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Motivation, basic psychological needs and intention to be physically active after a gamified intervention programme

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Abstract

The aim of the present study was to compare the possible effects of a gamified programme and a traditional instructional approach in secondary physical education at the level of intrinsic motivation, autonomy satisfaction, competence satisfaction, relatedness satisfaction, and intention to be physically active. A total of 54 year-nine students (14 ± 0.1 years) enrolled in two classes in the same high school participated. The school administration (totally anonymous to the study) distributed all the students among the two classes and the research team randomly considered one the experimental group ($n = 27$, 13 boys, 14 girls), which experienced a gamified learning unit, and the other the comparison group ($n = 27$, 15 boys, 12 girls), which followed a traditional instructional approach. Both study groups had the same physical education teacher with training and experience on several pedagogical approaches, including gamification. The study followed a pre-test, post-test quasi-experimental research design (the time lag between pre-test and post-test was nine weeks). The results showed significant differences at post-tests favouring the experimental group in all the variables assessed. In conclusion, the results from the present study provided support for the use of gamification in physical education since it was associated with increased levels of students' intrinsic motivation, basic psychological needs and intention to be physically active more than a traditional approach. Therefore, gamification could be considered a positive pedagogical framework for secondary physical education. Nevertheless, more studies with larger variability in contexts, participants and content are needed.

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Gamification, physical education, secondary education, motivation

Introduction

One of the leading frameworks used to understand individuals' behaviours is self-determination theory (Deci and Ryan, 1985a). It encompasses five mini-theories that have evolved over the past 40 years (Vansteenkiste et al., 2010). The first one is cognitive evaluation theory, which tries to uncover the connections between events and individuals' interest in them, examining the factors that support or undermine this attention (Deci and Ryan, 2000). Deci (1975) suggested that people, by nature, have intrinsic motivation, which promotes engagement in the activity. Intrinsically motivated individuals perform an activity for its own sake, because it is inherently satisfying, and this behaviour has an internal perceived locus of causality (Vansteenkiste et al., 2010). Self-determination theory acknowledges five more types of behavioural regulations: integrated, identified, introjected, external (from most to least forms of self-determined motivation), and a final category: amotivation (Boiché et al., 2008). Intrinsic motivation has been linked to more adaptive individuals, better experiences in physical education and positive outcomes such as enjoyment, engagement or competence (Vasconcellos et al., 2020), including objectively measured physical activity practice among adolescents (Kalajas-Tilga et al., 2020). Controlling external events (e.g. rewards, competition, deadlines and surveillance) has been found to weaken individuals' intrinsic motivation, because they shift the perceived locus of causality from internal to external (Deci and Ryan, 1985b). Autonomy-supportive contexts that promote individuals' basic psychological needs have been found to promote their intrinsic motivation (Ryan and Deci, 2017).

Based on self-determination theory, Vallerand (1997) proposed a hierarchical model of intrinsic and extrinsic motivation to understand individuals' motivation (determinants and consequences) at different levels of generality: (1) global: general motivational orientation (personal trait); (2) contextual: motivational orientation in a given context (e.g. education and sport); and (3) situational: motivation to be involved in a specific activity at a given time (e.g. task and game). The hierarchical model also looks at the potential sources of motivation: (1) social factors: controlling versus autonomy-supportive contexts (interpersonal) and (2) next higher level of motivation: contextual motivation influences situational motivation (intrapersonal). Finally, the hierarchical model postulates that individuals' motivation can lead to cognitive, affective and behavioural consequences (Vallerand and Ratelle, 2002).

Individuals' basic psychological needs are the central focus of another mini-theory within self-determination theory: basic needs theory (Ryan and Deci, 2002). It supports the idea that three innate psychological needs 'are necessary for psychological and physical health and social wellness' (Vansteenkiste et al., 2010: 131): autonomy refers to feelings of being the owner of one's behaviour, competence deals with beliefs of being effective in one's goals, and relatedness refers to emotions of being a valued member of a community (Ryan and Deci, 2017). The support or nurturing of these needs has been connected to adaptive behaviours and health (Kinnafick et al., 2016). In a recent review conducted in physical education contexts, Vasconcellos et al. (2020) found that basic needs thwarting was linked to controlling motivation, maladaptive functioning and psychological ill-being, while autonomy, competence and relatedness support were strongly linked to autonomous motivation, which was positively connected with adaptive outcomes such as optimal functioning and psychological growth (Warburton et al., 2020).

