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Systematic Review

Gamification in Physical Education: A Systematic Review

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Abstract: Background: In the last 10 years, gamification has entered the educational field incrementally. The subject of Physical Education has been one of the scenarios where multiple gamified learning environments were carried out. The objective of this work was to evaluate and analyze the scientific evidence of the pedagogical proposals and didactic experiences that have used gamification in the Physical Education classroom in Kindergarten, Elementary School and Middle, Junior and High School. Methods: A systematic review has been carried out following the recommendations set by the PRISMA Declaration. A total of five international databases were used: Web of Science (WoS), Scopus, Sport Discus, ERIC and Psycinfo. The descriptors "gamification", "gamify" and "Physical Education" were used, limiting the search to December 2021. Several inclusion and exclusion criteria have been established, selecting only empirical research articles. Results: The search yielded a total of 177 eligible articles, and finally, 17 scientific articles that addressed the effects of gamification in Physical Education were selected. No gamified didactic experiences have been found in Early Childhood Education, but they have been found in Elementary School (7 experiences) and Middle, Junior and High School Education (10 experiences). Most of the studies have confirmed an improvement in motivation and commitment toward physical exercise in students; only one study has confirmed improvements in academic performance. The diversity of the applied protocols and the different evaluation instruments used by the researchers prevent a meta-analysis of the data. Some studies that have used a hybrid pedagogical model are recorded, combining gamification with other pedagogical models, and confirmed positive effects on different variables such as intrinsic motivation or autonomy in learning. Conclusion: The results of this review suggest the need to continue evaluating the effects of applying gamification, as an active methodology, in the Physical Education classroom.

Keywords: gamification; physical education; pedagogical models; active methodologies; motivation

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1. Introduction

A recent literature review on what quality Physical Education is like concludes, among other aspects, that it should use active methodologies [1].

Active methodologies are those that seek greater learning by students, enhancing their sociability and teamwork, meaningful learning and critical thinking, and learning interactivity [2].

The student becomes an active part in the process of building knowledge, following the principles of neuroeducation: experimentation, curiosity, emotion, motivation and attention [3]. On the other hand, the teacher assumes the role of a guide or facilitator of learning. In recent years, active methodologies have captured the attention of many researchers and adopted an exponential growth evolution [4]. In addition, multiple benefits are confirmed, in its implementation, not only in face-to-face education and in different

areas of knowledge and educational stages [5–9] but also in non-attendance [10]. Among the so-called active methodologies is gamification, in addition to Inverted Learning, Project-Based Learning and Game-Based Learning, among others.

Educational gamification is a technique that consists of transferring the mechanics of games and video games to the educational field, with the aim of seeking behavior modification. Thus, it creates attractive and interesting didactic experiences to increase the motivation of the students, their commitment and learning of the contents of the subject or the enjoyment of the pedagogical tasks themselves, always using the motivational elements of the games [11].

Well-planned and correctly implemented gamification in the classroom generates in students a certain sense of control and assumption of responsibility in the teaching–learning process. Being able to also contribute effectively so that students focus and enjoy more in the construction of learning than in studying just to pass the exam [12].

The latest literature reviews carried out by different authors on gamification in education confirm an annual increase in the number of publications on this subject [13–17] and a focus on three aspects: the use of video games in educational settings, the effects of technology on learning and the study of flipped classroom experiences [18]. One of these reviews [16] used the scientific mapping method, visualizing that gamification has been implemented in different areas, but highlighted the educational field. This has attracted the largest number of investigations related to improving the motivation, commitment and performance of students participating in gamified experiences, as well as the study of gamification combined with other technologies, such as social networks, virtual and augmented reality or mobile applications.

It should also be noted that the application of gamification in the Physical Education (PE) classroom is compatible with other active methodologies and/or PE pedagogical models that have shown positive effects on student learning, such as cooperative learning, service learning, sports education, adventure education or the movement-oriented practice model, among others, addressed by multiple authors [19–24]. Even some researchers [25,26] confirm greater advantages in the hybrid implementation of pedagogical models over isolated implementation, justifying that the former can promote results in many different domains, overcoming the limitations of individual pedagogical models.

Due to all these antecedents, the objective of this work was to carry out a systematic review of the empirical research articles that have addressed the effects of the creation of gamified learning environments (GLE) in the PE classroom in Kindergarten, Elementary School and Middle, Junior and High School. This article seeks to compile and synthesize, in a single document, all the results of original research related to gamification in PE that were published until 2021 (inclusive) in peer-reviewed scientific journals indexed in five leading international databases.

2. Materials and Methods

A systematic review has been carried out on the creation of GLE in PE in the different educational stages. Given the heterogeneity of the nomenclature of the educational stages in the educational systems of countries around the world, in this study, it has been decided to establish 3 school educational stages based on the age range of the subjects of the research sample, thus establishing the following: Kindergarten (0–6 years), Elementary School (6–12 years) and Middle, Junior and High School (12–18 years). Systematic review has been chosen because it is a type of research through which researchers summarize evidence in a certain field of knowledge or topic, using a rigorous process (to minimize biases) through which the studies are identified, evaluated and synthesized in order to respond to the research objective and establish the main conclusions about the analyzed documents [27].

2.1. Protocol and Registration

The recommendations of the PRISMA Declaration [28] were used to carry out this systematic review. A total of 27 items indicated by said declaration were fulfilled.

2.2. Eligibility and Risk Criteria

With the aim of evaluating the possible risks of biasing the information, the following inclusion criteria have been developed (Table 1), applied in the search phase of the manuscripts and in the phase of preparing the results.

