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"PE Money Heist": Gamification, Motivational Regulations and Qualifications in Physical Education

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A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009
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Abstract

The aim of this study was to assess the impact of a gamified programme in Physical Education classes on the motivational regulations and grades of secondary school students in comparison to a traditional teaching approach. The sample consisted of 102 students in the year 10 (4th year of secondary education) (16.7 ± 0.43 years old) from the same school in the province of Barcelona, who were divided into an experimental group (gamification) (*n* = 51, 18 boys and 33 girls) and a comparison group (traditional approach) (*n* = 51, 20 boys and 31 girls). The study followed a quasi-experimental design, pretest-posttest (eight weeks), using the Perceived Locus of Causality Scale (PLOC) and analysis of final ratings. Only the gamified programme achieved significant changes in intrinsic motivation, lack of motivation and identified, introjected and external regulations, although to a greater extent in intrinsic motivation. These students also obtained significantly higher final grades. In short, the application of a gamified programme as an emerging pedagogical model can generate positive effects among students in terms of motivation and academic performance.

Keywords: motivation, pedagogical innovation, pedagogical models, secondary education.

Introduction

One of the main theoretical frameworks used to understand individuals' motivational regulations in different contexts, as well as in physical education (PE) (Erpič, 2011), is that of the Self-Determination Theory (SDT; Deci & Ryan, 1985). SDT posits the existence of different types of regulation along a continuum of self-determination (Boiché et al., 2008). At one extreme is intrinsic motivation (the most self-determined), which refers to doing an activity that is satisfying in itself and that, as a result of doing it, provides fun and enjoyment (these become important to the individual). It must be noted that intrinsic motivation has been linked to better PE experiences and positive outcomes (Vasconcellos et al., 2020), including physical activity practice (Kalagas-Tilga et al., 2020). At the other end of the continuum is lack of motivation, which refers to a lack of interest in doing an activity (Vansteenkiste et al., 2010). Between the two, extrinsic motivation is situated in its four types according to the degree of internalisation of the individual's behaviour and self-determination (Ferriz et al., 2015): a) external regulation: regulated behaviour to avoid punishment or obtain a reward (the activity has not been internalised at all); b) introjected regulation: regulated behaviour to avoid feelings of guilt and increase self-esteem in an activity that has been internalised somewhat (these two regulations are included in controlled extrinsic motivation); c) identified regulation: behaviour regulated by the benefits of performing a task that is understood and to which a certain personal value is associated; and d) integrated regulation: behaviour regulated by the integration of a specific behaviour among those consistent with oneself after a process of reflection and awareness of what one wants to be (these last two regulations are included in independent extrinsic motivation). Along these lines, more self-determined forms of motivational regulation (intrinsic motivation, integrated regulation, identified regulation) have been associated with an active and healthy lifestyle, whereas less self-determined forms (external regulation, introjected regulation, lack of motivation) have been associated with negative results, such as withdrawal from physical activity (Granero et al., 2014; Hagger & Chatzisarantis, 2007).

Elements that are external to the individual that arouse a feeling of "controlling" their behaviour, such as rewards, punishments, deadlines, competitions or monitoring, and that seem to "force" them to behave in a particular way, decrease intrinsic motivation, interest and willingness to do an activity, because they shift the perceived focus of causality from internal (self) to external (other) (Deci & Ryan, 1985). Furthermore, some types of regulation, such as introjected regulation, have been associated with both adaptive and non-adaptive outcomes (Vasconcellos et al., 2020), although, as the behaviour is only partially internalised, it is often not sustained over time (Pelletier et al., 2001). Fortunately, autonomy-supportive contexts, which promote individuals' basic psychological needs, also promote their intrinsic motivation (Deci & Ryan, 1985).

Researchers, such as Pérez-Pueyo & Hortigüela (2020), argue that PE is an essential curricular subject when it comes to promoting students' healthy physical habits which are transferable to their daily lives outside school and that will accompany them throughout their adult lives. However, not all students feel motivated towards PE (Ntoumanis, 2001); an idea that is exacerbated with students in secondary schools, some of whom describe it as "humiliating, frustrating, embarrassing and barely tolerable" (Portman, 1995, p. 452). Contrary to the profile of the uncritical and romanticised teacher, whose blindness reaffirms his or her idea that PE is liked by all students (Flores-Aguilar et al., 2019), teachers should remove the blindfold to act on the basis of the real socio-emotional and psychological needs of 21st century students, especially the young adults (Gutiérrez et al., 2011). For this reason, the new PE model calls for an urgent rethinking of its teaching across multiple aspects (López-Pastor et al., 2016). For example, teachers need to incorporate innovative pedagogical approaches that increase student ownership (Lim et al., 2019), in order to facilitate a set of successful experiences that meet their needs and maintain and/or increase their motivation (Fernández-Río et al., 2020; Pérez-Pueyo & Hortigüela, 2020).

