

Application of Game Based Learning Model to Improve Volleyball Learning Outcomes for Students at State Islamic High School

Pinkan Setya Dhita¹, Agung Wahyudi²

¹²Pendidikan Jasmani Kesehatan dan Rekreasi, Universitas Negeri Semarang, Jawa Tengah, Indonesia

Author's Email: pinkandita02@students.unnes.ac.id, agungwahyudi@mail.unnes.ac.id

Correspondent Author: pinkandita02@students.unnes.ac.id

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Abstract

This study aims to analyze the influence of the Game-Based Learning model on improving volleyball learning outcomes of students in class X MAN 2 Banyumas, especially in upper service materials. The main premise of this study is that volleyball learning packaged through play can create a more active, contextual, fun, and meaningful learning experience than learning that is centered solely on the repetition of techniques. The research hypothesis states that there is an increase in student learning outcomes after the application of the Game-Based Learning model in the affective, cognitive, and psychomotor domains. This study uses a quantitative approach with a one-group pretest-posttest design experiment. The study participants totaled 38 students, consisting of 13 male students and 25 female students. The research instruments include knowledge tests, attitude assessment sheets, upper service skills rubrics, and learning observation sheets. Data were analyzed using descriptive statistics, Shapiro-Wilk normality test, paired sample t-test, Wilcoxon test, and Cohen's effect measure d. The results of the study showed an increase in the average score in all areas of learning outcomes. The affective score increased from 51.26 to 57.92; cognitive score increased from 83.16 to 91.05; and psychomotor scores increased from 62.13 to 69.08. The difference test showed a significant increase in the affective, cognitive, and psychomotor domains with a p value of < 0.05 . The effect size showed a large influence on the affective domain and a moderate influence on the cognitive and psychomotor domains. Thus, the research hypothesis is accepted. The Game-Based Learning model has proven to be effective in improving students' overall volleyball learning outcomes.

Keywords: Game-Based Learning; learning outcomes; ball; top serve; physical education.

INTRODUCTION

Physical education has a strategic role in shaping students' movement competencies, fitness, social attitudes, and thinking abilities through active and meaningful learning experiences. In the context of learning game sports, volleyball is one of the important materials because it combines technical skills, tactical understanding, decision-making, cooperation, and emotional control in game situations. It is not enough that volleyball learning is geared solely towards mechanical mastery of movement, but it is also necessary to develop students' ability to understand the function of techniques in the game, assess the success of movement, and apply them effectively in changing situations. Several studies show that physical education learning designed through an active, collaborative, and game-based approach can increase student involvement, learning motivation, and cognitive and psychomotor learning outcomes (Ezeddine et al., 2025; Gil-Arias et al., 2021; Cuckoock et al., 2022; Ryan, 2026; SueSee & Pill, 2025).

In volleyball learning in school, basic skills such as serving, passing, and simple play are often the main indicators of learning success. However, the practice of learning in the field still shows several obstacles. Students often have difficulty performing volleyball techniques consistently, lack confidence when executing moves in front of friends, and cannot relate technique practice to actual game situations. This problem is also seen in the volleyball learning of students in class X MAN 2 Banyumas, especially in the low active participation, the lack of optimal ability to evaluate techniques, and the lack of maximum mastery of the upper serve. This condition shows that the learning approach that is too teacher-centered, repetitive drills, and direct instruction is not

fully able to answer the diverse learning needs of students. Similar findings were reported in a study on students' difficulties in volleyball learning, which confirms that traditional models tend to limit tactical understanding, participation, and skill transfer into real play (Dao & Nguyen, 2021; Ihsan et al., 2023; Sgrò et al., 2022; Yulianti, 2025).

The latest literature offers various approaches to overcome these problems, one of which is through Game-Based Learning. This approach places games as the primary vehicle for learning so that students not only repeat techniques, but also understand when, why, and how techniques are used in the context of games. Models such as Teaching Games for Understanding, Tactical Games Model, Sport Education, small-sided games, and game modifications have been widely used to improve volleyball skills, motivation, game knowledge, as well as student involvement in physical education (Batez et al., 2021; de Oliveira Castro et al., 2022; Gil-Arias et al., 2021; Mahedero et al., 2021; Sgrò et al., 2021). Other research has also shown that the application of game-based learning, cooperative learning, and innovative pedagogical models can improve academic learning time, technical knowledge, game performance, and student learning outcomes on volleyball materials (Akkaya & Mirzeoglu, 2024; Arantes et al., 2025; Astuti et al., 2024; Darmawan et al., 2025; Hastie et al., 2023).