Table 1. Publication selection process and inclusion and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
1.a. Scientific documents published in original article format.	2.a. Scientific documents that are not original articles, such as doctoral theses, books, book chapters, conferences, conference papers, editorials, etc.
1.b. Quantitative research (observational, experimental or quasi-experimental), qualitative or with mixed design.	2.b. Scientific documents that do not have at least access to the abstract.
1.c. Research that addresses the creation of GLE in PE, including those that use a hybrid pedagogical model, combining another methodology with gamification.	2.c. Scientific documents that address gamification without being contextualized to PE.
1.d. Research that addresses gamification in any of these educational stages: Early Childhood, Primary or Secondary Education.	2.d. Scientific documents that address Physical Education but do not offer details of the gamified system.
1.e. Scientific documents published until 31 December 2021, whose language is English or Spanish (title, abstract and keywords).	2.e. Duplicate studies.

2.3. Information Sources

To ensure the correct choice of information sources, it was decided to include 5 international databases in the search, arguing the following reasons:

(1) Web of Science (WoS): It is one of the most important international databases in the world, collecting more than 170 million scientific documents. The entire main catalogue has been used.
(2) Scopus: Because it is an outstanding multidisciplinary database compiling more than 70 million scientific documents.
(3) Sport Discus: Its incorporation was considered due to its specialty in the field of physical activity, compiling articles related to PE.
(4) ERIC: Its incorporation has been considered because it is a database specialized in education and has a strong link with PE as a curricular subject.
(5) Psycinfo: This database from the field of psychology was incorporated due to the link between gamification and the psychological field.

2.4. Search

The search was carried out in January 2022. The scientific articles that resulted from the combination of the following descriptors were included: ["Gamification" OR "Gamify"] AND "Physical Education"; selecting as search fields: title, keywords, abstract or subject. The search deadline was set to 31 December 2021. Subsequently, all the references that were extracted were uploaded to the Proquest© Refworks bibliographic manager, where the filtering was carried out to find duplicates, and the registered articles were filtered.

Five phases of the systematic review were established. In the first, the databases in which the search for bibliographic references on gamification and PE would be carried out were determined and the terms to be searched and the combination of Boolean operators were agreed upon. In the second phase, the articles resulting from the application of the first one were selected, incorporating the inclusion criteria 1.a., 1.b., 1.c., 1.d and 1.e and obtaining a total of 177 eligible papers. In the third phase, the articles were transferred to the Refworks bibliographic manager for the purification of the files and elimination of duplications, leaving a total of 87 articles after applying the exclusion criterion 2.e.

In the fourth phase, all the papers were read carefully and the exclusion criteria 2.a., 2.b., 2.c. and 2.d were applied, resulting in a final sample of 17 articles. Among the articles that were rejected are gamified didactic proposals that were not carried out, gamified didactic experiences in PE but in the university stage, didactic experiences in PE but outside the school teaching environment (not in PE class) and others causes (Figure 1).

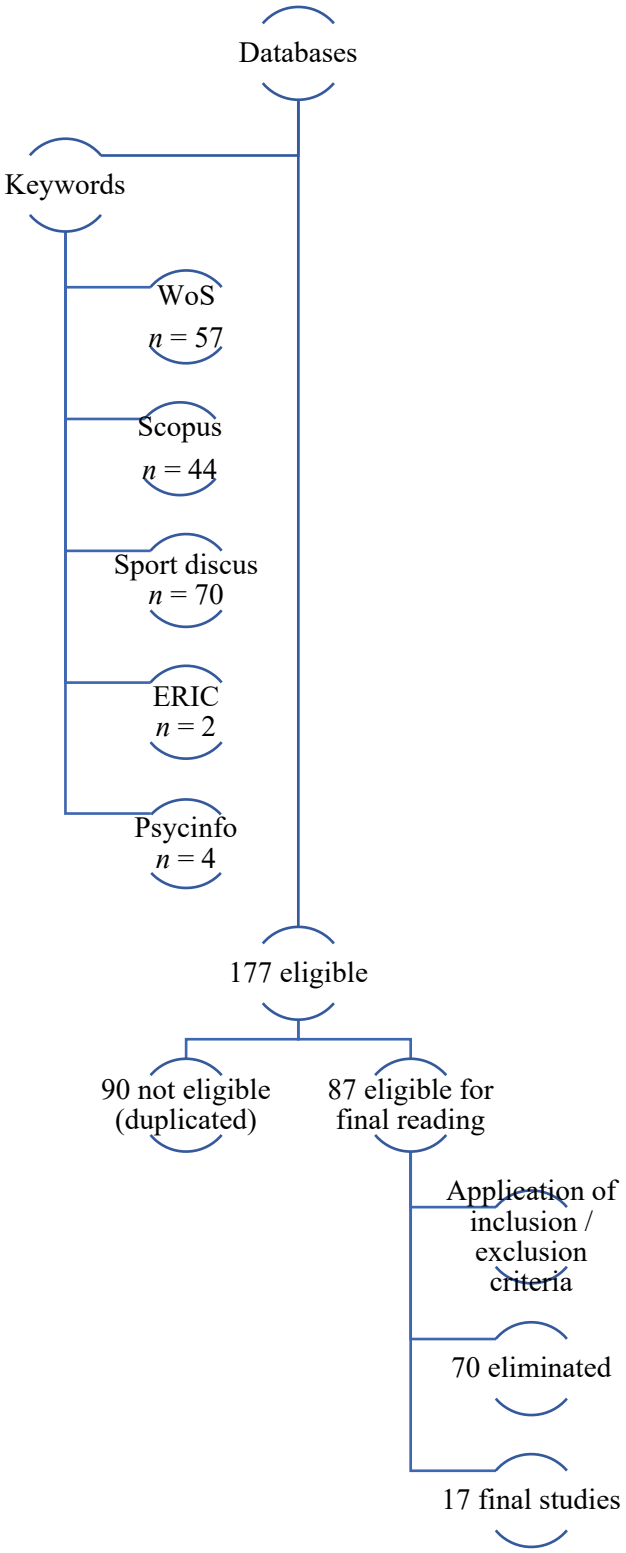

Figure 1. Flowchart of the review on gamification in Physical Education.