Among the adaptive outcomes that physical education teachers should try to promote in their students, adopting a physically active lifestyle should be one of the first on the list (Sallis and

McKenzie, 1991). The theory of planned behaviour (Ajzen, 1985) highlights that intention is the closest predictor of behaviour, since it reflects the motivation to engage in it (Hein et al., 2004). Therefore, students' intentions to become physically active could be considered an indicator of willingness and a predictor of future behaviours (Goudas et al., 1994). From the integrated consideration of self-determination theory, theory of planned behaviour and Vallerand's hierarchical model of intrinsic motivation (Vallerand, 1997), the trans-contextual model of motivation was developed (Hagger et al., 2003). It hypothesises the idea that an autonomy-supportive physical education context can increase students' autonomous motivation in leisure-time physical activity (Hagger and Chatzisarantis, 2016), and this pathway has been supported in several studies in school (Koka et al., 2020) and sport contexts (Lee et al., 2019). Exploring this line of thought, game-based approaches in physical education have been found to produce an increase in students' autonomy perceptions (Smith, 2010), and gamification is a novel game-based pedagogical approach, receiving special attention in certain countries (e.g. Spain and the US) that should be further explored.

For more than a decade the term gamification has been used in areas such as business, health, marketing and, finally, education. It has been defined as 'the use of game design elements in non-game contexts' (Deterding et al., 2011: 5) to promote desired behaviours or outcomes (Zichermann and Cunningham, 2011). It tries to increase individuals' participation, called 'users', incorporating game elements such as leader boards and immediate feedback, creating a sense of empowerment and engagement (Figueroa, 2015). Game-design elements have been grouped into three main classes (Werbach and Hunter, 2012): (a) dynamics: to portray an ample view of the whole venture (e.g. the narrative, the progressions and the levels); (b) mechanics: to make the game progress (e.g. the rules, the challenges and the rewards); and (c) components: include the specific elements of the structure (e.g. the teams, the points and the badges). A gamified framework tries to: (a) promote interconnections between students because they have to work in groups (relatedness); (b) help students improve because they have to master certain skills (competence); and (c) help students work independently because they have to progress with limited help from the teacher (autonomy). Therefore, there seems to be a connection between gamification and students' basic psychological needs and self-determination theory.

Gamification is a novel pedagogical framework in physical education that is slowly receiving attention. However, it has been scarcely investigated in physical education, and research has produced inconsistent results. In a pre-experimental study (no control group), Fernandez-Rio et al. (2020) found an increase in a large sample ($n = 290$) of primary and secondary education students' intrinsic motivation after experiencing three consecutive gamified learning units (15 weeks, 30 physical education lessons). It was based on the Marvel universe of superheroes to work on cooperative games, body parts, coordination and throwing skills (primary education), conditioning, health and dodgeball (secondary education). Themes such as enjoyment, friends and learning emerged from the students' responses, while the teachers highlighted workload, portfolio and narrative. However, in a quasi-experimental study (control and experimental groups), Quintas et al. (2020) found no significant effects in a large sample ($n = 417$) of primary education students' motivation and basic psychological needs, while commitment to and behaviour to learn did increase after experiencing a learning unit (12 sessions) to work on body expression, rhythm and dance. Finally, in a quasi-experimental study (control and experimental groups), Segura-Robles et al. (2020) found an increase in a group ($n = 64$) of secondary education students' intrinsic motivation, autonomy, satisfaction, enjoyment and academic performance, after experimenting with an eight-session gamified learning unit on conditioning and health. There seems to be a need to conduct more research on this novel pedagogical approach to better understand how it works in physical education contexts.

