



Using Gamification in Teaching Physical Education: A survey review

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Abstract

Nowadays, the determining role that Physical Education (PE) assumes for cognitive, psychomotor and affective development is widely accepted. Even so, several investigations continue to report the difficulty in motivating children to be involved and participate in PE classes through traditional teaching methods. Thus, to combat this scourge, gamification has been suggested as a useful tool to increase students' motivation to practice PE. Based on these considerations, the main objective of this survey review was to critically analyze the potential impact of using gamification in PE classes. The Preferred Reporting Items for Systematic reviews and Meta-Analyses literature search extension (PRISMA-S) guidelines were advised for this survey review. After searching procedures, 68 articles remained for analysis. Traditional teaching models can be applied by using the direct instruction model, and teaching dominated approaches. By contrast, nowadays physical education and sports education have been based on game-based models. From this, gamification strategies seem to be valid and efficient as a contribute to the previous ones, applying game elements, mechanics, and principles to non-game contexts to enhance engagement and intrinsic motivation. Thus, gamification models extend to as fundamental element the theory of self-determination expressed by theory of gamified learning, dynamical model for gamification of learning, goal-access-feedback-challenge-collaboration, gamification, and virtual gamification. This investigation allows us to conclude that the inclusion of gamification in PE classes seems to translate into an increase in motivation in children and youth. For this reason the introduction of technology in classes seems to be a key factor to increase sports participation, regular physical activity and improve motor learning and control.

Keywords: Sport, Children, Health, Motivation, Learning



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GAMIFICATION IN PHYSICAL EDUCATION
<http://mjssm.me/?sekcija=article&artid=269>

Cite this article: Ferraz, R., Ribeiro, D., Alves A.R., Teixeira, J.E., Forte, P., Branquinho, L. (2024) Using Gamification in Teaching Physical Education: A survey review. *Montenegrin Journal of Sports Science and Medicine*, 20 (1), 31–44. <https://doi.org/10.26773/mjssm.240304>

Received: 16 September 2023 | Accepted after revision: 02 January 2023 | Early access publication date: 01 February 2024 | Final publication date: 15 March 2024

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Conflict of interest: None declared.

Introduction

Physical Education (PE) plays a key role in cognitive skills, psychomotor and affective development (Ferraz et al., 2023; Silva et al., 2022), while encouraging healthy lifestyles and encourages peer socialization during childhood and adolescence (Sortwell et al., 2022). Also, the PE has a strong focus for developing metacognition, emotional skills and psychosocial enjoyment in the teaching and learning process (Quennerstedt, 2019; Wang et al., 2022). Emphasizing these assumptions, other investigations have shown the benefits of PE for the development of the student's metacognition, motor proficiency in motor performance skills, and emotional physical benefits lifelong physical activity (PA) (Costa et al., 2015; Sortwell et al., 2022; Spanaki et al., 2016). Also, children and youth who have greater motor skills (i.e., such as muscle strength and power), are better prepared to develop motor performance skills that enhance the learning of different sports (Branquinho et al., 2022; Ferraz et al., 2020). It is at early ages that the sensitive phases of development occur (Ozturk Ertem et al., 2019), and the inclusion of PE in the curriculum allows a harmonious multilateral and interdisciplinary development, enabling the development of motor and basic skills (Rus et al., 2019). In this sense, the structured development of children and youth through PE environments is an emerging topic in contemporary society and one that continues to need to be investigated (Branquinho et al., 2022).

In particular, gamification strategies have been gaining prominence in different education environments, given the combination of cutting-edge mobile technology, virtual reality and social networks (Jayanthi et al., 2022). Concretely, gamification can be defined by the integration of game elements and mechanics into PE lessons, aiming to create a more dynamic and interactive learning environment (Arufe-Giráldez et al., 2022). The gamification strategies should be applied in integration with existing teaching models into different educational domains in childhood and adolescence (Santos et al., 2023). These domains are fundamental for the healthy development of children and can be seen as predictors of regular participation in PA and motor development (Bailey et al., 2009; Batista et al., 2019). For these reasons, it is essential that teachers and researchers develop innovative and playful methodologies to motivate students and promote a taste for PA, motor skills and psychosocial engagement (Dichev et al., 2015; Landers, 2015). So far, some approaches have been carried out in this direction (Aktop & Karahan, 2012; Metzler, 2017; Syrmpas et al., 2017), but more research still needed on new practices and methodologies that can be used in the context of PE to promote participation for the structured development of children and youth (Pate et al., 2006; Sallis & McKenzie, 1991; Tappe & Burgeson, 2004). Even so, the literature reports that traditional teaching models continue to prevail in classrooms (Area-Moreira et al., 2016; Harvey et al., 2020). However, the normative charging of PA for all students' children and young has been critically discussed in sport pedagogy (Sortwell et al., 2022; Syrmpas et al., 2017). In this sense, gamification strategies seems to emerge, according to independent factors, such as age, sex and applications contexts (e.g., PE and/or sports games) (Fulton, 2019; Kulkarni et al., 2022; Pozo et al., 2018; Quintas et al., 2020).

Teaching models are characterized as global plans aimed at transmitting a central idea for teaching through a standardized theoretical structure that simplifies the teacher's decision-making of teacher (Metzler, 2017; Pozo et al., 2018).

Particularly, gamification strategies in teaching PE involve the use of game elements and game design techniques to enhance the learning experience and engage students in educational activities (Dichev et al., 2015). While gamification is a powerful and engaging teaching strategy, it is often integrated into existing teaching models to enhance the learning experience (Arufe-Giráldez et al., 2022). Gamification strategies allows for the setting of specific objectives in PE classrooms, providing a clear pathway for achievement problem-solving, decision-making, and strategic thinking, which are cognitive skills important in sports practice (Fulton, 2019; Quintas et al., 2020). These strategies leverage the motivational aspects of games to promote active participation, increase student motivation, and foster a deeper understanding of the subject matter. More important, gamification strategies have demonstrated short-term benefits (motivation and engagement in PE classes) and the long-term benefits (lifelong maintenance of PA, exercise and sports concepts) for children and youth (Kulkarni et al., 2022). It is important to note that gamification strategies should be thoughtfully designed, aligning with the learning goals and objectives of the educational context (Fulton, 2019; Kulkarni et al., 2022). When implemented effectively, gamification can enhance student motivation, promote active learning, and create an enjoyable and immersive educational experience (Kulkarni et al., 2022).