2.5. Study Selection

Once the filtering was performed, each of the references was carefully read, analyzing the title, abstract and full text. In the case of articles whose full text was not open access, the authors were contacted to request a copy of the manuscript. Contact with the authors was established through their institutional email or through the international research platform Researchgate. All studies that did not meet any of the inclusion criteria were excluded. A total of 70 scientific articles were eliminated. The selection of the studies was carried out by three researchers independently, subsequently agreeing on their selection based on the inclusion and exclusion criteria previously established in Table 1.

2.6. Data Extraction Process and Listing of These

All the data of the articles were incorporated into an Excel sheet, breaking down the information into different categories. The data dump process to the Excel file was carried out by two researchers and a third researcher acted as reviewer/auditor.

A total of 5 broad categories of analysis were established, with a total of 30 subcategories listed in Table 2.

Table 2. Categories and subcategories established for the analysis of the articles of the systematic review. Note: Category 1. Publication Data; Category 2. Research Design; Category 3. Characteristics of the Sample; Category 4. Characteristics of the Gamified Learning Environment; and Category 5. Objectives and Results.

Category 1	Category 2	Category 3	Category 4	Category 5
Publication year Paper title Publication type Type of scientific document Authors Number of authors Journal name Journal area Country of the first author	Study design Type of investigation Analysis type	Sample size Age mean N°. of men N°. of women Educational stage	Avatar customization Presence of narrative Narrative theme Use platform Platform type Describe mechanics Describe dynamics Reward type used Gamified environment type	The purpose of the study Analyze the impact Instrument used Main results

3. Results

To present the results of the articles that have been incorporated in this review on the creation of PGL in PE, it has been chosen to group the works according to the educational stage where gamification was applied. Initially, and in order to contextualize all the research, a table (Table 3) is presented with the articles found in each of the educational stages. Subsequently, a narrative description of the main contributions and/or findings of each of the scientific articles is made, accompanied by a summary table with some of the categories analyzed. A meta-analysis could not be performed due to the lack of uniformity in the protocols of the analyzed studies and the impossibility of calculating the effect size.

Table 3. Number of articles that addressed research in Physical Education and gamification.

Educational Stage	Number of Scientific Articles	Authors
Kindergarten (0–6 years)	0	-
Elementary School (6–12 years)	7	Bellamy [29]; Chuang and Kuo [30]; Fernández-Río J et al. [23]; Quintás-Hijós et al. [31]; Quintás-Hijós et al. [32]; Parra-González et al. [33]; Serrano-Durá et al. [34].
Middle, Junior and High School (12–18 years)	10	Quintero et al. [35]; Monguillot-Hernando et al. [36]; Martín-Moya et al. [37]; Patricio et al. [38]; Segura-Robles et al. [39]; Valero-Valenzuela et al. [40]; Parra-González [33]; Melero-Cañas D et al. [41]; Melero-Cañas D, et al. [42]; Real et al. [43].

Note: The study by Fernández-Río et al. [23] mainly addresses the Elementary School stage but also incorporates a small sample with ages from Middle, Junior and High School.

Given that the names of the different educational stages may vary from one country to another, depending on the type of educational system it has, the age group to which each stage refers has been included so that the data from the studies can be extrapolated to the educational context of different countries.

3.1. Gamification in Physical Education in Kindergarten (0–6 Years)

At this stage, no research articles have been found that address the creation of a GLE in PE.

3.2. Gamification in Physical Education in Elementary School (6–12 Years)

In the field of Elementary School, a total of seven scientific articles have been found (Table 4). The vast majority of them investigate the creation of a GLE with the aim of improving motivation and commitment toward the practice of PE on the part of students. A study analyzed the possible impact of gamification on the academic performance of students, finding an improvement in this. The study by Parra-González et al. [33] found that Elementary and Middle, Junior and High School students who had a gamified learning environment obtained better scores in the student–student relationship, autonomy, collaboration and resolution dimensions than pre-university students.

The total sample size for studies with a mixed design (quantitative and qualitative) was n = 516 and n = 142 for quantitative. Three investigations had a control group and an experimental group, four with pretest and post-test variables measurements and three studies presented only an experimental group. As for the most present elements of gamification, there are points and badges, and a single article talks about the narrative. A great diversity of the evaluation instruments used and the means to evaluate the objectives are also detected, from discussion groups and portfolios to ad hoc questionnaires or validated questionnaires, among other instruments. The duration of the GLE ranges from 1 month to a full school year.

Table 4. Analysis of the articles that provide scientific evidence on gamification in PE in Elementary School.

