



Effectiveness and Challenges of Gamification in Physical Education: A Systematic Review

Ni Putu Dwi Sucita Dartini^{1ABCDE}, I Wayan Artanayasa^{1BCDE}, Kadek Rihendra Dantes^{1ABDE},
Dewa Gede Hendra Divayana^{1BCDE}, I Ketut Sudiana^{1BCE} and I Ketut Yoda^{1BCDE}

¹Universitas Pendidikan Ganesha

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Corresponding Author: Ni Putu Dwi Sucita Dartini, e-mail: sucita.dartini@undiksha.ac.id

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Abstract

Background. Physical education faces challenges in increasing student motivation, participation, and engagement. One innovative approach that has emerged is gamification, defined as the application of game elements in a learning context.

Objectives. This study examines the effectiveness and challenges of implementing gamification in physical education through a systematic literature review.

Materials and Methods. The review included literature searches using the keywords “gamification” OR “gamified” AND “physical education” OR “PE”. Article selection followed the PRISMA procedure, and content analysis was conducted based on the dimensions of effectiveness and challenges of gamification in physical education. A total of 496 articles were initially identified from the Scopus and ERIC databases. After the screening process, 25 articles published between 2015 and 2025 were included in the analysis.

Results. The results indicate that gamification positively contributes to increased motivation, student engagement, physical activity, motor skill development, academic achievement, and the strengthening of personality and social skills in physical education. Identified challenges include limitations in technological infrastructure, low levels of digital literacy among teachers, gamification designs that are not contextually appropriate, short intervention durations, and the lack of standardized evaluation tools.

Conclusions. The study contributes to the development of innovative, technology-based, and adaptive physical education strategies. The findings can guide the design of physical education learning that is more innovative, contextual, and responsive to students' needs.

Keywords: gamification, physical education, motivation, student engagement.

Introduction

Physical education is an integral part of the education curriculum that aims to develop motor skills and knowledge, social-emotional development, encourage an active and healthy lifestyle, and maintain mental health (Fitzpatrick, 2010; Sirojova, 2024). However, in practice, physical education often faces various challenges, such as limited resources, lack of motivation, lack of technology integration, limited involvement, and the use of strategies that do not adequately accommodate students' learning needs

(Samsudin et al., 2024). These challenges result in less than optimal learning outcomes, low student participation and less development of knowledge, physical and social skills.

One innovative approach that has gained traction in recent years to address challenges in the learning process is the application of gamification. Gamification refers to using game elements such as points, rewards, challenges, and experiences in non-game contexts or everyday activities to increase student engagement and motivation (Sal-de-Rellán et al., 2025). Gamification has been widely used in various educational contexts, including physical education, where it has been proven to increase student motivation, participation, and meaningful learning experiences. For example, Yuan et al. (2024) note that the use of gamification in physical education from an adaptive education perspective

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may contribute to increased learning motivation, support students' mental well-being, and promote personality development. This aligns with research by Sotos-Martínez et al. (2023), which highlights the effectiveness of gamification in motivating students and fulfilling their learning needs. This study reveals that gamification can significantly increase independence, competence, and caring while reducing demotivation.

Using game elements in a gamification approach increases students' interest and motivation and creates meaningful learning and enjoyable learning experiences. Several studies have shown that applying gamification in physical education strengthens students' commitment to participating in physical activities and improves their perception of physical education as a subject (Jeong et al., 2022; Viciano et al., 2025). Integrating technology in gamification has also proven effective in physical education learning. For example, the integration of gamification with the hybrid Teaching Personal and Social Responsibility (TPSR) model can improve physical fitness and weekly physical activity time and reduce students' sedentary time during a nine-month intervention (Melero-Cañas, Morales-Baños, Manzano-Sánchez, et al., 2021). Implementing gamification using simple technology such as activity trackers can increase the number of daily steps students take and is positively received by teachers and students (Vorlíček et al., 2024). Using wearable devices and a project-based approach proves that students can actively move around while learning to analyze their activity data (Jeong et al., 2022).

Although there are many positive reports on the effectiveness of gamification in physical education, this approach can also have adverse effects if it is not designed correctly and appropriately. For example, if it focuses too much on competition, it can neglect the intrinsic elements of the activity itself (Hanus & Fox, 2015). Excessive competence can increase stress, reduce focus, and create student inequality (Kai, 2012; Maroy & van Zanten, 2007; Pike et al., 2018). Differences in age, gender, physical abilities, and cultural backgrounds among students also influence their responses to gamification, requiring a contextual and adaptive approach (Fernandez-Rio et al., 2022). Existing studies indicate that although gamification has many positive effects, a more careful examination is needed to understand the dynamics of its implementation in physical education.