In addition, game-based learning is considered relevant because it can present a learning atmosphere that is more fun, challenging, and close to student characteristics. Modifications of the size of the field, the number of players, the rules of the game, the target movement, and a simple form of competition can help students learn gradually without losing the context of the game. In volleyball, this approach gives students the opportunity to practice top serve, receive the ball, set up positions, and make decisions more naturally. Studies on TGfU interventions, Tactical Games Models, small-sided games, and app-based learning show strong opportunities to improve game performance, engineering skills, motivation, fitness, and student participation (Aryanti et al., 2022; Ningrum et al., 2021; Septiyanto & Suryobroto, 2025; Stojanović et al., 2023; Wibowo et al., 2024). Thus, Game-Based Learning can be a pedagogical alternative to transforming volleyball learning from just a technique practice to a more contextual, active, and meaningful learning experience.

Nonetheless, some research gaps can still be identified. First, some studies focused more on motivation, participation, or game performance in general, while studies that specifically tested the improvement of top-serve learning outcomes in three domains, namely affective, cognitive, and psychomotor, were still limited. Second, a lot of research has been done in the context of elementary schools, colleges, or sports clubs, so the empirical evidence on Madrasah Aliyah or high school students still needs to be strengthened. Third, some studies use development design, case studies, or action research, while experimental research that tests the influence of the Game-Based Learning model on measurable volleyball learning outcomes still needs to be expanded, especially in the context of physical education learning in Indonesia (Dewanti et al., 2023; Ferriz-Valero et al., 2022; Qu et al., 2025; Scott, 2024; Zhang, 2022). Therefore, research is needed that not only offers learning solutions but also tests its effectiveness through experimental design.

Based on this background, this study aims to analyze the influence of the Game-Based Learning model on improving volleyball learning outcomes of students in class X MAN 2 Banyumas, especially in the upper service material which includes affective, cognitive, and psychomotor domains. The novelty of this research lies in the application of the Game-Based Learning model in the design of experimental research in the context of volleyball learning at Madrasah Aliyah, with a focus on improving the learning outcomes of the upper serve in a

multidimensional manner. The scope of the study was limited to volleyball learning of grade X students, the application of modified games as the main learning strategy, and the measurement of changes in learning outcomes before and after treatment. The results of this study are expected to make an empirical contribution to the development of physical education learning strategies that are more active, contextual, fun, and evidence based.

METHODS

Research Design

This study uses a quantitative approach with a pre-experimental one-group pretest-posttest design. This design was chosen because the study aims to test changes in students' volleyball learning outcomes before and after being given treatment in the form of the application of the Game-Based Learning model. This design allows researchers to compare the initial and final scores of the same group so that changes in learning outcomes can be analyzed measurably. The research design pattern is expressed as O_1-X-O_2 . O_1 as a pretest, X as a game-based learning treatment, and O_2 as a posttest. The use of experimental design in physical education learning is relevant to test the effectiveness of pedagogical models on improving student learning outcomes, movement skills, participation, and comprehension in the context of sports games (Akkaya & Mirzeoğlu, 2024; Astuti et al., 2024; Ihsan et al., 2023; Sgrò et al., 2022).

Participants

The research participants were students in class X of MAN 2 Banyumas Research who participated in physical education learning on volleyball materials. The number of participants was 38 students, consisting of 13 male students and 25 female students. All participants participated in a series of studies ranging from pretest, treatment, to posttest so that no data was lost in the analysis process. The selection of class X students is based on the consideration that the basic technical material of volleyball, especially the upper serve, is in accordance with the learning achievements of physical education at the high school level. In addition, the characteristics of students at this level allow for the application of game-based learning that emphasizes active engagement, cooperation, decision-making, and technical evaluation in game situations.

