The effect of game-based learning variations on elementary school students' straddle jump gymnastics skills

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ABSTRACT

Background: Physical education in primary schools is essential for the development of students' motor skills, including gymnastic abilities such as the straddle leap. In fact, numerous students continue to struggle to execute these movements accurately because of repetitive teaching approaches that fail to engage them actively. Consequently, a more stimulating and diverse educational methodology, including game-based activities, is required.

Objectives: This study examines the impact of fluctuations in game-based learning on the enhancement of straddle jump gymnastics skills among primary school students.

Methods: This research employed a quantitative methodology using a pre-experimental framework, namely the One-Group Pretest–Posttest Design. The study population comprised all 40 fourth-grade students at Citungku Elementary School, who were sampled using a total sampling technique. Data were gathered via a practical examination of straddle jump movement proficiency, adhering to the Australian Gymnastic Federation's evaluation criteria, which encompass four components: the initiation, propulsion, suspended posture, and landing. The intervention lasted four weeks and included eight sessions featuring activities such as squat jumps, mirror jumps, rope skipping, and hopscotch, all aimed at training the elements of the straddle jump. The Shapiro-Wilk normality test and paired-samples t-test were conducted in SPSS version 27 for data analysis.

Results: The study found an improvement in students' capabilities following the implementation of game-based learning modifications. The mean pretest score of 58.00 rose to 74.76 in the posttest. The paired-samples t-test yielded a t value of -9.894 and a p-value of 0.001 (< 0.05), indicating a significant difference between pre- and post-treatment outcomes. This demonstrates that the executed game activities facilitated improvements in students' motor coordination, push-off strength, body control during floating, and landing methods during the straddle jump movement.

Conclusions: Variations of game-based learning, including squat jumps, mirror jumping, rope skipping, and hopscotch, have demonstrated efficacy in enhancing straddle jumping gymnastics skills among elementary school students while fostering a more dynamic and pleasurable physical learning experience.

Keywords: game variations, motor skills, straddle jump gymnastics.

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INTRODUCTION

Physical education is a crucial component of the school education process, helping develop students' physical abilities, motor skills, and social and emotional skills. Physical education in elementary schools includes gymnastics. Gymnastics lessons aim not only to improve physical fitness but also to train students' motor coordination, balance, courage, and self-confidence (Budi & Listiandi, 2021). In the context of elementary school education, gymnastic skills such as straddle jumps are basic movements that are crucial to master because they support the development of fundamental motor skills in elementary school-aged children (Tauchid, Warni, & Kahri, 2020).

However, in elementary school physical education lessons, many students still struggle to perform the straddle jump correctly. This movement requires optimal coordination between the run-up, takeoff, body position during flight, and landing (Habibi & Tjaahyo Kuntjoro, 2023). Students' difficulties in mastering these skills are often influenced by monotonous, teacher-centered learning methods, leading to a lack of motivation to participate in the learning process actively. Monotonous learning situations can reduce students' interest in learning and participation in physical activities, especially in gymnastics material, which some students find difficult and challenging (Dupri et al., 2021).

One of the most recommended approaches in physical education is game-based learning. This strategy emphasizes active, enjoyable learning and offers students a wider variety of movement experiences (Marcella, 2022). Previous research, according to Rejeki et al (2024), shows that game-based learning can increase student participation, learning motivation, and basic motor skills in school-age children. This approach also allows students to learn motor skills in a more interactive, context-based way. These activities enhance the learning process (Fauzi et al., 2023).

A previous study has shown that integrating games into physical education learning can improve motor skills, movement coordination, and student involvement in physical activity (Sudrazat & Rustiawan, 2020). Game activities provide students with the opportunity to practice movements repeatedly in a more enjoyable context and free from learning pressures (Handayani et al., 2023). In addition, game-based learning can foster a more collaborative learning environment, increase students' self-confidence, and support the development of social skills through student interactions (Petruk et al., 2022). For example, a study by Timba & Yanuarius (2020) shows how squat jumps training affects students' long jump abilities in elementary school. Furthermore, a study by Suharnoko & Firmansyah (2018) titled "Development of a Jumping Learning Model Through Mirror Jump Games for Elementary School Students" focuses on developing a mirror jump game model as an effort to improve students' jumping abilities in general. Although both studies make important contributions to the development of game-based learning models in physical education, they have not comprehensively examined how the combination of various game variations affects specific gymnastics skills, such as the straddle jump, in elementary school students.

Although several studies have shown the effectiveness of game-based learning approaches in improving students' motor skills, most remain focused on developing basic motor skills in general or on implementing only one type of game in the learning process (Estrellado et al., 2023). Research specifically exploring the impact of

combining various game variations on the improvement of gymnastics skills, especially straddle jump movements, among elementary school students remains relatively limited (Louk et al., 2023).

