Digital Gamification And Physical Activity Of Students

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Abstract:
Physical Education is one of the cornerstones of education, promoting the overall development of students on a physical, psychological and social level. It cultivates skills that contribute to physical health, motor ability and self-confidence, while enhancing collaboration and social interaction. While its importance is recognised, one of the main problems it faces is low student participation, mainly due to lack of interest or the inability to link activities to their needs and interests. In this context, approaches such as gamification offer solutions to enhance engagement and participation, creating a learning environment that is both fun and educational. Gamification is a pedagogical method that utilizes mechanisms from games, such as level progression, rewards, scores and challenges, in non-playful environments. Its main goal is to motivate students, creating positive motivation for participation and engagement. In a course like Physical Education, where engagement and active participation are critical, incorporating this method can be a catalyst for creating a more engaging and dynamic learning environment. This study focuses on the theoretical investigation of the connection between gamification and physical activity, analyzing how these mechanisms can enhance educational practice and provide solutions to chronic problems of participation. Through the analysis of the relevant literature and research findings, it is confirmed that gamification can act as a motivation and engagement tool. By creating challenges that meet students' potential, their sense of autonomy and achievement is enhanced, making them feel active members of the learning process. In addition, the ability to collect virtual rewards, such as medals or points, and participate in competitions help create a fun experience that motivates even the most reluctant students. This method helps maintain interest by fostering consistency and active participation over time. At the same time, gamification contributes to the development of social skills, encouraging cooperation through team activities and friendly competition. Students learn to work together to achieve common goals, cultivating communication and relationship management skills. Especially for more reluctant students or those with lower motor skills, the ability to participate in activities tailored to their abilities creates an inclusive environment, enhancing self-esteem and sense of belonging. Through this process, the Physical Education lesson is transformed from a formal activity into an experience that empowers all students. While gamification offers significant benefits, it is not devoid of challenges. One of the key problems is an overemphasis on extrinsic motivation, such as rewards and scores, that can undermine students' internal motivation. To address this issue, teachers need to focus on creating activities that enhance autonomy, a sense of achievement and social interaction. In addition, limitations such as lack of equipment, insufficient teacher training and different abilities of students can be obstacles to the effective implementation of the method. However, with proper training and the use of affordable technological tools, these obstacles can be overcome. Through this study, guidelines for the implementation of gamification in Physical Education are proposed. Specially designed digital tools can support the personalisation of teaching, providing feedback and progress data. At the same time, the connection of Physical Education with other subjects, such as technology, sciences and arts, can create an interdisciplinary environment that enriches the learning experience. The use of augmented reality and other innovative technologies offers further possibilities for student engagement. Overall, gamification is presented as an innovative method that can transform the teaching of Physical Education. This approach not only improves participation and performance, but also creates an environment that enhances students' autonomy, collaboration and personal development. Future research and practical applications can contribute to the further exploitation of this method, shaping a more participatory and effective educational future.
Key Word*: Gamification; Digital Technology; Gymnastics; Teachers; Students.*

I.   Introduction

Physical Education (PE) plays an important role in the overall development of students, enhancing physical health, psychological well-being and social skills. The integration of PE in the educational program offers a unique opportunity to form active and healthy habits from an early age, while promoting holistic personal development. In the physical dimension, participation in PE activities has been shown to improve

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physical fitness, enhance muscle strength and promote motor dexterity. Studies have shown that fitness cultivated through PE can be a foundation for adopting an active lifestyle in adulthood . Participation in organized PE programs helps prevent chronic diseases such as obesity, cardiovascular diseases and type 2 diabetes[4]. In the psychological sphere, PE helps reduce stress, improve mood and boost self-esteem. The psychological benefits derive from the release of endorphins during physical activity, while the structure of PE courses promotes personal growth through challenges and successes[5]. In particular, students gain confidence through goal achievement while developing stress coping strategies. In the social dimension, PE promotes skills of cooperation, communication and mutual respect. Through team sports and other collaborative activities, students learn to work together to achieve common goals while developing leadership and problem-solving skills[19]. These social skills help prepare them for a successful personal and professional life[36].

Despite its proven benefits, PE faces significant challenges in modern times. One of the biggest constraints is insufficient funding and limited time devoted to PE programmes in many schools. Often, PE is considered less important than other academic subjects, so it is not adequately integrated into the curriculum[4]. In addition, the lack of adequately trained staff may limit the quality of the natural gas provided. Teachers need specialized training to use effective teaching methods and adapt to the needs of different students[31]. Another challenge concerns the reduction of physical activity due to digital technologies and sedentary lifestyle. Students today spend more time on electronic devices, which reduces their active participation in physical education activities[40]. Finally, cultural diversity creates additional requirements for the adaptation of PE programmes to the specific needs of different student populations. Teachers must take cultural and social differences into account to ensure equal participation of all pupils[83].

