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Game-Based Training Model: Does It Improve Fundamental Badminton Young Athletes' Skills?

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Abstract

Background: The application of game models in badminton for young athletes is considered very appropriate. Game models incorporate training elements suitable for young athletes, who are still in a developmental stage that requires play, so that training can be maximized, as athletes feel more relaxed and have more fun in the program.
Aims: The research aims to examine the effectiveness of the game model in improving young athletes' badminton skills.
Methods: This study used a quantitative descriptive quasi-experimental design. The research design used in this study was "The One Group Pretest Posttest Design" with no control group.
Results: The Wilcoxon test in Table 3 above shows that the pretest and posttest scores for badminton skills were significantly different ($p < 0.05$). Thus, the game model is efficacious in improving athletes' badminton skills.
Conclusion: The game model applied in this study demonstrates high effectiveness in improving young athletes' badminton skills. Therefore, the researcher recommends using a game-based training model to improve young athletes' badminton skills. Implementing game-based training models can significantly enhance the development of young badminton athletes. By integrating play-oriented activities into training, coaches can create a more engaging and motivating environment that aligns with children's developmental needs. This approach not only improves technical and tactical skills in badminton but also promotes enjoyment, reduces training stress, and fosters long-term athlete participation.

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INTRODUCTION

Training programs for young badminton athletes tend to emphasize technical mastery and training intensity, with little attention to the characteristics of children's physical, cognitive, and psychological development. Understanding these dynamics is crucial for designing effective strategies through the frequency of technical actions and tactical approaches, which explains the complexity in gaining a strategic advantage in badminton (Sheng et al., 2025). This incongruent approach can hinder skill optimization, reduce motivation to practice, and negatively impact long-term athlete development. Traditional badminton teaching methods have received much criticism among educators (Li & Jawis, 2024; Hsu et al., 2024). With advances in multimedia technology, professionals suggest integrating it into the badminton teaching process. Therefore, the effectiveness of early childhood athlete development needs to be based not only on technical and physical aspects, but also on the implementation of a training model that aligns with children's developmental needs.

In line with these issues, badminton in Indonesia has a unique position: individuals from various social backgrounds play it, and it is a significant source of national pride (Ardha, 2024; Liu,

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2023). According to Coenga et al., (2025), the main objective in badminton is to score points by accurately directing the shuttlecock onto the opponent's court while preventing it from landing on one's own court. This goal is particularly important for young athletes, who differ from adult athletes in their physical, cognitive, and emotional development, and who require age-appropriate training models to optimize skill mastery and performance. Therefore, talent identification and sports training programs must be systematically designed for athletes' developmental stages, including in badminton. Several studies, Ma et al., (2025) Hoskin, (2025) emphasized that badminton achievements in the Asian region, including Indonesia, are inseparable from the process of identifying talented athletes from an early age.

Ideally, training begins in childhood, as brain development and motivation to learn tend to be more optimal during this phase than during adolescence (Martínez-Santos et al., 2020;Fandakova & Hartley, 2020). However, a common problem is the inconsistency of the training program, which should be designed using a game-based approach (Saleh & Fauzan, 2024; Niyazov et al., 2024). Badminton training for young athletes generally emphasizes a combination of technical skills, strategy, and physical fitness in a competitive environment, where every aspect of the game determines the outcome (Zhu et al., 2024). Training typically focuses on strength, coordination, balance, plyometrics, agility, and high-intensity training (Weng et al., 2025; Ma, et al., 2025). To maximize the potential of young athletes, training needs to be designed through a game-based learning model that emphasizes enjoyment, active engagement, and gradual mastery of techniques and tactics

Game-based learning models play an important role in coordinating children's movements through sports activities, including badminton. Badminton has a positive impact on heart and lung health, as well as children's basic physical development (Arif et al., 2024; Ma et al., 2025). Training using play-based models can foster a sense of enjoyment and independence, as well as increase intrinsic motivation and a positive relationship with the learning experience (Bermudez et al., 2023). Play-based models have a positive impact on children (Coenga et al., 2024). They significantly impact children's physical and cognitive development, enabling their application in learning and training practices to improve motor skills and thinking abilities. Previous research indicates that training young athletes using play-based models can be effectively implemented (Valero-Velenzuela, 2024; Ma et al., 2024).