Based on this review, this study was conducted to identify and analyze the effectiveness and challenges of implementing gamification in physical education based on the results of previous studies over the past 10 years. By analyzing various findings on the implementation of gamification in the context of physical education from multiple countries, this study is expected to contribute theoretically and practically to support the application of the gamification approach in physical education. There are two critical questions to be answered in this study: (1) How effective is gamification in physical education? and (2) What challenges are faced in implementing gamification in physical education? This study combines the results of various previous studies to create a more complete picture of the effectiveness and challenges of implementing gamification in physical education lessons. This study is expected to significantly contribute to developing effective, inclusive, and sustainable

gamification-based physical education learning strategies that are adaptive and technology-based.

Materials and Methods

Study Design

The method used in this study was a Systematic Literature Review (SLR) with the help of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to systematically review empirical research articles discussing the effectiveness and challenges of implementing gamification in physical education. This design was chosen to ensure that the data identification process was conducted transparently, systematically, and reproducibly so that each stage could be traced and replicated by other researchers.

Eligibility Criteria

This study used the PICO (Population, Intervention, Comparator, and Outcome) approach to determine inclusion and exclusion criteria (Kloda et al., 2020). Table 1 illustrates the PICO approach in this study.

Table 1. Overview of PICO

Element	Description
P (Population)	Involving teachers and students in physical education learning at school
I (Intervention)	Research focusing on the implementation of gamification in physical education
C (Comparison)	No specific comparison conditions were specified in the inclusion criteria.
O (Outcome)	Effectiveness and challenges of implementing gamification in physical education

The following inclusion and exclusion criteria are used to select research results or articles to be included in the SLR.

Inclusion criteria include: (1) Scopus and ERIC database in the last 10 years (2015-2025), (2) studies involving teachers and students involved in physical education in schools, (3) focus on the implementation of gamification in physical education, (4) field studies such as qualitative, quantitative, or mixed-method studies that are relevant, (5) articles written in English, (6) articles obtained in full-text.

Exclusion criteria include: (1) articles published outside the specified timeframe, (2) studies outside of physical education in schools, such as in community settings, (3) studies focusing on gamification approaches in general without discussing physical education, (4) non-empirical research such as book chapters, literature reviews, or meta-analyses, (5) articles not written in English, and (6) the article does not display the full-text

Search Strategy

The literature search procedure was conducted using the Scopus and ERIC databases. The search and data identification process was carried out on July 9, 2025, using the keywords "gamification" OR "gamified" OR "game

elements” AND “physical education” OR “PE” OR “physical activity” OR “physical education and sport”. The search was limited to peer-reviewed journal articles published in English with a publication period ranging from 2015 to 2025. The identification results from each database in the form of RIS files were then imported into the reference management software Mendeley. Next, duplicate articles with similarities were removed to avoid repetition of the same studies, thereby maintaining the accuracy of the number of articles, avoiding selection bias, and increasing the validity of article selection.

Study Selection

The article selection process was carried out in several stages in accordance with the PRISMA guidelines. The identification stage was carried out by collecting all articles obtained from the database, then managing them using the Mendeley reference management tool to remove duplicates. Next, screening was carried out by reviewing the titles and abstracts to identify studies that were relevant to the research focus, namely the effectiveness and challenges of implementing gamification in physical education in schools. Full-text articles from selected studies were then assessed by two independent reviewers (WA and KS) separately based on predetermined inclusion and exclusion criteria. Any differences in decision were discussed to reach a consensus with a third reviewer (KY).

Data were systematically extracted to gather key information from each study meeting the inclusion criteria, including research design, sample characteristics, type of gamification used, reported learning outcomes, and implementation challenges. Data were then synthesized narratively by grouping findings based on model effectiveness and identifying implementation barriers that impact learning outcomes.

Quality Assessment and Risk of Bias

The methodological quality and risk of bias of the included studies were independently assessed by two independent reviewers (WA and KS) using the following assessment criteria: (1) clarity of research objectives, (2) appropriateness of research design, (3) sample characteristics and size, (4) data collection instruments, (5) data collection procedures, and (5) clarity of data analysis. Each study was rated as low, moderate, or high quality. Two reviewers independently conducted the quality assessment (WA and KS), and differences were resolved through discussion with a third party (KY). Overall, most studies showed moderate methodological quality, with common limitations related to small sample sizes and limited reporting of instrument validity and reliability procedures.