The rapid evolution of digital technology has transformed education, introducing tools and methods that improve the learning experience and accessibility. The development of digital tools offers flexibility and interaction, serving the needs of students at every level of education. Learning Management Systems (LMS), such as Moodle and Blackboard, are examples of tools that support lesson organization, interaction and assessment, offering teachers the ability to tailor their content to students' needs[81]. Digital tools play a particularly important role in shaping educational experiences that foster active participation. For example, platforms such as Classcraft and Google Classroom enable the integration of digital media such as videos, quizzes, and simulation activities, increasing content appeal and student engagement[47]. The personalization possibilities provided by these tools allow teachers to adapt the material to the individual needs and level of students, improving the learning process.

Gamification is one of the most innovative strategies to increase participation and motivation in the educational process. The term refers to the integration of elements from games, such as points, badges, leaderboards and challenges, into non-game environments. This approach promotes students' active participation, creating an environment that combines learning and entertainment. Studies show that gamification enhances student engagement, especially in online and hybrid teaching models. For example, using digital badges to reward achievement has been shown to increase students' mood and participation in higher education institutions[25]. At the same time, educational platforms, such as Kahoot and Quizizz, utilize gamification elements to create interactive activities that promote collaboration and creativity. An important success factor of gamification is the design of activities that combine elements of challenge, reward and fun. The use of the game MinecraftEdu in primary education, for example, allows students to explore educational topics through interactive simulations, developing problem-solving and critical thinking skills[72].

The integration of digital tools and gamification elements in education presents significant prospects, but also challenges. On the one hand, these tools allow to enhance participation, collaboration and interaction, creating more dynamic and engaging learning environments. On the other hand, insufficient technological infrastructure and lack of appropriate teacher education are major barriers to widespread adoption of these methods[11]. The strategic implementation of gamification elements also requires collaboration between teachers, technologists and designers to ensure that activities are tailored to students' needs and educational goals. Investing in educational tools such as Classcraft and Kahoot, combined with appropriate teacher training, can lead to significant improvements in teaching and learning[77].

The concept of gamification is an innovative pedagogical approach that utilizes game elements and mechanics in non-game-centric environments, such as education. Its goal is to increase students' engagement, participation, and motivation. Physical Education (PE), as a critical component for the development of physical activity, can greatly benefit from the application of this approach. More specifically, gamification in PE contributes to the cultivation of motivation for active participation and the formation of a positive attitude towards physical activity. According to systematic studies, the implementation of gamified programs in PE increases student engagement and promotes intrinsic motivation through the reinforcement of basic psychological needs, such as autonomy, connection and competence. These needs are central elements in self-identification theory, which is often used to explain the dynamics of gamification in learning and physical activity[3]. Gamification in PE can also help reduce negative attitudes, such as inaction and lack of motivation. In

research, it was observed that implementing gamified activities increased participation, cooperation and positive interaction among students, while reducing levels of indifference and denial[79].

The implementation of gamification in PE is not only limited to improving participation, but also includes the integration of digital technologies such as mobile applications and educational platforms. For example, using apps like ClassDojo offers teachers the ability to organize activities based on points, rewards and challenges, boosting student motivation[78]. In addition, incorporating physical activity-based digital games, such as exergames, has proven effective in improving motor skills and fitness. The use of such tools can be combined with didactic models, such as Mechanics-Dynamics-Aesthetics (MDA), to create interactive learning experiences[73]. Another example of application is the connection of gamification with virtual reality (VR), which enhances student engagement through the creation of engaging learning environments. According to research, the combined use of VR and gamification improved motor skills and overall learning experience in PE[28].

The objectives of this study focus on the theoretical investigation of the relationship between gamification and physical activity, as well as on the emergence of practical applications of this approach in educational practice. Gamification, as a method that incorporates game mechanics in non-playful environments, has proven highly effective in mobilizing and engaging individuals in a variety of contexts. In the context of physical education, it has the potential to enhance students' participation in activities that are often considered monotonous or less interesting. The theoretical investigation focuses on the analysis of the basic principles and mechanisms of gamification, such as levels, scores, rewards and challenges, and how these can be incorporated into physical activity programs.

The first objective is to highlight how this methodology mobilizes participation by enhancing autonomy, a sense of achievement and connection with others. Self-Determination Theory provides the appropriate framework for understanding the motivation that is created, as it focuses on satisfying basic psychological needs. At the same time, this study examines how gamification can be applied in educational practice to enhance the physical activity of students of different ages and fitness levels. The integration of digital tools, such as applications and software adapted to the individual needs of each student, emerges as a key strategy for the implementation of this approach. Through the use of these tools, students can monitor their progress, compete amicably with each other and achieve goals related to both physical activity and general skills development.

The second objective of the study is to highlight the practical potential of gamification to improve physical education teaching. The development of cross-curricular activities, where physical activity is combined with other subjects, such as science or geography, offers the potential for richer learning experiences. One example is the integration of augmented reality (AR) into motion games, where students explore natural or cultural landscapes while participating in activities that require movement and collaboration. The study also examines the potential barriers and limitations that may arise when implementing gamification in physical education. These limitations include teachers' lack of familiarity with technology, variations in students' skill levels and lack of appropriate equipment. However, ways to address these problems are proposed, such as teacher training, tailoring activities to each student's needs and using low-cost digital tools.

