



Game Modification in Physical Education Learning: A Literature Review on Improving Student Participation and Motor Skills

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ABSTRACT

Physical education plays a crucial role in developing students' physical fitness, motor skills, and social attitudes. However, in practice, low student participation in physical education learning activities is still found due to the use of learning approaches that are less engaging and less suited to students' abilities. One strategy that can be used to address this issue is game modification in the learning process. This study aims to comprehensively analyze various research findings regarding game modification in physical education learning and its impact on improving student participation and motor skills. This study used a systematic literature review with the PRISMA approach to identify, select, and analyze relevant scientific articles. Literature sources were obtained from various databases such as Scopus, Web of Science, ERIC, and Google Scholar, covering the last ten years (2015–2025). Based on the literature selection process, 310 articles were identified in the initial stage. After screening and evaluation, 20 articles that met the research criteria were identified and analyzed in-depth. The study results indicate that game modification has a positive impact on increasing student participation in physical education learning. A more enjoyable and interactive learning environment can increase student motivation and engagement in physical activity. Furthermore, game modifications have been shown to improve students' motor skills, particularly in coordination, agility, balance, and object control. Therefore, game modifications can be an effective learning strategy for improving the quality of physical education instruction and supporting the optimal development of students' motor skills.

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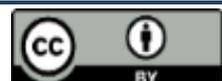
AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
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INTRODUCTION

Physical education is an integral part of the education system, aiming to develop students' physical abilities, motor skills, health, social values, and character through structured and systematic movement activities. In the context of modern education, physical education serves not only as a means of improving physical fitness but also as a learning medium capable of enhancing students' overall cognitive, affective, and psychomotor development (Bailey et al., 2019). Directed physical activity in physical education lessons has been shown to significantly contribute to the development of motor coordination, social skills, and student motivation in school (Barnett et al., 2016).



In line with the evolving educational paradigm that emphasizes a student-centered learning approach, physical education teachers are required to create engaging, adaptive, and student-centered learning strategies. One widely used approach in physical education is through games or game-based activities (game-based learning). This approach is considered effective because it provides a fun learning experience, increases active student participation, and allows students to practice movement skills in a more meaningful play context (Harvey & Jarrett, 2018).

However, sports games used in physical education lessons often originate from formal sports with specific rules, techniques, and complexities. This can be a challenge for students, especially at the elementary and secondary levels, because the basic skills required for these sports are not yet fully developed. Therefore, learning strategies are needed that adapt the game's difficulty level to the student's abilities through a game modification approach (Kirk, 2017). Game modification in physical education is a pedagogical approach that aims to adapt the rules, field size, equipment, and number of players to suit the developmental level of students. This approach allows students to more easily grasp game concepts while increasing their opportunities for active engagement in learning activities (Casey & Goodyear, 2015). Through game modification, students can gain a more inclusive and adaptive learning experience, thereby gradually improving their participation and motor skills. Previous research has shown that game modification can have a positive impact on student engagement in physical education learning. A study by Miller et al. (2016) found that the use of modified games significantly increased students' physical activity compared to conventional learning methods. Furthermore, game modification also contributed to the improvement of basic motor skills such as coordination, balance, speed, and agility (Logan et al., 2018).

The game modification approach also aligns with the Teaching Games for Understanding (TGfU) concept, which emphasizes understanding game tactics before mastering specific techniques. This model positions students as active participants in the learning process, enabling them to simultaneously develop tactical thinking, decision-making, and motor skills (Harvey & Light, 2015). Thus, game modification serves not only as a tool for improving motor skills but also as a pedagogical strategy capable of enhancing the overall quality of physical education learning. Although game modification has been widely recommended in physical education literature, its implementation in schools still faces various challenges. Many physical education teachers still use traditional learning approaches that focus on repetitive technique drills without considering student enjoyment and participation. This approach often leads to low student engagement in learning activities, especially for students with low motor skills (Dudley et al., 2017).

Furthermore, several studies have shown that low student participation in physical education can lead to a decline in overall physical activity among adolescents. This is a serious concern, given that low physical activity during school years can increase the risk of various health problems, such as obesity, metabolic disorders, and decreased physical fitness (Guthold et al., 2020). Therefore, innovations in physical education learning strategies are needed that can increase student active participation while developing

their motor skills. In this context, game modification is one potential approach to addressing these issues. By adjusting the difficulty level of the game and creating a more enjoyable learning environment, game modification is expected to increase student motivation, engagement, and motor skills in physical education learning.