The aim of the present study was to deepen our knowledge of gamification in physical education and to compare the possible effects of a gamified programme and a traditional instructional approach in a secondary school. The first goal was to investigate the impact of a gamification programme on the satisfaction of the students' basic psychological needs. The second goal was to evaluate the impact on the students' intrinsic motivation. The third and final goal was to estimate the influence of both programmes on the students' intentions to be physically active. The first hypothesis was that the gamified framework would support the students' basic psychological needs. The second hypothesis was that the students who experienced gamification would increase their intrinsic motivation. The third and final hypothesis was that the gamified structure would increase the students' intentions to be physically active.

Methods

Participants

A total of 54 year-nine students (14 ± 0.1 years) enrolled in two different classes in the same high school in western Spain participated. The school administration (totally anonymous to the study) distributed all the students among the two classes based on its own criteria and the research team randomly considered one the experimental group ($n = 27$, 13 boys, 14 girls), which experienced a gamified learning unit, and the other the comparison group ($n = 27$, 15 boys, 12 girls), which followed a traditional instructional approach. Both study groups had the same physical education teacher. He had previous training and experience in several pedagogical approaches, including gamification. The goal was to conduct the study in an intact school context (not manipulated by the research team), and it followed a pre-test, post-test quasi-experimental research design (Cohen et al., 2011).

Procedure

First, permission to conduct the study was obtained from the first researcher's university ethics department (Code UEDU 03/2020). Second, the project was fully explained to the school administration to obtain permission to conduct the study. Third, the students and their parents were contacted to describe the intervention programme and for those willing to participate in the study, their parents signed a written consent. They were told that they could leave the study at any time and that their answers would not affect their physical education grades, because confidentiality was guaranteed. All parents and children agreed to participate.

Intervention programme

At the beginning of the second semester of the 2019–2020 school year, both study groups experienced (at the same time) a similar learning unit on fitness and coordination through group jump ropes and Double Dutch rope jumping. It was based on the current Spanish legislation, which highlighted the need to work on these skills using innovative approaches. The learning unit lasted nine sessions (one per week, 90 min each), and included skills such as group jump rope (entering from both sides of the rope), Double Dutch jump rope and group jump rope choreography (using all types of jumps) (Figure 1).

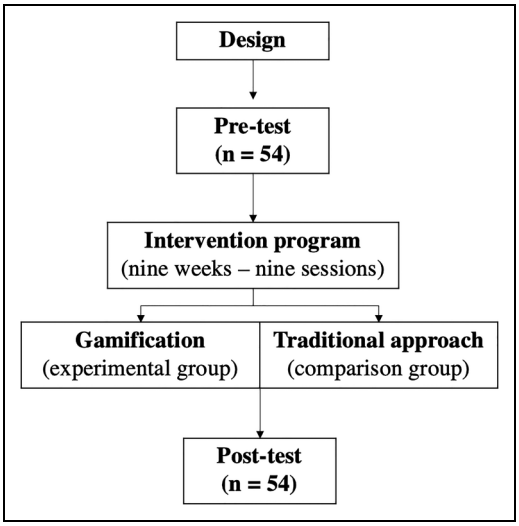

Figure 1. Flowchart of the study.

Participants in the experimental group experienced a gamified learning unit. The project was inspired by the *Dragon Ball Z* manga animated series,[1] which generates great interest among adolescents. According to Werbach and Hunter (2012), choosing an engaging narrative for students is a key element in a gamified project. The intervention programme was based on previous studies on gamification (Dichev and Dicheva, 2017; Fernandez-Rio et al., 2020; Quintas et al., 2020), and it included the basic elements of gamification previously introduced (Werbach and Hunter, 2012). They are all synthesised in Table 1 and a few examples are shown in Figure 2.