Gamification can contribute substantially to improving student engagement and creating a positive attitude towards physical education. Through the emergence of real applications, such as the use of cooperative games, the promotion of friendly competition and the provision of feedback through games, students develop motor skills, boost their self-confidence and learn to appreciate the importance of physical activity for their health.

In summary, this study seeks to lay the theoretical and practical foundations for the utilization of gamification as a tool that strengthens educational practice. Its application in educational practice has the potential to transform the teaching of physical education, making it more attractive, effective and adapted to the needs of modern times.

II. Theoretical Framework
Definition and Elements of Gamification

Gamification is defined as the integration of game elements and game mechanics into non-game-centric environments to increase user engagement, participation, and performance. The term was originally introduced in 2002, but has gained more popularity in recent years due to its application in education, health, and business[37]. Using features commonly found in games—such as points, levels, challenges, and rewards—gamification turns ordinary tasks into more immersive and enjoyable experiences. In education, gamification can make learning more interactive and engaging, as it allows students to see their lessons as quests or adventures[38]. This approach not only holds students' attention, but also encourages a sense of accomplishment as they progress through various stages of learning.

Key features of gamification include levels, scores, achievements, challenges, and social interaction. These elements are designed to enhance participation and create motivation to learn:

- *Levels:* Levels act as progression mechanisms, allowing students to perceive their development. Students often feel satisfaction when they level up, which enhances their inner motivation[59].
- *Scores: Scores* provide a measure of performance. In the educational process, scores can be used as feedback tools that show students how they respond to activities[92].
- *Achievements:* Achievements are awards that students receive for completing specific goals. They motivate through external recognition, while enhancing self-confidence[66].
- *Challenges:* Challenges enhance critical thinking and problem-solving skills. A successful challenge requires a careful balance between difficulty and learner abilities[45].
- *Leaderboards: Leaderboards* enhance social interaction through healthy competition. Research shows that leaderboards increase participation when designed correctly, but may discourage lower-achieving students[20].

A study that looked at a mobile app for physical activity showed that gamified elements such as leaderboards and progress trackers significantly boosted participants' motivation and engagement, especially among those who previously had less physical activity[43]. By incorporating game-like elements, users feel more capable of achieving their goals. Gamification has been successfully implemented in several educational areas:

- *Language Learning:* Platforms like Duolingo use levels, achievements, and leaderboards to motivate users to practice their language every day.
- *STEM Education:* Engineering and computer science students have shown increased participation and performance through gamified activities[52].
- *Special Education:* In students with learning disabilities, the use of gamification has been shown to increase participation and engagement[20].

Motivational Theories Supporting Gamification

Gamification is an innovative approach that draws on motivational theories to enhance participation and engagement in non-game environments, such as education. The two dominant theories supporting the design and implementation of gamification are Self-Determination Theory (SDT) and Flow Theory. These theories focus on understanding the mechanisms that motivate people to engage in activities with interest and commitment.

Self-determination theory (SDT), developed by[75], refers to a psychological approach to motivation that focuses on the importance of satisfying three basic psychological needs: autonomy, competence and connection. The theory divides motivation into two categories: endogenous and extrinsic.

- *Intrinsic motivation* comes from the inner satisfaction a person feels when performing an activity. It is the desire to participate in an activity for the enjoyment or challenge it offers, without the need for external rewards[74]. For example, in a gamified learning environment, students who solve puzzles about the pleasure they derive from the process, They are driven by intrinsic motivation.
- *Extrinsic motivation* is based on external factors, such as rewards or punishments. However, SDT argues that extrinsic motivation can transform into more autonomous when the individual recognizes the value of the activity. This process, called internalization, is critical for effective gamification. For example, when students participate in activities to earn points or achievements, but over time recognize the educational value of these activities, extrinsic motivations turn into endogenous ones[57].

Gamification can be designed in a way that meets these psychological needs:
- *Autonomy*: Allowing students to choose their activities or determine their rate of progress.
- *Proficiency:* Creating challenges that are demanding but achievable so that students feel competent when they complete them.
- *Connecting:* Providing opportunities for collaboration and social interaction through group gamified activities[62].

Autonomy and support from teachers are critical to enhance internal motivation. Activities that involve personal choice, such as games that adapt to the student's preferences, enhance inner motivation and improve learning outcomes[51].

The Theory of Flow, proposed[21], describes the psychological state in which the person is completely absorbed in an activity. This state is characterized by a sense of control, high concentration and enjoyment. Flow is one of the pursuits of gamification, as it enhances engagement and performance[63]. Basic Elements of Flow are:
- *Clear Goals:* Participants need to know what to do and why.
- *Instant Feedback:* Participants receive information about their progress, helping them adjust their behavior.
- *Balance of Challenge and Skills:* Activities should be difficult enough to be interesting but not so difficult as to cause frustration.