Sheng, (2025) found that using game-based training models for young athletes maximized their performance while still allowing them to enjoy the program. Play-based or game-based training models are highly effective for young badminton athletes, as they integrate play with structured physical activity. This approach not only enhances coordination, cardiovascular health, and overall physical development but also nurtures psychological well-being, including happiness, independence, and intrinsic motivation. Through enjoyable and developmentally appropriate training experiences, young athletes can improve both their physical and cognitive skills while maintaining enthusiasm for the sport.

Game-based training models are effective for young badminton athletes because they integrate elements of play with structured physical activity, improving coordination, cardiovascular health, physical development, and psychological aspects such as happiness, independence, and intrinsic motivation. Fun, developmentally appropriate training improves physical and cognitive abilities while maintaining enthusiasm. However, children's training must be age-appropriate because their bodies are still susceptible to heavy loads and high intensities, which can negatively impact both their physical and mental health (Wu et al., 2024). Aerobic capacity is well developed, but anaerobic capacity is limited, and the body is still susceptible to injury. Therefore, game-based training models can maximize young athletes' abilities without eliminating the element of fun.

Game-based training models have been widely researched; several badminton-specific models have not been tested, particularly in the context of young athletes in Indonesia. This study aims to develop a game-based training model that encompasses all basic badminton techniques,

with the hypothesis that such a model can comprehensively improve athletes' skills. This research offers novelty as no previous studies have comprehensively examined all technical aspects in young athletes.

METHOD

The research design is quasi-experimental. The experimental research method is a research approach that aims to describe the cause-and-effect relationship between two variables. The research design used in this study is "The One Group Pretest Posttest Design," or there is no control group. This research uses a descriptive, quantitative approach with a quasi-experimental design to identify and describe the causal relationship between the application of the game model (independent variable) and improvements in badminton skills (dependent variable) in young athletes. The "One Group Pretest-Posttest Design" was selected because the study focuses on measuring changes within the same group before and after treatment, without a control group. This design is considered appropriate when the main goal is to determine the effectiveness of an intervention in a naturally existing group, especially when it is not feasible to form a control group due to practical or ethical constraints.

Participant

The population used was 50 male and female young badminton athletes. The sample size calculation for the entire population followed the recommended guidelines for the event-per-variable (EPV) ratio, which was set at 50. The formula used was N=200+50i, where 'i represents the number of independent variables included in the final model. Therefore, the sample size used in this study had an average age of 10.40 ± 1.18 years, height of 155.04 ± 3.54 cm, weight of 32.79 ± 5.44 kg, BMI of 11.74 ± 1.71 kg/m-2, and FAT of 8.14 ± 1.19%. The sample is shown in Table 1.

Validity and Reliability

The instruments used test guidelines, including short serve test, long serve test, lob test, and smash test, with content validity values (0.25-1.00), factorial validity (0.62-0.83), test and retest reliability (0.80-0.94), and inter-rater reliability (0.82-0.92). This initial validation study confirmed that outcome- and process-based badminton test guidelines can be used to measure and improve the level of badminton skill mastery in beginner badminton athletes aged between 10 and 12 years.

Instrument

The test instruments used in this study were basic badminton skill test instruments with the following test guidelines: short serve test, long serve test, lob test, and smash test. To assess young athletes' badminton skills, a pretest was administered to obtain initial data. Then, the research sample received 12 sessions of treatment over 3 weeks, with three treatments delivered in 1 week.

Analysis Plan

Data analysis techniques were carried out using an effectiveness test to determine the effect of the pretest results on the posttest results and using a quasi-experimental method, and analyzed using a non-parametric paired data difference test, namely the Wilcoxon Signed Ranks Test, to determine the effectiveness of the game model in improving students' badminton skills. The first step was to determine the descriptive statistics and characteristics of the respondents using anthropometric data, followed by a normality test to assess whether the data were normally distributed. The data was considered normally distributed if the significance level (sig) was greater than 0.05. The normality test was performed in IBM SPSS Statistics ver. 26 for Windows using the Shapiro-Wilk test, and the hypothesis test used an effectiveness test to determine the game model's effectiveness in improving students' badminton skills, using a percentage formula.