Due to the decreasing motivation of students to participate in the discipline of PE, there is an urgent need for pedagogical innovation and formative change in the teaching of PE. In this sense, the gamification of the teaching process has been suggested as an effective and innovative approach for this purpose (Quintas et al., 2020). The potential impact of gamification on the PE teaching process continues to arouse debate and attention in the scientific community (Fernandez-Rio et al., 2020; Pérez-Muñoz et al., 2022). Therefore, it is important to clarify how we can develop PE teaching environments based on gamification strategies. For these reasons, the objective of this survey review was to critically reflect on how gamification can influence the development and involvement of students in the PE discipline.

Materials and Methods

Search Strategy

The Preferred Reporting Items for Systematic reviews and Meta-Analyses literature search extension (PRISMA-S) guidelines were advised for double-check review (Rethlefsen et al., 2021). To carry out this narrative review, the available literature was consulted through searches carried out in the Web of Science, Google Scholar and PubMed databases. Articles published between 2000 to present were considered for analysis. The search strategy was based on the combination of two primary keywords ("gamification" and "physical education"), using a Boolean operator: "gamification" AND "physical education" The inclusion criteria for the articles were: (1) relevant data on gamification in the PE teaching process; (2) experimental studies in students who used gamification as a learning methodology; (3) original papers or books that are fully text accessible in English and published in peer-reviewed Sports Science journals; (4) high-caliber research that complies with CONSORT standards. Studies were excluded if: (1) they did not include data relevant to this study according to the inclusion criteria or studies that address gamification in contexts other than education, specifically

teaching PE.; (2) others research fields and non-human participants; (3) articles with poor quality in the description of study sample and screening procedures according to CONSORT stands; (4) low level of evidence studies such as reviews, abstracts and papers for conferences, surveys, articles of opinion, commentary, books, magazines, editorials or case studies. The articles were selected based on the evaluation of the title and abstract. All articles or books that did not focus on the investigation were excluded. In total, 105 articles were considered relevant for this review. After this procedure, 68 articles remained for analysis (Figure 1).

Quality Assessment and information handling

Current survey review was based the methodological quality by the CONSORT stands for the Consolidated Standards of Reporting Trial (Cuschieri, 2019). All articles were read in detail and evaluated for relevance and quality by two senior researchers with experience and relevant publications in the

field. All articles that did not meet the criteria were excluded. Two independent authors (R.F. and L.B.) conducted the literature search strategy between January and June 2023. A third reviewer (J.E.T.) was named in to mediate arguments between the authors about the study's selection.

A survey and narrative interpretation was subsequently carried out to scrutinize the theoretical considerations and future perspectives about gamification in teaching PE. The summary of previous research was compiled in: (a) teaching models in PE; (b) game-based models in PE; (c) gamification in PE; (d) classification of gamification strategies; (e) gamification strategies for teaching PE; (f) the role of gamification in socio-affective and motor development during PE; (g) interdependent factors contributes for gamification strategies. The information were further analyzed using a narrative review methodology (Silva et al., 2022) to expose the explanation of subject matter and theoretical basis, as well as the practical application and suggestions for further research.

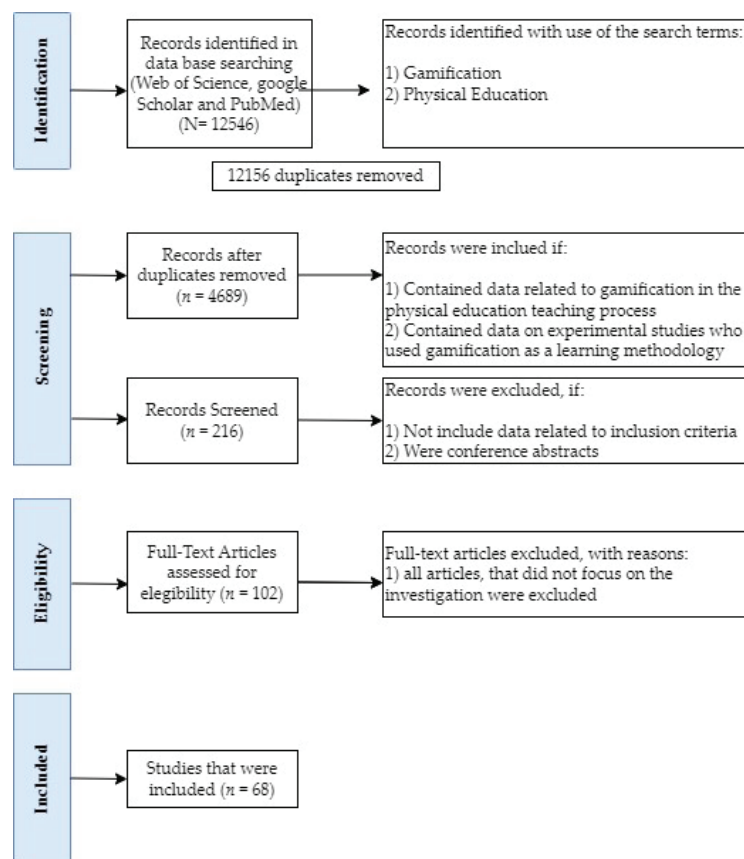


Figure 1. PRISMA Flowchart with included studies

Results

Teaching Models in Physical Education

The teaching of PE is a continuous process, which intrinsically results from new theories alluding to the teaching-learning process, following recent theories that highlight the reorganization of the process of motor development and performance in the school context (Ferraz et al., 2023). In this regard, several teaching models have been promoting innovative processes in the way students learn. Traditionally, the Direct Instruction Model, which directs the teaching-learning process in the teacher, has been the most used in the school context (Dyson et al., 2004). This approach gives the student a passive role, essentially connoted by the reproduction of