Authors/ Country	Objective	Duration	Participants				Pretest–Post-Test	Design	Hybridization Pedagogical Model	Scientific Evidence Evaluation Instrument	Gamification Elements	Results
			Control Group		Experimental Group							
			n	$\bar{x}$	*n*	$\bar{x}$						
Bellamy, United Kingdom [29]	Enhance children's motor skills work.	School year	-	-	-	-	-	Descriptive with quantitative and qualitative analysis.	-	Not indicated.	Badges	Greater commitment to motor skills work.
Chuang et al., Taiwan [30]	Improve the motor performance of children with motor problems through an exergame.	School year	-	-	6	-	-	Longitudinal, quantitative and quasi-experimental.	-	Not indicated.	Points	Improved motivation and commitment to motor practice.
Fernández-Río et al., Spain [23]	Explore how gamification can be used in PE and what experiential effects it can have on students and teachers, as well as the possible improvement of motivation.	30 sessions of 50 min (15 weeks) Frequency 2 per week/ 50 min each	-	-	290 F = 138 M = 152	6–7 (*n* = 126) 11–12 (*n* = 57) 12–14 (*n* = 107)	Yes	Pre-experimental. Descriptive. Quantitative and qualitative.	-	Questionnaire (The subscale Intrinsic Motivation of the Spanish validated version of the Revised Perceived Locus of Causality Scale), discussion group, portfolio (for teachers) and drawings (only in 6–7 year old students).	Badges Points Rewards Narrative	Increased intrinsic motivation of students.
Quintás-Hijós et al., Spain [31]	Analyze the effects of a gamified exergaming intervention in PE classes on psychological variables, such as motivation, fluency, basic psychological needs, and academic performance.	1 month (12 sessions of 45–60 min (9 h) Frequency 3 per week/ 60 min each	191 F = 101 M = 90	11.1 + −1.7	226 F = 121 M = 105	11.1 + −1.7	Yes	Longitudinal, quantitative and natural experiment (quasi-experimental) with a non-randomized controlled design.	Traditional didactic intervention vs. a gamified exergaming intervention.	Ad hoc questionnaire and other validated questionnaires (Perceived Locus of Causality Scale; Dispositional Flow Scale-2 and Basic Psychological Needs in Exercise Scale).	Badges Points Insignias	Improvement of basic psychological needs, academic performance and motivation and disposition of students to learn.

Table 4. *Cont.*

Authors/ Country	Objective	Duration	Participants				Pretest–Post-Test	Design	Hybridization Pedagogical Model	Scientific Evidence Evaluation Instrument	Gamification Elements	Results
			Control Group		Experimental Group							
Quintás-Hijós et al., Spain [32]	Study the applicability of the gamified exergaming intervention using a qualitative method.	1 month (12 sessions of 45–60 min (9 h) Frequency 3 per week/ 60 min each	191 F = 101 M = 90	11.1 + −1.7	226 F = 121 M = 105	11.1 + −1.7	Yes	Longitudinal, qualitative and natural experiment (quasi-experimental) with a non-randomized controlled design.	Traditional didactic intervention VS a gamified exergaming intervention.	Field notes, ad hoc open-ended questionnaire, semi-structured individual interviews and focus group interviews.	Badges Points Insignias	The facilitators were the realism of its didactic design and its adaptability to different educational contexts. The main barriers were materials and facilities.
Parra-González et al., Spain [33]	To compare the effects of gamification and flipped classroom in primary, secondary and high school students and analyzing different psychological and psychosocial variables.	A Didactic Unit of Physical Education composed of 8 sessions	-	-	100	9–10	-	Study with quantitative methodology and through a quasi-experimental research design. There was no control group.	-	Data collection was carried out through an ad hoc questionnaire.	Badges	Gamification was better valued by Primary and Secondary Education students compared to Baccalaureate students who preferred the flipped classroom. Higher scores were obtained in different variables such as student–student relationship, autonomy or collaboration.
Serrano Durá et al., Spain [34]	To compare the effect of two postural education intervention programs in Physical Education using a traditional methodology versus gamification.	6 sessions	17 F = 11 M = 6	12–13	19 F = 8 M = 11	12–13	Yes	Quantitative study, with pre- and postintervention program with quasi-experimental design.	-	The COSACUES and COSACUESAEF questionnaires and the physical tests Bering–Sørensen Test, Side Bridge Test and Prone Forearm Plank Test. For the measurement of motivation, the Feeling Scale was used and the perception of effort was measured with the OMNI Scale.	Does not specify	It was found that the girls assimilated the contents better with the gamified methodology. A greater perception of effort and greater motivation was also confirmed with the gamified intervention.

Note: F = Female, M = Male, N = Number of students, $\bar{x}$ = Mean age. A longitudinal study has been understood as a research design that repeats the measurement of the same variables after a short, medium or long period of time. The Parra-González [33] study is a work that also addresses Middle, Junior and High School.

3.2.1. Improved Commitment and/or Motivation to Practice PE and/or Physical Activity

The article developed by Bellamy [29] focuses on a Primary Education school in Carmarthenshine, Wales, which partnered with an e-commerce company to develop and improve PE and the school gym through a health and fitness gamified program. In this program, they provide rewards using a badge system to enhance the development of children's motor skills.

Another investigation with a quasi-experimental design carried out in six children with sensory integration dysfunction assesses the efficacy of a sensory and motor stimulation program based on the use of video games that promote motor skills [30].

The authors, Fernandez-Río Javier et al. [23], present an interesting quantitative and qualitative study where they work with a sample of 290 students of Primary and Secondary Education, creating a GLE based on the theme of superheroes during 30 sessions distributed over 15 weeks. PE teachers from four educational centers are involved in the gamification and there is an increase in the intrinsic motivation of the students. Four of the five elements identified as central to promoting meaningful experiences in PE and sport are present in this work [44], these being social interaction, fun, challenge and learning, lacking the analysis of motor competence. They also highlight that the teachers expressed that the gamified process involved a large workload. Parra-González et al. [33] highlight that there is a greater motivation for students to use gamification in Primary Education compared to the last years of Secondary and Baccalaureate. The article by Serrano Durá et al. [34] found that girls assimilated the contents better with the gamified intervention than with the traditional methodology and, in general, both sexes had greater motivation and effort with the gamification.

