization, and psychological factors of athletes. On the other hand, the development of sports science and training technology has made rapid progress, but its transfer into the practice of training in the field is still very slow. This research is urgent given that Indonesia has great potential in developing quality young volleyball athletes, and with the right training model, achievements at the regional and international levels can be significantly improved in the medium and long term.

The novelty of this research lies in its integrative and contextual approach that combines multiple domains in one comprehensive training model. In contrast to previous studies that tended to focus on one aspect (technical, physical, or psychological), this study integrates detailed biomechanical analysis, periodization of training based on periodization models, development of specific physical components (explosive power, eye-hand coordination, flexibility, and reaction time), and psychological interventions to improve motivation and consistency of exercise. The developed model also uses the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) framework, which ensures that each component of the program is evidence-based and can be evaluated systematically. Another aspect of the novelty is the use of real-time measurement and feedback technology to provide athletes with direct information about the accuracy and quality of their spikes, making the learning process more effective and efficient. This research also develops programs that are measurable and can be tailored to the individual needs of athletes, which has been a challenge in mass training. Thus, this research not only produces new training models but also provides a framework that can be adapted and further developed for different contexts and levels of athletes' ability (Arga, 2025a; Badwi et al., 2025).

The long-term impact of this research is expected to create a paradigm transformation in the volleyball athlete coaching system in Indonesia, from a conventional trial-and-error approach to a structured and measurable science-based approach (Sufitriyono et al., 2025). Practically, the training model developed can be a standard reference for volleyball coaches at various levels, ranging from clubs, schools, to national training, so that there is an improvement in the quality of training evenly throughout Indonesia (Arga, 2025a; Badwi et al., 2025).. In the context of long-term athlete development, this research can be the foundation for developing a more

effective talent identification and development system, where young athletes can be developed with the right methods from an early age so that they reach peak performance at the optimal age (Arga, 2025a). From an academic perspective, this research opens up opportunities for further research that can explore other specific aspects of volleyball training, such as blocking, serving, or defence, using a similar framework (Arga, 2025b; Inpres, 2023).

Therefore, the present study aimed to develop and validate a spike accuracy training model for young volleyball athletes at Tulung Selapan Club. Specifically, the study sought to (1) identify existing problems in spike training, (2) design and develop new training models with variations, (3) validate the models through expert assessment, and (4) evaluate their feasibility and effectiveness through trials with young athletes.

METHODS

This study employed a Research and Development (R&D) approach with the ADDIE model, which consists of five phases: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE framework was chosen because it provides a systematic and iterative process for developing instructional models that are both effective and contextually relevant (Setiawan et al., 2021).

The participants in this study were young volleyball athletes aged between 12 and 16 years from Tulung Selapan Club. The research was carried out in two stages of trials. The small-scale trial involved 15 athletes, while the large-scale trial involved 25 athletes from the same club. In addition to the athletes, three experts participated in the validation process: one motion expert, one instructional media expert, and one volleyball practitioner.

The research procedure began with the analysis phase, where problems and needs were identified through direct observation and discussions with coaches. It was found that many athletes struggled with spike accuracy due to the use of monotonous and conventional training methods. Based on these findings, the design phase focused on creating three training models (AKN 1–AKN 3) with a total of nine variations. These models were specifically designed to improve spike accuracy, strength, coordination, and reflexes, while utilizing simple and accessible equipment such as tennis balls, high-bounce balls, cones, and nets.

In the development phase, the designed models were validated by three experts using structured questionnaires. The validation process employed the Content Validity Ratio (CVR) and the Content Validity Index (CVI) to assess the relevance, clarity, and feasibility of each model. Revisions were made based on the feedback received from the experts. The implementation phase consisted of two trials. In the small-scale trial, 15 athletes practiced the newly designed models, after which their responses and experiences were collected. The large-scale trial involved 25 athletes and served to further test the feasibility and effectiveness of the models under broader application.