Sampling Procedures

The sampling technique uses *purposive sampling*, which is the selection of participants based on certain criteria that are in accordance with the research objectives. The inclusion criteria in this study include active students in class X, participating in physical education learning, participating in volleyball materials, having initial volleyball learning scores that still need to be improved, and being in physical and mental conditions that allow them to participate in learning activities. Exclusion criteria include students who have suffered a serious injury, have a history of chronic illness that inhibits physical activity, or do not follow one of the measurement stages. This technique is used so that the samples involved are completely in line with the needs of the game-based volleyball learning experiment.

Intervention

The treatment in this study is the application of the Game-Based Learning model to volleyball learning upper service material. This model places play as the primary context of learning so that students not only repeat techniques separately but also practice serving techniques in modified game situations. Modifications are made through setting service targets, target areas, number of players, simple game rules, role rotation, and scoring challenges. Through this approach, students are directed

to understand the relationship between serving technique, ball direction, punch strength, body position, and strategy of earning points.

The implementation of learning consists of introductory, core, and closing activities. In the introductory activity, the teacher conditions the students, conveys the learning objectives, and explains the indicators of upper service skills. In the core activities, students did warm-ups, brief basic technique exercises, service games with targets, small group games, and evaluation of movement errors through teacher and peer feedback. In the closing activity, students and teachers concluded the material, reflected on the difficulty of movement, and related the game experience with the principles of upper service techniques. The application of game-based learning was chosen because various studies show that this approach can improve students' motivation, participation, tactical ability, and learning outcomes in physical education (Ezeddine et al., 2025; Cuckoock et al., 2022; Ryan, 2026; SueSee & Pill, 2025).

Instruments

The research instruments consisted of a knowledge test, an attitude assessment sheet, a rubric on top service skills, a student observation sheet, and a teacher's observation sheet. The knowledge test is used to measure students' cognitive ability in understanding the concept of upper serving, analyze technical errors, and determine motion improvement solutions. This test is multiple-choice with a score of each item of 10 so that the final score is converted to the range of 0–100. Attitude assessment is used to measure the affective domain of students during the learning process. The aspects assessed include cooperation, honesty, respect, enthusiasm, confidence, and sportsmanship. Each aspect is scored based on the emergence of student behavior during learning. Skill assessments are used to measure the psychomotor domain of the upper service. The skills rubric includes four main indicators, namely initial stance, execution movement, ball contact, and final movement. Each indicator is assessed based on the quality of the implementation of student movements. Student observation instruments are used to record student involvement in learning, while teacher observation instruments are used to ensure that treatment is carried out according to learning procedures.

Research Procedure

The research procedure is carried out through three main stages, namely pretest, treatment, and posttest. In the pretest stage, students are given initial measurements that include affective, cognitive, and psychomotor aspects. This measurement aims to obtain an overview of students' initial abilities before the application of the Game-Based Learning model. After that, students take part in game-based volleyball learning as an experimental treatment. All learning activities are carried out according to the scenarios that have been prepared, by emphasizing play activities, modification of movement tasks, feedback, and evaluation of upper service techniques. After the treatment is completed, students take a posttest with an equivalent instrument to find out the change in learning outcomes after learning.

Data Analysis

Data were analyzed quantitatively using descriptive and inferential statistics. Descriptive statistics are used to obtain average scores, standard deviations, minimum scores, and maximum scores in each area of learning outcomes. The normality test was conducted using Shapiro-Wilk because the sample size was less than 50 students. If the data is distributed normally, the difference in pretest and posttest scores is analyzed using *a paired sample t-test*. If the data is not normally distributed, the analysis is confirmed using the Wilcoxon test. The significance level is set at $\alpha = 0.05$. In addition, effect measures were calculated using Cohen's *d* to determine the strength of the effect

of treatment on student learning outcomes. The interpretation of the results is not only based on significance values, but also on the magnitude of the average increase and the size of the effect so that the conclusions of the study have statistical and practical meaning. This analysis strategy is in accordance with the character of physical education experiment research that assesses changes in learning outcomes before and after learning interventions (Darmawan et al., 2025; Dewanti et al., 2023; Septiyanto & Suryobroto, 2025).