Against this backdrop, the emergence of gamification in educational institutions is of particular interest. With its origins in the business world, gamification refers to the introduction of the main elements of games in non-game environments (Werbach & Hunter, 2012), with the eventual goal of bringing about a change in users' (players') behaviour (Zichermann & Cunningham, 2011). At the school level, this study considers gamification to be an emerging pedagogical model (PM) "that uses game elements to develop specific curricular content within a context, which includes tasks and activities adapted to the dynamics of the game to achieve the educational objectives set, and not simply for fun" (Fernández-Río & Flores-Aguilar, 2019, p. 11). When it comes to its design, and under this perspective of gamification as a PM, Blázquez & Flores-Aguilar (2020) propose a structure centred on two phases: a) the "didactic phase", which corresponds to the

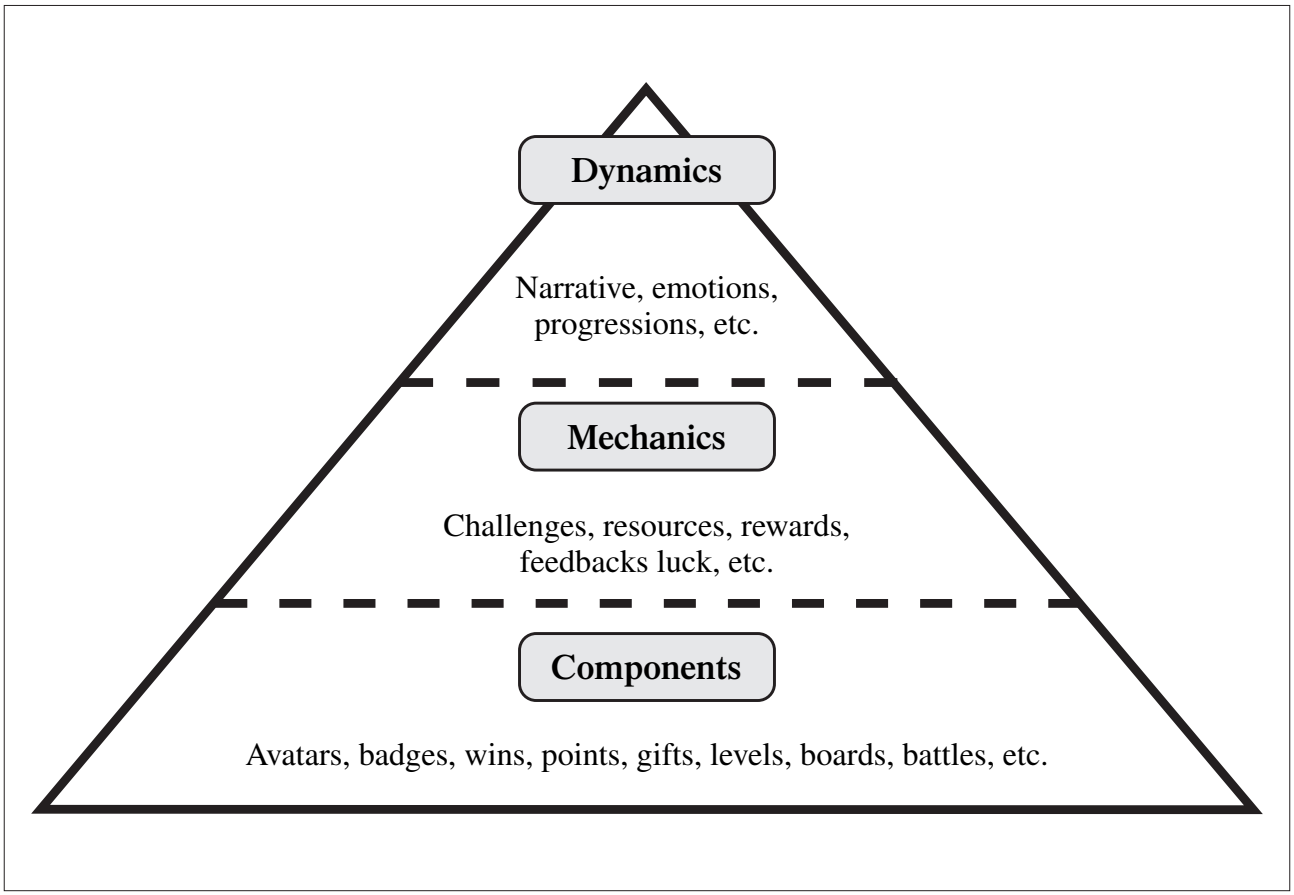

Figure 1
Basic elements of games according to Werbach and Hunter (2012).

selection of competences, objectives, contents, assessment criteria, etc. according to the corresponding curricular regulations; and b) the "gamified phase", which focuses on the choice and adaptation of some of the main basic elements of Werbach & Hunter's (2012) game (Figure 1).

Despite the fact that the incorporation of gamification in PE lessons is on the rise, its research is still incipient, and even inconsistent and vague (Fernández-Río et al., 2020; Ferriz et al., 2020; Navarro-Mateos et al., 2021). In the framework of primary and secondary education, Fernández-Río et al. (2020) found an increase in the participating students' intrinsic motivation; something that was also found, together with an increase in the levels of autonomy and responsibility, in Valero et al. (2020) study (especially in girls), although in the latter the gamified experience was hybridised with the personal and social responsibility model. Intrinsic motivation, basic psychological needs and intention to be physically active also increased among the secondary school students studied in Fernández-Río et al. (2022) study. Also in secondary education, Segura et al. (2020) found an increase in young adults' intrinsic motivation, autonomy, satisfaction, enjoyment and academic performance after the application of gamification hybridised with the flipped classroom. Again in this educational cycle, the gamified experience of Sotos et al. (2022) study produced positive changes in intrinsic motivation. In addition to improving basic psychological needs, this gamification increased self-determined motivation and reduced lack of motivation. In contrast, Quintas et al. (2020) found no impact on students' intrinsic motivation, external