RESULTS AND DISCUSSION

Results

Based on the research conducted, several results were obtained, which will be presented in the sub-chapters, tables, and figures below. Table 1 below shows the results of the BMI description, as well as anthropometric data, which can be seen in Table 1 below:

Table 1. Anthropometric Data

Variable	Statistical Data		
	Mean (SD)	Min	Max
Age (year)	10,40 ± 1,18	10,00	12,00
Height (cm)	155,04 ± 3,54	158,50	163,50
Weight (kg)	32,79 ± 5,44	30,50	41,68
BMI (kg/m²)	11,74 ± 1,71	10,62	15,25
FAT (%)	8,14 ± 1,19	7,40	10,15

Table 1 presents the anthropometric characteristics of young badminton athletes aged 10–12 years. The table summarizes key anthropometric variables, including height, body weight, body mass index (BMI), and body fat percentage, along with their mean values, standard deviations, and minimum–maximum ranges. Overall, the results indicate relatively consistent anthropometric profiles among the participants, reflecting a homogeneous sample in terms of physical characteristics. This homogeneity supports the suitability of the sample for further analysis. Following the presentation of anthropometric data, the results of the descriptive analysis are provided in Table 2:

Table 2. Descriptive Statistical Analysis

	Minimum	Maximum	Mean	Std. Deviation
Pretest Short Serve	50	70	58.00	6.07
Posttest Short Serve	67	81	72.25	4.88
Pretest Long Serve	33	62	45.40	8.35
Posttest Long Serve	45	73	60.80	7.66
Pretest Lob Shot	60	82	71.60	5.68
Posttest Lob Shot	70	91	78.75	5.240
Pretest Smash Shot	15	28	20.25	3.24
Posttest Smash Shot	20	32	26.20	3.51

Table 2 presents the descriptive analysis of pretest and posttest data from young badminton athletes. The measurements were conducted before and after the implementation of the game-based training model and included assessments of short serve, long serve, lob, and smash performance. The table reports the minimum and maximum values, mean scores, and standard deviations for each basic technical skill, providing an overview of performance changes following the intervention. Subsequently, Table 3 presents the results of the Shapiro–Wilk normality test, which assesses the distribution characteristics of the collected data.

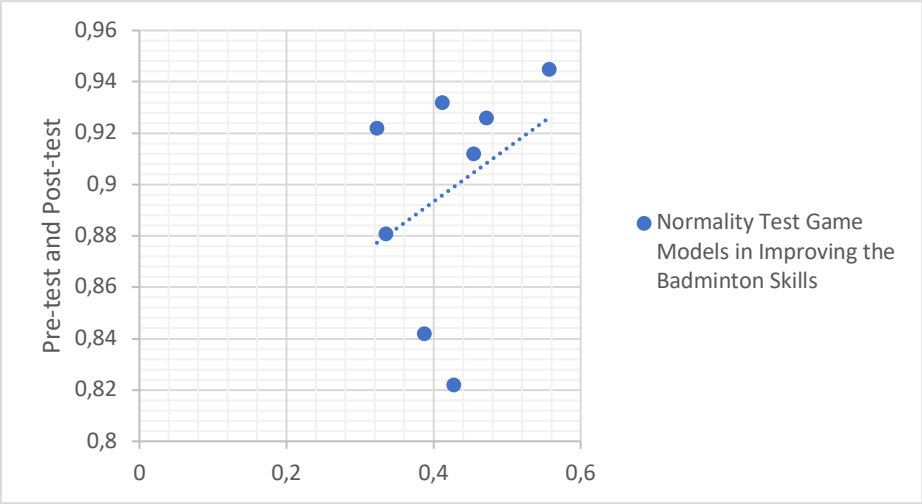

Figure 1. Normality Test Results (Shapiro-Wilk)