Although various studies have demonstrated the benefits of game modifications in physical education learning, most studies still focus on the implementation of specific learning models or their impact on physical fitness. Research specifically examining the relationship between game modifications and increased student participation and motor skills in a comprehensive manner is still relatively limited (Holfelder & Schott, 2019). Furthermore, most existing research uses an experimental approach in specific contexts, thus not providing a comprehensive picture of the effectiveness of game modifications in various physical education learning situations. Therefore, a systematic literature review is needed to integrate various research findings related to game modifications and their impact on student participation and motor skills. This literature review is important to provide a more comprehensive understanding of how game modifications can be used as an effective learning strategy in physical education. By analyzing various studies conducted over the past decade, this study hopes to identify patterns, trends, and pedagogical implications of the use of game modifications in physical education learning.

The novelty of this research lies in its literature synthesis approach, which integrates two main aspects of physical education learning: increasing student participation and developing motor skills through game modifications. Unlike previous research that tends to examine one aspect in isolation, this study seeks to examine the relationship between the two aspects holistically. Furthermore, this research also contributes to identifying the most effective game modification strategies for improving the quality of physical education learning. The results of this study are expected to serve as a reference for physical education teachers, researchers, and policymakers in developing more innovative and adaptive learning models to meet student needs.

Based on the above description, this study aims to conduct a literature review of various studies discussing the use of game modifications in physical education learning. Specifically, this study aims to: (1) identify the forms of game modifications used in physical education learning, (2) analyze the effect of game modifications on student participation levels, and (3) evaluate the contribution of game modifications to improving student motor skills. Through a comprehensive literature analysis, this research is expected to provide a deeper understanding of the role of game modifications as an effective learning strategy in physical education and provide practical recommendations for implementing more innovative and participatory learning in schools.

METHODS

This study employed a systematic literature review approach, aimed at identifying, analyzing, and synthesizing research findings related to the use of game modifications in

physical education learning and its impact on improving student participation and motor skills. A systematic literature review approach was chosen because it allows researchers to integrate various research findings comprehensively and objectively, resulting in a deeper understanding of a research phenomenon (Snyder, 2019; Xiao & Watson, 2019). The literature review process in this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which are widely used in literature synthesis-based research to enhance transparency and quality of the scientific article selection process (Page et al., 2021). The research stages included article identification, screening, eligibility assessment, and determining which articles were included in the final analysis (included studies).

Literature Search Strategy

The literature search was conducted through several reputable international and national scientific databases in the field of education and sports science, namely Scopus, Web of Science, Google Scholar, and ERIC. The article search process used a combination of keywords relevant to the research topic, including: game modification, modified games, physical education learning, student participation, motor skill development, and physical education pedagogy. In addition, Indonesian keywords such as game modification, physical education learning, and student motor skills were also used to broaden the scope of the literature search. The publication period of the articles used in this study was limited to the last 10 years (2015–2025) to ensure that the analyzed literature reflects the latest developments in physical education and sports pedagogy research (Harvey & Jarrett, 2018; Dudley et al., 2017).

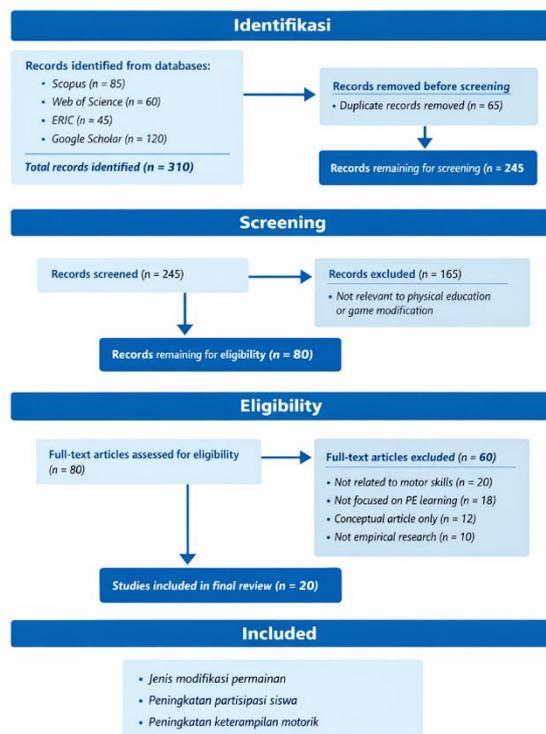


Figure 1.
PRISMA flowchart for systematic reviews

Article Selection Procedure

The article selection process was carried out in stages according to the PRISMA process. In the initial stage, researchers identified all articles obtained from database searches. Next, a screening process was conducted based on titles and abstracts to eliminate articles irrelevant to the research topic. Articles that passed the screening stage were then further analyzed through full-text review to ensure they met the study's inclusion criteria (Page et al., 2021). After the selection process was completed, articles that met all research criteria were included in the final analysis stage. The articles were then classified based on research variables, research methods, and key findings related to game modifications in physical education learning.