regulation and lack of motivation, but some positive effects on basic psychological needs and academic performance. On the other hand, the students in Monguillot et al. (2015) study agreed in describing gamification as a useful and motivating experience, with which they better learned the skills that were taught. Together with the decrease in PE anxiety, improved learning of physical fitness content was also one of the advantages reported by primary school girls in Rodríguez-Martín et al. (2022) study.

Despite all these positive results, gamification is not effective (Quintas et al., 2020) *per se* (Quintas et al., 2020). An uncritical and mistaken conception of educational gamification can lead to the reduction of all its potentialities with the emergence of the so-called "pseudo-gamifications" (Flores-Aguilar & Fernández-Río, 2021), whose motivational effects (mostly extrinsic) are very detrimental to students (obsession with winning, group conflicts, etc.) (Dichev & Dicheva, 2017, Hanus & Fox, 2015; Pérez-Pueyo & Hortigüela, 2020). For this reason, in addition to disseminating a set of didactic guidelines that allow teachers to design appropriate gamified experiences (Blázquez & Flores-Aguilar, 2020), more research is currently needed, with clear procedures, validated tools and larger samples, to evaluate the real impact of gamification on students (Fernández-Río et al., 2020), especially at the motivational level (Ferriz et al., 2020).

Therefore, the main objective of the study was to assess the impact of a gamified PE programme on all motivational regulations and grades on a set of secondary school students in comparison with a traditional teaching approach. Unlike previous studies, this intervention programme followed the guidelines of Blázquez and Flores-Aguilar (2020) for the adoption of gamification as an emerging PM.

Methodology

Participants

A total of 102 students in year 10 (4th year of secondary education) (16.7 ± 0.43) from the same school (subsidised) in the province of Barcelona agreed to participate. An experimental (gamification) group was randomly assigned (51 students: 18 boys and 33 girls) and another comparison group (traditional approach) (51 students: 20 boys and 31 girls). It should be highlighted that neither group had experienced gamification before, and that the same PE teacher delivered the sessions for both groups. This teacher was trained in the design and use of gamification over an entire academic year at university. Similarly, during the course of the experiment, the teacher was constantly supported and supervised by two experienced researchers in the field. The study followed a quasi-experimental, pretest-posttest experimental and comparison group design (eight sessions) (Cohen et al., 2011).