The image above shows the results of a Wilcoxon test, indicating that the pretest and posttest scores were significantly different ($p < 0.05$). Thus, the game model is effective in improving students' badminton skills**.**

Table 3. Wilcoxon Test Results

	Mean	Ties	Sig. < 0,05	Description
Pretest Short Serve	58,00	0	0,01	Significant
Posttest Short Serve	72,25		0,04	
Pretest Long Serve	45,40		0,00	
Posttest Long Serve	60,80		0,02	
Pretest Lob Shot	71,60		0,00	
Posttest Lob Shot	78,75		0,00	
Pretest Smash Shot	20,25		0,03	
Posttest Smash Shot	26,20		0,01	

The Wilcoxon test results presented in Table 3 indicate significant differences between pretest and posttest badminton skill scores among. The overall significance value was below 0.05, indicating that the game-based training model had a statistically significant effect. These findings suggest that the implemented game model is effective in enhancing badminton skills among young athletes aged 10–12 years.

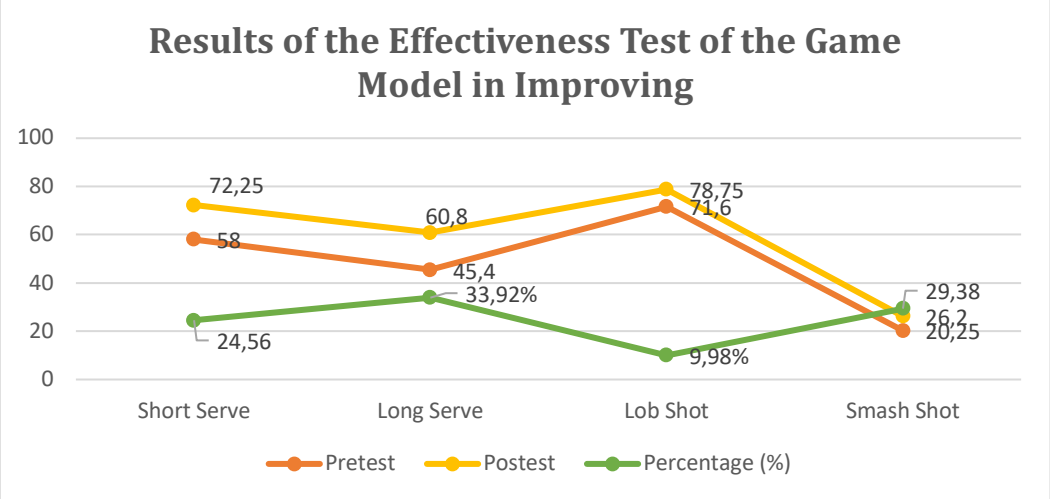

Figure 2. Effectiveness Test of the Game Model in Improving

Based on Figure 2, the effectiveness analysis of the game-based training model shows an increase in mean scores from pretest to posttest across all assessed badminton skills. The percentage improvements observed were 24.56% for the short serve, 33.92% for the long serve, 9.98% for the lob shot, and 29.38% for the smash shot. These results indicate that the implemented game model exhibits a measurable level of effectiveness in enhancing the badminton skill performance of athletes aged 10–12 years.

Discussions

The application of the game model has proven to be an effective approach in enhancing badminton skills, as it provides a structured yet dynamic learning environment that emphasizes both technical and tactical development. By situating training within game-like scenarios, athletes are encouraged to engage in meaningful practice that integrates motor coordination, decision-making, and situational awareness. Furthermore, the game-based approach promotes active participation, motivation, and enjoyment, which are essential for sustained learning and skill mastery. Overall, the game model's effectiveness lies in its ability to bridge technical training with real-match demands, thereby supporting comprehensive player development in badminton.