knowledge transmitted by the teacher. Even so, this teaching model has proved to be unappealing because it ignores the need to solve problems related to the low motivation that students show in the modalities addressed in PE (Siedentop et al., 2011). This model assumes the teacher as a central core in majority of the decision-making regarding the teaching-learning process, particularly in prescribing the pattern of student involvement in learning tasks. In this domain, the teacher delimits the rules and procedures for student management to obtain maximum effectiveness in the teaching-learning activities developed by them (Mesquita et al., 2009). Teacher-centred learning and direct and whole group instruction are also described as lecture-based teaching (i.e. especially teaching of

rules, guidelines and key points) (Boling & Robinson, 1999; Esslinger et al., 2016), lecture-based teaching (Dyson & Casey, 2016; Esslinger et al., 2016), skill drills and repetition (i.e., analytic perspective) (Faulkner & Finlay, 2002), and other teaching dominated approaches such as expository teaching, teacher-dominated discussions, whole-class teaching and behaviorist approach (Fernandez-Rio et al., 2020; Rethlefsen et al., 2021). Other relevant model that has been used in PE teaching is the Sport Education Model, which seeks to broaden students' experiences and challenges traditional pedagogical approaches (Siedentop et al., 2011). This model aimed to develop competence, literacy, and enthusiastic sportspersons, being commonly considered as a student-led approach (Hastie & Wallhead, 2016; Wallhead & O'sullivan, 2005). The Sport Education Model is a comprehensive and student-centered approach to PE that aims to enhance the learning experience and overall engagement in sports. It was developed by Daryl Siedentop in the 1980s and has been widely implemented in PE programs around the world (Siedentop et al., 2011). The model seeks to replicate the characteristics of actual sports teams and competitions to provide students with a more authentic and enjoyable sports experience (Hastie & Wallhead, 2016; Wallhead & O'Sullivan, 2005). A learner-based approaches revolutionize PE teaching, with game-based models gaining increasing application and interest in PE, with particular evidence for the teaching games for understanding model (TGfU) (Webb et al., 2006). Overall these models can be classified as learner-centered or student-centered teaching approaches so it is essential to particularise the main premises, objectives and scopes of game-based models in PE.

Game-Based Models in Physical Education

Game-based learning involves using actual games or modified versions of games to teach specific skills, concepts, or knowledge (Mesquita et al., 2012; Rink, 2001). In PE classrooms, this approach may also involve using sports games, mini-games, or game-like activities to teach fundamental movement skills, sports tactics, or fitness concepts (Arufe-Giráldez et al., 2022; Rink, 2001). The TGfU model could be considered as a model reference in the teaching of PE. This model highlights the importance of understanding and reflection in the game, on the part of the student, focusing in this way on their awareness and decision-making tactics according to the context in which they are inserted or through the practice of modified game versions (e.g., simplified games, conditioned games) appropriated to the students' proficiency needs (Webb et al., 2006). Based on TGfU, a second-generation related models reported in the literature such as Game Sense (Thorpe, 1996); Tactical Games Model (Mitchell et al., 2020); Tactical Decision Learning Model (Gréhaigine et al., 2005); Invasion Competency Games Model (Tallir et al., 2003), Games Concept Approach (Rossi et al., 2007); Play with Purpose (Pill, 2007); Ball School (Kröger et al., 1999), Game Insight (Pill, 2007); Inventing Games Model (Butler, 2015). The Non-linear Pedagogy model is also referred which was developed and built on an ecological dynamics approach (Nathan et al., 2017). On the basis of this pedagogical framework is exploratory learning, with an emphasis on encouraging individualized movement solutions for individuals (Chow & Atencio, 2014). In fact, TGfU and derived models use teaching tactics principles and rules, that is, technical skills are built from the context of the game and its understanding (Mesquita

et al., 2009; Metzler, 2017). Also, a progression of tasks of increasing complexity is used, without obeying a rigid hierarchy, nor passing through all levels, but with the manipulation of tasks dictated by the particularities of learning (Farias et al., 2018; Mesquita & Graça, 2011). The concept of learning to play follows, in a simpler than formal context, with active instruction from the teacher is also a relevant purpose (Farias et al., 2018; Mesquita et al., 2012).

It is fundamental to mention that no model that is suitable for all learning involvements and therefore a fundamental issues must be taken into account by the teacher to use the teaching models that best suit the needs of students (Rink, 2001). In this context, the constrains-led approach (Chow et al., 2021) has been an effectively applied approach in PE contexts and sports games to enhance student engagement, skill development, and overall enjoyment of sports and physical activities (Ferraz et al., 2023; Silva et al., 2022). For example, small-sided games involving a modify traditional sports games to be played with fewer players and in smaller playing areas (Teixeira et al., 2022), are commonly used in various settings, including schools, recreational programs, and sports clubs. This strategy promotes active participation, teamwork, and the application of skills in a game-like settings (Santos et al., 2023; Santos et al., 2016). It also allows for more opportunities for students to be actively involved compared to traditional large-scale games (Ferraz et al., 2023; Silva et al., 2022).

