Gamified Physical Exercise and Mental Health in Adolescence

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Interest in gamified physical activity has been driven by its potential to benefit student mental health. Integrating gamified practices for mental health improvement represents a significant innovation within multidisciplinary approaches to enhancing mental well-being. Gamified physical activity positively influences adolescents' mental health and well-being. Additionally, there is a need for improved application and game design to enhance learning within school contexts. Tailoring exergames to fit specific disciplines and school-related characteristics can promote healthier mobile application usage and offer significant benefits for the mental health of young individuals.

gamification mental health physical activity adolescence

1. Introduction

There are applications for performing gymnastics, such as "Zombies, Run!" and "Nike Training Club", among others, which exemplify gamified exercise. These applications enhance physical well-being and play a crucial role in improving mental health. Regular engagement in such activities can lead to stress reduction, mood elevation, improved sleep quality, and increased self-esteem. Gamification in health and wellness applications is strategically utilized to make exercise more engaging, thereby aiding in the prevention and management of both physical and mental health issues, such as anxiety, depression, and cognitive deterioration. This approach underscores the integral relationship between physical activity and mental well-being.

According to [1], adolescence is a relevant period of development; it occurs between 10 and 19 years of age, and it is crucial for adequate mental and physical development, in which sports activity is essential for the benefits it implies.

The authors of [2] highlighted the advantages of gamified sports practice related to feelings of well-being. The positive experiences derived from games mediated by virtual environments were highlighted by [3], especially that of good humor and decreases in negative feelings (which have been its main benefits). In [4], it was stated that gamification is a good practice for positive social support in the case of adolescents with some disease.

Gamified virtual sports practice, such as running, swimming, and cycling, motivates and generates a more significant learning experience; moreover, gamified psychological strategy is currently being used to improve motivation for practicing these sports [5][6]. Now, various platforms and applications are available for gamified exercise, as exemplified by videogame consoles like Xbox with Kinect and Wii Fit with Balance Board [7]. These platforms transform physical exercise into a playful and entertaining experience, offering a unique way to combine physical activity with interactive gaming. These systems allow users to engage in various sports activities, from yoga to aerobics, in a fun and appealing manner, thus promoting an active and healthy lifestyle. Furthermore, children grow by playing; as such, gamification can be seen as something natural and consubstantial to this developmental period [8]. The purpose of gamification is to persuade users to change their habits or behavior through the fun of physical exercise [9].

As previously mentioned, various platforms and applications are available for gamified exercise, which transform physical activity into a playful and entertaining experience [7]. These tools make exercise more attractive and promote healthy habits, such as maintaining regularity in exercise, improving adherence to fitness programs, and developing healthy competition. Through gamification, greater social connection is encouraged, and self-regulation and personal progress monitoring are incentivized, increasing intrinsic motivation towards an active and healthy lifestyle.

Increasingly, gamification is gaining strength as an active methodology. Children like to play and be entertained; therefore, creating their own gamified apps [10][11][12] and carrying out playful, educational activities to learn in a fun way would be an interesting and innovative proposal. There is still a false belief that play has more to do with leisure than learning. However, the crucial role that the experience of pleasure has in the consolidation of learning [13][14][15], as well as in achieving a healthy and balanced development [16], has long been demonstrated. The author of [8] is an expert and thought leader in gamification. They ask parents to play with their children and understand the educational possibilities of videogames and the apps they frequently use.

Traditional video games favor the flow of positive feelings; however, gamification produces experiences loaded with feelings of power and autonomy that multiply the motivational [17][18] and emotional effects of the playful experience and consolidate behaviors or habits more effectively [9].

1.1. Mental Health Implications

The study of [1] refers to mental health problems and the extent to which they can cause risky behaviors for general health, as well as how they indirectly affect physical health. In this sense, there is no health if there is no mental health [19]. Mental illness brings with it economic, social, employability, and productivity problems, as well as critical repercussions for the families of those who are suffering from some mental health problem.

Suicide is the fourth leading cause of death among young people (i.e., those aged 15–29 years). Failure to address adolescent mental health disorders has consequences that extend into adulthood, with implications for physical and psychological health, as well as the possible prevention from leading fulfilling lives [1][20][21].

In [22], gamified physical practice was shown as an essential resource for preventing the onset of mental illness. Physical activity has shown to have a positive influence on physical and mental health; it increases well-being [23][24] as well as decreasing stress and depression [25][26].