Fizi, (2023) stated that the analysis of research results revealed that play models are effective in improving motor skills. In general, play models can be used as a practical model to increase the motivation of young athletes in physical education learning. The existing systematic review has been developed by incorporating the early education stage into the study process. The play method is a learning approach that helps children understand how to apply techniques in game situations, where they actively create rules and express their skills to achieve learning goals (Behnamnia et al., 2020). In addition, special attention is directed to the analysis of the dynamics and mechanics used in the game (Camacho-Sánchez et al., 2023). Li et al (2018) modified the game model to simplify the learning and practice process for all young athletes, while emphasizing certain aspects of the game. The game model is one of the models with a fairly high effectiveness in improving badminton skills in young athletes because, during the game, young athletes are encouraged to solve tactical problems and make their own decisions (Chatzipanteli et al., 2016).

This game model is particularly relevant for sports that require high levels of precision and concentration, such as golf, woodball, bowling, and snooker.*net/wall games*is an individual or team game in which points are earned when a ball or similar object is successfully dropped into the opponent's area or placed in a space on the opponent's court by passing the ball over the net at a certain height, preventing the opponent from returning it (Sander & Fogt, 2022). This is possible because training with a play model supports the process of automating movements. Through consistent repetition of exercises, athletes can improve technical precision, resulting in more accurate and skilled movements (Stone et al., 2022). The study also shows the effectiveness of game models in improving young athletes' badminton skills. Furthermore, with game models, young athletes will not get bored quickly because training with them is more varied, providing them with the opportunity to train more engagingly and avoid monotony (Rossi et al., 2022).

Game models can also be designed with varying levels of difficulty in mind, adapting to each young athlete's abilities (Hare et al., 2022). This allows young athletes to develop optimally and gain greater confidence when playing. This finding is supported by research by Li et al., (2025), which states that applying game models to badminton has been shown to increase young athletes' interest in learning. This is because young athletes enjoy these models, creating a more enjoyable learning environment. Through movement practice in the game, young athletes become more skilled at playing badminton and demonstrate improved abilities compared to their previous experiences. According to Purwanto et al., (2024), incorporating game elements into physical learning objectives enriches the learning experience while helping students develop coordination, strength, and balance, which in badminton significantly assist and accelerate the development of young athletes.

Implementing a game-based training model also has a positive impact on both players and coaches (Liang, 2022). Although technical and tactical experience varies greatly, individual improvement can still be achieved through the application of game strategies and the development of player abilities (Siyahtaş & Ceviz, 2025). For players, this model not only improves technical skills but also deepens tactical understanding, enabling them to better control the game. Meanwhile,

coaches benefit from structured training guides that facilitate effective, efficient training sessions and maximize time utilization (Ma et al., 2024). This is further supported by Hartt et al. (2020), who argued that implementing a game-based model encourages active student involvement in the learning process and helps develop coordination, strength, and balance through experiential learning.

Based on the percentage results above, the game model is most effective on long serve strokes because, for young athletes, long serves are the most basic and easiest to learn. With the game model, young athletes' understanding of these training techniques will improve. This is also supported by the opinion of Hasibuan et al., (2025), long serves are a fundamental technique that plays a major role in determining the quality of the game. Structured and varied training methods, such as game models, can contribute to improving basic badminton skills, including long serves (Li, et al., 2024). Improving long serve skills is expected to positively contribute to a player's overall performance on the court. A needs analysis of a creative, game-based badminton long-serve learning model shows that it can attract young athletes and improve their skills.

In smash strokes, it turns out that the playing model has a good effect on young athletes, as seen from the results of the study, where the smash stroke has the second-highest percentage. This is supported by the opinion of Stone et al., (2022) that the playing model for badminton smash strokes will be effective if the player can hit hard and straight diagonally. In addition, Khalil et al., (2022) stated that play-based learning can increase athlete motivation. However, several challenges remain, including the need to implement this method effectively. This affects the effectiveness of learning and the achievement of educational goals in improving students' physical and mental health, which plays an important role in helping young athletes be more focused when competing in high-intensity badminton. The posttest results were better than the pretest results and showed that the model applied had a positive effect in the research and could be used.