Gamification can create flow conditions through the careful design of activities that balance challenge and skill. Games that include increasing levels of difficulty can help students feel that they are evolving and at

the same time maintaining their interest[48]. Also, the flow is influenced by cultural factors. Research shows that in China, students tend to experience flow in activities that include practice skills, while in Western societies the flow often arises from challenges that require high creativity[63].

The Role of Digital Technology in Physical Education
Digital technology has revolutionized the way physical education is taught, creating more opportunities to enhance student engagement. Through tools such as mobile apps, wearables, augmented reality (AR) and digital platforms, teachers can offer a personalized and interactive learning experience. Digital technologies not only facilitate access to educational materials but also enhance participation and learning experience through interactions and feedback. Indicatively, the use of digital applications to monitor physical activity and student feedback. With apps like Strava or MyFitnessPal, students can record their activities and receive real-time feedback, enhancing their sense of autonomy and competence[8]. This practice incorporates the principles of self-determination theory, promoting both intrinsic and extrinsic motivations.

The integration of digital technologies in physical education includes a variety of applications designed to support learning and physical activity. The use of augmented reality (AR) and virtual reality (VR) creates interactive learning environments, which enhance motivation and engagement. Students can participate in activities that represent real conditions or historical events through technology. AR increases the effectiveness of physical education education through information visualization[8]. Mobile apps, such as Fitbit and Google Fit, allow students to track their physical activity and stay fit. These technologies enhance self-monitoring and provide insights that help improve performance. E-learning platforms, such as Moodle, have been used to create personalized learning programs. Teachers can provide videos, interactive quizzes, and simulations, making physical education more accessible and fun for students[43].

Gamification in PE is an effective method of boosting participation through the introduction of game elements such as points, challenges and rewards. Research has shown that students who participate in gamification activities are more likely to continue participating in physical activities for longer[14]. It leverages mechanisms such as points, levels, and achievements to enhance learning attractiveness and promote students' active participation[3]. Linking games to education has been shown to increase engagement, autonomy and pleasure, helping to improve learning outcomes. Gamification in PE incorporates elements such as:
- *Levels and Points:* Students level up and earn points through their participation. This creates a sense of progress and enhances intrinsic motivation[79].
- *Challenges and Quests:* Challenges motivate and enhance student engagement by using educational activities that require problem-solving[13].
- *Real-Time Feedback:* Feedback is critical to improving performance and maintaining engagement. Gamification learning systems provide information that boosts students' confidence[29].

Gamification in physical education has proven effective in several areas:
- *Increased Participation and Motivation*. Research shows that gamification improves student engagement and performance, mainly through the use of applications such as ClassDojo[78].
- *Improvement of physical skills*. The use of gamified activities in physical education enhances motor skills and promotes fitness[58].
- *Development of social skills*. The social interaction promoted through gamification helps students develop collaboration and communication skills[11].

Indicative applications in PE are the use of augmented reality (AR) which creates interactive learning environments, allowing students to participate in unique simulations. Apps like Duolingo and Fitocracy provide an interactive learning framework that helps students achieve specific goals through Virtual Activities and Models[58]. Custom activity such as the educational games "STAR WARS: The First Jedi" which are used to link physical activity to popular cultural references, enhance participation and mental well-being[67].

III.   Benefits Of Gamification In Physical Activity
Incentive Enhancement
Enhancing motivation in physical education is one of the most critical goals in promoting physical activity among students. In this context, elements such as levels, scores, rewards and challenges play a central role. These practices are based on psychological theories, such as Self-Determination Theory (SDT), which focuses on autonomy, competence and connection[68]. Levels and Scores create goals:
- *Levels* act as progression mechanisms, creating clear goals that reinforce a sense of competence. Progress through levels gives students a tangible measure of their development while enhancing their inner motivation. For example, in activities such as football, promotion to higher levels proves effective in enhancing participation[55].

- *Scores* provide feedback on students' performance, boosting their confidence and motivation to achieve higher goals. Studies have shown that students who receive feedback through scores tend to engage more and show greater progress[80].

Rewards, whether external (such as certificates) or internal (such as a sense of accomplishment), are a key element in enhancing extrinsic motivation. According to self-determination theory, rewards associated with the value of an activity can lead to long-term commitment[65]. Challenges, on the other hand, promote critical thinking and decision-making. In studies, students who participated in challenge-based activities reported higher levels of satisfaction and an increased sense of achievement[86].

Boosting motivation can be achieved through creating an environment that promotes autonomy, competence and a sense of connection. The use of learning environments that allow students to choose activities or roles has been shown to be effective in increasing autonomy and participation[41]. In addition, customized physical activity programs, which focus on students' needs and interests, help boost engagement. Research has shown that students with higher levels of autonomy showed better performance and greater commitment to their activities[6]. Transformative teaching, which focuses on creating a positive learning climate, can increase levels of enthusiasm and commitment. Students who perceived their teachers as supportive show higher levels of autonomy and enthusiasm[14].