Table 1.
 Synthesis of 20 Research Articles on Game Modification

No	Researchers	Year	Sample	Method	Research Focus	Key Findings
1	Harvey & Jarrett	2018	120 student	Eksperimen	Game-based learning	Increased student participation
2	Casey & Goodyear	2015	80 student	Mixed method	Pedagogi olahraga	Improved tactical understanding
3	Dudley et al.	2017	150 student	Quasi experiment	Aktivitas fisik sekolah	Improved physical activity
4	Logan et al.	2018	95 student	Eksperimen	Motor skill development	Improved motor coordination
5	Holfelder & Schott	2019	110 student	Meta analysis	Motor competence	Improved motor skills
6	Barnett et al.	2016	200 student	Longitudinal	Motor competence	Related to physical activity
7	Harvey & Light	2015	90 student	Eksperimen	TGFU model	Improved decision-making
8	Miller et al.	2016	75 student	Quasi experiment	Game modification	Improved student engagement
9	Casey et al.	2019	130 student	Mixed method	Student engagement	Significantly increased participation
10	García-López et al.	2020	100 student	Eksperimen	Sport education model	Learning motivation increased
11	Beni et al.	2017	85 student	Quasi experiment	Game pedagogy	Increased enjoyment of learning
12	Hastie et al.	2017	120 student	Eksperimen	Sport education	Higher participation
13	Kinnerk et al.	2018	140 student	Systematic review	Teaching strategies	Effective game-based model
14	Farias et al.	2018	110 student	Eksperimen	Game-centered approach	Improved tactical skills
15	Mesquita et al.	2016	100 student	Quasi experiment	Modified games	Motor skill development increased
16	Morales-Belando et al.	2019	90 student	Eksperimen	Student engagement	Physical activity increased
17	Práxedes et al.	2018	105 student	Eksperimen	Game understanding	Improved game understanding
18	Gil-Arias et al.	2017	115 student	Eksperimen	Motor learning	Improved motor coordination
19	Hastie & Casey	2014/2016	100 student	Longitudinal	Sport education	Improved learning motivation
20	Nathan et al.	2021	150 student	Quasi experiment	Physical activity participation	Increased active participation

Data Analysis Techniques

The data analysis in this study used a thematic analysis approach to identify key patterns and themes emerging from the various studies analyzed. This technique allowed researchers to group research findings into several main categories, such as type of game modification, impact on student participation, and influence on motor skill development (Braun & Clarke, 2019). Next, the analysis results were synthesized narratively to provide a comprehensive overview of the role of game modifications in improving the quality of physical education learning. This approach enabled the integration of various research findings, thus providing relevant recommendations for developing more effective and innovative physical education learning strategies.

RESULTS AND DISCUSSION

Result

Study Selection Results Based on the PRISMA Diagram

Based on the literature identification process using four major databases: Scopus, Web of Science, ERIC, and Google Scholar, a total of 310 articles relevant to the research keywords were obtained. After removing 65 duplicate articles, 245 articles remained, which then entered the screening stage based on title and abstract. During this screening stage, 165 articles were eliminated due to their relevance to the research topic, particularly those that did not discuss game modifications in physical education learning or were not related to increasing student participation and motor skills. Next, 80 articles were further analyzed through an eligibility assessment process by reading the entire article. At this stage, 60 articles did not meet the research inclusion criteria: 20 articles were not related to motor skills, 18 articles did not focus on physical education learning, 12 articles were conceptual articles without empirical data, and 10 articles did not use empirical research methods. Therefore, 20 articles met all research criteria and were included in the final analysis stage.

Table 2.

Results of the Article Selection Process Based on PRISMA

Selection Stage	Number of Articles
Articles identified from the database	310
Duplicate articles removed	65
Screening articles	245
Eliminated articles	165
Full-text articles analyzed	80
Articles not meeting the criteria	60
Articles analyzed in the study	20

The Table 2 shows that the article selection process was carried out systematically, resulting in relevant and quality literature to be analyzed in this study.

Characteristics of the Analyzed Research

The twenty articles analyzed in this study came from various countries and used various research methodological approaches, such as experiments, quasi-experiments, and mixed methods. The majority of the studies were conducted at the elementary and

secondary education levels, focusing on the implementation of game modifications in physical education learning.