3.2.2. Improved Academic Performance and Motivation and Enjoyment of PE

Exergames and gamification have been present in a work carried out by Spanish authors [31] and that had a scientific design carrying out a natural experimental investigation with a control and experimental group and, pretest–post-test, measuring the motivation of the Primary Education students and their predisposition for learning dance activities. The control group received a total of nine sessions with a traditional methodology and the experimental group enjoyed the experience of a video game linked to dance and the use of the gamification platform called Classdojo. The results confirm a higher level of motivation and academic performance in the experimental group, who also had a better disposition for learning these contents. Some of these authors [32] also addressed a qualitative analysis of the fusion of gamification and used exergames to teach content related to dance in Primary Education, verifying that the attitudes shown by the teachers and students were very positive, but their expectations about its future use were not conclusive. Correct compatibility with the study plan was also verified, and in general, the students and teachers perceived more enjoyment, motivation, a taste for dance, creative inspiration and autonomous learning.

3.3. Gamification in Physical Education in Middle, Junior and High School (12–18 Years)

At this stage, 10 articles were selected that met the inclusion and exclusion criteria (Table 5). All studies have addressed gamification as a means to improve student motivation and greater involvement in PE class. In addition, several studies have been observed that have analyzed the effects of gamification combined with other pedagogical models, thus opting for a hybrid pedagogical model. Some of the models with which gamification has been combined are: flipped learning, cooperative learning or the pedagogical model of personal and social responsibility.

Table 5. Analysis of the articles that provide scientific evidence on gamification in PE in Middle, Junior and High School.

Authors/Country	Objective	Duration	Participants				Pretest–Postest	Design	Hybridization Pedagogical Model	Scientific Evidence Evaluation Instrument	Gamification Elements	Results
			Control Group		Experimental Group							
			n	x̄	*n*	x̄						
González et al., Spain [35]	Achieve subject matter and key competencies objectives in PE by enhancing the development of digital competence through a futuristic GLE.	22 sessions of 50′ (3 months) Frequency 2 per week/ 50 min each	-	-	31 F = 11 M = 18	13–14 years	-	Incidental sampling Longitudinal Mixed Descriptive	Transmedia storytelling and cooperative leaning	Ad hoc questionnaire and open questions.	Points Levels Badges	Increased motivation and effective involvement of students in the subject of PE.
Martín-Moya et al., Spain [37]	Identify motivational variations according to the theory of achievement goals through a gamification called "DiverHealth".	13 sessions of 45′ (3 months) Frequency 1 per week/ 45 min each	-	-	30 F = 15 M = 15	17–18	Yes	Longitudinal Quantitative Descriptive and quasi-experimental	-	Achievement Motivation for Learning in Physical Education (AMPET) questionnaire.	Points Badges Rewards Leaderboards	Increased motivation and commitment of students toward learning.
Monguillot et al., Spain [36]	Analyze the impact of gamification as a fun and motivating educational tool to promote healthy lifestyles and, specifically, to apply the healthy heart rate (FCS) in aerobic resistance tasks.	12 sessions of 60 min (3 months) Frequency 1 per week/ 60 min each	-	-	99	11–12 years	-	Non-probability and intentional sampling Investigation action Longitudinal Mixed Descriptive	-	Ad hoc questionnaire, participant observation technique and discussion groups.	Points Levels Badges Leader-boards	Increased motivation toward learning PE content.
Patricio et al., Brazil [38]	Build and test a gamification protocol to increase the frequency of physical activity, through active video games, in overweight adolescents in school settings.	12 sessions of 60 min. (4 weeks) Frequency 3 per week/ 60 min each	27 F = 17 M = 10	15–19 years	37 F = 21 M = 16	15–19 years	Yes	Experimental Randomized intervention study Quantitative Descriptive	-	Ad hoc questionnaire, anthropometry and Body Mass Index.	Challenges Virtual Awards Points Competition	The gamification intervention increased levels of physical activity practice.

Table 5. *Cont.*

Authors/Country	Objective	Duration	Participants				Pretest–Postest	Design	Hybridization Pedagogical Model	Scientific Evidence Evaluation Instrument	Gamification Elements	Results
			Control Group		Experimental Group							
Segura-Robles et al., [39] Spain	Know the effects of two active methodologies (flipped learning and gamification techniques) on various variables such as autonomy, socialization, competition, enjoyment, motivation and boredom in PE classes.	8 sessions of 60 min (5 weeks) Frequency 2 per week/ 60 min each	32 F = 15 M = 17	15	32 F = 21 M = 11	15	Yes	Intentional sampling Experimental Quantitative	Flipped learning Scape room	3 questionnaires: Basic Psychological Needs in Exercise Scale, Sport Motivation Scale and Sport Satisfaction Instrument.	Challenges	Increased intrinsic motivation, enjoyment of classes and academic performance, although the latter not significantly.
Valero et al., Spain [40]	Analyze the impact on student motivation using a hybrid pedagogical model of personal and social responsibility and gamification.	10 sessions of 55 min (3 months) Frequency 1 per week/ 55 min each	-	-	55 F = 28 M = 27	14.29	Yes	Convenience sampling Observational descriptive with mixed methodology	Pedagogical model of personal and social re-sponsibility (MRPS)	3 instruments: Personal Responsibility Observation System and Social (SORPS). Lince Plus software. Motivation questionnaire was the educational motivation scale in secondary (EME-S).	Esthetic	It was concluded that the application of a program based on the hybridization of the MRPS pedagogical model and gamification is effective in improving their levels of autonomy, responsibility and motivation.
Parra-González et al., Spain [33]	To compare the effects of gamification and flipped classroom in primary, secondary and high school students and analyzing different psychological and psychosocial variables.	A Didactic Unit of Physical Education composed of 8 sessions	-	-	414	12–13 16–17	-	Study with quantitative methodology and through a quasi-experimental research design. There was no control group.	-	Data collection was carried out through an ad hoc questionnaire.	Badges	Gamification was better valued by Primary and Secondary Education students compared to Baccalaureate students who prefer the flipped classroom. Higher scores were obtained in different variables such as student–student relationship, autonomy or collaboration.