Different approaches continue to exist for teaching PE, but due to the need to fill gaps and increase the motivation of PE classes, new approaches continue to be required. Following this line of reasoning, in the search for new didactic approaches, gamification emerges that has gained strength in recent years in the educational field (Arufe-Giráldez et al., 2022). This methodology is currently expanding and involves different mechanisms of games in the classroom. The game is considered as the central motivating element in the classroom, while this methodology is considered active, as the student is active in the learning process, making the teaching and learning process more enjoyable, meaningful and effective (González et al., 2020). Faced with this reality, the discipline of PE has been one of the scenarios where multiple experiments were developed to consolidate gamified learning environments (Arufe-Giráldez et al., 2022). For these reasons, it is important to know in more detail the pedagogical proposals and didactic experiences of gamification that have been used in the PE classroom (Ferraz et al., 2023; Silva et al., 2022).

Gamification in Physical Education

Gamification involves applying game elements, mechanics, and principles to non-game contexts to enhance engagement and motivation (Teixeira et al., 2022). In PE, gamification may include the use of points, badges, leaderboards, rewards, challenges, and levels to motivate students and create a more game-like atmosphere (Ferraz et al., 2023; Silva et al., 2022). Indeed, the engagement and motivation is considered a fundamental element for the practice of PA, and the theory of self-determination (Ryan & Deci, 2017) is one of the most used structures to understand this phenomenon. In fact, new generations have been considered particularly difficult to motivate when traditional teaching methods are applied (Fernandez-Rio et al., 2020). Although there is a continuous effort through teachers and education professionals to apply new and innovative teaching methodologies, many students

consider traditional schooling boring and ineffective (Putz et al., 2020). Thus, gamification strategies should be applied into a student-centered teaching model to promote active learning, collaboration, and problem-solving within the constructivist framework. A teaching model provides a framework for structuring lessons, planning curriculum, and facilitating learning. It outlines the overall philosophy, goals, and methods of instruction was typically encompasses by the teaching models (Ferraz et al., 2023; Silva et al., 2022). Gamification has been defined as a pedagogical strategy and/or methodology. Although should not be considered a teaching PE model in itself (Arufe-Giráldez et al., 2022), could be a important methodological tool for its implementation.

The intrinsic technological nature of modern times is inducing continuous changes in the daily actions and behaviors of the population in general and particularly of young people (Maldonado Berea et al., 2019). Curiously in the field of education, technology is reaching a prominent role (Area-Moreira et al., 2016). This fact has led to the emergence of new pathways of teaching and learning content based on innovative perspectives, in which students assume a remarkable role (Li et al., 2019). In this sense, educational agents identified the challenging need to refine teaching methodologies that are efficient in sharing knowledge and that ensure student involvement and motivation (Putz et al., 2020). In this regard, students assume that they prefer engaging and interactive learning activities (Kiili, 2005), which makes playful learning emerge as a potential solution, as it promotes new skills and stimulates increased knowledge (Pereira et al., 2019; Putz et al., 2020). In this sense, a new pedagogical approach called gamification is becoming increasingly popular in educational contexts (Koivisto & Hamari, 2019; Ouariachi et al., 2020; Putz et al., 2020) and particularly in encouraging PA practice in young populations (Fernandez-Rio et al., 2020; Ferriz-Valeiro et al., 2020; González et al., 2020; González-González et al., 2018; Kostenius et al., 2018; Quintas et al., 2020; Segura-Robles et al., 2020). Gamification has been defined as the use of game design elements in any non-game system context to increase users' intrinsic and extrinsic motivation, helping them to process information, or even help them to better achieve goals and/or help them change their behavior (Hamari et al., 2014; Treiblmaier et al., 2018). Gamification was inserted in education when design elements and game experience were considered in the formulation of learning processes (Dichev & Dicheva, 2017; Dicheva et al., 2015). Previous investigations have shown that gamification can promote intrinsic motivation (Goh et al., 2017; Hamari & Keronen, 2017), convert learning more engaging and attractive (Çakıroğlu et al., 2017; Gatti et al., 2019), and increase student knowledge retention (Arufe-Giráldez et al., 2022; Majuri et al., 2018). Furthermore, another investigation found that students were more involved in gamified environments compared to non-gamified environments (Tsay et al., 2018). Specifically in the case of PE, gamification seems to present itself as an undoubtedly powerful tool for the promotion of healthy lifestyle habits and underlining motivations for the practice of sports in children and adolescents. In fact, gamification strategies contribute to sustained interest and long-term engagement in physical education. Students are more likely to retain knowledge and skills acquired through gamified activities due to the enjoyable and memorable nature of the learning experience (Çakıroğlu et al., 2017; Gatti et al., 2019).

Classification of Gamification strategies

Applying gamification in education has been made from the lowest to the highest educational levels based, leading to various gamification-based models and frameworks: (1) theory of gamified learning or gamification (Landers, 2015); (2) dynamical model for gamification of learning (DMGL) (Kim & Lee, 2015); (3) goal-access-feedback-challenge-collaboration (GAFCC) gamification (Huang & Hew, 2018); (4) model for introduction of gamification into e-learning. Indeed (Urh et al., 2015), gamification (Landers, 2015), gamified learning (Kim & Lee, 2015), intelligent gamification (FIG) (Fulton, 2019) and/or gamefullness (Deterding et al., 2011) has been the terminology applied in recent years in to describe gamification learning. These approaches have been applied to enhance the educational contexts of e-learning, applied sciences (Vries et al., 2006) and working environments. Landers et al. (Landers et al., 2017; Landers, 2014) defends that the game element can strongly influence the learner's attitude and behaviour within an existing instructional content and method, thus effectively altering the learning outcome. Quality and results of instructional design (a moderating process) and/or by directly affecting learning (a mediating process) (Landers, 2014). Kim & Lee (2015) explored the primary self-determination factors (i.e., curiosity, challenge, fantasy and control) for DMGL model underpinned by ARCS model (i.e., attention, relevance, confidence, and satisfaction), MDA framework (i.e., mechanics, dynamics and aesthetics), game design features (GDF) (i.e., game play and balance) and key characteristics of a learning game (KCLG) (i.e., control, contingency, choice, and power contribute. Huang & Hew (2018) developed a theory-driven gamification model for higher education based on motivation needs (i.e., goal, access, feedback, challenge and collaboration), design five-stage gamification procedure: 1st stage (examination): to investigate the precise learning objectives, learner context, and technological affordances of a given online platform, such as a learning management system; 2nd stage (decision-making): to identify the motivational components such as (i.e., goal, access, feedback, challenges, collaboration) that need to be strengthened or added; 3rd stage (match): pick which gamification tactics to use by matching motivational features with game design components and learning activities; 4–5th stages (design implementation and evaluation): implement the design in actual classes and evaluate the design. Consider the implementation outcome once the design has been implemented and look at whether the design need improvement (Huang & Hew, 2018; Kim & Lee, 2015). Deterding et al. (2011) reported a human-computer interaction for serious games, pervasive games, alternate reality games, or playful design.