Materials

A validated Spanish version of the Perceived Locus of Causality Scale (PLOC) (Ferriz et al., 2015) was used. This tool consists of 24 items grouped into six subscales: intrinsic motivation (i.e. "because PE is fun"), integrated regulation (i.e. "because it suits my way of life"), identified regulation (i.e. "because I want to learn sport skills"), introjected regulation (i.e. "because I want the teacher to think I am a good student"), external regulation (i.e. "because I will get in trouble if I don't do it") and lack of motivation (i.e. "I don't really know why"). The scale had the title: "I participate in PE classes..." and participants responded on a Likert scale from one ("strongly disagree") to seven ("strongly agree"). In the present study the Cronbach's alphas obtained were the following, in the pretest and posttest, respectively: intrinsic motivation: .810 and .756; integrated regulation: .884 and .881; identified regulation: .801 and .849; introjected regulation: .645 and .619; external regulation: .661 and .707, and lack of motivation: .666 and .614. All are considered to be acceptable (Martínez et al., 2014). At the end of the intervention programme, final marks were awarded to each student (scale from 0 to 10) on the basis of the same assessment tools used in the two groups.

Procedure

In accordance with the Declaration of Helsinki (2013) protocol, ethical consent was obtained from the University of Vic-Central University of Catalonia. Secondly, the leadership team of the school where the intervention programme was to be carried out was contacted to obtain their permission. Thirdly, the students and their families were contacted to explain the project and all those who wanted to participate handed in a consent form signed by their parents or legal guardians. It stated that they could leave the study at any time, that all data would be treated confidentially and anonymously, and that the data would not affect their academic grade in PE. Finally, the main researcher administered the questionnaires to all students during the PE class and encouraged the participants to answer as truthfully as possible. The approximate duration of the administration was about 20 minutes.

Intervention Programmes

During the 2019/20 academic year, two didactic units (DU) were carried out simultaneously: one was developed with gamification as a PM and the other with a traditional methodology. Both DUs had eight fitness and health-oriented sessions, distributed in two one-hour sessions per week over a four-week period. The two intervention programmes had the same learning objectives, content, criteria and assessment tools (table 1 and 2). For its preparation, the teacher resorted to the existing curriculum in Catalonia: Decree 187/2015, of 25 August, on the organisation of the teaching of compulsory secondary education.

Table 1
Curricular information of the two learning experiences.

Catalan Regulations: Decree 187/2015 of 25 August. **Curricular Dimension:** Healthy Physical Activity.		
Competences specific to PE	**Curricular content**	**Curricular assessment criteria**
C1. Implement a work plan to improve or maintain individual fitness in relation to health.	• Strength and speed: concept, characteristics, effects and training methods. Safety standards and risk prevention.	2. Relate physical activities to the effects they have on the human body's various systems.
	• Fitness and health assessment tests (questionnaires, tests and quizzes).	4. Measure the intensity of the task performed using the heart rate. 7. Become aware of individual physical condition and show willingness to improve it.
	• Design and execution of a warm-up suitable to the physical activity to be performed. • Elements of a task plan.	1. Plan and implement a general warm-up, recognising its main effects.
Learning objectives	**Learning content**	**Specific assessment criteria**
1. Assessing individual fitness and health.	• Physical fitness tests (Cooper run test, long jump, medicine ball throw, etc.)	1. Identify individual physical fitness strengths and weaknesses. 2. Identify individual physical condition and develop personal commitments, through a portfolio.
2. Identify the elements of a task plan.	• The elements of the task plan: assessment of the level of physical condition, assessment of interests, establishment of objectives, selection of physical capacities, selection of exercises, review of materials to be used and organisation of the session.	3. Develop a task plan aimed at strength or speed work.
3. Design appropriate warm-ups for the designed physical activity.	• Indentifying the different parts of an activation-warm-up phase: joint mobility, continuous running, stretching. • Creating an appropriate warm-up for the activity to be performed.	4. Develop an appropriate activation phase for the physical activity to be performed. 5. Perform heart rate monitoring during the activation phase.
4. Build a task plan for each skill (strength and speed).	• Creating a task plan to work on strength. • Creating a work plan to work on speed.	3. Develop a task plan aimed at strength or speed work. 6. Execute a task plan developed by another group and relate the work plan to the effects it has on the various systems in the human body.

Table 2
Assessment schedule in the two learning experiences.