Table 5. *Cont.*

Authors/Country	Objective	Duration	Participants				Pretest–Postest	Design	Hybridization Pedagogical Model	Scientific Evidence Evaluation Instrument	Gamification Elements	Results
			Control Group		Experimental Group							
Melero-Cañas D, et al., Spain [41]	To analyze the effects of a hybrid Physical Education program (gamification + personal and social responsibility model) on physical fitness, body composition and sedentary and physical activity times in adolescents.	9 months. 2 sessions per week of 55 min.	*n* = 37 M = 20 F = 17	13.7	113 M = 62 F = 51	14.5	Yes	A group-randomized controlled trial	Pedagogical model of personal and social responsibility (MRPS)	Questionnaire Youth Activity Profile—Spain. The Physical Fitness and Body composition were evaluated with the protocol of HELENA study.	Narrative Challenges Badge Immediate feedback Class climate Final state	It is confirmed that the gamified hybrid intervention produced improvements in cardiorespiratory fitness, agility and speed-agility, in addition to reducing sedentary time during the week and weekend. The students in the control group obtained a greater increase in Body Mass Index.
Melero-Cañas D, et al., Spain [42]	To analyze the effects of a hybrid program (gamification + model of personal and social responsibility) on the cognitive performance and academic performance of adolescent students.	9 months. 2 sessions per week of 55 min.	*n* = 37 M = 20 F = 17	13.7	113 M = 62 F = 51	14.5	Yes	A group-randomized controlled trial	Pedagogical model of personal and social responsibility (MRPS)	The NIH Examiner battery (University of California—San Francisco, USA) was used to assess verbal fluency and planning, and the Stroop Color and Word test was used to measure cognitive inhibition. The academic performance was evaluated with the grades obtained by the students in different subjects.	Narrative Challenges Badge Immediate feedback Class climate Final state	Improvements were confirmed in the experimental group in cognitive performance but not in academic performance.
Real M. et al., Spain [43]	Contrast the effect of an intervention in a teaching unit applying gamification, in comparison with another in which traditional teaching styles were used, on situational motivation regarding the contents of corporal expression in adolescents.	Didactic unit on African dance and corporal expression of 5 weeks, with 2 weekly sessions of 60 min	49	15.5	49	15.5	Yes	Quasi-experimental and quantitative study, with pretest and post-test	-	Different questionnaires measuring basic psychological needs support (CANPB), satisfaction (BPNES), motivation (CMEF) and motivational climate (PEPS; SSI-EF) were used.	Challenges Rewards Role-playing game Points Levels Classification Narrative Progression	The results suggest that the use of gamification improves student motivational variables such as: support for autonomy, support for social relations, autonomy, intrinsic motivation, identified motivation and external motivation.

Note: The Parra-González study [33] is a work that also addresses Elementary School.

The largest sample size recorded was 414 students and the smallest was 30 students. Five investigations had a control group and an experimental group, five studies had only an experimental group and there were seven with pretest and post-test variables measurements. Regarding the most present elements of gamification, there are points, levels, badges, leaderboards, challenges and rewards, and in a single article, esthetics are discussed. The vast majority of researchers used questionnaires for data collection, these being of various kinds. The duration of the GLE ranges from one month to one year, the most frequent period of time.

Improved Commitment and/or Motivation to Practice PE and/or Physical Activity

Some authors have approached gamification as an alternative to traditional PE teaching models based on textbooks and the standardization of learning. Thus, Quintero-González, Jiménez-Jiménez and Area Moreira [38] present a gamification experience for the Secondary Education classroom in which students are invited to overcome a series of challenges in a GLE with a futuristic theme and demonstrating an outstanding use of Information and Communication Technologies (ICTs) with a focus on a transmedia narrative and cooperative learning. Through this environment, different competences and objectives of the PE subject have worked and confirm an increase in student motivation and a greater effective involvement in class work.

In Secondary Education, there is also another gamified didactic experience [36] with a duration of 3 months and through which about 100 students of the 2nd Year of Secondary Education improved their motivation toward learning the contents of the subject after experiencing a gamified Didactic Unit. The evaluation instrument was a questionnaire created ad hoc by the study authors and a qualitative socio-critical methodology was used. Another similar study [37] confirmed an increase in the commitment to learning in the group that underwent a gamification project. Its authors conclude that a strategy for learning healthy habits and practicing physical activity through gamification could improve student motivation. Reducing, through gamification, the prevalence of overweight and obesity in adolescents has also been one of the challenges for some researchers. Thus, a study [38] was carried out in 65 Brazilian adolescents with overweight and/or obesity. The objective was to implement a program of 12 sessions of 50 min of active video games (AVG). The authors used a randomized intervention with a control group that only played these video games and another experimental group that underwent challenge-based gamification in order to stimulate a greater amount of physical activity. The results confirm an increase in the time of adherence to the physical exercise program. This study is pioneering in addressing this concern for the health of students within the school setting.

Other authors [39] have carried out an investigation with a sample of 64 secondary students, confirming an increase in satisfaction and enjoyment, as well as an increase in intrinsic motivation and a predisposition toward learning after having used a hybrid teaching model that combined gamification with flipped learning. The authors of this study report on the need to make the scientific community aware of the potential of combining active methodologies, both face-to-face and digital, in the teaching and learning process in the field of PE, in order to raise awareness in the field teaching group of the benefits reported after its application. In the study of Real, M. et al. [43], the results suggest that the use of gamification improves student motivational variables such as: support for autonomy, support for social relations, autonomy, intrinsic motivation, identified motivation and external motivation.

