



Development of Underhand Volleyball Passing Game Model for Female Students of Class X Vocational High School

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Abstract

PJOK learning on volleyball material, especially underhand passing skills, is still dominated by conventional approaches which have an impact on the low learning motivation of female students. This study aims to develop a feasible, practical, and effective underhand passing volleyball game model for female students of class X Vocational High School (SMK). Analysis, design, development, implementation, and evaluation are all elements of the ADDIE model with the research and development (R&D) method. The research involved female students of class X from one of the vocational high schools in Mojokerto City. Data were collected through expert and practitioner validation questionnaires and learning motivation questionnaires. The research results showed a feasibility level of 93.18% from expert validators and 95.45% from practitioner validators, categorized as very feasible. The product's effectiveness was shown by an average learning motivation score of 137.52 out of an ideal score of 175, categorized as effective. The developed game model was declared feasible and effective for the learning motivation of female students in PJOK (Physical Education, Sports, and Health) learning.

Keywords: Model Development, Game-Based Learning, Underhand Pass, Volleyball, Learning Motivation

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INTRODUCTION

In the era of contemporary education, PJOK (Physical Education, Sports, and Health) learning must focus on the creation and application of engaging, innovative learning models that are appropriate to the characteristics of students (Muhali, 2019; Rizani & Muljani, 2022). One of the innovations emerging in the world of education is the development of game-based learning models, which can help facilitate student understanding and motivation to learn (Mustafa, 2020). Field learning experiences show that, especially in underhand volleyball passing, PJOK learning still tends to use conventional approaches that emphasize monotonous technical drills (Wibisono & Guntur, 2025), thus requiring the development of game-based learning models specifically designed to increase learning motivation while creating a meaningful learning experience. Furthermore, one of the main obstacles in less varied approaches tends to decrease the learning motivation and active participation of students,

especially female students who are more sensitive to stressful or unpleasant learning experiences (Zunidar, 2022).

The problem of low learning motivation and poor underhand passing skills among female students needs serious attention because these skills play a strategic role in increasing confidence, courage, and active involvement in volleyball games (Marquez-Barquero & Christian, 2019). Female students at vocational high schools tend to have higher psychological sensitivity towards stressful, monotonous, or pain-inducing learning experiences, such as the use of a standard hard ball in underhand passing practice. Furthermore, Physical Education, Sports, and Health (PJOK) learning, which is still dominated by drill-based training methods, has the potential to decrease learning motivation and hinder the creation of meaningful learning (Lindsay & Spittle, 2024). Therefore, a more humanistic and enjoyable learning approach that is in line with the characteristics of female learners is needed so that the objectives of Physical Education, Sports, and Health (PJOK) learning can be optimally achieved (Wei & Duan, 2024).

Previous research has investigated volleyball learning models, such as the volleyball smash model for vocational high school students and playing strategies to improve passing skills at certain levels (Karisman & Supriadi, 2022; Rahadian, 2019). However, research that specifically develops a game model to increase learning motivation and underhand passing skills in volleyball, focusing on female students in the 10th grade of vocational high schools, is still very limited. Previous research was conducted at primary and junior secondary school levels, without considering the characteristics of vocational education and the psychological needs of female vocational high school students (Sahabuddin et al., 2025; Sitinjak et al., 2024). Based on this, there is a research gap that needs to be filled by developing a contextual and adaptive game model in line with the vocational education environment.

This research offers novelty by developing an underhand volleyball training model specifically designed based on the characteristics of female students in vocational high schools. The developed training model integrates gamification-based learning principles, which have proven effective in enhancing student engagement, intrinsic motivation, and tactical understanding in PJOK (Physical Education, Sports, and Health) learning (Hsbollah & Rosli, 2022; Raharjo et al., 2024). This research provides novelty in its effort to combine a structured game approach with the physical and psychological developmental needs of female students in the context of vocational education, ensuring that underhand passing learning is not only focused on motor skills but also on a safe, enjoyable, and meaningful learning experience (Multazam Setiawan et al., 2025; Panjaitan & Fardana, 2023).

This study aims to develop a feasible, practical, and effective underhand passing volleyball game model for female students in grade X of vocational high schools (N. W. Agustina et al., 2023; Dwi Agustin et al., 2025). Specifically, this study is expected to have an impact on learning motivation and active participation of students in Physical Education (PJOK) learning (Majid et al., 2025; Ningsih, 2024). This study is also expected to be an empirical reference and creative solution for PJOK teachers in designing volleyball learning that suits the characteristics of female students in vocational education.