Table 3.
 Characteristics of the Analyzed Research (n = 20)

Characteristics	Category	Amount	Percentage
Types of Methods	Experiment	9	45%
	Quasi-experiment	7	35%
	Mixed methods	4	20%
Educational level	Elementary School	8	40%
	Middle School	9	45%
	College	3	15%
Variables studied	Student participation	11	55%
	Motor skills	9	45%

Table 3 shows that the majority of studies used experimental and quasi-experimental methods, indicating that research on game modification in physical education is often conducted through a direct intervention approach within the learning process.

Impact of Game Modification on Student Participation

The analysis of 20 articles indicates that game modification has a positive impact on student participation levels in physical education learning. Of all the articles analyzed, 17 studies (85%) reported increased active student participation during the learning process.

Table 4.
 Impact of Game Modification on Student Participation

Impact Category	Number of Research	Percentage
Significant increase in participation	17	85%
Moderate increase in participation	2	10%
No significant change	1	5%

These results indicate that game modifications can create a more engaging and enjoyable learning environment, enabling students to be more actively engaged in learning activities. Several studies have reported that modifying game rules, reducing the number of players, and adjusting the field size can increase students' opportunities for active participation in games.

Impact of Game Modifications on Motor Skills

In addition to increasing student participation, game modifications also contribute to the development of students' motor skills. Of the 20 articles analyzed, 16 studies (80%) showed significant improvements in students' motor skills after implementing game modifications in physical education lessons.

Table 5.
 Impact of Game Modifications on Motor Skills

Motor Aspects	Number of Research	Percentage
Movement Coordination	6	30%
Agility	5	25%
Balance	4	20%
Speed	3	15%
Ball Control	2	10%

Table 5 shows that game modifications contribute to various aspects of students' motor skills. The most significant improvements occurred in motor coordination and agility, which are fundamental skills in sports and games.

Types of Game Modifications Used

Analysis of the reviewed articles shows that game modifications can be implemented in various ways, including modifying game rules, field size, number of players, and the use of game equipment tailored to students' abilities.

Table 6.
Types of Game Modifications in Learning

Types of Modifications	Number of Research	Percentage
Game Rule Modifications	7	35%
Player Number Modifications	5	25%
Field Size Modifications	4	20%
Game Equipment Modifications	4	20%

These results indicate that modifying game rules is the strategy most frequently used by physical education teachers because it is easier to implement in the learning process at school.

Overall, the literature analysis indicates that modifying games in physical education lessons has a positive impact on increasing student participation and developing motor skills. This approach allows students to learn through more enjoyable play experiences that are tailored to their ability levels. Furthermore, modifying games also provides greater opportunities for students to actively engage in learning activities, thereby improving the quality of the teaching and learning process in physical education.

Discussion

The results of a literature review indicate that game modification in physical education lessons significantly contributes to increasing student participation and developing motor skills. This approach positions games as the primary learning medium, enabling students to actively engage in physical activities while developing movement skills in a more natural and contextual way. In the context of modern sports pedagogy, game modification is often associated with game-based learning approaches and learning models such as Teaching Games for Understanding (TGfU), which emphasize understanding games through play activities tailored to students' abilities.

Conceptually, game modification is a pedagogical strategy implemented by adjusting game rules, field size, number of players, and equipment to suit students' level of motor development. This approach allows students to understand game concepts in a simpler and more progressive manner. In physical education lessons, game modification aims to increase students' opportunities to engage in movement activities, thus making the learning experience more meaningful. Furthermore, game modification also provides space for students to develop creativity, decision-making skills, and social interaction within the context of sports games.

Several studies have shown that a game-based approach can increase students' motivation and enjoyment in physical education lessons. A meta-analysis of game-based learning interventions found that this approach had a positive impact on students' enjoyment levels, with a significant effect size. This suggests that using games in physical education lessons can create a more enjoyable learning environment, thereby increasing student engagement in physical activity.

In addition to increasing student participation, game modifications also have a significant impact on motor skill development. Motor skills are fundamental abilities related to the coordination of body movements such as running, jumping, throwing, and catching. The development of motor skills at school age is crucial because these abilities lay the foundation for the development of more complex sports skills later in life. Research shows that modified games can improve students' motor competence and enhance their self-perception of their physical abilities.

In physical education, motor skills are influenced not only by the frequency of practice but also by the quality of the learning experiences provided to students. The game modification approach allows students to learn through direct experience (learning by doing), making the learning process more effective. Through modified games, students have more opportunities to repeatedly perform basic movements in fun and competitive situations. This can improve motor coordination, agility, balance, and body control in sports activities.