RESULTS

The results of this study illustrate the change in student volleyball learning outcomes after the application of the Game-Based Learning model in upper service learning. The analysis was carried out on three domains of learning outcomes, namely affective, cognitive, and psychomotor. All data analyzed came from 38 students, with no data lost in each pretest and posttest measurement.

Based on the results of descriptive statistics, there was an increase in the average score in all areas of learning outcomes after treatment. The average affective score increased from 51.26 ± 7.914 in the pretest to 57.92 ± 8.254 in the posttest. This increase shows an average difference of 6.66 points or around 12.99%. In the cognitive domain, the average score increased from 83.16 ± 13.377 to 91.05 ± 11.099 , with a difference of 7.89 points or around 9.49%. Meanwhile, the psychomotor domain increased from 62.13 ± 13.779 to 69.08 ± 10.938 , with a difference of 6.95 points or around 11.19%.

Table 1. Descriptive statistis

Measurement	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
Affective Pretest	38	0	51.26	7.914	33.00	63.00
Cognitive Pretest	38	0	83.16	13.377	50.00	100.00
Psychomotor Pretest	38	0	62.13	13.779	44.00	94.00
Affective Posttest	38	0	57.92	8.254	40.00	73.00
Cognitive Posttest	38	0	91.05	11.099	60.00	100.00
Psychomotor Posttest	38	0	69.08	10.938	44.00	88.00

The increase in the minimum score in the affective domain from 33.00 to 40.00 and the cognitive domain from 50.00 to 60.00 shows a shift in student achievement in the low-score group. In the cognitive domain, the maximum score remains at a score of 100.00, which indicates that some students have achieved optimal scores both before and after treatment. However, the decrease in standard deviation from 13,377 to 11,099 indicates that students' cognitive achievement becomes more even after learning. In the psychomotor realm, the average increases even though the maximum value of the posttest is lower than the pretest. This suggests that the main improvement occurred in the general tendencies of the group, rather than solely in the achievement of the highest scores of individuals.

Table 2. Normality test result

Measurement	Valid	Shapiro-Wilk	P-value of Shapiro-Wilk	Range
Affective Pretest	38	0.948	.078	30.00
Cognitive Pretest	38	0.911	.005	50.00
Psychomotor Pretest	38	0.922	.011	50.00
Affective Posttest	38	0.961	.198	33.00
Cognitive Posttest	38	0.786	< .001	40.00
Psychomotor Posttest	38	0.959	.170	44.00

The normality test using Shapiro-Wilk showed that not all data was normally distributed. Pretest affective data were normally distributed, $W = 0.948$, $p = 0.078$, and posttest affective data were also normally distributed, $W = 0.961$, $p = 0.198$. However, pretest cognitive data, $W = 0.911$, $p = 0.005$, posttest cognitive, $W = 0.786$, $p < 0.001$, and pretest psychomotor data, $W = 0.922$, $p = 0.011$, were not normally distributed. Normally distributed posttest psychomotor data, $W = 0.959$, $p = 0.170$. Therefore, the interpretation of the results of the difference test is carried out by considering parametric tests and nonparametric confirmations.

Table 3. Paired sample test result

Pretest - Post test	Test	Statistic	z	df	p	Location Parameter	SE Difference	95% CI for location parameter	
								Lower	Upper
Affective	Student	-3.455		37	0.001	-6.658	1.927	-10.563	-2.753
	Wilcoxon	122	-3		0.003	-8		-12	-3
Cognitive	Student	-11.779		37	< .001	-7.895	0.67	-9.253	-6.537
	Wilcoxon	0	-4.782		< .001	-10		NaN	NaN
Psychomotor	Student	-2.48		37	0.018	-6.947	2.802	-12.625	-1.27
	Wilcoxon	152	-2.296		0.022	-9.5		-15.5	-0.5

The results of the differential test showed that there was a significant improvement in all areas of learning outcomes. In the affective domain, the paired sample t-test showed a significant difference between the pretest and posttest, $t(37) = -3.455$, $p = 0.001$, with an average difference of -6.658. The results of the Wilcoxon test also confirmed a significant difference, $z = -3.000$, $p = 0.003$. A negative sign on the test result shows that the calculation is made from the pretest score minus the posttest, so that it substantively leads to an increase in the score after treatment. In the cognitive domain, the increase was also significant, $t(37) = -11.779$, $p < 0.001$, with an average difference of -7.895. Wilcoxon's results showed the same findings, $z = -4.782$, $p < 0.001$. These results show that the learning model applied can improve students' understanding of the upper service material, including aspects of technical knowledge, principles of movement implementation, and evaluation of movement errors.