The comparison group experienced a similar learning unit, but the only difference was that it followed a traditional instructional approach. It was student-centred and focused on skill acquisition (Metzler, 2017). This means that tasks were selected and introduced by the teacher, who also paced instruction and practice time. He proceeded using small steps at a fast pace to offer active practice and to encourage students' success and achievement (Rosenshine, 1983). The students' duty was to participate, only. Every session included three parts: (1) warm-up: to have students ready for the class, they performed stretching and mobility exercises and tag games; (2) main part: tasks and exercises designed to improve students' jumping skills from individual to Double Dutch; and (3) cool-down: stretching exercises to calm the students and have them ready for the next class. To avoid possible bias (e.g. designing a boring, non-appealing traditional learning unit), the research team designed fun and enjoyable tasks and sessions for the participating students, which were also high quality to promote learning. Therefore, students were actively involved to promote success and capitalize on academic learning time (Gettinger and Seibert, 2002). Furthermore, many 'opportunities to respond' were delivered using developmentally appropriate tasks (Partin et al., 2009).

The same physical education teacher taught both study groups. He was knowledgeable on traditional instructional approaches, but before the study, he completed a semester on pedagogical models, which included gamification (18 weeks, three hours/week: 1.5 theory, 1.5 practice), conducted by a university expert on the topic. The final version of both learning units was reviewed by

Table 1. Elements used in the gamification *Dragon Ball Z*.

Narrative	The teacher and the class received a letter from *Son Goku* (*Z Warriors* leader) asking for help. A few months earlier, a group of villains captured *Krilin* (his friend) and *Z Warriors* must find the seven balls to free him. Unfortunately, they have only found five and they are weak now. *Son Goku* needs to find more *Z Warriors* to fight and defeat the last two villains who have the last two balls. Would the students become *Z Warriors* to continue the adventure?
Missions, levels and challenges	The project included two missions: (1) the battle against *Freezer* and (2) the battle against *Cell*. In the first mission, the teams had to learn group jump ropes entering from both sides (the good and the bad). In the second mission, the teams had to learn to Double Dutch jump rope and create a choreography. Each mission included three levels of increasing difficulty (individual and group): (1) basic (novel warrior): at least one member cannot enter from both sides of the rope; (2) intermediate (transitional warrior): at least one member cannot enter from one side of the rope; and (3) advanced (radical warrior): all members can enter from both sides of the rope. To accomplish both missions and obtain the two dragon balls left, the participating teams had to overcome nine motor cooperative challenges (e.g. the whole group had to perform, at least, one jump with no mistakes or interruptions; the whole group had to Double Dutch in <1 min; the group had to Double Dutch and perform a choreography with one stunt).
Players, teams and avatars	Five heterogeneous groups in terms of gender and grade point average were created at the beginning of the learning unit (four members each). Each group represented a character of the series: *Gohan, Vegeta, Bulma* and *Goten Trunks*. Each group designed its own avatar, which identified the team during the whole adventure.
Rewards	*Magic beans*: One was earned at the end of every challenge, mission and at some points of the experience map (board). *Group points for attitude*: They were obtained weekly based on attendance, active participation, wearing the right clothes… they were necessary to move along the experience map. *Surprise scratch cards*: They included benefits for the final assessment (e.g. extra time in the choreography; one mistake-free during the performance; extra points in the individual score). Each student, individually, could obtain one card trading the *magic beans* earned.
Board	It was a big map located on a class wall. Each group had a game piece with its avatar, which was moved to the different destinations along the three paths outlined. Each team had to choose one (the longest one included more rewards). The movement was dependent on the points earned weekly. The points were registered using *ClassDojo*. The board did not highlight winners or losers, it just helped locate every team during the game.
Social area	With the needed parental permission, the experience included a private Instagram profile. Students were allowed to upload photos and videos of performing the motor challenges. This material was used for self and co-assessment.
Special events	There were three: (1) the search for the lost *magic beans* (teams tried to find the *beans* hidden in the schoolyard), (2) *Flash-Mob*: jump rope in the schoolyard (teams performed their choreographies in front of the schoolmates), (3) final tournament (teams performed their choreographies in front of a jury, which assessed them).
Awards	During the last session, awards and diplomas were handed to all the participating teams.