METHOD

The research and development (R&D) approach was used in this study with the aim of producing a product in the form of a volleyball learning game model for underhand passing movements for female students in grade X of vocational high schools (SMK). The development model used is ADDIE, which includes the stages of analysis, design, development, implementation, and evaluation (Branch, 2009). The ADDIE model was chosen based on its systematic and flexible characteristics, as well as its ease of implementation in physical education learning in schools, while also allowing for continuous improvement through the evaluation process (Hari Cahyadi, 2019).

The implementation stage was carried out through limited trials and extensive trials to obtain an overview of the feasibility and practicability of the product (Rifaldo et al., 2025). The limited trial involved 12 female students, while the large-scale trial involved 33 female students. The evaluation stage was carried out continuously to assess the suitability of the game model with the learning objectives and the students' responses to the application of the developed model (Siregar & Rhamayanti, 2025).

This research was conducted at one of the Vocational High Schools (SMK) in Mojokerto City during the current academic year, with female students in class X (ten) as the research subjects. The selection of subjects was done purposefully, considering the characteristics of female students and their mastery of underhand volleyball skills. The game model developed is expected to be an effective, engaging, and appropriate alternative for Physical Education, Sports, and Health (PJOK) learning for female students in Vocational High Schools.

RESULTS AND DISCUSSION

Result

This research produced a volleyball learning game model that focuses on the underhand passing skill for female students of class X at a vocational high school (SMK),

developed through the ADDIE stages. The research was conducted in November 2025 at one of the SMKs in Mojokerto City, involving female students of class X. A small-scale trial with 12 students indicated that the model could be implemented effectively and received a positive response, where the use of balloon balls as media enhanced students' confidence in performing underhand passes.

Product feasibility is reviewed through expert validation. The assessment includes aspects of content feasibility, theoretical consistency, clarity of the learning model, as well as readability and language (Yuliana & Ahmad, 2019). Validation is also carried out by practitioners, namely vocational high school Physical Education teachers, to determine the level of practicality and applicability of the product in the field. The assessment includes aspects of suitability with school conditions, practicality of implementation, attractiveness of learning, student engagement, and safety aspects (Cahyono et al., 2023; Handoyo et al., 2023). The assessment results show a score of 42 out of a maximum score of 44 with a feasibility percentage of 95.45%, which falls into the very feasible category. The recapitulation of expert and practitioner validation results is presented in the following Table:

Table 1. Validation Score Description

No	Validation	Result (Percent %)	Description
1	Expert Validator (Lecturer)	93,18%	Highly feasible to use
2	Practitioner Validator (PJOK Teacher)	95,45%	Highly feasible to use
	Total Persentase	94,32%	

The average feasibility percentage is 94.32%. This indicates that the developed volleyball underhand passing game model has a very high level of feasibility from expert validators and practitioners.

The effectiveness of the product is reviewed from the aspect of student learning motivation. A blueprint for the learning motivation instrument covers four main dimensions: attention, relevance, confidence, and satisfaction (Wahyudi et al., 2017). A motivation questionnaire was administered to 33 female students after participating in a large-scale product trial. The results of the descriptive statistical analysis of student learning motivation scores are presented in the following table:

Table 2. Descriptive Statistics of Female Students' Learning Motivation Scores (n = 33)

Statistics	Score
Minimum Score	120
Maximum Score	175
Average Score	137,52
Maximum Ideal Score	175

Based on the table, an average score of 137.52 was obtained from the maximum ideal score of 175, indicating that the students' learning motivation is in the high category.

The product effectiveness category based on the percentage of learning motivation scores is presented in the following table:

Table 3. Effectiveness Category of the Underhand Volleyball Game Model Product

Percentage Interval	Category
$\geq 85\%$	Highly Effective
$70\% - < 85\%$	Effective
$55\% - < 70\%$	Moderately Effective
$< 55\%$	Less Effective

The distribution of product effectiveness is shown in the following table:

Table 4. Distribution of Product Effectiveness Based on Learning Motivation Scores

Category	Number of Students	Percentage
Highly Effective	4	12,12%
Effective	28	84,85%
Moderately Effective	1	3,03%
Less Effective	0	0%
<i>Total</i>	33	100%

Based on Table 4, as many as 84.85% of students are in the effective category and 12.12% are in the very effective category. Only a small proportion of students are in the sufficiently effective category, and there are no students in the less effective category. These results indicate that the underhand passing game model based on games is effective for the learning motivation of female students in PJOK (Physical Education, Sports, and Health) learning.