In the psychomotor domain, the results of the paired sample t-test also showed a significant increase, $t(37) = -2.480$, $p = 0.018$, with an average difference of -6.947. The Wilcoxon test supports these results, $z = -2.296$, $p = 0.022$. Thus, the application of Game-Based Learning has a positive influence on the ability to practice service to students. These findings are in line with research on volleyball learning that shows that game-based approaches, cooperative models, and learning strategies that place students in game situations can improve students' knowledge, technique skills,

and psychomotor learning outcomes (Akkaya & Mirzeoğlu, 2024; Astuti et al., 2024; Ihsan et al., 2023; Sgrò et al., 2022).

The effect measure showed that the improvement in learning outcomes was not only statistically significant but also had practical significance. Cohen's value of d in the affective domain is -0.823 , which indicates a large effect. In the cognitive domain, Cohen's d is -0.541 , while in the psychomotor domain it is -0.558 ; Both showed moderate effects. The negative sign again indicates the direction of the pretest calculation minus the posttest, so the absolute value is used to interpret the strength of the effect.

Table 4. Effect size

Pretest - Post test	Cohen's d	SE Cohen's d	95% CI for Cohen's d	
			Lower	Upper
Affective	-0.823	0.276	-1.188	-0.450
Cognitive	-0.541	0.049	-0.878	-0.197
Psychomotor	-0.558	0.242	-0.897	-0.213

The greatest effect is in the affective realm. This shows that game-based learning has a strong impact on aspects of attitude, engagement, courage, and student participation in volleyball learning. Moderate effects on the cognitive and psychomotor domains suggest that improved understanding of concepts and practice skills requires a repetitive, directed, and contextual practice process. In the context of physical education, these results support the position of *Game-Based Learning* as an approach that not only improves the learning atmosphere but also strengthens students' multidimensional learning outcomes (Darmawan et al., 2025; Ezeddine et al., 2025; Qu et al., 2025).

The results of the graph processing in Figure 1, Figure 2, and Figure 3 show a consistent pattern of improvement from pretest to posttest. In Figure 1, the affective graph shows an increase in the average point from about 51 to 58. This increase reinforces the statistical results that students show positive changes in attitude, participation, and engagement during learning.

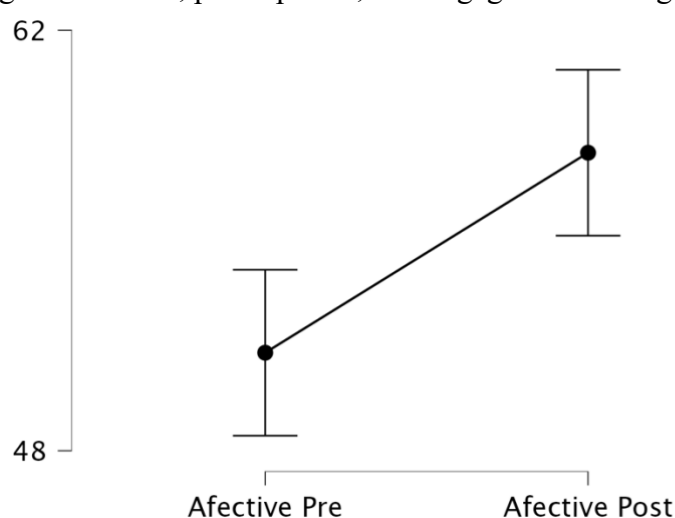


Figure 1. Comparison of pre and post test learning outcomes in the affective domain

Figure 2 shows the sharpest improvement in the cognitive domain. The average point of the posttest is higher than the pretest, with a clear visual distance. This shows that after the implementation of game-based learning, students better understand the concepts, rules, and principles of the implementation of the upper service. The decrease in standard deviation in cognitive data also showed that student achievement became more homogeneous after treatment.