Results

Study Selection Results

A total of 496 documents were identified through searches using the Scopus and ERIC databases. Of these 496 articles, 182 were filtered out, including 15 similar documents that were detected as deleted, 162 documents that were marked as ineligible by the automation tool, and 5 documents without abstracts, leaving 314 articles to be shared. During the screening phase, 243 documents were excluded because

they were not published in article form and 34 documents were not selected because they were not relevant to the topic, leaving 37 articles that were considered eligible. There were 12 documents excluded for various reasons, including studies not conducted in schools and full papers not available. Thus, there were 25 articles selected for systematic review. Figure 1 shows the process of identifying and screening articles relevant to the stages of systematic review.

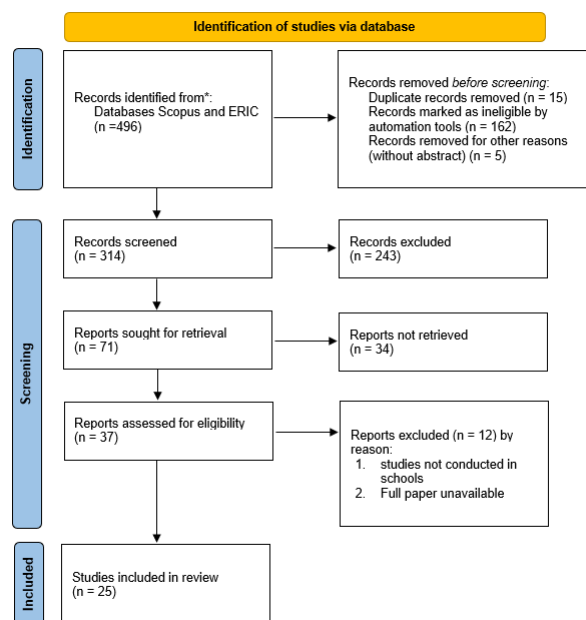


Fig. 1. Stages of Article Screening Using the PRISMA Method

Publication Trends

Research on the implementation of gamification in physical education shows fluctuating and inconsistent progress. Although researchers set inclusion criteria for articles published in the last 10 years (2015-2025), articles relevant to the topic were only discussed in the last 5 years, namely 2020-2025. This indicates that the approach to implementing gamification in physical education has only developed in the past five years. This suggests a positive trend and the potential for further research as the adoption of technology and innovative methods in physical education continues to grow. Figure 2 shows the distribution of the analyzed articles.