A sedentary lifestyle, characterized by low or no physical activity, is known to be the fourth leading cause of death worldwide, and it represents a risk factor for heart disease, diabetes, and cancer [21]. A sedentary lifestyle is also a cause of early mortality [27], which is why the new global action plan on physical activity has established the goal of reducing physical inactivity by 10% in 2025 and 15% by 2030 [28]. Thus, the need arises to consider gamified physical activity as a possible solution, due to its potential motivational and positive effects on well-being, enjoyment, happiness, and fun [29].

In [30], it is stated that a gamification strategy increases motivation for physical activity, which itself decreases and prevents sedentarism [31]. Smartphones and health apps can help people to modify or maintain healthy behaviors, and the authors of [32][33] considered that gamification could promote healthy behaviors and habits.

In the last decade, there has been an increased interest in researching games related to healthy habits, possibly due to the diversification of their clinical application. The approach to researching gamification and health together from an interdisciplinary perspective is novel [34]. If gamification, as an innovative methodology, is applied to sports practice, then its benefits toward mental and physical health will increase the appreciation of the scope of these techniques.

1.2. Gamification in the Educational Context

Educational gamification appeared when elements based on game design were integrated into the design of the formative process [35]. Specifically, in Physical Education, gamifying means “transforming the class itself into a game based on a narrative” [36]. Didactic strategies and training environments that favor motivation and a classroom climate oriented to learning have been proposed [37][38]. These are fundamental conditions for activating the self-regulation cycles of learning [39][40], and, with it, the competence for autonomous and self-directed learning follows [41]. When this occurs, in this sense, the gamification of the process can create elements derived from the game experience, which can configure an actual learning situation [42]. This supposes not so much the stimulation of extrinsic motivation with prizes and incentives but rather the construction of a methodology that is part of a coherent and contextualized didactic proposal [43].

Information and communication technologies (ICT), social networks, and the development of specific apps focused on models for promoting individualized learning have departed from the model of single spaces (gymnasiums, physical education classrooms, etc.). This step can contribute to institutional improvement and change processes towards more inclusive institutional approaches adapted to diversity [44]. The literature evidences the benefits of gamification as a tool for educational inclusion and the convenience of structuring didactic proposals with this active methodology in the classroom. The aim of this is to achieve a greater involvement of teachers and students in the life of the classroom and the school [5][6].

In relation to non-formal and informal education contexts, the boom in portable technology, together with the value of games as a motivating element, have made the ways of staying active and the tools to achieve it more versatile [45].

Gamified physical activities are proving more attractive and exciting for young people and adolescents, who increasingly seem to report a greater interest in active living and in leisure models that are increasingly moving away from sedentary lifestyles [46][47]. Rewards, continuous updates, personalization of challenges and activities, and the duality of the modality (individual/group) favor and incentivize young people and adolescents to engage in physical activities [48]. Gamified physical activity benefits those who practice it, mainly because it improves the well-being, mental health, commitment, and satisfaction

of those who perform it [49]. Gamification helps turn physical exercise into a habit [50], one of the basic principles of individual health engagement and care.

2. The Relationship between Gamified Physical Exercise and Mental Health in Adolescence

The study of [51] involved an analysis of the technical, educational, and psychological dimensions related to motivation and the stereotypes of the apps they studied. In the psychological dimension, motivation and the presence of stereotypes were evaluated. In terms of motivation, they measured whether there was gamification and rewards, whether there was access to training data, whether improvement was observed over time by monitoring progress, whether results were shared on social networks, and whether there was feedback. The game mechanics were extracted from each paper so as to identify those most frequently used in the healthcare sector. The applications investigated were those identified as the most widely used in the health sector, with game mechanics ranging from step counting, running, home and outdoor exercise, fitness, weight loss, height gain, hiking, and cycling. In terms of stereotypes, it was assessed whether gender-based behavioral patterns were used. The analysis of motivation showed that 48% of the apps scored good and excellent, and it also highlighted that the collective experience of network users was the activity that most motivated adolescents.

In order to define the stereotypes, predefined patterns of behavior were considered that indicated how women and men should be, act, think, and feel. No gender stereotypes were found in 58% of the apps, although only three (10%) were not considered as proposing gender roles for each exercise. Thirty-three percent of the apps analyzed showed few or quite a few stereotypes, and ten percent (three apps) showed many stereotypes. The authors considered that the apps aimed at weight loss were oriented to one of the genders, and this was evident even in the title.