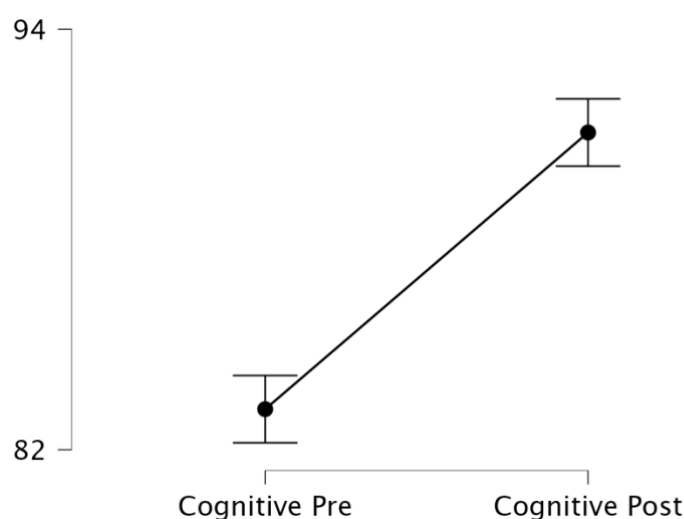


Figure 2. Comparison of pre and post test learning outcomes in the cognitive domain

Figure 3 shows the increase in the psychomotor average from pretest to posttest. Although the visual improvement is not as sharp as the cognitive realm, the direction of the graph still shows positive changes. This indicates that students' service skills develop after learning, but improving motor skills tends to require longer practice time than improved cognitive comprehension. Thus, data visualization supports the statistical results that the Game-Based Learning model has a positive impact on students' volleyball learning outcomes in the affective, cognitive, and psychomotor domains.

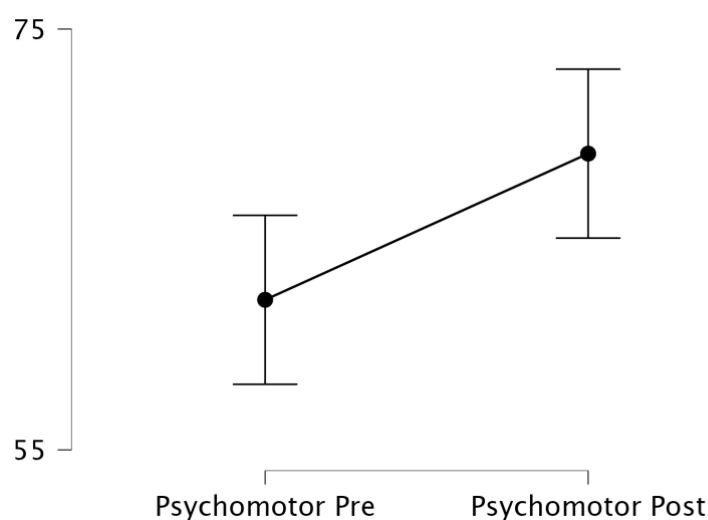


Figure 3. Comparison of pre and post test learning outcomes in the psychomotor domain

Overall, the results of the study show that the application of the *Game-Based Learning* model in volleyball learning provides a significant improvement in the learning outcomes of students in class X of MAN 2 Banyumas. Improvements occurred in all domains measured, namely affective, cognitive, and psychomotor. These findings indicate that game-packed volleyball learning can be an effective pedagogical strategy to improve student engagement, understanding, and practice skills in top-serve materials.

DISCUSSION

The findings of this study show that the Game-Based Learning model makes a positive contribution to students' volleyball learning outcomes in the affective, cognitive, and psychomotor domains. Rationally, the increase occurs because game-based learning brings a learning experience closer to the actual game situation. Students not only mechanically imitate the movement of the upper serve but also learn to understand the function of the technique, choose the direction of the target, read the situation, work together, and evaluate the motion errors directly. These characteristics are in accordance with the principles of game-based pedagogy that emphasizes activities, challenges, social interactions, and movement problem-solving in meaningful contexts (Camacho-Sánchez et al., 2023; Ezeddine et al., 2025; Cuckoock et al., 2022; Ryan, 2026; SueSee & Pill, 2025).