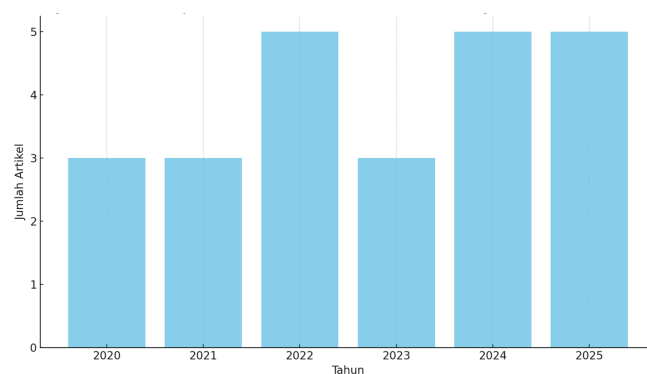


Fig. 2. Publication Trends by Years

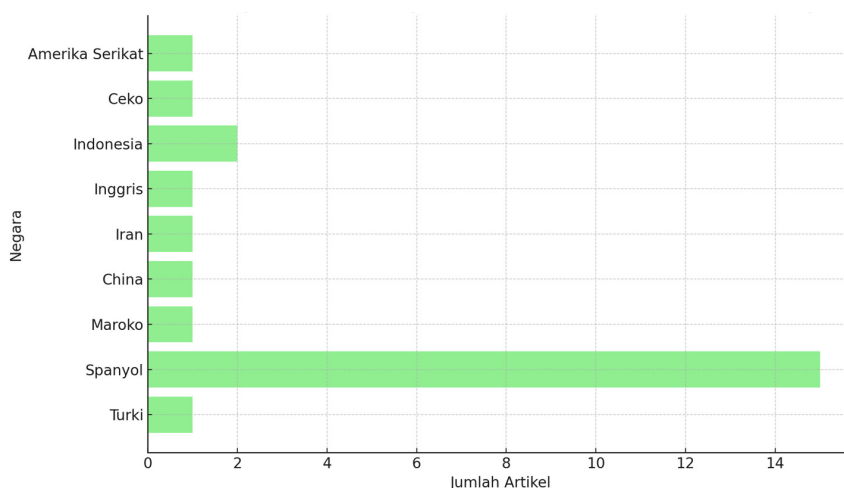


Fig. 3. Distribution of Research Areas

Figure 2 shows the number of articles discussing the application of gamification in physical education in recent years. In 2020 and 2021, there were three articles each year, then increased to 5 articles in 2022. Although it dropped to 3 in 2023, interest in this topic rebounded in 2024 and 2025, with five articles each year. This graph illustrates a fluctuating trend but indicates that interest in physical education gamification has grown recently.

Geographical Distribution of Studies

The trend of gamification research in physical education shows a wide distribution across countries. The results of the analysis show variations in research contributions between countries, as shown in Figure 3.

Figure 3 shows a horizontal bar chart depicting the distribution of research areas on implementing gamification in physical education. This graph shows that

Spain dominates with the highest number of articles at 15. Meanwhile, countries such as Indonesia, Turkey, Morocco, China, Iran, the United Kingdom, the Czech Republic, and the United States contribute only 1–2 articles. This indicates that Spain is the focal point of research in this field, while other countries still show limited involvement.

Effectiveness of Gamification Implementation in Physical Education

The results of several studies demonstrate the effectiveness of gamification implementation in physical education across six main themes: increased motivation, satisfaction, student engagement, and active participation; increased physical activity and active lifestyle; improved fitness and motor skills; enhanced academic performance; and strengthened personality and social skills, as shown in Table 2.

Table 2. Effectiveness of Gamification Implementation in Physical Education

Effectiveness	Number of Studies	Studies Reporting
Increased motivation	10	Cakir et al. (2025); Flores-Aguilar et al. (2023); Montiel-Ruiz et al. (2023); Quintas et al. (2020); Soriano-Pascual et al. (2022); Sotos-Martinez et al. (2022); Sotos-Martínez et al. (2023); Valero-Valenzuela et al. (2020); Vorlíček et al. (2024); Yuan et al. (2024)
Increased satisfaction, engagement, and participation among students	8	Cakir et al. (2025); Jeong et al. (2022); Santurio & Fernández-Río (2022); Sotos-Martinez et al. (2022); Utamayasa et al. (2025); Vorlíček et al. (2024); Wahyuniati et al. (2025); Wibowo (2024)
Increased activity or active lifestyle	7	Cakir et al. (2025); Fernandez-Rio et al. (2022); Melero-Cañas et al. (2021); Melero-Cañas, Morales-Baños, Manzano-Sánchez et al. (2021); Montiel-Ruiz et al. (2023); Pourabbasi et al. (2020); Viciana et al. (2025)
Improved motor skills and fitness	5	Fernández-Vázquez et al. (2024); Lamrani & Abdelwahed (2020); Melero-Cañas et al. (2021); Melero-Cañas, Morales-Baños, Manzano-Sánchez et al. (2021); Utamayasa et al. (2025)
Improved academic performance	5	Flores-Aguilar et al. (2023); Jeong et al. (2022); Melero-Cañas, Morales-Baños, Ardoy et al. (2021); Pourabbasi et al. (2020); Quintas et al. (2020)
Strengthened personality and social skills	5	Lamrani & Abdelwahed (2020); Montiel-Ruiz et al. (2023); Parra-González et al. (2020); Soriano-Pascual et al. (2022); Valero-Valenzuela et al. (2020); Wibowo (2024); Yuan et al. (2024)

Table 3. Challenges of Implementing Gamification in Physical Education

Challenges	Number of Studies	Studies Reporting
Limited infrastructure and technology	5	Flores-Aguilar et al. (2023); Jeong et al., (2022); Utamayasa et al. (2025); Vorlíček et al. (2024); Yuan et al. (2024)
Low digital literacy among teachers	5	Cakir et al.,(2025); Montiel-Ruiz et al. (2023); Soriano-Pascual et al. (2022); Wibowo (2024); Yuan et al. (2024)
Gamification design not contextual	4	Flores-Aguilar et al. (2023); Lamrani & Abdelwahed (2020); Pourabbasi et al. (2020); Santurio & Fernández-Río (2022)
Short intervention duration	4	Fernández-Vázquez et al. (2024); Melero-Cañas, Manzano-Sánchez et al. (2021); Sotos-Martínez et al. (2023); Viciano et al. (2025)
Evaluation not yet standardized	4	Parra-González et al., (2020); Quintas et al. (2020); Sotos-Martínez et al. (2022); Wahyuniati et al. (2025)