They considered physical exercise for its aesthetic dimension without considering its relevance for the health, quality of life, and social relationships of the people who participate. Apps such as “Nike Run Club”, “Decathlon Coach-Fitness Run”, “Fitness Online-Exercises at home and in the gym”, and “Adidas Training” showed a commitment to minimizing stereotypes and prejudices related to physical exercise. There are apps for creating nature trails “Ko moot” and “AllTrails”, which allow for the creation of routes in groups; these apps can help to promote healthy exercise in the context of adolescents, although it was found that there are no specific apps on the market adapted to educational contexts. No specific apps were found for ages 12 to 17, 57% had no age restriction, 36% were classified as for ages 4 and over, 4% were for ages 9 and over, and 4% were for ages 17 and over.

The study by the authors of [52], in their review of studies, found that active pedagogies favored the psychological and psychosocial aspects of students, thereby highlighting that gamification promotes success in students in the last years of primary education and the first years of secondary education, which is evidenced in their improvements in academic performance. The models developed by different authors that were used to create and build exercise applications were discussed. They explained that badges, points, rewards, and narrative were used in the documents. They evaluated them with different questionaries, some of them ad hoc, semi-structured, individual interviews; focus group interviews; and tests. Some students gave feedback about the fact that they preferred flipped classrooms rather than traditional classes. They noted that there are no studies in early childhood education, and that there are few in the stages prior to university; as such, they recommended further research. What was beyond doubt was that gamified practice in education improves motivation towards the subject of physical education and its practice in addition to improving cognitive performance. It was also found that gamification improved relational skills, autonomy, collaboration, and conflict resolution in primary and secondary school students.

In addition, the study of [53] analyzed 15 physical exercise and yoga apps, out of which six presented elements such as gamification, points, rewards, goals, or graphics. “Exercise and Yoga app for stress relief”, “Yoga for anxiety, stress and depression relief” and “Self-Management Depression: Daily Exercise (GGDE)” were some of the apps related to physical activity that were analyzed. These apps focus on problems such as anxiety, stress, depression, insomnia, and eating disorders. To manage these problems, they propose meditation, breathing exercises, mindfulness, and cognitive behavioral therapy. The results showed that 51% of the selected apps used gamification to motivate users to continue using them, and 32% provided social functions such as chats.

The study by [54] showed the main types of games tested and applied in the improvement of mental health. If more research, faster iterations, rapid testing, non-traditional collaborations, and user-centered approaches were not produced for responding to the diverse needs and preferences of users, in rapidly changing environments, gamification in health areas could be hampered. Regarding the relationship between physical activity and mental health, nine studies were found on exergames (games based on sport or movement, and whose use was mainly in the older adults tested). Significant effects on the improvement of depressive symptoms were reported.

In addition, the study of [55] conducted a physical gamified practice experience in a Scottish community. The intervention offered 20 local points of common interest, 'Beat Boxes', and a topic of conversation among the inhabitants of Stranraer of "the game itself". The sample included people aged under 11 years old (out of 327, 12 completed); people aged 12–17 years old (out of 285, 15 completed); 18–29 years old (out of 216, 21 completed); and the rest were 858 people aged up to 70 years (out of which 99 completed). "Beat the Street" was used to increase user participation by designing gamified activities. Radio Frequency Identification (RFID) scanners, i.e., the 'Beat Boxes', were located half a mile apart throughout the city, and the residents received 10 points each time two consecutive 'Beat Boxes' were touched with an RFID card within 1 h. People competed to see which schools and groups conducted the most physical activity over the course of the game, with the highest scorers being rewarded. This study found a positive relationship between gamified physical activity and mental well-being.

The study by [56] used the free online program Lunar Magic School during the lockdown period of COVID 19 on students under 12 years of age and their families. This program was carried out for one month and included nine weekly activities based on physical exercise and music. Some of the examples of these activities were as follows: the creation of sports circuits or magic yoga, creative activities using household materials, emotional educational activities through drawing monsters and storytelling, etc. The gamification consisted of simulating a magic school in which each family could obtain medals as a reward for activities that were well performed.

Parents reduced their anxiety and perception of their children's physical and psychological discomfort. The results have been encouraging, moving from risk scores due to the confinement situation to scores similar to those of the pre-pandemic period. The program helped the children to improve their emotional management, reduce their stress levels, and regain higher degrees of physical activity as a family.

The study by [57] developed an exergame platform to improve motivation levels toward sports practice from the age of 4 years. It analyzed the increase in depression and obesity in children, as well as its relationship with sedentary lifestyles and poor sports practice. This platform promotes self-regulation and autonomy in children. Competitiveness should be avoided, and collaboration should be favored. The social distance, lack of relational skills, and excessive time spent by children watching screens decrease their interest in sports practice, increasingly distancing these young people from a healthy model and lifestyle.