In another study [40] with a hybrid methodological approach, the model of personal and social responsibility was combined with gamification in a sample of 28 girls and 27 boys from Compulsory Secondary Education with a mean age of 14.29 years. The intervention took place over 10 sessions distributed over a quarter. The authors highlight, as the main finding, the prevalence of the transfer of autonomy and responsibility in the teacher's behaviors to the participants, which generated a more self-determined motivation among the students, thus improving the levels of autonomy, responsibility

and motivation. In a similar study by Melero-Cañas [41] with the hybridization of the social and personal responsibility model and gamification, it was confirmed that the gamified hybrid intervention produced improvements in cardiorespiratory fitness, agility and speed-agility, in addition to reducing the time of sedentary lifestyle during the week and weekend. The students in the control group obtained a greater increase in Body Mass Index. These same authors, in another similar study [42], confirmed improvements in the experimental group in cognitive performance but not in academic performance. However, in the work of Arufe-Giráldez et al. [45], a higher academic performance was observed in university students in a gamified intervention during an academic year. This indicates that more studies are necessary to confirm a possible higher academic performance with gamified techniques.

The study by Parra-González et al. [33] is a study that compared the effects of a gamified Didactic Unit versus a flipped classroom Didactic Unit. As the main findings, the authors highlight that both active methodologies favor different psychological and psychosocial variables of the students, highlighting that the flipped classroom is more successful in pre-university stages with older adolescents and gamification in students of Primary Education and first years of Secondary.

4. Discussion

The objective of this systematic review was to analyze all the scientific literature published on gamification and PE in the different educational stages, specifically to evaluate and analyze the effects produced by the GLE in the PE classroom in Kindergarten, Elementary School and Middle, Junior and High School.

Gamification is presented in the educational field as a technique that can have different positive effects on students, from improvements in their social behavior to increases in levels of motivation or academic performance [18].

The vast majority of studies have focused on studying the motivation of students toward PE or learning the contents of the subject, confirming an increase in this. It can be argued that the use of rewards or punishments through points (health, experience or damage points) in the creation of a GLE can have a double motivational aspect, increasing motivation in some students and not affecting, or even decreasing, motivation in others [46]. In our review, all studies have confirmed improvements in student motivation; however, not all studies used a randomized controlled design with a control and experimental group and a pretest and post-test. In an investigation that addressed the effects of a GLE in the university classroom with a randomized controlled design, an increase in external regulation was recorded only in the experimental group. Furthermore, this group achieved significantly better academic performance. The findings of this study suggest that gamified implementation is beneficial for academic performance in college, although intrinsic motivation does not change. Furthermore, the nature of rewards or punishments, as a characteristic of this pedagogical approach, could play an important role in the expected results, because external regulation increased significantly after the intervention [47].

Escaravajal-Rodríguez and Martín-Acosta [48] conducted a literature review related to gamification in PE using the databases Dialnet, EBSCOhost and Web of Science and the academic search engine Google Scholar. A total of 19 works were selected and confirmed that 42.1% corresponded to didactic experiences and 31.6% to didactic proposals. Most of the works dealt with gamification in the Secondary Education stage (52.2%) followed by the university level with 26.1%. The authors conclude that gamification presents positive results and that teachers use it more and more.

In another study [49] that addressed a review of the literature on gamification and PE, a greater number of articles published on this subject were found in the Elementary School stage, followed by the stage of Middle, Junior and High School and Higher Education. These results are different from those found in our review. The reason may be that these researchers took into account all types of work, most of the articles being didactic experiences (69.2%) followed by research articles (23.1%) and reflections on gamification and PE (7.7%),

similarly noting the scarcity of articles that investigate the effects of this technique on the different elements or variables related to learning. In our work, we have only selected scientific articles that provide scientific evidence, using research protocols with greater or lesser scientific rigor. It should be noted that only 4 of the 17 studies analyzed followed a controlled study design, one being random and the rest non-random.

Another aspect to discuss is that no scientific evidence has been found for the use of gamification in PE in Kindergarten. This may be due to the fact that at this stage, some authors have confirmed that in itself the student's motivation is high and perhaps the creation of a GLE is not so necessary to improve the intrinsic and extrinsic motivation of students [50,51]. However, in a study [52] that compared the levels of physical activity of children aged 4–6 years in the Early Childhood Education classroom, during the school day and according to the methodology used, it was found that they spend most of their time in class in a sedentary way, while in the experimental group that used active methodologies, they registered the highest amount and intensity of physical activity. Although children in Early Childhood Education have high levels of motivation, some studies confirm that 90% of Early Childhood Education centers only teach 1 or 2 sessions of Physical Education a week, often being taught by professionals who are not experts in Physical Education [53]. Therefore, the contribution of more scientific evidence at this stage could be interesting.

Another reason that can justify the scarcity of scientific production related to gamification in PE in the stage of Kindergarten, Elementary School and Middle, Junior and High School may be the lack of training in active methodologies in the faculties of teacher training. In a study [51] carried out in a sample of 220 PE teachers in Primary and Secondary Education, it is concluded that active methodologies are applied by a small number of PE teachers in their lessons, while a combination of methodologies predominates. In addition, teachers highlight the lack of training in active methodologies, despite the fact that the learning they try to encourage is in line with those associated with active methodologies. Another qualitative study [54] carried out in PE teachers in Secondary Education suggests that although teachers recognize the benefits of active teaching that endows students with autonomy, traditional, reproductive and directive teaching styles prevail in their professional practices. These results are in line with other research [55] carried out in a sample of 205 PE teachers in Early Childhood and Primary Education that confirms that traditional methods are mostly accepted in all stages of professional experience, being higher in teachers with a range of 6 to 11 years of experience, with teachers opting more for individualizing, cognitive and creative styles than female teachers, although in both cases they use traditional styles. However, in a recent work [56] that investigated the perception of a sample of more than 300 university students (future teachers of PE in Secondary Education) in relation to the use of active methodologies by its teachers, it was detected that they perceived that their teachers make use of different organizational modalities, methodological strategies and evaluation systems that favor the use of active methodologies.