Challenges in Implementing Gamification in Physical Education

Several studies have shown the challenges faced in implementing gamification in physical education. For example, five out of 25 studies indicate that the main challenges in implementing gamification are limitations in infrastructure and technology and low digital literacy among teachers. Next are challenges related to gamification design that is not contextual, short intervention duration, and evaluation that is not yet standardized, with four studies discussing each of these issues. Table 3 provides an overview of the challenges of implementing gamification in physical education.

Discussion

The findings of this study indicate that the implementation of gamification in physical education has a positive effect on various aspects of learning, such as increased motivation, student engagement, academic achievement, promotion of an active lifestyle, fitness, and motor skills, as well as strengthening psychological aspects such as independence, responsibility, and social skills. Motivation is the dominant finding that proves the effectiveness of gamification in physical education, which several previous studies have reinforced. Fernandez-Río et al. (2022) and Sotos-Martínez et al. (2022) show that gamification increases intrinsic motivation, satisfaction with learning, and the intention to exercise continuously. These results are supported by research by Yuan et al. (2024), which emphasizes that the application of adaptive gamification can increase student motivation, mental health, and personality development. Student satisfaction, engagement, and participation in physical education also experienced significant improvements, as shown in the study by Cakir et al. (2025), through studies utilizing gamification integrated with physical activity trackers and combining Self-Determination Theory and Flow Theory, it has been shown that gamification can increase the number of daily steps taken by students, boost positive energy, and strengthen both cognitive and affective engagement of students in physical education lessons. The integration of technology in gamification, such as the use of wearables, Edmodo, and virtual reality technology, has proven to enhance student participation, engagement, and collaboration (Jeong et al., 2022; Montiel-Ruiz et al., 2023; Utamayasa et al., 2025). Gamification with the Coaching

Games model also showed a significant increase in student engagement in physical education (Wahyuniati et al., 2025). This indicates that motivation and engagement are two key pillars that strengthen the effectiveness of gamification in physical education

Improvements in motor skills, physical activity, and fitness were consistent findings in applying gamification. Research by Viciano et al. (2025) using a brief but regular intermittent gamification approach has been shown to increase physical activity in elementary school children, with an increase in the number of daily steps, reaching the target of 10,000 steps per day. This is reinforced by research by Vorlíček et al. (2024), who showed that the Gamifter app can increase physical activity by increasing the number of daily steps taken by students through the use of activity trackers (Garmin VivoFit trackers) and promoting an active and healthy lifestyle. The implementation of gamification has also been proven to improve basic motor skills. (Utamayasa et al., 2025) and improved physical fitness such as cardiorespiratory endurance, strength, balance, and motor coordination (Fernández-Vázquez et al., 2024; Melero-Cañas, Manzano-Sánchez, et al., 2021). Jeong et al. (2022) study also found that students' active involvement in physical activities was accompanied by the ability to analyze movement data.

Gamification has an effective impact not only on physical aspects but also on cognitive and affective domains. Hybrid gamification intervention using the TPSR model can improve cognitive inhibition, verbal abilities, and academic achievement (Melero-Cañas, Morales-Baños, Ardoy et al., 2021). This is reinforced by research conducted by Parra-González et al. (2020) and Lamrani & Abdelwahed (2020), which found that well-designed and contextual gamification can increase student satisfaction, early literacy, and creativity. Participation-based gamification design can increase students' understanding of physical activities and improve academic scores and achievements (Flores-Aguilar et al., 2023; Quintas et al., 2020; Rice et al., 2025). In addition, strengthening personality aspects such as responsibility and social skills is an important theme in these findings. The combination of gamification and the TPSR model can strengthen students' character traits such as independence, personal responsibility, and collaboration (Soriano-Pascual et al., 2022; Valero-Valenzuela et al., 2020). This is reinforced by Wibowo (2024) research, which shows that gamification has a strong relevance in improving students' self-esteem, learning satisfaction, and motor skills, even when

combined with conventional training approaches. Lamrani & Abdelwahed (2020) reported that social interaction increased in young children through educational games developed based on Montessori principles. These results are important because they show that gamification is fun and sustainably shapes students' social character.