In light of these issues, this study focuses on the low-straddle jump gymnastics skills of elementary school students, which are caused by the limited variety of learning methods in physical education. This situation indicates that further research is needed, particularly in integrating various types of games designed to train the movement phases in straddle jump gymnastics (Kollo et al., 2024). Therefore, innovation in learning is needed to increase student involvement and provide more diverse movement experiences through a game-based learning approach (Asmi et al., 2018).

In line with these issues, the purpose of this study was to analyze the effects of variations in game-based learning on the improvement of straddle jump gymnastics skills in elementary school students. The game variations in this study included squat jumps, mirror jumps, rope skipping, and hopscotch, designed to train the movement components of straddle jump gymnastics: approach, takeoff, floating position, and stance.

Based on this conceptual framework, the proposed research hypothesis is that applying variations of game-based learning in physical education improves straddle jump gymnastics skills in elementary school students. Therefore, this research is expected to provide theoretical and practical contributions to the development of physical education learning models in elementary schools, particularly in improving gymnastics skills through a more innovative, active, and enjoyable learning approach for students.

METHODS

Study Design and Participants

This study used a quantitative methodology to assess how different kinds of games affected primary school students' ability to improve their straddle jump gymnastics. The researcher was able to gather quantifiable, statistically analysable data using a quantitative technique, which produced objective, broadly applicable results (Abdullah & Mongsidi, 2022). Strong evidence for the relationship between the variables under study, that is, differences in game kinds and straddle jump gymnastics skills, is provided by this method, which also makes hypothesis testing easier. A pre-experimental one group pretest-posttest design was employed in the study (Figure 1). Before the game versions are implemented, students will complete a pre-test to gauge their proficiency in straddle jump gymnastics. Students will take a final test (post-test) to gauge their skill gain following an intervention session that teaches straddle jump gymnastics utilizing a variety of game types (Abdullah & Mongsidi, 2022). Because it allows comparison of skills before and after treatment, this approach is extremely useful for evaluating how well different game types improve gymnastics abilities.

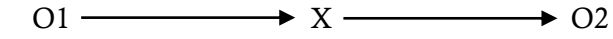

Figure 1. Schematic representation of the one-group pretest–posttest design (O_1 = pretest, X = intervention, O_2 = posttest).

In this research, the population comprises all individuals or objects under study. Specifically, the population studied comprised all 40 fourth-grade students at

Citungku Elementary School: 19 in class 4A and 21 in class 4B. These students were chosen because the school has adequate facilities for implementing gymnastics programs and is committed to developing physical education in line with the national curriculum. Furthermore, combining these two classes allows researchers to access a relevant and diverse population and to observe variations in responses to different teaching models. This also provides a deeper insight into the influence of the social environment and varying teaching methodologies on students' physical skills.

This study used a total population sampling (census) technique, and the entire population served as the research sample. Furthermore, the author has received permission from teachers and parents to conduct this research experiment on students. The use of total sampling allows the author to provide equal opportunities for the population to serve as research participants. This statement aligns with Arieska's (2018) definition of total sampling as a technique in which every individual in the population has an equal chance of being selected.

Ethical approval statement

The Physical Education Study Program at Universitas Pendidikan Indonesia conducted an ethical feasibility assessment for this research. Based on the research permit letter number B-256/UN40.C2.1/PT.01.01/2026, this research was deemed feasible. All actions involving human participants were conducted in accordance with the principles of research ethics outlined in the Declaration of Helsinki. Furthermore, the authors obtained permission from the parents of the students and teachers involved, and informed consent was obtained before the study began.

Research Instruments

Data were collected using a performance-based test designed to assess students' straddle jump skills. This approach was selected because the measured outcomes are practical. The assessment criteria were adapted from the Australian Gymnastics Federation INC guidelines (Heri, Rusilowati, & Raharjo, 2017), which are widely used in physical education research.

The instrument evaluates four components: approach, take-off, flight, and landing. Each component is rated on a three-point scale (1–3) based on the quality of movement execution. Higher scores indicate more accurate and controlled performance, while lower scores reflect technical deficiencies.

The maximum total score is 12. To facilitate interpretation, scores were converted into percentages using the formula:

Score = (Total Score / Maximum Score) × 100.

Content validity was established through alignment with standardized gymnastics assessment criteria. Reliability was ensured by applying consistent scoring procedures across all observations.

Research Procedure

The intervention was implemented over four weeks, comprising eight instructional sessions conducted during regular physical education classes. Each session lasted approximately 60 minutes. The instructional design incorporated a series of game-based activities to enhance fundamental movement skills associated with the straddle jump.