Discussing the hybridization of pedagogical models and the incorporation of gamification in the teaching–learning processes, although there are few works in the literature that address this, the evidence points to possible improvements in the motivation of the students and in the learning of the contents of PE using a hybrid pedagogical model. Thus, in a study [57] not included in this review due to not meeting one of the inclusion criteria, the effects of gamification combined with the pedagogical model flipped learning in the matter of Natural Sciences, using a pretest–post-test design. The findings obtained showed that the application of this hybridization increased the motivation of the students, as well as their autonomy and self-regulation when facing the contents of the course. In another recent study [25], the authors proposed an educational intervention in Secondary Education students using a hybrid model that combines cooperative learning, adventure education and gamification; on this occasion, the study does not present scientific evidence and is published only as a didactic proposal, showing the reader educational guidelines for its implementation.

It should be noted that the link between video games and PE class and gamification is also present in the literature on gamification, having found a total of three works that addressed the use of active video games or exergames and their positive effects [30–32]. A study carried out in a sample of 47 university students, future PE teachers in Primary Education on a gamified session based on the adaptation of the Fortnite video game, confirms that said didactic proposal improved the motivation of students toward sports practice and their adherence to it, favoring collaborative teamwork and the promotion of values [58]. This last work is focused on the stage of Primary and Secondary Education, but it was not included because the experience was carried out in university students.

It should be noted that in the gamification proposals of the 17 scientific documents selected for this review, not all the elements recommended by the authors were present when establishing gamified learning environments.

There are multiple existing models that can explain the processes involved in gamification. Some models are not typical of the educational field, such as Chou's explanatory model, the Octalysis Framework [59], or the Kaleidoscope of Effective Gamification [60], both more ascribed to the business field. However, others do, such as the taxonomy of Toda et al. [61] and the model called Edu-Game [62], a system that facilitates the mechanics of creating a gamified learning environment, paralleling the elements of the educational curriculum and the game. Or finally, the model based on four blocks [63], presented here in Figure 2, which are limited to the educational field and can be a reference model for all the research on gamification in all educational stages. This model is based on four large blocks of elements, educational, motivational, game and prior knowledge elements, and explains how each of the large elements and their corresponding sub-elements should be planned in order to have a certain coherence and synergy between all of them to guarantee the success of the gamification.

Figure 2. Creating a Gamified Learning Environment (GLE) [63].

In order to achieve the greatest effects of gamification, it is recommended that pedagogical proposals are gamified in PE use and to correctly plan the use of these elements. In agreement with other authors [15], gamification has become a research focus with enormous potential but more work with appropriate designs is necessary as the available studies have their limitations and many of them are not scientifically sound enough.

Finally, it is necessary to discuss the relevance of Physical Education to promote healthy lifestyle habits and avoid physical inactivity in infancy, childhood and adolescence. Some authors have addressed multiple systematic reviews on the importance of working on student health in Physical Education [64,65]. Teachers must not only choose what health content to teach or work on but also how to teach it, with what methodology they can cause a change in the student's lifestyle, favoring the practice of physical activity beyond

school, and thus avoiding the appearance of multiple diseases associated with a sedentary lifestyle [66].

Abundant scientific evidence confirms multiple benefits of practicing physical activity in school educational stages [67–69], including obtaining benefits in cognitive competence [70,71]. Gamification can be presented as a means to cause positive changes in the behavior of students by increasing the levels of physical activity and the emotional state, as well as favoring the attitude and motivation toward the practice of physical activity [72].

5. Conclusions

The analysis of the systematic review carried out on the use of gamification in PE reveals a low scientific production in the stages of Primary and Secondary Education and an absence of this in Early Childhood Education. The vast majority of the studies that addressed gamification in the PE classroom confirmed improvements in the motivation of students toward learning the contents of the subject and an increased commitment to the practice of PE/physical activity. Only one study analyzed the positive impact on academic performance, and another study did not find any effect on academic performance, but it did on cognitive performance.

The diversity of the research protocols and instruments used to evaluate the different variables studied stands out. On the other hand, a very low number of studies that used randomized controlled designs and a certain lack of planning of all the elements involved in a gamified system are also confirmed. All this suggests the need to continue investigating the possible positive effects that the implementation of gamified pedagogical proposals may have in the PE classroom, whether incorporated in isolation or using a hybrid model in combination with other active methodologies, such as the flipped classroom, the model of personal and social responsibility or cooperative learning.

6. Limitations and Proposals

This systematic review has several limitations, among them the difficulty in finding, in some scientific articles, clear and concise information on the protocol used in the re-search and in the creation of the gamified learning environment, although most of the authors were contacted personally to collect more information about their studies, this contact was not successful with some authors, obtaining only the information published in the article itself.

For future studies, it is recommended to use common protocols to be able to perform a meta-analysis with the data of various investigations. It is also necessary that more gamified pedagogical proposals be addressed using all the necessary elements for the creation of a gamified learning environment in order to accurately measure the effectiveness of this technique in the PE classroom.

The use of a control and experimental group, and a pretest and post-test, guarantees greater scientific solidity. On the other hand, using the same test to measure how the students' commitment, their motivation or another variable changed will allow a meta-analysis to be carried out and to create a greater scientific base on educational gamification. For example, in relation to the measurement of the physical condition or psychomotricity of students, it could be interesting to use standardized test batteries such as Eurofit or the MABC-2, respectively.

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