Each game format is designed to reflect the characteristics of young elementary school athletes, thereby creating a more enjoyable and effective learning environment (Trajkovik et al., 2018). The play model provides young athletes opportunities to practice while observing, encouraging teamwork and understanding of situations during matches, and improving motor skills in a supportive and motivating learning environment (Shepelenko et al., 2023). Additionally, student athletes value coaches who build trust and respect, provide encouragement and support, offer constructive feedback, and have strong communication skills (Tiberi et al., 2024). In addition, research results show that the game model, when combined with the player's motor skills, significantly improves the skills of beginner badminton players (Hung, et al., 2018). In addition, the game model presented introduces a new nuance aimed at improving basic technical abilities among young beginner athletes (Ruslan et al., 2021). Therefore, it can be said that the effectiveness of the game model in improving the badminton skills of young athletes is effective, and based on several expert opinions that support this discussion, the game model provides a better experience for young athletes in facing future matches.

Implications

The results of this study have important theoretical and practical implications. Theoretically, the finding that game models effectively improve badminton skills in young athletes reinforces the view that experiential learning and game situations are more relevant than conventional, repetitive methods. In practice, this approach can be used by coaches, sports teachers, and club coaches to design training programs that are more engaging and motivating and that can develop athletes' technical, cognitive, and decision-making skills. Furthermore, the application of game models supports long-term development by creating a fun training environment and reducing boredom, potentially increasing the sustainability of young athletes' participation in the sport. These implications also open up opportunities for further research across different age groups and skill levels, as well as exploring combinations with other approaches to develop more comprehensive coaching strategies.

Research Contribution

This study highlights the significant effectiveness of game-based models in improving badminton skills among young athletes, reinforcing the theoretical perspective that learning through

direct experience and game situations is more adaptive than conventional repetitive methods. Beyond technical skill development, game experiences contribute to mental readiness and decision-making abilities in competitive contexts, emphasizing the importance of designing game models that are active and contextualized as a key strategy in youth athlete development. The contribution of this research lies in providing empirical evidence that game-based approaches are not only relevant for enhancing fundamental skills but also support long-term athlete development. Practically, this study offers an innovative training alternative for coaches, physical education teachers, and club trainers to design programs that are more engaging, adaptive, and aligned with the developmental characteristics of young athletes, while also opening avenues for future research to examine the effectiveness of game models across different age groups and skill levels, as well as their integration with other approaches such as mental training and performance analysis technologies to achieve a more comprehensive athlete development strategy.

Limitations

The limitations of this study include the fact that, although the number of participants was considered adequate, only young athletes participated. Furthermore, this study had limitations related to gender. Among the young athletes, some had not yet trained and were included in the study. Experience is a continuous variable, so this could be considered a limitation.

Suggestions

In this study, the majority of participants were young male athletes. The number of young female athletes is still minimal. Therefore, future studies are expected to include more young female athletes, or at least equal numbers of young male athletes. Further research is expected to expand the variables discussed and ensure that each young athlete selected is at the same level or has been participating for a long time.

CONCLUSION

The effectiveness test conducted provided positive results regarding the badminton skills of young athletes. This was evident in all aspects, including long serves, short serves, lob shots, and smash shots among young athletes. These findings have practical implications in screening and providing training through game models to young athletes in accordance with their developmental stages. Coaches, managers, or people involved in badminton can apply this model to achieve maximum results, as it creates a fun effect in the game when applied on the field. For further research, the results can be combined with technical or physical training reinforcement using the game model, making it more complex based on the results of the game model applied in this study, especially with the integration of technology in other game models.

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AUTHOR CONTRIBUTION STATEMENT

EFN was responsible for the study's design and conceptualization. NFS and SN were responsible for writing the manuscript. LSR was responsible for data analysis and for discussing the findings. Data processing and collection, as well as full responsibility in the field during the study, were carried out by MA and NA.

AI DISCLOSURE STATEMENT

The author declares that this research was prepared, researched, written, and edited without the aid of artificial intelligence (AI) techniques. The author takes full responsibility for the content of the publication.

CONFLICTS OF INTEREST

There is no conflict in this article.

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