Game-based environments were developed to emphasized gamification in a broad spectrum where it can be found in: (1) complete and serious games: health games, new games, heavy games, educational games, simulation and training games; (2) game design (gamification itself): game elements, technology, practices (serious games); (3) persuasive and extensible games: live action role-playing (LARP) games, alternate reality games, augmented reality games, location-based games; (4) playful interaction, design and toys. Virtual realities and augmented feedback should be also considered for gamification strategies in education contexts (Silva et al., 2022). Game based learning has also gained interest for PA, exercise and sport, with PE being a major contributor (Erenli, 2013). Another research in-

ferred the effects of an innovative experience, which included a gamification proposal during classes at a sports university (Pérez-López et al., 2017). The results showed that gamification enhanced the development of a good learning climate, and that students and teachers expressed that they felt better with learning experiences through gamified practice. In addition, another study (Hernando et al., 2015) carried out in secondary education, used gamification as a motivating and fun tool to encourage healthy lifestyle habits and specifically to apply adjusted heart rates in different resistance exercises. The results indicated that both students and teachers praised the use of gamification as a motivational strategy to enhance learning. Recently, another investigation (Fernandez-Rio et al., 2020) also reported significant increases in students' intrinsic motivation after experiencing the implementation of

gamification. Yet, Ferriz-Valero et al. (2020), showed that the implementation of gamified strategies was beneficial for academic performance, however the results related to motivation did not showed significant changes. In an increasingly globalized, competitive and computerized era, it is imperative that teaching spaces have new technological innovations to obtain advantages and enhance new skills among students and teachers in the teaching, learning and inclusion process (Borg et al., 2011). If students need a differentiated (i.e., gamified) education, teachers need to be able to adequately respond to this need (Erenli, 2013). However, teachers have shown concern about the workload of the new pedagogical approach (Fernandez-Rio et al., 2020). Figure 2 presented the several theoretical approaches, models and frameworks applied in the traditional teaching and gamification approach in teaching PE.

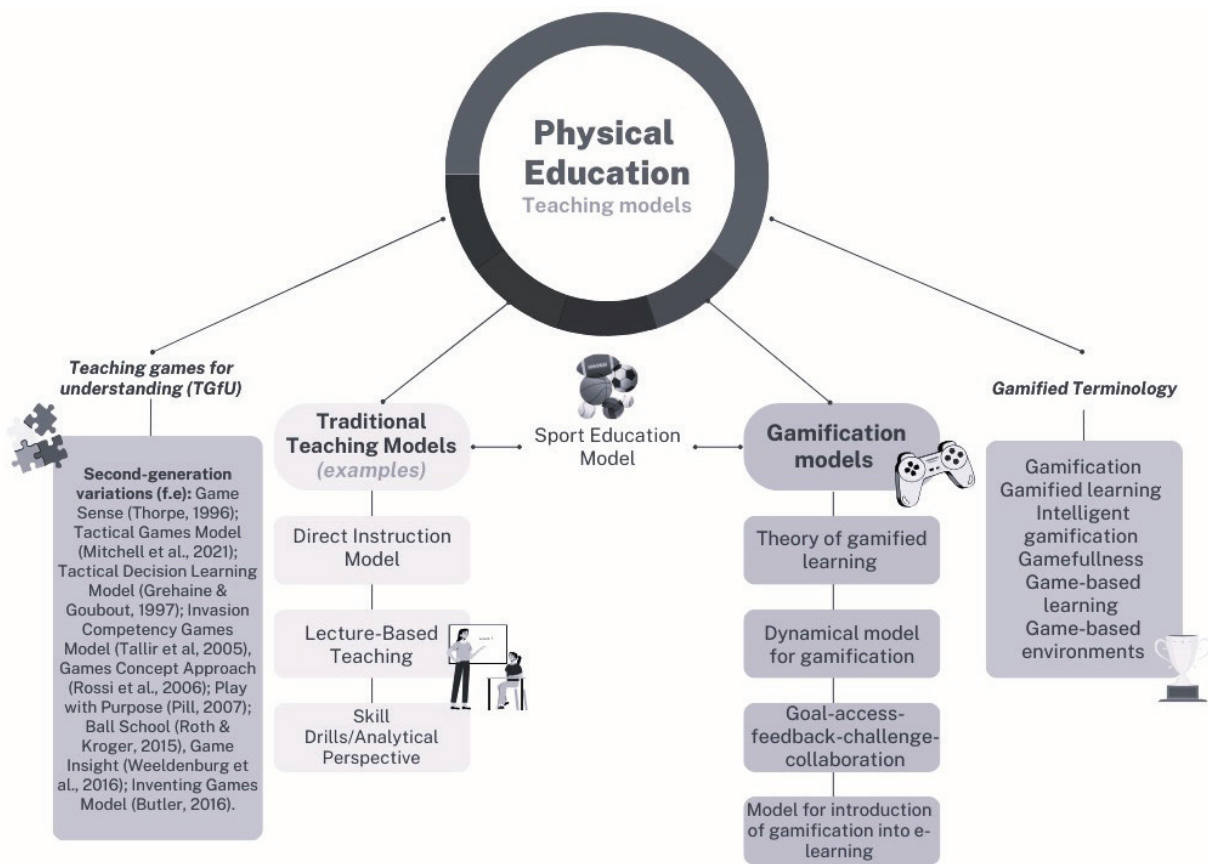


Figure 2. Teaching Physical Education using traditional, game-based and gamification models