Figure 2. Some examples of the basic elements of gamification.

the research team. The process was based on Goodyear's (2017) continuous professional development, where the research team provided support and supervised the implementation.

Measures

Motivation. The intrinsic motivation subscale of the Spanish validated version (Ferriz et al., 2015) of the perceived locus of causality scale (Goudas et al., 1994) was used to assess participants' motivation (the other subscales of the instrument were disregarded to avoid a long instrument that could be tiring for the participants). It includes four items (e.g. '…because it is fun') preceded by the stem: 'I participate in the physical education class…'. Participants responded to a Likert-type

scale ranging from one ('totally disagree') to seven ('totally agree'). In the present study, Cronbach's alphas were 0.854 and 0.872 at pre- and post-tests, respectively.

Basic psychological needs. The need satisfaction subscales of the Spanish validated version (Longo et al., 2018) of the need satisfaction and frustration scale (Longo et al., 2016) were used. It includes nine items grouped in three subscales: autonomy satisfaction (e.g. 'I feel I'm given a lot of freedom in deciding how I do things'), competence satisfaction (e.g. 'I feel I am very good at the things I do'), and relatedness satisfaction (e.g. 'I feel the people I interact with really care about me'). Items were preceded by the stem: 'In my physical education class…' and participants responded on a Likert-type scale ranging from one ('totally disagree') to seven ('totally agree'). In the present study, Cronbach's alphas were: autonomy: 0.855 and 0.791, competence: 0.893 and 0.793, and relatedness: 0.749 and 0.782 at pre- and post-tests, respectively.

Intentions. The Spanish validated version (Moreno et al., 2007) of the intention to be physically active scale (Hein et al., 2004) was used. It includes four items (e.g. 'I'm interested in developing my physical fitness') preceded by the stem: 'Regarding your intention to be physically active after graduation…'. Participants responded on a Likert-type scale ranging from one ('totally disagree') to five ('totally agree'). In the present study, Cronbach's alphas were 0.805 and 0.818 at pre- and post-tests, respectively.

Data analyses

All data were analysed using the statistical package SPSS 22.0 version. Descriptive analyses were initially conducted. The *F*-test is considered a valid statistical procedure under non-normality conditions when skewness and kurtosis range between −1 and 1 (Blanca et al., 2017), and in the present study these were 0.325 and 0.639, respectively. Therefore, several multiple analyses of variance (MANOVA) were conducted to assess differences among study groups. Finally, multiple analyses of covariance (MANCOVA) were conducted to assess post-test differences after counting for pre-test values. In addition, effect size, using Cohen's *d* (1988), small <0.5, moderate 0.50–0.79, large ≥0.80, and power were also obtained.

Results

The results from the MANOVA pre-test conducted on all variables did not show any statistically significant mean differences: Wilks' Lambda, $\Lambda = 0.824$, $F(5, 48) = 2.052$, $P = 0.088$.

To assess pre-post intragroup changes, Student *t*-tests were conducted and they showed significant mean increases in the experimental group in all the variables: intrinsic motivation ($P = 0.001$, $d = 1.48$), autonomy satisfaction ($P = 0.001$, $d = 0.65$), competence satisfaction ($P = 0.003$, $d = 0.77$), relatedness satisfaction ($P = 0.010$, $d = 1.01$), intention to be physically active ($P = 0.001$, $d = 0.75$) and only autonomy satisfaction ($P = 0.027$, $d = 0.65$) in the comparison group.

Finally, to assess post-test differences between study groups, a MANCOVA, using pre-test scores as covariates (Garaigordobil and Martinez-Valderrey, 2015), was conducted on all variables. The results showed that there were statistically significant mean differences: Wilks' Lambda, $\Lambda = 0.547$, $F\ (5, 43) = 7.135$, $P = 0.001$, $\eta = 0.453$, power = 0.997. Subsequent individual analysis of covariances reflected that these mean differences were obtained in intrinsic motivation: $F(1, 9.112) = 26.850$, $P = 0.001$, $\eta = 0.364$, power = 0.999, autonomy satisfaction: $F(1, 3.055) =$

4.337, $P = 0.043$, $\eta = 0.084$, power = 0.532, competence satisfaction: $F(1, 4.718) = 11.681$, $P = 0.001$, $\eta = 0.199$, power = 0.917, relatedness satisfaction: $F(1, 4.093) = 9.736$, $P = 0.003$, $\eta = 0.172$, power = 0.863, and intention to be physically active: $F(1, 3.321) = 3.321$, $P = 0.004$, $\eta = 0.167$, power = 0.853 (Table 2).