Improving Engagement and Consistency

The active participation and consistency of students in physical education are key objectives for promoting healthy lifestyles and achieving learning outcomes. Gamification, an innovative pedagogical approach using game elements, has been shown to improve engagement and performance in various educational contexts, including physical education[29].

Students' active participation is enhanced when activities are designed in a way that promotes autonomy, challenge and social interaction. The use of game elements, such as points, levels, and challenges, has been shown to increase students' inner motivation. In the context of physical education, students participate more actively when they feel in control of their progress[78].

Using apps like ClassDojo and Fitocracy allows students to monitor their performance and receive real-time feedback, which increases their confidence and engagement[79]. Successful Examples of Gamification Interventions are:

- *Program "Marvel PE"*. This program was based on the Marvel Heroes universe and incorporated gameplay elements, such as points and challenges, into physical education activities. Students who participated reported increased enjoyment and a sense of accomplishment, which boosted their engagement[29].
- *Program "ClassDojo"*. This app was used to enhance participation in physical education classes. Students who participated in this gamified program showed improvement in internal motivation and behavior regulation compared to traditional teaching[79].
- *"Beat the Street"*. This program, implemented at the community level, used game elements such as points and progress maps to promote physical activity. Participants reported an improvement in their physical activity levels even two years after completing the program[39.]
- *Gamification in Digital Learning*. At the university level, incorporating digital game elements into physical education programs, such as the "Quizizz" and "Just Dance Now" apps, had a positive impact on student engagement and performance[73].

Gamification also helps maintain consistency in participation. Elements such as challenges and rewards give students reasons to stay active. Brief gamification interventions have a greater effect on behavior retention compared to long-term interventions[46]. The use of mobile applications such as "Active Team" allows monitoring students' progress and improving their consistency, especially in social activities[76].

Integrating Technology into Cross-Curricular Learning

Interdisciplinary learning is an innovative approach that combines different subjects, such as physical education, mathematics, and science, through the integration of digital tools. The aim is to create a rich and comprehensive learning experience. The use of technology facilitates the connection of these objects, promoting creativity, critical thinking and collaboration among students[16]. The connection of Physical Education with other subjects through digital tools could be done by:

- *Mathematics*. The integration of physical education and mathematics using digital tools, such as augmented reality (AR) applications, has shown that students not only increase their physical activity but also improve their math skills. In one study, students who participated in embedded activities showed significant improvement in abstraction skills and a reduction in sedentary time[15].

- Science. The use of motion analysis tools and software to study biomechanics was incorporated into physical education to link the sciences with motor development. Students developed a deeper understanding of scientific methodology through practical applications[56].
- *Technology and Engineering.* Incorporating engineering principles into physical education activities, such as designing sports equipment, has been shown to enhance critical thinking and problem-solving skills. This approach supports the development of innovation and creativity in students[1].

The integration of technology into cross-curricular learning offers a variety of benefits that enhance the educational process and student engagement:

- *Strengthening Engagement.* The use of digital platforms, such as tablets and data analysis software, offers students interactive experiences that promote their engagement in the learning process. In a study that looked at the use of iPads in badminton classes, students developed higher levels of interest and performance[42].
- *Development of critical thinking.* The integration of tools such as design and simulation software enhances critical thinking, helping students connect theoretical concepts with practical applications [42].
- *Interdisciplinary Cooperation.* Linking disciplines promotes collaboration between students of different skills and interests, leading to more creative solutions and greater understanding [6].

Programs such as:

- *Integrated Mathematics and PE Program.* This project linked physical education with mathematics through the use of digital tools to record and analyze data. Students developed problem-solving skills through interactive activities[15].
- *"U-Shaped" Integration Model.* This model integrated different subjects, such as physical education, science and technology, promoting students' overall development. Students improved their motor performance and understanding of scientific concepts[53].
- *CLIL and PE Integration.* The application of CLIL (Content and Language Integrated Learning) in physical education linked language development with physical activity, enhancing students' communication and collaboration skills[90].

The integration of technology into cross-curricular learning requires significant infrastructure and appropriate teacher education. Moreover, ensuring equality in access to digital tools is crucial for the success of programmes. However, the prospects for improving the quality of education and preparing students for the future are great.