Gamification strategies for teaching Physical Education

Literature compiles some common gamification strategies used in PE: (1) classification points, badges, and leaderboards – implementing a system of points, badges, and leaderboards can provide a sense of achievement and healthy competition among students. Points can be awarded for completing tasks or achieving specific learning objectives, while badges recognize milestones or specific accomplishments. Leaderboards display the progress and rankings of students, fostering a sense of achievement and motivation (Plass et al., 2020); (2) quests and missions – structuring educational activities as quests or missions can create a narrative framework that immerses students in a game-like experience. Students may be given a series of challenges or tasks to complete, earning rewards or unlocking new content as they progress. This approach can enhance engagement and provide a clear sense of purpose and progres-

sion (Kapp, 2013; Krath et al., 2021); (3) virtual rewards and unlockable content – offering virtual rewards, such as virtual goods or in-game items, can incentivize students to actively participate in learning activities. For example, completing a quiz could unlock additional educational resources, access to exclusive content, or virtual currency that can be used within the learning environment (Orji et al., 2018); (4) progression and leveling up – adopting a leveling system where students can advance through different levels or stages based on their progress can provide a sense of achievement and mastery. As level advance, they may unlock new challenges, content, or privileges, motivating them to continue learning and progressing (Kapp, 2012; Ortega-Sánchez, 2022); (5) collaborative and competitive elements – incorporating collaborative and competitive elements into educational activities can promote teamwork and engagement (Huang & Hew, 2018). Students can

work together in teams to solve problems or compete against each other in educational games or challenges. This encourages interaction, cooperation, and healthy competition among students; immediate feedback and performance tracking; providing immediate feedback on students' performance can simulate the instant feedback often found in games (Fulton, 2019). This feedback can help students gauge their progress, identify areas for improvement, and adjust their learning strategies accordingly. Performance tracking, such as progress bars or visual representations of achievement, can further motivate students to strive for continuous improvement (Andrade et al., 2016); (6) narrative and storytelling – utilizing storytelling techniques can engage students and create a compelling learning experience. Presenting educational content within a narrative framework or using characters and plotlines can make the learning material more relatable and memorable (Chitra, 2021; Cruz-Campos et al., 2022; Garone & Nesteriuk, 2019).

Also, gamification teaching strategies in PE involve the integration of game elements and game design principles to enhance student engagement, motivation, and skill development (Plass et al., 2020). These strategies leverage the motivational aspects of games to create a more immersive and enjoyable learning experience (Fulton, 2019; Landers et al., 2017). Here are some main gamification teaching strategies in PE. Game-based learning introduce game-based activities where physical movements and skill development are embedded within a game context (Garone & Nesteriuk, 2019; Landers, 2015). This can include modified versions of traditional games, fitness challenges, or cooperative games that require students to apply physical skills while achieving specific objective (Kim & Lee, 2015). Applying digital platforms and mobile apps, or interactive fitness technology to gamify PE (Orji et al., 2018; Silva et al., 2022; Wang et al., 2022). These platforms can offer virtual simulations, interactive challenges, or leaderboards that track students' progress and provide immediate feedback with avatars, rewards, and levels to enhance motivation and engagement (Ortega-Sánchez, 2022). Fitness quests and challenges: design fitness quests or challenges that students can complete individually or in teams. These quests can involve setting personal fitness goals, tracking progress, and unlocking awards or achievements as they reach specific milestones. Incorporate elements like points, badges, or levels to create a sense of achievement and progression (Kapp, 2013; Kim & Lee, 2015). Effective implementation involves aligning gamification strategies with educational objectives to expand pedagogical implications, considering individual differences, and creating an inclusive and enjoyable learning environment (Orji et al., 2018; Silva et al., 2022; Wang et al., 2022).

Gamification allows for the explicit definition of objectives and goals within the game-based model, by using goals provide students with a sense of direction and purpose, and progress tracking allows them to see their advancements, fostering motivation (Wang et al., 2022). Setting specific, achievable goals within the gamified model gives students a clear sense of direction (Prakash & Manchanda, 2021). Goal-oriented learning helps students stay focused, and achieving these goals becomes a source of motivation and satisfaction (Huang & Hew, 2018). Gamification encourages continuous learning by providing an idea of continuous improvement motivates students to explore new concepts and skills, contributing to sustained engagement with an extensive practical application of technology (Cruz-Campos et al., 2022; Huang & Hew, 2018). Other

rising field in gamification strategies are the augmented reality (AR) and virtual reality (VR). The teachers can introduce AR or VR technologies to create immersive PE experiences (Silva et al., 2022). Students can engage in virtual simulations that require physical movements, practice skills in virtual environments, or participate in interactive games that blend PA with digital elements (Orji et al., 2018; Silva et al., 2022; Wang et al., 2022). In the same vein the interactive feedback and progress tracking using wearable fitness trackers or sensors that provide real-time feedback on students' performance during physical activities (Teixeira et al., 2021, 2022). These devices can track metrics like heart rate, steps, or movement accuracy, providing immediate feedback and allowing students to monitor their progress over time. Team challenges and tournaments promote teamwork, cooperation, and healthy competition. These can include modified versions of popular sports or game activities where students compete against each other (Andrade et al., 2016; Orji et al., 2018).