Discussion

The main aim of the present study was to deepen our knowledge on gamification in physical education, by comparing the effects of a gamified programme and a traditional instructional approach in secondary physical education to work on fitness and coordination (Double Dutch rope jumping). The results showed significant differences at post-tests favouring the experimental group, which experienced gamification, in all the variables assessed: intrinsic motivation, autonomy satisfaction, competence satisfaction, relatedness satisfaction and intention to be physically active.

The first hypothesis was that the gamified framework would support the students' basic psychological needs and the results sustained it. Previous research highlighted the connections between these needs' support and individuals' intrinsic motivation (Deci and Ryan, 1985b). The current findings could be considered important because proper development of individuals' basic psychological needs is essential for psychological, social and physical health (Vansteenkiste et al., 2010). Moreover, Kinnafick et al. (2016) found that the support of these needs was associated with adaptive behaviours. In this same trend, Vasconcellos et al. (2020) connected the three needs (autonomy, competence and relatedness) with autonomous motivation and this type of motivation with adaptive outcomes (productivity and cooperation). Elements of the gamified framework such as the selection of the path to travel in the adventure (autonomy), the time to practice and learn, even master, the jumps (competence) and the choreography that each group had to create to perform in front of the class and the rest of the school (relatedness) probably helped the students perceive that the class was an autonomy-supportive context. Those contexts, which can be considered supporting or nurturing of the individuals' basic needs, have been linked to their autonomous motivation,

Table 2. Pre- and post-test results.

	Experimental group		Comparison group			
	Pre M (SD)	Post M (SD)	Pre M (SD)	Post M (SD)	*P*	*d*
Intrinsic motivation**	3.72 (1.03)	4.38*[a] (0.63)	3.48 (0.77)	3.42[b] (0.66)	0.001	0.364
Autonomy satisfaction**	2.74 (0.68)	3.88*[a] (0.78)	2.70 (1.1)	3.33*[b] (0.90)	0.001/ 0.027	0.084
Competence satisfaction**	3.16 (1.03)	3.75*[a] (0.58)	3.19 (0.87)	3.23[b] (0.75)	0.003	0.199
Relatedness satisfaction**	3.70 (0.93)	4.30*[a] (0.67)	3.54 (0.94)	3.64[b] (0.64)	0.010	0.172
Intention to be physically active***	3.54 (1.07)	4.44*[a] (0.68)	3.94 (0.65)	3.94[b] (0.64)	0.001	0.167

Note: M = mean; SD = standard deviation; *pre–post intragroup significant differences; [a,b]different superscripts in the same row indicate post-test intergroup differences; $P < 0.05$; d = effect size (Cohen's d); **range = 1–7; ***range 1–5.

which has been positively connected with adaptive outcomes such as optimal functioning and psychological growth (Warburton et al., 2020). Therefore, the pedagogical approach used in the experimental group, gamification, seemed to have helped to create a positive framework for these young students' basic psychological needs and, consequently, global development. Properly framed, a gamified framework tries to: (a) promote connections between the students working in groups (relatedness); (b) help students learn to master skills (competence); and (c) foster students' independent work, limiting the help from the teacher (autonomy). Consequently, gamification has the necessary ingredients to support students' basic psychological needs.