Improved learning outcomes can also be understood through higher student engagement during learning. In modified games, students have more opportunities to try serves, receive feedback, correct mistakes, and repeat skills in fun situations. This strengthens affective engagement, cognitive understanding, and motor experience simultaneously. In the context of volleyball learning, approaches such as TGfU, Tactical Games Model, Sport Education, small-sided games, and modified games have been shown to help students develop game knowledge, technical skills, motivation, and game performance in a more contextual manner (Akkaya & Mirzeoğlu, 2024; Arantes et al., 2025; Astuti et al., 2024; Batez et al., 2021; Darmawan et al., 2025; Gil-Arias et al., 2021; Hastie et al., 2023; Sgrò et al., 2021; Sgrò et al., 2022).

The results of this study support previous findings that game-based learning can improve the quality of physical education learning. Research on volleyball shows that game strategies can strengthen students' basic skills, motivation, game knowledge, and engagement (Aryanti et al., 2022; de Oliveira Castro et al., 2022; Ningrum et al., 2021; Septiyanto & Suryobroto, 2025; Stojanović et al., 2023; Wibowo et al., 2024). These findings are also in line with studies showing that games, cooperative learning, and innovative learning models can improve volleyball learning outcomes and student learning activities (Akkaya & Mirzeoğlu, 2024; Astuti et al., 2024; Candra & Nazirun, 2021; Fizi et al., 2023; Longakit et al., 2024; Satria et al., 2024).

Other support emerges from research that places assessments, social skills, and learning experiences as important parts of game learning. Dewanti et al. (2023) emphasized the need for game performance-based assessment in volleyball learning, while Moon and Park (2023) showed that assessment techniques in volleyball learning can strengthen the quality of skill evaluation. Zhang et al. (2025) also emphasized that the assessment of football skills based on game scenarios is important to understand learners' performance more authentically. This is relevant to this study because learning outcomes are not only seen from the result of the stroke, but also from attitudes, understanding, and skill processes.

However, the results of this study need to be read proportionally. Some studies show that the effectiveness of game-based learning does not always stand alone, but rather is influenced by motor skills, students' initial experience, form of exercise, and learning structure. Ihsan et al. (2023) and Yulianti (2025) found that volleyball learning outcomes are influenced by the interaction between learning methods and students' motor skills. Apidogo et al. (2021) and Qu et al. (2025) show that variation, repetition, and contextual interference play a role in the mastery of volleyball techniques. Rihatno et al. (2024), Redublado and Sumalinog (2024), Ferriz-Valero et al. (2022), and Zhang (2022) also show that other strategies such as distributed practice, jigsaw learning, flipped classroom, and technology-assisted learning can contribute to volleyball skills. Therefore, Game-Based Learning is

effective, but it still needs to be combined with technical instruction, demonstrations, feedback, and assignment adjustments according to the student's characteristics.

Theoretically, these findings can be explained through constructivist approaches, game pedagogy, and nonlinear pedagogy. In game-based learning, students build understanding through hands-on experience, social interaction, motion exploration, and problem-solving. Nonlinear pedagogy views movement skills as the result of interactions between individuals, tasks, environments, and game rules, so that task variations can encourage more functional movement adaptations (Gómez-Criado & Valverde-Esteve, 2021; Cuckoock et al., 2022; Ryan, 2026). In volleyball, this is seen when students learn to associate the top serve with the direction of the ball, strength, body position, goal, and chance of earning points.

From a skill development perspective, top serve is not only ball-hitting movements, but also technical-tactical activities that involve coordination, perception, attention, cognitive regulation, and decision-making. Saleem and Al-Zuhairi (2024) show that cognitive regulation affects volleyball service performance, while Laclote-Gutierrez et al. (2025) affirm that serve has an important tactical function in the game. Other research has also shown that motor coordination, balance, attention, and movement control play a role in the mastery of volleyball skills (Al-Aboudi & Katta, 2023; Marinho & das Virgens Chagas, 2022; Nurodin & Asmawi, 2024). Thus, when serve is taught through target play and simple competitive situations, students not only practice technique, but also develop cognitive control and tactical decisions.