IV.   Challenges And Limitations Of Gamification
Overemphasis on Extrinsic Motivation

The use of extrinsic incentives, such as rewards and bonuses, has a long history of shaping behaviors in education. However, overemphasizing these motivations can cause a number of negative consequences for students' learning and personal development. Recent research suggests that while extrinsic motivation may temporarily enhance participation, it can undermine the intrinsic motivation necessary for long-term commitment and lifelong learning[24]. The most significant effect of overusing extrinsic rewards is a decrease in intrinsic motivation. When students focus more on rewards than activity, their sense of satisfaction with the learning process itself decreases. This phenomenon is known as the "undermining effect" and has been documented in numerous studies[64]. Too much focus on rewards can limit creativity, as students tend to choose safer and more predictable solutions to secure rewards. In addition, the sense of autonomy is reduced, which is a key factor in maintaining internal motivation[22]. Relying on extrinsic motivation encourages students to focus on immediate rewards, neglecting long-term goals such as developing problem-solving skills and critical thinking[12]. Research in neuroscience shows that extrinsic motivation influences activity in the brain, especially in the prefrontal cortex and striatum region, related to reward processing. When the focus is only on external rewards, brain activity decreases in the area associated with internal motivation, limiting a person's willingness to continue an activity after the reward has been removed[64]. There are alternative interventions that can have positive results such as focusing on autonomy, harnessing social rewards and introducing interest-enhancing activities. Providing students with choice enhances their sense of control and inner motivation. For example, introducing options into physical education activities can improve commitment[24]. Instead of material rewards, social rewards, such as praise and recognition, have a positive effect without reducing internal motivation[7]. Incorporating activities that spark interest in students, such as games with educational content, enhances engagement without the need for extrinsic rewards[51].

Application to Heterogeneous Populations

Teaching physical education to heterogeneous populations is a multidimensional challenge. This heterogeneity results from the diversity in students' physical skills, perceptions, cultural backgrounds and socioeconomic status. Understanding these parameters and developing appropriate strategies is a key step in creating an inclusive learning environment[83]. Students come from different cultural contexts, which influence their perception of physical education and physical activity. In research with high school students in the U.S., it was found that cultural perceptions significantly affect their participation and motivation[69]. Physical education is often seen by students as a secondary subject, limited only to physical activities. This can reduce motivation and participation, particularly in students with lower levels of physical ability[82]. In physical education classes, students often show different levels of physical performance. This heterogeneity can lead to exclusion of low-skilled students, while high-skilled students may suffer due to lack of challenge[13]. Students with special needs may require individualized interventions to fully integrate into the course. Teachers often feel inadequate due to the lack of appropriate education to support these students[54]. Pedagogical strategies such as differentiated teaching, cultural sensitivity and teamwork should be developed. Diversification of content and activities is essential to address heterogeneity. Research shows that differentiated teaching can enhance participation and meet the needs of different groups of learners[50]. Cultural sensitivity in education can improve student engagement. Activities that recognize cultural differences help reduce prejudice and foster collaboration[85]. Working in heterogeneous groups helps shape social skills and promotes inclusion. Heterogeneous groups foster collaboration and interaction between students with different abilities[9]. Digital tools provide opportunities for personalised learning and progress monitoring. The use of apps, such as physical activity tracking, can facilitate the participation of lower-skilled students[88]. Incorporating interactive games encourages participation and reduces students' anxiety about their performance. This strategy is particularly effective in students with low motor skills[85].

Technological and Pedagogical Limitations

The integration of technology and the development of pedagogical strategies are major challenges for physical education. However, constraints related to lack of equipment and insufficient teacher training continue to hinder effective teaching. Analyzing these factors is essential to develop strategies that will address barriers and promote quality in physical education[23]. Research shows that there is a significant difference in access to technological equipment between schools in different regions. Limited equipment, such as tablets, interactive whiteboards and motion sensors, limits the integration of technology into physical education classes[84]. The cost of purchasing and maintaining technological equipment remains one of the biggest obstacles for schools. The need for more cost-effective solutions has led to research into alternative ways of using technology, such as mobile apps[89]. Although the use of technology enhances teaching, many teachers have not received the necessary training to use technological tools in physical education. Teachers often feel ill-prepared to incorporate technology into their lessons[71]. The lack of knowledge about the use of digital tools, such as virtual learning platforms and physical activity monitoring apps, limits teachers' ability to enhance students' learning[33]. Large numbers of students per class and limited teaching time are major obstacles. Using digital tools that facilitate personalized learning can help manage these challenges[60]. Professional development programs incorporating internships and on-site training can boost teachers' confidence and skills. In a 10-week study, participating teachers reported an improvement in their abilities to use technology in teaching[87]. Creating affordable technology tools, such as physical activity tracking apps, could reduce costs and increase accessibility[23]. Cooperation with universities and technology companies can enhance the development of educational programs and the supply of equipment to schools[89].

V.   Suggestions For Applications

Guidelines for Teachers

Gamification is a modern pedagogical approach that applies game elements to non-game environments to enhance participation and interest. In physical education, gamification offers the potential to improve student motivation while enhancing learning through activities that combine entertainment and education[30]. Gamification is based on models such as "Mechanics-Dynamics-Aesthetics" (MDA), which incorporates game mechanics, dynamic and sensory experience to create interactive environments. Tools such as "Just Dance Now" exergames have proven effective in implementing this approach, especially at younger ages[73]. Technology is an integral part of gamification, with apps like ClassDojo providing capabilities to track progress and generate incentives through virtual rewards[79].

Creating a gamification course starts with setting clear educational goals. Activities should be designed to include challenges, rewards, and clear feedback to maintain interest[91]. Differentiating content according to students' skill levels is crucial. Teachers can use scalable challenges to meet the needs of different groups of

learners. Introducing topics, such as superheroes, can enhance student engagement. In a study using the MarvPE program, there was a significant increase in students' internal motivation[29].