Finally, implement leaderboards or point systems to track team rankings and recognize achievements. It is crucial apply personalized learning paths to students' individual abilities, goals, and interests (Kapp, 2012, 2013). Allow students to choose activities or challenges that align with their preferences and skill levels. Offer a variety of options and create opportunities for students to explore different areas of interest within PE (Hakulinen, 2015). The strategies for personalized learning paths can be narrative/storytelling, reflection/goal setting, and group collaboration and /or social interaction. Each of these points has particular characteristics (Hakulinen, 2015; Plass et al., 2020). Create a narrative framework or storyline that connects physical activities and skill development. Incorporate characters, quests, or plotlines to make the learning experience more engaging and immersive. Students can progress through the narrative by completing challenges, unlocking new content, or advancing to higher levels (Landers, 2015). Encourage students to reflect on their PE experiences, set personal goals, and track their progress. Provide opportunities for self-assessment, goal setting, and reflection on achievements. This promotes self-awareness, autonomy, and a sense of ownership over their learning (Cruz-Campos et al., 2022; Huang & Hew, 2018). Collaboration and social interaction among students through gamified activities. Incorporate cooperative games, group challenges, or team-based activities that require students to work together to achieve common goals. Encourage communication, teamwork, and peer support (Prakash & Manchanda, 2021; Urh et al., 2015). By implementing gamification teaching strategies in PE, educators can enhance student engagement, motivation, and skill development. These strategies provide a fun and interactive approach to learning, promoting a lifelong love for PA and overall well-being (Orji et al., 2018). There are other examples of gamification strategies in educational environments such as PE classrooms, such as achievement badges allows to create a system of achievement badges for various accomplishments, such as mastering a specific skill, consistently participating, or achieving fitness goals (Landers, 2015). The badges provide a visual representation of students' accomplishments, encouraging a sense of achievement and motivating them to pursue additional challenges. Developing fitness challenges set up such as step counts, distance covered, or time spent on physical activities (Cruz-Campos et al., 2022). Students can compete individually or in teams using interactive fitness apps or gamified

platforms designed for physical education. These can track progress, set goals, and provide challenges (Huang & Hew, 2018). Organize team-based challenges or competitions where students work together to achieve a common goal (Prakash & Manchanda, 2021; Urh et al., 2015). Other strategies was to role-playing games to incentive programs with skills levels and progression where students earn rewards (e.g., extra break time, choosing an activity) based on their level of participation and achievements (Hakulinen, 2015).

The role of gamification in socio-affective and motor development during Physical Education

For these reasons, educational institutions must define attractive and differentiating strategies that allow not only the satisfaction and motivation of their professionals, but also rewarding results in terms of learning on the part of their students (Plowman & Stephen, 2005). Through the nature of the elements of rewards or punishments - characteristic of the gamified pedagogical approach, an important role can be seen in the results regarding the teaching and learning process of PE, since the external regulation seems to increase significantly after the sessions of PE intervention (Ferriz-Valero et al., 2020). Furthermore, the gamification model can be a resource capable of producing positive psychological effects in PE classes (Quintas et al., 2020). The gamification of teaching can therefore be a bridge between the student, learning and the real world (Erenli, 2013), provoking benefits in basic psychological needs, enhancing academic performance, and increasing motivation (Quintas et al., 2020).

Thus, pedagogical success in PE requires, on the part of the teacher, the ability to articulate diagnostic, instructional and management skills, adapting their action and behavior to the particularity of each educational situation. Additionally, the training needs of the students should be also considered to provide better learning conditions. These adjustments can be fundamental to stimulate the participation and motivation of students and teachers during PE classes. It is known that games reflect many of the realities of the real world, so it is important to take advantage of this opportunity for the elaboration and planning of games, according to the objectives listed to work on a certain theme.

Interdependent factors contributes for gamification strategies

Applying gamification strategies could be affected by the following interdependent factors contributors in PE lessons (Kapp, 2012; Landers, 2014; Siedentop et al., 2011): (1) student engagement: the level of student engagement and motivation plays a crucial role in the success of gamification. If students are not interested in the gamified elements or do not find them meaningful, the effectiveness of the strategy may be limited; (2) learning objectives: The alignment between the gamification strategies and the learning objectives in PE is essential. The gamified elements should support and reinforce the intended learning outcomes; (3) game design: the design of the gamified elements, including the choice of game mechanics, rewards, challenges, and feedback mechanisms, can impact how students respond to the gamification strategy; (4) teacher support and guidance: teachers' understanding and implementation of gamification play a vital role in its success. Teachers need to provide clear instructions, feedback, and support to help students navigate the gamified learning environment effectively; (5) individual differences: Students have diverse learning

preferences, motivations, and abilities; (6) gamification strategies should consider these individual differences to ensure inclusivity and provide personalized learning experiences; (7) intrinsic and/or extrinsic motivation: The balance between intrinsic motivation (motivation from within, driven by interest and enjoyment) and extrinsic motivation (motivation from external rewards or incentives) should be considered when designing gamified elements; (8) technology and resources: the availability and access to technology and resources can affect the implementation of gamification. The use of digital tools and platforms may require proper infrastructure and support; (9) feedback and progress tracking: providing timely and constructive feedback, as well as opportunities to track progress and achievements, can enhance student motivation and engagement; (10) social interaction: Incorporating social interaction and collaboration among students through gamified elements can promote teamwork and peer support; (11) cultural and contextual considerations may influence students' responses to gamification. It is essential to consider cultural sensitivity and adapt gamification strategies accordingly; (12) time and scheduling: the amount of time allocated to gamification activities within the PE curriculum can impact the depth and frequency of the gamified experiences. Toda et al. (2019) proposed a taxonomy to describe game-based elements and gamification strategies based on five variables: (1) comprehensibility: the "name," which is the standardized idea for the collection of game elements; (2) description: the explanation of the topic; (3) relevance: the element's significance throughout the entire taxonomy; (4) examples: the instances connected to the notion and definition; (5) coverage: the total taxonomy represented. The 21 components in this package accurately depict and cover the game aspects required for instructional applications.