These findings are also relevant to the development of contemporary physical education learning models that emphasize active, personal, collaborative, and meaningful learning experiences. Studies on pedagogical models, gamification, serious games, and digital game-based learning show that games can increase motivation, learning readiness, engagement, and academic performance when designed according to learning objectives (Andreu, 2023; Li & Lim, 2025; Martinez et al., 2022; Merino-Campos et al., 2023; Montiel-Ruiz & Calderón, 2025; Oliveros & Fernandez-Rio, 2022; Pérez-López & Navarro-Mateos, 2022; Prieto & Aguilar, 2022; Sotoca-Orgaz et al., 2025). In the context of physical education, this principle reinforces the position of Game-Based Learning as an approach that is not only oriented to the outcome of movement, but also to the formation of a complete learning experience.

The practical implication of this study is that physical education teachers can use Game-Based Learning as a more active, contextual, and adaptive volleyball learning strategy. Teachers can design service games to the target zone, small group games, scoring challenges, role rotations, and simple motion error evaluation. The form allows students to learn top-serve techniques in a context close to real play. However, teachers still need to combine games with technique demonstrations, individual corrections, reinforcement of concepts, and clear feedback so that students are not only actively playing but also understand the correct quality of movement.

Teachers also need to adapt the game to the student's ability level. Grouping by ability, peer assessment, and rule modification can help students with different abilities still have an appropriate learning experience (Azzaloulidine & Erturan, 2025; Mahedero et al., 2021; Tokay & Akil, 2025). In addition, learning needs to assess affective, cognitive, and psychomotor aspects in an integrated manner so that student learning outcomes are seen comprehensively. Thus, Game-Based Learning can be an effective pedagogical alternative to improve the quality of volleyball learning, if it is systematically designed, adjusted to student characteristics, and supported by appropriate

performance assessments (Dewanti et al., 2023; Farias et al., 2022; da Silva et al., 2022; Risma et al., 2024).

CONCLUSION

Based on the results of the study, the application of the Game-Based Learning model in volleyball learning has been proven to have a positive influence on improving the learning outcomes of students in class X MAN 2 Banyumas. Improvements occurred in three main domains, namely affective, cognitive, and psychomotor. In the affective realm, game-based learning can encourage student involvement, cooperation, sportsmanship, confidence, and enthusiasm during the learning process. In the cognitive realm, students show an increased understanding of the concept of upper service, principles of technique implementation, movement error analysis, and correction strategies. Meanwhile, in the psychomotor realm, students experience development in upper service skills, especially in the aspects of initial attitude, movement execution, ball contact, and final movement. These findings suggest that volleyball learning packaged through play is more effective in creating an active, fun, contextual, and meaningful learning experience. The Game-Based Learning model not only helps students master techniques mechanically but also connects top-serve skills with real-life game situations. Thus, this model can be used as an alternative to physical education learning strategies to improve the quality of volleyball learning processes and outcomes in schools. This research provides a practical contribution for physical education teachers in designing more participatory, adaptive, and development-oriented learning outcomes.

RECOMMENDATION

Based on the results of the research, physical education teachers are advised to apply the Game-Based Learning model as an alternative to volleyball learning strategies, especially in upper service materials. This model can be used to create a more active, fun, and contextual learning atmosphere so that students not only practice techniques but also understand the application of techniques in game situations. Teachers need to design a simple, gradual, and appropriate form of play according to the student's ability, such as serving games to the target area, small group games, or awarding additional points based on the accuracy of the ball's direction. In its implementation, teachers still need to provide demonstrations, technique corrections, and direct feedback so that students can correct movement errors appropriately. Learning assessment should also include affective, cognitive, and psychomotor domains so that student learning outcomes can be known comprehensively. Schools are expected to support the implementation of game-based learning by providing adequate learning facilities, such as volleyball, net, court, and appropriate assessment media. For future researchers, it is recommended to use an experimental design with a control group so that the effectiveness of the Game-Based Learning model can be compared more robustly. Future research may also expand the subject at different school levels, increase the duration of treatment, and test the influence of this model on other volleyball skills such as passing, smash, and blocking.

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