Through a careful planning of physical education lessons with gamification, there will be significant benefits for students. Gamification has been shown to increase students' internal motivation, enhancing engagement and maintaining attention. Group activities with games enhance social skills, helping students learn to work effectively in teams[7]. Studies have shown that gamification reduces disruptive behaviors, promoting positive interaction in the classroom[78]. On the other hand, there are also challenges that need to be addressed. The gamification application may require more preparation from teachers. Professional development programs are essential to enhance their skills. The absence of appropriate infrastructure can limit gamification implementation. The use of mobile devices and applications can provide an economically viable solution[34]. Creating activities that respond to students with different skill levels is challenging. Digital applications tailored to each student's needs can facilitate the process[91].

Development of Digital Platforms

Gamification tools offer opportunities to enhance participation and skills development through the use of interactive and engaging methods[30]. Digital tools that could be used are:

- *ClassDojo.* ClassDojo is an app that integrates gamification elements such as leaderboards, rewards, and challenges to enhance students' engagement in physical education. In one study, using the tool significantly increased students' internal motivation and improved their social skills[79].
- *Just Dance Now*. Just Dance Now is an exergame app that combines music and movement to motivate students through entertainment and physical activity. Papers incorporating this tool demonstrated a positive effect on student engagement[73].
- **FitQuest.** FitQuest is used to track physical activity through motion sensors and provide personalized feedback. The tool helps improve students' physical fitness and enhances awareness of their potential[27].

Digital platforms that could be used should offer the potential for interactivity with collaboration, evaluation with feedback and personalization. Platforms like Berguru enable collaboration between students, encouraging social interaction and skills development. The use of sensors and analytical data from platforms such as Digital Forms of Assessment enables real-time monitoring of performance, providing analytical feedback to both students and teachers[70]. The use of artificial intelligence and machine learning on platforms such as FitQuest allows activities to be tailored to each student's needs[10].

The benefits of gamification through the use of digital tools are increased student participation, skills development and the ability to monitor student progress. Digital tools enhance student participation, making the lesson more interesting and interactive. Studies show that platforms using gamified features increase engagement by 70% compared to traditional methods[2]. The use of tools such as ClassDojo and Just Dance Now helps develop collaboration skills and self-esteem, particularly in students with lower physical abilities[79]. Also, digital tools allow for easy recording and analysis of student progress, enabling accurate assessment and guidance[70].

But the use of digital tools and platforms faces challenges that need to be addressed. The absence of adequate infrastructure and access to technology may limit the application of digital tools in physical education. Incorporating cost-effective solutions can mitigate this problem. Teachers need training to reach the full potential of these tools. Specific professional development programs can meet this need[10].

Cooperation between teachers and technologists

Cooperation between PE teachers and Technologists-Programmers can enhance the quality of teaching, incorporating cross-curricular elements and innovative technological solutions. This synergy aims to create courses that combine physical education with other subjects, promoting the development of 21st century skills such as critical thinking, collaboration and digital literacy[17]. The integration of cross-curricular elements in physical education enhances the understanding of multifaceted concepts. One example is the collaboration between physical education teachers and secondary school teachers, which led to the creation of activities that combined physical activity with geography, offering students an engaging experience[32]. Study findings showed that collaboration between physical education teachers and teachers of other disciplines improves lesson design. The results showed that students benefited significantly from the interaction between different disciplines[17]. Cooperation between teachers and technologists enhances teachers' skills, promoting innovation and adaptation to new pedagogies[44]. At the same time, the integration of collaborative practices promotes inclusion and facilitates the participation of students from different socio-economic and cultural backgrounds[35].

VI. Conclusions

The present study demonstrated that physical education is an integral part of the educational process, promoting the holistic development of students on a physical, psychological and social level. However, contemporary challenges, such as infrastructure shortages, student diversity and limitations in teacher training, require increased support from politicians, teachers and parents. With appropriate interventions, physical education can continue to play a central role in cultivating healthy, happy and socially active citizens. The digitalization of education and gamification are catalytic factors for the upgrading of physical education. With the use of tools such as interactive platforms and exergames, students' participation, creativity and critical thinking are enhanced. Despite the challenges, these approaches promise to deliver more engaging and rewarding learning experiences. Theories such as Self-Determination Theory and Flow Theory offer a powerful theoretical framework for the application of gamification. Self-determination emphasizes meeting basic psychological needs, such as autonomy and a sense of achievement, while Flow Theory focuses on creating experiences that fully absorb participants. The combination of these theories can lead to the design of activities that are both enjoyable and efficient. Boosting motivation in physical education, through mechanisms such as scores, levels and rewards, is central to promoting physical activity. These strategies help students develop positive attitudes towards health while helping to create sustainable habits for a healthy lifestyle. The integration of technology in physical education and its connection with cross-curricular disciplines opens up new perspectives for education. Through innovative approaches such as the use of augmented reality (AR) and collaborative activities, students develop skills that are essential for modern society. Overemphasizing extrinsic motivation, such as rewards, can have negative consequences, as it may reduce intrinsic motivation. Creating environments that promote autonomy, creativity and social support offers a more balanced approach, ensuring students' long-term participation and development. The implementation of physical education in heterogeneous populations requires differentiated strategies that take into account the diverse needs of students. Differentiated teaching, cultural sensitivity, and the use of technology can create a learning environment that encourages the participation of all students. However, technological and pedagogical limitations in physical education require concerted efforts to upgrade infrastructure and train teachers. With the right support, technology can transform teaching, offering more engaging and effective learning environments. Collaboration between teachers and technologists is critical to the development of cross-curricular programs in physical education. This synergy facilitates the creation of innovative courses, enhancing student engagement and fostering skills necessary for the future. With well-designed interventions, physical education can leverage technology and gamification to deliver quality learning experiences that inspire students to adopt a healthy lifestyle and develop into active citizens of society.