However, the study also found various challenges in implementing gamification in physical education. The first challenge is limited infrastructure and technology, as shown in a study by Utamayasa et al. (2025), which stated that not all schools have the Virtual Reality (VR) devices needed for intervention. The lack of digital infrastructure support, such as wearables, and the availability of funds are serious obstacles to implementing gamification in physical education (Vorlíček et al., 2024; Yuan et al., 2024). Using gamification approaches based on popular media requires supporting equipment such as projectors, speakers, or suitable learning spaces (Flores-Aguilar et al., 2023). The next challenge is the low level of digital literacy among teachers. For example, not all teachers can utilize digital platforms such as Edmodo or activity tracking engines (Cakir et al., 2025; Montiel-Ruiz et al., 2023). This is reinforced by research by Wibowo (2024) and Yuan et al. (2024), who state in their study that systematic teacher training is essential for the optimal integration of gamification in physical education.

Several studies highlight that an excessive emphasis on competition in gamification can have negative effects. Research by Santurio & Fernández-Río (2022) reported that several students and parents had criticized the high intensity of competition in the "quidditch-muggle" model, which could potentially overshadow the social and emotional aspects of the student's learning experience. Although gamification was implemented simply, its application must be adapted to the local culture and context. (Flores-Aguilar et al., 2023; Pourabbasi et al., 2020). In addition, the gamification approach must consider the child's age so as not to cause excessive cognitive and emotional stress (Lamrani & Abdelwahed, 2020). Most studies indicate that the short duration of gamification interventions limits their long-term impact. For example, an intermittent program lasting five weeks (Viciano et al., 2025) and VR use tested for only six weeks (Fernández-Vázquez et al., 2024) without follow-up measurements, leaving the sustainability of students' physical behaviour changes yet to be proven. Some studies indicate that there are no standardized evaluation tools to comprehensively measure the outcomes of gamified learning, so they do not represent all aspects of learning (Sotos-Martínez et al., 2023; Wahyuniati et al., 2025). These challenges are important considerations for designing more mature, sustainable gamification models that can address the diversity of school conditions.

Based on this, this study contributes to the development of physical education using innovative and technology-based approaches. These findings can expand gamification pedagogical models with contextual approaches oriented toward 21st-century learning. This study implies that the gamification approach can be applied in various formats and adapted to teacher readiness, student characteristics, and infrastructure support.

However, this systematic review study has limitations that need to be considered when interpreting the results of the study. The database sources used were limited

to Scopus and ERIC, so it is possible that other studies related to the implementation of gamification in physical education were not identified. This study only included articles in English, so publications in other languages could not be accommodated, meaning that a global view of the implementation of gamification in physical education has not been described. The results of the study show limitations related to the geographical concentration of research, which is mostly in Europe (Spain, England, the Czech Republic, and Turkey) and a number of studies in Asia (Indonesia, China, and Iran), the United States, and Morocco (Africa). This indicates that the development of gamification in physical education is still dominated by Europe, which could potentially cause the findings to reflect the education systems and physical education learning practices in those countries. The limited number of studies on other continents shows an unbalanced view of the topic. This imbalance could limit the generalization of findings in a broader context. Future studies are expected to expand the database used and broaden the geographical coverage by involving more studies from various regions in an effort to expand the perspective and validity of the findings.

Conclusions

The results of a systematic review indicate that gamification is effective in physical education. Incorporating game elements into the learning process can increase students' active participation physically, cognitively, socially, and emotionally. Gamification demonstrates that learning with game elements can be meaningful and enjoyable. Research shows that gamification increases student motivation and participation because it creates a challenging and enjoyable learning environment, which has a positive impact on motor skills, academic achievement, and the strengthening of personality and social skills.

However, several challenges have been identified in implementing gamification in physical education. Limited infrastructure and teachers' digital readiness and competency are key barriers. Without these two factors, implementing gamification in learning will be extremely difficult. Furthermore, a less contextual gamification design can potentially distract from learning. The short duration of interventions in studies also hinders measuring the long-term impact of gamification approaches, and the lack of standardized evaluations can lead to less valid and comprehensive assessments.