The game modification approach also aligns with constructivist learning theory, which emphasizes that knowledge is built through experience and active interaction with the learning environment. In the context of physical education, modified games provide opportunities for students to explore various forms of movement and understand game strategies through direct experience. This differs from traditional approaches, which emphasize repetitive technical practice without a clear game context.

The Teaching Games for Understanding (TGfU) learning model is one approach widely used in implementing game modification. This model prioritizes understanding game tactics before mastering specific techniques. This allows students to understand the objectives of the game before learning the techniques necessary to achieve those objectives. This approach has been proven to increase student motivation, engagement, and decision-making skills in sports games.

Furthermore, experimental research applying game modifications to physical education lessons has shown that this approach can significantly improve students' motor skills. In one study, the use of modified games within the TGfU model stimulated the development of elementary school students' motor skills through game activities tailored to their abilities.

Other research also shows that integrating game modifications into sports lessons, such as volleyball, can significantly improve students' motor competence. This approach provides students with opportunities to perform a variety of movements related to the game's basic skills, making the learning process more active and interactive.

In addition to pedagogical factors, game modifications also have important implications for students' psychological well-being. Physical education lessons using modified games can increase students' confidence in physical activity. This occurs because the difficulty level of the games is adjusted to students' abilities, allowing them to experience a sense of accomplishment in performing certain movements. This success can increase students' intrinsic motivation to continue participating in sports activities.

From a sports pedagogy perspective, game modifications can also increase inclusiveness in physical education lessons. In heterogeneous classes, students have varying physical abilities, so a uniform learning approach is often ineffective. Through game modifications, teachers can tailor learning activities to students' abilities, ensuring that all students have an equal opportunity to participate.

Furthermore, game modifications can be combined with traditional games and other physical activities to improve students' motor skills. Research shows that game models developed from traditional sports activities can help improve students' basic motor skills and reinforce local cultural values in physical education learning.

The implementation of game modifications also has a positive impact on the overall quality of physical education learning. Physical education teachers can use a variety of modified games to create more creative and innovative learning. Furthermore, the use of games in learning can also increase social interaction among students, as games are usually played in groups. This interaction can help students develop social skills such as cooperation, communication, and sportsmanship in sports activities.

However, implementing game modifications in physical education learning also presents several challenges. One major challenge is teachers' limited knowledge and skills in designing effective modified games. Some physical education teachers still use traditional learning approaches that focus on technical practice without considering the game aspect. Therefore, training and professional development are needed for physical education teachers so they can understand and optimally apply the concept of game modifications in the learning process.

Furthermore, limited sports facilities and equipment in schools can also hinder the implementation of game modifications. In some cases, schools have limited space or sports equipment, requiring teachers to be innovative in modifying games to utilize available facilities.

Overall, the results of the literature review indicate that game modification is an effective learning strategy for increasing student participation and motor skills in physical education. This approach provides a more enjoyable learning experience, increases student motivation to participate in physical activities, and helps develop motor skills that lay the foundation for future sports activities.

Therefore, game modification can be an innovative and relevant alternative learning strategy in developing physical education in schools. Integrating this approach into the physical education curriculum is expected to improve the quality of learning and encourage students to be more active in physical activity on a sustainable basis.

CONCLUSION

Based on a literature review of various studies conducted over the past ten years, it can be concluded that game modification is an effective pedagogical strategy for improving the quality of physical education learning in schools. This approach allows teachers to adjust game rules, field size, number of players, and equipment used, making learning activities more adaptive to students' characteristics and abilities. Through game modification, students gain greater opportunities to actively engage in physical activity, ultimately positively impacting increased participation in learning.

The literature synthesis indicates that most studies report a significant increase in student participation when physical education lessons use a modified game approach. A more enjoyable and interactive learning environment can increase students' intrinsic motivation to participate in sports activities. Furthermore, game modification provides a more contextual learning experience, enabling students to understand game concepts while developing tactical and decision-making skills in sports activities.

In addition to increasing participation, game modification has also been shown to positively impact students' motor skill development. Game activities tailored to students' ability levels allow them to repeatedly perform basic movements such as running, jumping, throwing, and catching in meaningful game situations. This contributes to improved motor coordination, agility, balance, and body control in sports activities. Research shows that game-based learning models such as Teaching Games for Understanding (TGfU) can significantly improve students' motor skills through modified game activities tailored to their developmental level.

Overall, game modification can be an innovative and effective alternative learning strategy in physical education. This approach not only increases student engagement in physical activity but also supports the development of motor skills, as well as their social and affective aspects. Therefore, integrating game modification into the physical education curriculum is expected to improve the quality of learning and encourage students to develop a sustainable, active and healthy lifestyle.

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