The study by the authors of [58] determined that the implementation of an intervention based on Teaching Personal and Social Responsibility (TPSR) and the use of gamified activity provided a positive emotional climate in the classroom. They used rewards and there was immediate and individual feedback on the students' motor actions through a social network or face-to-face in physical education classes, all of which improved the cognitive performance of secondary school students. The intervention was able to improve some executive functions (EF) such as cognitive inhibition and verbal fluency. The observations of these data highlighted the importance of promoting and enhancing cognitive processes for better academic performance.

The study by [59] was conducted by applying the "Healthy Teens in School" program, which is a ten-week online program designed to promote a healthy lifestyle and reduce the risk of eating disorders and obesity. It uses gamification, assesses eating behavior and risk of its disorders, weight, weight/figure concerns, physical activity habits, stress management, depression, anxiety, self-esteem, and quality of life. A group of normative adolescents was assigned to the "Healthy Habits" track, and overweight adolescents were assigned to the "Weight Management" track. In ten modules, the students learned about building a healthy lifestyle, balanced eating, and physical activity habits, as well as about ways to improve their body image and satisfaction with their body.

The study by the authors of [57][60] dealt with the Healthy Jeart application, an app that seeks to encourage adolescents to adopt a healthy lifestyle based on physical exercise, adequate nutrition, and physical and psychological well-being. In addition, the app involves affective–sexual relationships, the use of ICT, and it also concerns itself with addictions. It is primarily focused on students between 8 and 16 years old and teachers. Avatar Jeart accompanies participants. Through the challenges that start in the gamified app and continue in the classroom, the authors created combinations through which to adapt the app to different educational stages. The app was created in 2008 and continues to be updated, thus aiming to keep the interest of its users. Students can create healthy ideas that have to be approved by the administrators before publication. Participants have to collect healthy food during the game and are encouraged to avoid unhealthy elements. There are different tips that refer to sport, physical activity, and sedentary lifestyles. "Food" is about disproving some of the myths and false beliefs related to food, as well as for suggesting healthy habits. "Physical well-being" deals with rest, sleep, personal hygiene, and time management. "Psychological wellness" deals with self-esteem, interpersonal skills, and emotional intelligence, and "Sexual affective" focuses on intimate relationships, delving into the myths of romantic love, and promoting healthy relationships. "Toxic and addictions" have content on alcohol, tobacco, cannabis, bongs, and other substances. "New technologies" deals with the good use and abuse of ICT, as well as how to protect oneself in social networks.

The study by [61] used an exergame (a digital motor game with the aim of stimulating motor skills in its users). Just Dance Now proved to be a suitable game for the practice of dance in educational centers. The learning content was gamified, and 10 exergame dances were selected from among the 300 dances on the web platform. The selection criteria were difficulty, motor skills, different cultural dances, and the appropriateness of values to the age of the students. The ClassDojo virtual platform was used to gamify the intervention sessions, and a game board was created with Microsoft Excel (v. 10). This study showed that gamification provided a greater overall positive feeling and more motivation in the majority of the student body. The exergames produced more fun and learning, as well as improving the coordination and motor skills of the students. Although scientific interest has been shown in understanding separate effects, the combination of gamification as a method and exergames as a tool is considered significant in terms of learning. In this case, the Mechanics–Dynamics–Aesthetics gamification model and the exergame Just Dance Now were used with significant benefits in improving motivation, well-being, and satisfaction.

In [62], it was found that most of the selected articles reported on the benefits of gamification and applied games that were specifically related to chronic disease rehabilitation, physical activity, and mental health. Gamification generates motivation and engagement in the short term. The time of that engagement must be increased for mental health and physical improvement by improving the apps, such that motivation and commitment to healthy lifestyles can be perpetuated.

In [63], it was shown that there is evidence for the effectiveness of physical activity gamification interventions in improving participation and engagement in physical activity. There is a need to evaluate the effectiveness of combining gamification with mobile activity devices in terms of promoting physical activity. The review revealed that the gamification of physical activity had been applied to various population groups and was widely distributed among young people, but it was less distributed among older adults and patients with any disease. Most of the studies (60%) combined gamification with mobile devices to enhance behavior changes towards physical activity, and 50% of the studies used theories or principles to design gamified physical activity interventions. The most commonly used game elements were goal setting, progress bars, rewards, points, and feedback. This study demonstrated that gamified interventions increase participation in physical activity; however, the results varied widely, and moderate changes were achieved.

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