Finally, in the evaluation phase, the overall effectiveness and feasibility of the training model were assessed. Data collected from expert validation and athlete

responses were analyzed using descriptive quantitative methods. The CVR was calculated to determine the proportion of experts rating an item as essential, while the CVI measured overall content validity. Athlete and coach responses from both small- and large-scale trials were expressed in percentages and classified ranging from “very poor” (0–20%) to “very good” (91–100%) (Djajanegara, 2020). This process ensured that the final version of the spike accuracy training model was valid, practical, and effective for use in volleyball training at Tulung Selapan Club.

RESULTS AND DISCUSSION

The development of the spike accuracy training model followed the ADDIE framework and produced three training models with nine variations (AKN 1–AKN 3). These models were designed to improve accuracy, coordination, strength, and reflexes using simple equipment such as tennis balls, high-bounce balls, cones, and nets. After the initial design, the models were validated by three experts representing the fields of motion science, instructional media, and volleyball coaching.

The validation results demonstrated that the training models met the required standards of content validity. The Content Validity Ratio (CVR) and Content Validity Index (CVI) scores indicated that the items in the training program were rated as relevant and appropriate by the experts. Average CVR scores ranged between 0.10 and 0.30, which fell within the acceptable threshold of validity. This confirmed that the developed models adequately represented the components necessary for improving spike accuracy in volleyball.

Following expert validation, small- and large-scale trials were conducted to evaluate the practicality and effectiveness of the training models. In the small-scale trial, involving 15 athletes, the training model received feasibility ratings above 70%, which placed it in the “good” category. Athletes expressed that the exercises were engaging, motivating, and easy to understand. Many reported that the variety of drills helped them maintain focus and reduced the monotony of conventional training methods.

The large-scale trial, which included 25 athletes, yielded consistent results. The feasibility ratings again surpassed 70%, with assessments ranging from “good” to “very good.” Coaches and athletes alike highlighted that the developed models not only improved technical spike accuracy but also enhanced player motivation and participation during training sessions. These findings indicate that the developed training model is both feasible for practical use and effective in improving volleyball spike accuracy among young athletes at Tulung Selapan Club.

The results of this study align with previous research that emphasizes the importance of varied and structured training methods in volleyball. Mahfud et al. (2023), for instance, demonstrated that hanging ball drills significantly improved spike precision, while Iksal et al. (2023) found strong correlations between physical factors such as leg and arm strength, eye-hand coordination, and spike accuracy. Similarly, Dahrial (2018) reported that leg explosive power contributed substantially to spike

performance. The current findings extend this body of knowledge by presenting a structured and validated training model developed systematically through the ADDIE process, ensuring both theoretical rigor and practical relevance.

Furthermore, the implementation of the ADDIE framework allowed for iterative revisions based on expert feedback and athlete responses, which strengthened the overall quality of the final product. This systematic approach ensured that the developed training models were not only scientifically grounded but also contextually suitable for the facilities and conditions available at Tulung Selapan Club. The engagement and positive feedback from athletes also highlight the motivational value of varied training models, an essential factor in sustaining long-term athlete development (Soulliard, 2019).

Taken together, the findings suggest that the spike accuracy training model developed in this study offers an effective solution to the limitations of conventional training approaches. By incorporating structured variations, accessible equipment, and validated content, the model provides a practical tool for coaches seeking to enhance spike performance in youth volleyball players.

CONCLUSION

This study developed and validated a spike accuracy training model for young volleyball athletes at Tulung Selapan Club using the ADDIE framework. The model, consisting of three training types with nine variations, was designed to enhance spike accuracy, strength, coordination, and reflexes through the use of simple and accessible equipment. Validation by experts confirmed that the model met content validity standards, while trials with 15 athletes in the small-scale stage and 25 athletes in the large-scale stage demonstrated feasibility ratings above 70%, categorized as “good” to “very good.”

The findings indicate that the developed training model is both feasible and effective in improving spike accuracy among young volleyball athletes. Beyond technical benefits, the model also proved to increase athlete motivation and engagement during practice, addressing the monotony of conventional training methods. Coaches can therefore adopt this model as a structured, engaging, and practical tool for enhancing volleyball training programs.

Future research should expand the application of this model to different age groups, competitive levels, and training environments to further test its adaptability and long-term impact on performance outcomes.

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