Means: assessment activities	Assessment techniques	Assessment tools		Minimum requirements
		Types	Weight (%)	Indicators
Activity 1: Develop and perform a strength or speed-related activation phase in groups.	Self-assessment + Peer-assessment	Culmination	15% 15%	• Calculate heart rate based on the intensity of the PC. • Select the exercises according to the session objectives. • The three parts of the activation phase appear. • Select creative and different exercises.
Activity 2: Develop and execute a strength or speed-related task plan as a group.	Co-evaluation + Peer-assessment	Evaluation target	10% 20%	• The elements of a task plan appear. • All members of the group participate in the creation of the training template and the development of the exercises. • Select creative and different exercises according to the session objectives. • Propose different levels of execution so that each person can work according to their physical capacities.
Activity 3: Physical Activity Diary	Self-assessment	Checklist	20%	• Evidence of the daily steps through screenshots posted weekly in the shared document on the *Drive*. • Use digital resources (*app* mobile phone, fitness watches, etc.) to measure daily steps. • Demonstrate a progression of daily steps. • Accumulate the agreed daily steps to be an active person.
Activity 4: Creating a learning folder (portfolio).	Peer-assessment	Culmination	20%	• Includes an individual sheet of personal commitments. • The portfolio is submitted with the formal aspects relevant to the school's rules on the presentation of work and has a coherent structure. • Selects materials and procedures that demonstrate the teaching and learning process, justifying their choices. • Makes corrections and improvements in relation to the *feedback* made by the teacher and peers. • Makes a final critical and reflective reflection of their learning process.

Based on ORDER ENS/108/2018, of 4 July, to express the degree of attainment of the curricular competence, the teacher carries out the following conversion: 0-49 points (NA: not achieved); 50-69 (SA: satisfactory achievement); 70-89 (NA: notable achievement (grade B)); 90-100 (EX: excellent achievement (grade A)).

Experimental Group: Gamified Approach

The experimental group was subjected to a gamified DU based on the TV series "Money Heist". The entire intervention programme was designed based on Blázquez & Flores-Aguilar's (2020) instructions for the creation of gamification in PE as a PM. Table 3 describes and summarises some of the most relevant features of the gamified phase.

Table 3
Description of the key elements of gamification.

Narrative

The general objective of the students, who were organised in groups, was to break into "The Royal Mint and The Health Care Centre" to make one million euros during the time they were inside and, as a result, escape to live in a paradise of money and health. To make this money they had to show evidence of healthy physical activity. This money accumulated throughout the DU was used to buy a plane ticket to Thailand to see the Professor (a character in the series), who was waiting for them on the island of Koh Tao.

Challenges and Missions

In order to achieve their goal, the students had to overcome a set of challenges grouped into 4 different missions:

- **Mission 1: Seize "The Royal Mint and the Health Care Centre."** They had to create a good team and prepare to enter "The Royal Mint and the Health Care Centre" (examples of activities: passing fitness tests and initiating the construction of a task plan) (Sessions 1 and 2).
- **Mission 2: Let's start the machines!** They had to make as much money as possible to be able to buy the plane tickets to go to Thailand (examples of activities: creating and leading warm-ups) (Sessions 3 and 4).
- **Mission 3: Let's build the tunnel.** This consisted of digging the longest possible tunnel in order to escape from the "The Royal Mint and Health Care Centre" and not get caught by the police (examples of activities: conducting strength and speed training; developing and conducting their own training, etc.) (Sessions 5, 6 and 7).
- **Mission 4: Escape!** They had to escape the country without being seen by the police and reach Thailand (Koh Tao island), where the Professor (character in the series) was waiting for them in order to live an idyllic and healthy life (examples of activities: see special event) (Session 8).

All these missions are identified on the experience platform (Genially) (Figure 2):
https://view.genial.ly/5dd9098751a61a0f71d7c123

Teams, Players and Avatars

Based on the initial physical assessment tests (speed and strength tests) and other criteria, such as gender, mixed groups of five were organised and stayed the same throughout the DU. Within each team, the students had to choose one of the characters from the series according to the one they felt most identified with: Berlin, Denver, Rio, Nairobi and Tokyo. There was also the character of the Professor, played by the PE teacher.

Rewards

- **Banknotes:** These were rewarded through the daily steps recorded (outside school hours) with the app, Strava. Each step was equivalent to €1.
- **Gold coins:** They were acquired in the different sessions through completing each session's challenges. Each coin was worth €100.
- **Gold bars:** These were rewarded for completing extra (non-compulsory) activities that were presented through Instagram. One bar was equivalent to €1,000.
- **Unlock codes:** These were rewarded for completing each mission and allowed access to the next mission by means of a secret code.