Longitudinal studies are recommended to assess the impact of gamification on changes in students' active lifestyle behaviors, fitness, and character development over time, given the limitations of future research designs. Research is needed on gamification designs that can be implemented in various school settings. Cross-disciplinary collaboration between physical education teachers, educational technologists, and educational psychologists can help strengthen the foundation of these ideas and ensure the success of gamification in physical education.

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Conflict of interest

The authors declare no conflict of interest.

AI-Usage Declaration

The authors declare that AI-assisted software (Watase Uake, ChatGPT, DeepL) was used to a limited extent to assist with language editing and readability of the manuscript. All aspects of the research, such as SLR design, determination of inclusion and exclusion criteria, article selection process, data extraction and analysis, interpretation of results, and drawing conclusions, were entirely carried out by the authors. The authors take full responsibility for the integrity of the article

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Ефективність і виклики застосування гейміфікації у фізичному вихованні: систематичний огляд

Ні Пугу Дві Сучіта Дартіні^{1ABCDE}, І Ваян Артанаяса^{1BCDE}, Кадек Ріхендра Дантес^{1ABDE}, Дева Геде Хендра Діванаяна^{1BCDE}, І Кетут Судіана^{1BCDE}, І Кетут Йода^{1BCDE}

¹Університет освіти Ганеша

Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів
Реферат. Стаття: 9 с., 3 табл., 3 рис., 36 джерел.

Актуальність. У сучасній системі фізичного виховання актуальною проблемою залишається підвищення мотивації, активності та залученості учнів до навчального процесу. Одним із перспективних інноваційних підходів є гейміфікація – використання ігрових елементів у навчальній діяльності.

Мета дослідження – проаналізувати ефективність та виклики застосування гейміфікації у фізичному вихованні на основі систематичного огляду наукової літератури.

Матеріали і методи. Пошук наукових джерел здійснювався у базах даних Scopus та ERIC за ключовими словами “gamification” OR “gamified” AND “physical education” OR “PE”. Відбір публікацій проводився відповідно до процедури PRISMA. Для узагальнення результатів використано контент-аналіз за двома напрямками: ефективність та виклики впровадження гейміфікації у фізичному вихованні. У результаті пошуку було ідентифіковано 496 публікацій. Після етапів відбору до аналізу включено 25 статей, опублікованих у 2015–2025 роках.

Результати. Узагальнення результатів досліджень свідчить, що застосування гейміфікації у фізичному вихованні сприяє підвищенню мотивації та залученості учнів, збільшенню рівня фізичної активності, розвитку рухових навичок, покращенню навчальних досягнень, а також формуванню особистісних і соціальних компетентностей. Водночас визначено низку проблемних аспектів, зокрема обмеженість технологічної інфраструктури, недостатній рівень цифрової компетентності вчителів, невідповідність окремих гейміфікаційних моделей освітньому контексту, коротку тривалість інтервенцій та відсутність стандартизованих інструментів оцінювання.

Висновки. Гейміфікація є перспективним інструментом підвищення ефективності навчального процесу з фізичного виховання. Отримані результати можуть бути використані для розроблення інноваційних, технологічно орієнтованих та адаптивних стратегій організації занять з фізичного виховання.

Ключові слова: гейміфікація, фізичне виховання, мотивація, залученість учнів.

Information about the Authors:

Dartini, Ni Putu Dwi Sucita: sucita.dartini@undiksha.ac.id; <https://orcid.org/0009-0004-3043-7286>; Department of Physical Education Health and Recreation, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

Artanayasa, I Wayan: wayan.artanayasa@undiksha.ac.id; <https://orcid.org/0009-0002-6674-9789>; Department of Physical Education Health and Recreation, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

Dantes, Kadek Rihendra: rihendra-dantes@undiksha.ac.id; <https://orcid.org/0000-0002-8288-0675>; Department of Educational Science, Postgraduate, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

Divayana, Dewa Gede Hendra: hendra.divayana@undiksha.ac.id; <https://orcid.org/0000-0001-7096-3396>; Department of Computer Science, Faculty of Engineering and Vocational, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

Sudiana, I Ketut: ketut.sudiana@undiksha.ac.id; <https://orcid.org/0000-0002-3060-6754>; Department of Sport Science, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

Yoda, I Ketut: yoda.ketut@undiksha.ac.id; <https://orcid.org/0000-0002-2522-1243>; Department of Sport Science, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Udayana Street No.11 Singaraja, Bali 81116, Indonesia.

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