Discussion

The development of a volleyball game model for underhand passing skills for female students in grade X of vocational high schools shows positive results in terms of feasibility, practicality, and learning effectiveness (Atik & Prasetyo, 2021). This model was developed through the ADDIE approach, which allows the development process to be carried out systematically and in accordance with the characteristics of female students in Vocational High Schools (Nilapantjuran, 2024).

The game model developed consists of several variations of underhand passing games using balloon balls and rubber balls or standard PBVSI balls. The game variations are designed gradually, starting from individual activities, paired games, group games, to mini volleyball games with modified rules. Game modifications are made to ensure each student has the opportunity to practice underhand passing actively and increase engagement during Physical Education, Sports, and Health (PJOK) learning (Dwi Putri & Wijaya, 2024).

The results of initial trials involving 12 female students indicate that the game model can be effectively implemented in Physical Education, Sports, and Health (PJOK) learning. The students were able to follow the entire sequence of the game and showed high enthusiasm, especially when using the balloon ball media. This media helped reduce the difficulty of the underhand passing movement, making the students more confident and brave to try. This finding reinforces the view that modifications to equipment and games are effective strategies for aligning skill demands with students' initial abilities (Lubay & Purnama, 2020).

The game model developed consists of variations of underhand passing activities arranged progressively, starting from individual drills to group games and mini volleyball games with modified rules. The gradual arrangement of activities aligns with the principles of motor skill learning that emphasize repetition of movement, progression, and active engagement of learners (Skulmowski, 2024). Through these game variations, learners have the opportunity to practice underhand passing in a fun and non-monotonous learning environment (Widya Agustina et al., 2023).

The results of expert and practitioner validation indicate that the game model has a very high feasibility level. The recapitulation of validation scores in Table 1 shows an average feasibility percentage of 94.32%, categorized as highly feasible. Expert validation confirms the model's alignment with the Vocational High School (SMK) PJOK curriculum and physical education learning theories, while practitioner validation shows that the game model is easy to implement, suitable for school conditions, and safe to use. This demonstrates that the developed product is not only conceptually sound but also applicable in real learning contexts.

The effectiveness of the game model is also reflected in the increase in student learning motivation. The analysis of learning motivation in Table 2 shows that the average motivation score falls into the high category. The distribution of effectiveness categories in Tables 3 and 4 shows that most students are in the effective and highly effective categories. This finding indicates that game-based underhand passing learning is capable of capturing students' attention, increasing their enthusiasm, and encouraging active engagement during Physical Education, Sports, and Health (PJOK) learning (Pangestu & Firmana, 2025).

The increase in learning motivation is closely related to the characteristics of game-based learning in which students are placed as active subjects of learning (I. Agustina et al., 2024). Games provide a fun learning experience, foster self-confidence, and reduce students' anxiety towards movement errors (Mahardhika et al., 2025). This aligns with learning motivation theory, which states that a meaningful and enjoyable learning atmosphere plays a

crucial role in increasing student interest and engagement, especially in physical education learning (Panjaitan & Fardana, 2023).

Overall, this discussion shows that the developed volleyball underhand passing game model has a positive contribution to PJOK learning in vocational high schools, especially for female students. This model meets the criteria of feasibility and practicality and is effective in terms of student learning motivation. Therefore, this game model can be used as an innovative, engaging, and student-centered PJOK learning alternative.

CONCLUSION

Based on the research and development that has been conducted, it can be concluded that the game-based underhand passing learning product is declared effective for the learning motivation of female students in Physical Education, Sports, and Health (PJOK) subjects. The results of descriptive statistical analysis indicate that the majority of students are in the effective and highly effective categories, with a high average learning motivation score. These findings prove that the application of game-based learning can create a fun learning atmosphere, increase active student engagement, and foster students' interest and enthusiasm in participating in PJOK learning, especially in the underhand passing volleyball material.

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