Challenges	Rewards	Badges (mission keys)
Session 1 = Submit application and physical evidence	10 gold coins	Mobile code (code 173)
Session 2 = Designing a task plan template	10 gold coins	
Session 3 = Running warm-ups	50 gold coins	Mobile code (code 27193)
Session 4 = Designing warm-ups	50 gold coins	
Session 5 = Carrying out training sessions	100 gold coins	Mobile code (code 548E)
Session 6 = Designing and conducting a training session	100 gold coins	
Session 7 = Carrying out and assessing other groups' training sessions	100 gold coins	
Session 8 = Capture a million: Escape	10,000 gold coins	Mobile code (code 8056)

Table 3 (Continued)
Description of the fundamental elements of gamification

Extra Activities
Through the Professors's Instagram account, extra activities were uploaded as "stories" and "*posts*" which the students had to perform and provide evidence of completion through photos, videos or screenshots in order to get some gold bars in return. These activities were as follows: a) Performing different strength exercises (examples: push-up challenge; plank and side plank challenges; squat challenge, etc.) *burpees* challenge; plank and side plank challenges; squat challenge, etc.); b) Recording a walking or running route with Strava (examples: routes of between 4 and 10 km; 15' or 30' routes, etc.).
Special Events
A single special event was held at the end of the DU (relating to an assessment activity, in this case a summative one). • **Capture a million!** With the "Capture a million!" competition, all the money they had collected during the course of the DU was put up for grabs, through different theory-related questions about the content of the DU. At the end they had to buy a plane ticket to escape. To achieve this, the whole class had to finish the competition with more than 50% of the money they had to make, so that if the class contained six groups and each group had the goal of making 1 million euros (six million in total), the budget of the whole class to be able to get the airline tickets was more than three million euros.
Social Area - Board
• **Drive:** An Excel file was created on Google Drive, shared with all the groups, and one of the members was responsible for ensuring that the rest of the group attached weekly screenshots of the steps taken that week, in order to keep track of the weekly activity and be able to exchange them for money in the last session of the DU. • **Instagram:** A private Instagram account was created where the teacher communicated with the students and gave them specific challenges. This tool was also used to share healthy lifestyle habits and the different content worked on in the sessions (strength, speed, warm-up, work plan, etc.), as well as the amount of money they had accumulated (Figure 3). • **Genially:** This is the platform that the students used to find out where they were in the game and to watch the videos of the missions and their objectives (board). https://view.genial.ly/5dd9098751a61a0f71d7c123
Certificates: The Plane Ticket
When the class as a whole achieved the final goal of raising more than 50% of the money set out in the initial objective (1 million per group), in recognition of their involvement and participation in the experience, they were given a plane ticket to Koh Tao so they could escape and complete the mission.

Figure 2
Visualisation of the Genially platform with the missions.

Grups	Diners (1 pas = 1 €)	Monedes d'or (1 moneda = 100€)	Lingots (1 lingot = 1.000€)	TOTAL
1C	447.304 €	261	0	473.404 €
2C	309.504 €	254	0	334.904 €
3C	524.538 €	225	0	547.038 €
4C	82.832 €	168	0	99.632 €
5C	59.694 €	167	0	76.394 €
6C	240.079 €	162	3	259.279 €

Figure 3
Visualisation of the teacher's Instagram account.

Control Group: Traditional Approach

The comparison group experienced the same DU but designed and developed in a more traditional teaching format, in which directive and task allocation styles were predominant (Metzler, 2017). This group performed different tasks in teams, which, unlike the experimental group, were organised randomly in each session. Activities such as physical tests for the initial assessment of physical condition, the construction of a task plan and the creation and application of warm-ups, as well as the development and implementation of speed and strength training were proposed. In the last session, the students completed a questionnaire online with different theoretical questions on all the content covered during the DU.

Data Analysis

All data collected from the questionnaire was analysed using SPSS 22.0 statistical software. Normality tests, descriptive and inferential statistics (T-tests, ANOVAs, MANOVAs and MANCOVAs) were performed. Finally, statistical power and effect size were calculated, using Cohen's (1988) *d* (small < .5, moderate .50-.79, large ≥ .80) and η^2 (Miles & Shevlin, 2001; small ≥ .01, moderate ≥ .06, large ≥ .14).