Beyond the findings of the study, the future necessitates a transformation and change of philosophy and teaching practices concerning, among others, the cognitive fields (Mathematics, Language, History, Technology, etc.) and Physical Education. It's an educational approach that uses elements from games, such as difficulty levels, scores, rewards, and challenges, to create an environment that inspires excitement and interest. This method encourages students to participate more zealously, supporting the development of motor skills, the enhancement of physical fitness and the cultivation of social skills. This approach is based on its ability to transform teaching into a highly dynamic experience, combining challenge and recognition. Using mechanisms such as gradual progress and recording achievements, students see themselves evolving, which gives them the impetus to keep trying. In addition, providing rewards, such as digital medals or commendations, enhances their sense of achievement and increases their loyalty. This method is not only limited to motivation, but also acts as a means of enhancing consistency. Through competitive activities or collaborative games, students feel part of a larger group, where their participation is considered important. This sense of belonging promotes commitment and responsibility, creating a culture of dedication and constant effort. The ability to adapt to the needs of each student is another advantage of gamification. Activities can be modified to suit different skill levels, allowing students with fewer physical abilities to participate equally while providing greater challenges to those who are more advanced. This helps balance out differences between students, creating an environment where everyone feels empowered and motivated. At the same time, the collaborative activities promoted by this method enhance the social dimension of the course. Through joint efforts, students develop skills such as cooperation, communication and solidarity. Building positive relationships within the classroom fosters an environment that inspires even the most reluctant students to actively participate, creating a harmonious and inclusive community. The use of technological tools further enhances the effectiveness of gamification. Apps that record activity data, interactive games, and progress-analysis software allow teachers to design personalized learning experiences. These tools make it easy to monitor performance, provide targeted feedback, and maintain interest in the course. In addition, this method contributes significantly to the development of students' self-esteem. Recognizing their efforts through specific rewards helps them feel competent and powerful. At the same time, accepting failure as part of the learning process cultivates emotional resilience, enabling them to face challenges with more confidence and a positive attitude.

Educational innovation is a key lever for shaping Physical Education as a modern, attractive and efficient subject that meets the needs of today's society. At a time when technological developments and changes in social structures are shaping new challenges for education, Physical Education cannot remain stagnant. Instead, it requires the integration of innovative approaches that will not only enrich the content and teaching methods, but also promote participation, creativity and the development of life skills.

The integration of technology in Physical Education classes offers a plethora of new possibilities. Through physical activity recorders, interactive apps, and augmented reality technologies, students can participate in activities that are more engaging and personalized. Such tools help improve engagement while providing immediate feedback and monitoring of their progress. In addition, linking the course to other sciences, such as mathematics, physics and biology, creates a new field of opportunities for cross-curricular learning. Activities that unite different disciplines help students understand multidimensional concepts and enhance their ability to think creatively and solve problems. For example, through physical activity monitoring, students can learn to analyze data, make calculations, or understand physiological body functions. Cultivating social skills is also a key objective of renewed teaching. Through group activities and collaborative projects, students develop communication skills, learn to cooperate effectively and cultivate a sense of responsibility. These skills, essential in every aspect of life, are further enhanced through activities based on collaboration and team effort. The emotional development of students is equally significantly enhanced. Through participation in activities that require perseverance, adaptability, and resilience, students learn to face challenges, manage frustration, and recognize their successes. These approaches not only contribute to the development of self-confidence, but also promote mental well-being. It is also important to improve evaluation methods. New techniques, such as the use of videos to record motor performance or data analysis applications, allow for objective and accurate assessment of students. This enables teachers to provide targeted feedback, while students understand their personal strengths and areas for improvement.

Prospects for further research should include studying the effects of cutting-edge technologies, such as artificial intelligence and machine learning, on students' motor skills and motivation. At the same time, new approaches to increase engagement and participation are being considered, while special emphasis is placed on inclusion to meet the needs of students with different levels of skills and abilities. The continuous development of teaching is necessary for Physical Education to remain current and functional. Through continuous research and the integration of new tools, the course can become a key pillar of education that shapes physically, mentally and socially healthy citizens of tomorrow.

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