Each session followed a structured sequence of activities. Squat jump exercises were used to develop lower-body strength and explosive power. Mirror-based jumping tasks were performed in pairs, where one student replicated the movements of another to promote coordination and body control. Jump rope activities were included to improve rhythm, agility, and coordination of footwork. In addition, a hopscotch-based activity required students to jump across marked floor patterns using one or both feet alternately, supporting the development of balance, coordination, and movement accuracy. All activities were systematically integrated into each session to facilitate progressive improvement in motor skills required for the execution of the straddle jump.

Data Analysis

The next step was to use SPSS version 27 to analyze the pretest and posttest data. The study started with a Shapiro-Wilk normality test because the sample size was less than 50 (Ahadi et al., 2023). Finding out if the gathered data are regularly distributed is the aim of this test. In order to ascertain whether there is a significant difference between the pretest and posttest results following the implementation of the four game variations, a paired sample t-test, also known as a paired sample t-test, must be performed if the findings are deemed normal (Wardani & Wafa, 2025).

RESULTS

The study's findings show data analysis of students' straddle jump gymnastics abilities before and after game modifications in sports learning. Forty-fourth-grade students at Citungku Elementary School completed pre- and posttests, which provided the data. The SPSS version 27 software was used to process the data. Based on the findings of the straddle jump skill assessments, Table 1 displays the average pretest and posttest scores.

Table 1. Descriptive Analysis

Results	N	Maximum	Minimum	Mean	Std. Deviation
Pre-test	40	83.00	33.00	58.00	12.82
Post-test	40	100.00	50.00	74.77	12.791

Table 2. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	0.125	40	0.117	0.957	40	0.131
Posttest	0.135	40	0.064	0.957	40	0.131

As presented in Table 1, the pretest scores for students' straddle jump performance (N = 40) had a mean of 58.00 and a standard deviation of 12.82. The scores ranged from 33.00 to 83.00. Recognizing this data highlights the effort involved, which can make the audience feel appreciated for their contribution to understanding student performance. The posttest results showed a mean of 74.77, a standard deviation of 12.79, and a score range of 50.00 to 100.00.

To assess data distribution, a normality test was conducted using the Shapiro–Wilk method, as the sample size was below 50. Explaining that significance values guide interpretation helps the audience feel more involved and confident in the analysis process. A significance value greater than 0.05 indicates that the data are

normally distributed, whereas a value below 0.05 suggests a deviation from normality. The results of the normality test are summarized in Table 2.

Table 3. Paired T-Test Results

	Mean	Std. Deviation	Std. Eror Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-Tailed)
				Lower	Upper			
Pretest-Posttest	-12.5	7.99	1.26	-15.06	-9.95	-9.89	39	0.001

The results of the paired-samples t-test showed a statistically significant difference between pretest and posttest scores (Table 3). With a sample size of 40, the analysis yielded a t-value of -9.89 and a two-tailed significance value of 0.001. Since the p-value is below the 0.05 threshold, the improvement in scores is statistically significant.

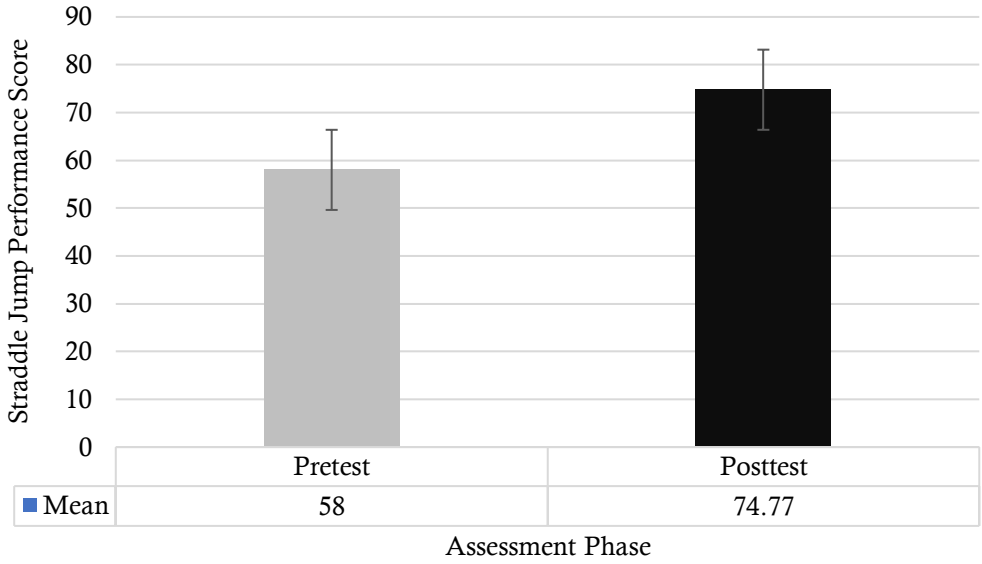

Figure 2. Comparison of pretest and posttest scores in straddle jump performance.