Results

Firstly, the Kolmogorov-Smirnov test showed that almost none of the variables followed a normal distribution ($p < .05$), but as skewness (.245) and kurtosis (.485) were within the allowed ranges (-1 and +1) parametric tests were used (Blanca et al., 2017). Secondly, a MANOVA was performed with the pretest values to check the initial homogeneity of the sample and the results showed that there was no significant difference in any of the variables between the comparison and experimental groups: Wilks' Lambda: .950, F (6, 90) = .791, $p = .579$. Therefore, both research groups could be considered similar. To test for

Table 4
Pre and posttest results of motivational regulations.

	Experimental group		Comparison group		*p*	*d*
	Pre M (SD)	Post M (SD)	Pre M (SD)	Post M (SD)		
Intrinsic motivation	3.38 (0.96)	4.00*[a] (0.64)	3.37 (0.81)	3.56[b] (0.70)	.001	.65
Integrated regulation	3.34 (1.07)	3.67[a] (0.98)	3.41 (1.07)	3.56[a] (1.02)	.063	-
Regulation identified	3.61 (0.92)	3.96*[a] (0.89)	3.75 (0.86)	3.68[a] (0.87)	.025	.31
Introjected regulation	2.91 (0.79)	3.47*[a] (0.87)	3.08 (0.75)	3.12[b] (0.72)	.001	.43
External regulation	3.01 (.93)	3.33*[a] (.91)	2.98 (.82)	2.95[b] (.82)	.042	.43
Lack of motivation	2.20 (.72)	1.87*[a] (.54)	2.01 (.87)	1.95[a] (.75)	.016	.12

Note: M = mean; SD = standard deviation; * = pre-post intragroup differences; different superscripts in the same row indicate significant intergroup differences at posttest. $p < .05$; d = effect size (*Cohen's d*).

intra-group changes pre-post, a *T* test for related samples was performed. The results showed that there were significant changes only in the experimental group and in the intrinsic motivation variables ($p = .001$, $d = .65$), identified regulation ($p = .025$, $d = .31$), introjected regulation ($p = .001$, $d = .43$), external regulation ($p = .042$, $d = .43$) and lack of motivation ($p = .042$, $d = .12$). The data shows that the effect size was larger for intrinsic motivation (moderate) than for the three regulations (small). Finally, to test for intergroup differences in the posttest, a MANCOVA was performed, which gave positive results: Wilks' Lambda: .810, F (6, 84) = 3.278, $p = .006$, $\eta^2 = .190$, power = .915. Subsequent univariate analyses showed that statistically significant differences occurred in intrinsic motivation ($p = .01$, $\eta^2 = .117$, introjected regulation ($p = .01$, $\eta^2 = .080$) and external regulation ($p = .05$, $\eta^2 = .042$) (Table 4).

Finally, a one-factor ANOVA was performed to compare the final marks obtained by each of the groups. The results showed significant differences ($p = .001$) between those obtained by the group that experienced gamification: 7.94 ± 1.53 and the traditional approach: 6.75 ± 1.13.

Discussion and Conclusions

The main objective of the present study was to assess the impact of a gamified programme on all motivational regulations of secondary school students in comparison to a traditional teaching approach. The results showed that only the gamified programme achieved significant changes after the intervention in intrinsic motivation, lack of motivation and identified, introjected and external regulations, although these were more significant in intrinsic motivation. In addition, after the intervention, the experimental group had higher levels of intrinsic motivation, introjected regulation and external regulation than the control group. Finally, students who experienced the gamified approach achieved significantly higher final marks.

The group of students who experienced gamification in their classes improved most significantly in all motivational regulations (including a decrease in lack of motivation), but most strongly in intrinsic motivation, so it can be considered a success. Previous research has shown contrasting results (Navarro-Mateos et al., 2021). While Fernández-Río et al. (2020 and 2022), Sotos et al. (2022), Segura et al. (2020) and Valero et al. (2020) found similar increases in motivation in secondary school students —albeit only the former used a "pure" gamified approach (the other two used the personal and social responsibility model and flipped learning, respectively)—, Quintas et al. (2020) found no significant increases. The increase in intrinsic motivation in the present study seems to indicate that students have internalised the gamified approach, that they find it intrinsically satisfying and, as a result, enjoy the activity, in this case the PE class in a gamified environment. This is highly significant, as intrinsic motivation, as well as more self-determined forms of motivation (integrated and identified regulation) have been associated with an active and healthy lifestyle (Granero et al., 2014; Hagger & Chatzisarantis, 2007) —one of the fundamental objectives of PE—, in addition to many other benefits noted in two recent reviews (Vasconcellos et al., 2020; White et al., 2020).