Concretely, gender, age, and the type of sport can significantly greatly influence the application of gamification strategies in PE (Quennerstedt, 2019; Siedentop et al., 2011). Each of these factors contributes to students' preferences, motivations, and learning styles, which need to be considered when designing and implementing gamified learning experiences (Dyson & Casey, 2016; Siedentop et al., 2011). Gender differences may influence the types of games or sports that students prefer. For example, some girls may feel more comfortable with certain sports, while boys may gravitate toward others (Esslinger et al., 2016). Gamification strategies should be designed to be inclusive and appealing to all genders, taking into account diverse interests and motivations (Deterding et al., 2011; Kapp, 2013). Teachers should avoid reinforcing gender stereotypes in gamified activities and promote equal opportunities for all students to participate and excel. Younger students may respond better to gamification strategies that involve colorful visuals, playful elements, and immediate rewards. Older students may prefer more sophisticated game mechanics and challenges that reflect their maturity level and interests (Siedentop et al., 2011). The complexity and difficulty of gamification elements should be adjusted to align with students' age and cognitive development. Different sports have unique characteristics and skill requirements (Akcaoglu et al., 2021). Gamification strategies should be tailored to suit the specific demands and objectives of each sport. For team sports, gamification can emphasize teamwork, communication, and strategy, whereas individual sports may focus on personal achievement and skill improvement (Quennerstedt, 2019). Sports with a competitive nature

may benefit from leaderboards and score-tracking, while cooperative sports may encourage collaborative challenges and shared achievements. Also, the students' motivation and interest in specific sports or physical activities can influence their engagement with gamification (Landers, 2015; Landers, 2014).

Practical applications, research limitations and future perspectives

The limitations of the current study should be taken into account when interpreting its conclusions. Methodologically, the reader should consider the narrative approach and the partial application of the PRISMA methodology (Ardern et al., 2022). Theoretically, it should be made clear that there are grey areas in the literature on teaching models, and that these are interconnected for both PE and sports games contexts (Silva et al., 2022). In future research, it is necessary to develop games through scenarios and daily challenges (Erenli, 2013). Most of the studies carried out so far have focused on studying students' motivation during PE classes or on learning subject content, and the results are encouraging in gamified contexts. In fact, the use of rewards or punishments through points (i.e., experience, damage points or health) in the creation of gamified learning environments can have a dual motivational aspect, increasing motivation in some students and not affecting, or even decreasing motivation in others (Van Roy & Zaman, 2019). The use of new methods can bring effectiveness to the autonomy and self-regulation of student learning (Silva et al., 2018), to contribute to the conception of learning spaces or improvements of institutional and professional initiatives in the classroom (Parra-González et al., 2020). Also, it is important to establish programs based on creativity, collaborative behavior and exploration of materials through programs in the student community, the sports system and lifestyles (S. Santos et al., 2023; Santos et al., 2016).

However, the implementation of gamification in physical education comes with various challenges and limitations. Students and teachers may resist the introduction of gamification, especially if they are not familiar with the concept or have a more traditional view of physical education (Ardern et al., 2022). Students with different athletic abilities may have varied levels of participation and success in gamified activities (Van Roy & Zaman, 2019). The technological development can be an barrier because teachers and schools may face technological challenges when implementing gamification strategies that require the use of digital devices improvement (Huang & Hew, 2018; Kim & Lee, 2015). Developing gamified activities that align with educational objectives without losing focus on learning can be challenging and needs a monitoring and control to understand if the gamification strategies can be challenging, especially in terms of their impact on learning (Kim & Lee, 2015). Otherwise, students may become excessively reliant on gamification elements for motivation, which may not be sustainable in the long term. Gamification strategies relying on technology may create disparities in access due to financial, infrastructure limitations and socioaffective factors (Deterding et al., 2011; Kapp, 2013). Without careful design, gamification can become superficial, with students focusing only on rewards rather than genuine learning (Arufe-Giráldez et al., 2022). Developing well-designed gamified activities may require specific design skills that not all teachers possess. Also, competition may lead to inequality if not managed properly, with some students feeling discouraged if they perceive they cannot compete (Quintas et al., 2020). Addressing these

challenges and limitations with careful consideration allows educators to maximize the benefits of gamification in physical education, creating an engaging and motivating learning environment for students (Fulton, 2019).

Finally, technology seems to play a key role when combined with gamification strategies to improve motivation for students and teachers using this teaching methodology compared to the use of traditional methods (Akcaoglu et al., 2021; Siedentop et al., 2011). In particular, the next research should try to understand which type of motivation is most improved by gamification-based strategies (whether intrinsic or extrinsic motivation as well as what role it plays in the persistence of practice and behaviours).

Conclusion

This review allows us to conclude on the potential benefit of using gamification for teaching PE. From this, gamification strategies seem to be valid and efficient as contribute to the previous PF models, applying game elements, mechanics, and principles to non-game contexts to enhance engagement and motivation in children and youth, specifically in PE classroom. Gamification models extend to as fundamental element the theory of self-determination expressed by theory of gamified learning, dynamical model for gamification of learning (DMGL), goal-access-feedback-challenge-collaboration (GAFCC) gamification, and virtual gamification. Evidence reports increases in motivation for students and teachers using this teaching methodology compared to the use of traditional methods. In this way, it is possible to expect that with the continuous technological advancement which it has been witnessed in this era, the overlapping of this type of teaching methodologies (i.e., gamification) to the detriment of other approaches may become a reality in the short term. The introduction of technology in the educational context can be the key to success in promoting children's lasting bonds with PE and consequently with sport for their lives. Even so, it is important to note that the pedagogical didactic strategies, the teaching model or the hybrid teaching model chosen by the teacher, must always adapt to the individual characteristics of the students and aim to enhance their sports abilities, regular PA, and motor control.

Funding

This project was supported by the National Funds through the FCT—Portuguese Foundation for Science and Technology (project UIDB04045/2020)

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

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