Figure 2 shows a clear improvement in students' straddle jump performance following the intervention. The mean score increased from 58 in the pretest to 74.77 in the posttest, indicating a substantial gain in performance. The upward shift in the mean, along with relatively consistent variability as reflected by the error bars, suggests that most students benefited from the intervention. These findings are consistent with the paired-samples t-test, which confirmed that the improvement was statistically significant ($p < 0.05$). Overall, the intervention appears to have had a positive effect on students' straddle jump skills.

DISCUSSION

The findings indicated that students' scores in straddle jump gymnastics improved with the introduction of game-based learning. Empirical data indicated that the average score of students rose from 58.00 in the pretest to 74.76 in the posttest, with a paired t-test yielding a statistically significant result ($t = -9.89$, $p < 0.05$). The data suggest that the learning activities conducted during the intervention period

correlated with enhanced student performance in executing the straddle jump movement.

From a pedagogical standpoint in physical education, these enhancements might be ascribed to the delivery of diverse movement experiences via play activities. The activities included in this study, including squat jumping, mirror jumping, rope skipping, and hopscotch, encompass movement patterns pertinent to the primary elements of the straddle jump: the approach, push-off, body coordination throughout flight, and landing control. Students engage in repetitive-movement workouts through play activities that incorporate locomotor movements. Prior research indicates that varied movement experiences and consistent practice are crucial for the cultivation of motor skills in physical education (Lestari et al., 2025).

The results of this study corroborate prior studies emphasizing the efficacy of game-based learning methodologies in physical education. Fauzi (2023) indicated that including traditional games in physical education classes enhances fundamental motor skills and student engagement in physical activity. This study's results further illustrate that game-based methods can facilitate the acquisition of specific gymnastics skills. The enhanced scores observed in this study suggest that game activities can serve as a medium for movement training, enabling students to engage in repetitive repetition within a more stimulating learning environment.

Moreover, the findings of this study corroborate prior research investigating the utilization of gaming activities to enhance jumping proficiency in primary school students. Suharnoko & Firmansyah (2018) found that mirror-jumping exercises enhance students' jumping proficiency and motor coordination. The study employed a singular game activity as a training medium. In contrast to that study, this research employed multiple game variations to train different movement components associated with straddle leaping in gymnastics. The combined implementation of various gaming activities offers students the opportunity to acquire a broader range of movement experiences, hence enhancing the development of more comprehensive motor abilities (Salsabila et al., 2025).

This study's findings also impact physical education teaching strategies in primary schools. Gymnastics techniques, such as the straddle jump, are frequently perceived as challenging by students due to the necessity of body synchronization, propulsive strength, and the audacity to execute the jump (Anggraeni et al., 2025). Incorporating play-based activities into the educational process helps foster a more dynamic and pleasurable learning atmosphere, consequently enhancing student participation in movement training programs. Prior studies have demonstrated that a play-based learning environment can enhance student motivation and involvement in physical education (Ansharullah et al., 2026).

Limitations of the study

This study indicated an enhancement in skill scores following the implementation of game modifications; however, the findings must be considered within the context of the research design's constraints. This study used a pre-experimental design with a single group and no control group, so the observed score increases cannot be entirely attributed to the treatment. Additional factors, such as prior learning experiences, student motivation, and supplementary physical activity beyond the educational process, may also have impacted the score improvements. Such constraints are

frequently observed in physical education studies undertaken within educational settings (Sahabuddin, Hakim, & Hasanuddin, 2025).

Consequently, more study is advised to employ a more rigorous research design, such as a quasi-experimental or experimental framework incorporating a control group. Moreover, research with a larger sample and across different schools could yield a more thorough understanding of the efficacy of game-based learning in enhancing gymnastics skills among primary school students (Mawardani et al., 2025).

CONCLUSION

This study demonstrates that the application of diverse game-based learning techniques can enhance the straddle vault gymnastics skills of elementary school students. Activities such as squat vault, mirror vault, jump rope, and hopscotch offer varied movement experiences, helping kids develop coordination, push-off strength, aerial body control, and enhanced landing skills. This method fosters a more dynamic and engaging learning atmosphere, promoting student involvement in the physical education curriculum.

The findings substantiate that employing a diverse array of games constitutes an effective pedagogical approach for imparting gymnastics abilities in elementary education. Therefore, physical education teachers are advised to integrate structured game activities into their lessons to enhance students' movement experiences and motor skill mastery. Future research might employ a more rigorous experimental design and a larger sample to strengthen findings on the efficacy of game-based learning in physical education.

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AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors used DeepL Translate and Grammarly to support translation, grammar checking, and language refinement. All generated outputs were carefully reviewed and edited by the authors to ensure accuracy, clarity, and adherence to academic standards. The authors take full responsibility for the content of this manuscript.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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No external financial support was received for the conduct of this research.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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