In the present study, identified regulation also increased significantly in the group that experienced gamification, reinforcing the positive connections promoted by intrinsic motivation. This increase seems to indicate that students understood the approach and the tasks that they were performing, and attached a certain personal value to them, engaging themselves by possibly experiencing a certain sense of freedom in performing them (Vansteenkiste et al., 2010). Elements that enhance the development of students' autonomy, such as the possibility of choice (of tasks or their intensity or size) or group work, have been pointed out as contributing to the development of more self-referenced forms of motivation (Vasconcellos et al., 2020), which is consistent with the findings of the present study.

On the other hand, introjected regulation and external regulation also increased significantly after experiencing gamification, although these increases were more subtle than those of intrinsic motivation. The increase in introjected regulation seems to indicate that students performed the tasks partly to increase their self-esteem and to avoid internalised feelings of guilt (Vanteenkiste et al., 2010). The fact that students worked in groups, and that individual contributions to the group were important to achieve group goals, likely made it easier for students to strive to do things to avoid disadvantaging their group and not feel guilty. Introjected regulation is associated with a certain internalisation of tasks (Deci & Ryan, 1985) —in the case of this study, to help the group—, which can also be considered positive. Moreover, this type of regulation has been associated with both positive and negative results (Vasconcellos et al., 2020), because it can promote feelings of anxiety or self-confidence. The increase in more self-determined forms of motivation seems to indicate that in the present study introjected motivation reflects students' positive feelings about the class design. This is, of course, speculation and more research is needed to verify this idea.

Likewise, the increase in external regulation indicates that students were motivated to achieve the final rewards of gamification, even if the behaviour was not internalised (White et al., 2020). Ryan (1982) noted that interest in an activity can be diminished by "controls" external to the person, but also "internal"; for example, when they feel that their self-esteem depends on the successful completion of an activity. Just as mentioned, students work in a group to achieve goals and their contributions were very important, therefore they likely felt "under pressure" to perform the task properly and "look good". In other words, in gamification there is a "battle" between elements that "encourage" the learners' autonomy, and thus their more self-determined motivation, such as the choice of tasks or the level of intensity of completion, and elements that "control" them, and thus increase their less self-determined motivation, such as the pressure to "contribute" to the group's achievement or to achieve the final rewards. In relation to the latter, research indicates that they can produce positive, negative or neutral results, and those that are performance-dependent, such as those of the gamification studied, do not have such a negative effect (Deci & Ryan, 1985), probably because they entail a satisfaction of competence in achieving them (Vansteenkiste et al., 2010). The results of the present study indicate that gamified contexts can direct students' motivational regulations towards a more or less self-determined point and therefore teachers should consider the elements of the context on which they place more or less value. As some authors have pointed out, the wrong approach to gamification can lead to a reduction of its potential (Dichev & Dicheva, 2017; Hanus & Fox, 2015) or, as the results of the present study point out, motivate students in a less "positive" (less self-referenced) way.

Finally, the final grades of the students who experienced gamification were significantly better compared to the group who experienced a traditional methodology. Previous research indicated that students reported improved performance through a gamified environment (Segura et al., 2020; Monguillot et al., 2015). Therefore, the results of the present study indicate that gamification is not "just playing", but that, if properly structured, can influence students' learning, improving their final performance. Again, we must remember that a correct approach is necessary in which the learning objectives are clearly integrated into the gamified structure (Fernández-Río & Flores-Aguilar, 2019). This is the only way to achieve learning outcomes and not just about novel and fun experiences.

In conclusion, gamification can significantly improve almost all types of motivational regulations of secondary school students, but most strongly intrinsic motivation. It could be said that in gamified environments there is a struggle between elements that favour students' autonomy and therefore their more self-determined motivation, such as the possibilities of choice of tasks or the level of intensity of completion, and elements that control them and therefore increase their less self-determined motivation, such as the pressure to contribute to the group's achievement or to reach the final results. Thus, gamified contexts can direct students' motivational regulations towards a more or less self-determined point and therefore teachers must consider the elements of the context they want to influence, to a greater or lesser extent, in order to achieve the desired positive effect. However, more studies with greater variability of contexts, participants and content are needed to confirm or refute the results obtained in the present study.

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