The second hypothesis was that the students who experienced gamification would increase their intrinsic motivation and the results obtained supported it. Previous research on behavioural regulations uncovered that intrinsically motivated individuals perform an activity for its own sake, because it is inherently satisfying, and this behaviour has an internal perceived locus of causality (Vansteenkiste et al., 2010). The results from the present study indicate that the gamified framework helped the students feel that the physical education class was appealing, motivating them intrinsically. Voices against gamification warn against the controlling external events embedded in its framework (e.g. rewards and deadlines), because they have been found to weaken individuals' intrinsic motivation, shifting the perceived locus of causality from internal to external (Deci and Ryan, 1985b). However, previous research revealed that depending on how these external events are used, they can produce different outcomes. When rewards are performance contingent (Deci et al., 1999) or when they are introduced in an informative way (Deci and Ryan, 1985b) their negative effect on intrinsic motivation is less severe. In the gamified intervention programme implemented, rewards were awarded based on the students' performance (e.g. jumps from both sides of the rope, Double Dutch choreography), individually or as a group, and they were linked to choice and decisions. Therefore, they were presented in a non-controlling manner (avoiding scoreboards) and the results indicate that they did not harm the students' intrinsic motivation; on the contrary, they significantly increased it. Of course, more research is needed to confirm this finding, because previous research has produced contradictory results: two studies obtained similar positive effects on primary and secondary education students (Fernandez-Rio et al., 2020; Segura-Robles et al., 2020), while in one no positive effects were observed (Quintas et al., 2020). In this last study, the intervention programme included a virtual gamified board where students could add the points awarded and obtain badges, which could have harmed students' intrinsic motivation. In the other two studies, one did not include scoreboards (Fernandez-Rio et al., 2020) and the other one did not fully explain this part of the intervention program (Segura-Robles et al., 2020). However, according to Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation, the results indicate that, in the present study, individuals' intrinsic motivation increased at the contextual (physical education class) and situational levels (gamified tasks). Moreover, the potential sources of motivation in this experience were, probably, interpersonal social factors (interconnections in the group work to learn) and autonomy-supportive contexts (choices and decisions to make), influencing contextual motivation on situational motivation (intrapersonal). Finally, individuals' motivation was associated with behavioural consequences: intentions to become physically active (Vallerand and Ratelle, 2002). Of course, this is speculative at this point and more research is needed.

The third and final hypothesis was that the gamified structure would increase the students' intentions to be physically active and the results supported it. This finding could be considered important because physical education teachers should try to promote physically active lifestyles (Sallis and McKenzie, 1991) and the results showed that gamification can enhance students' intentions to

become physically active, an indicator and a predictor of leisure physical activity practice. The previously introduced trans-contextual model of motivation (Hagger et al., 2003) indicates that autonomy-supportive physical education contexts can increase autonomous motivation in leisure-time physical activity (Hagger and Chatzisarantis, 2016). The results from the present study showed that the gamified context increased the students' autonomy and their intrinsic motivation. Therefore, it could be considered autonomy supportive. Game-based approaches have been found to produce an increase in students' autonomy perceptions (Smith, 2010), and gamification has been defined as 'the use of game design elements in non-game contexts' (Deterding et al., 2011: 5), confirming these links. Finally, the results also showed that the framework was associated with these students' intentions to become physically active outside of the school. Based on the aforementioned information, the results from the present study suggest that a novel pedagogical approach, gamification, seems to support the trans-contextual model of motivation. An autonomy-supportive context in physical education (gamification) significantly increased students' in-class intrinsic motivation, which positively affected their intention to be physically active outside the school. Nevertheless, more research is needed to confirm this connection. In extracurricular contexts, previous research also found that gamification can help promote healthy habits among children and adolescents (González-González et al., 2018). Therefore, this pedagogical approach can help youngsters develop healthy habits when it is used in school and extracurricular contexts. The current Spanish legislation on physical education demands teachers use innovative pedagogical approaches to create autonomy-support contexts that could promote students' healthy behaviours in and out of the school setting and gamification could be one of them. However, in the Spanish context, more research is still needed to analyse its effects on the students involved.

The present study is not without limitations. The first one is the small number of participants. Two year-nine classes and 54 students represent a small sample, and more studies with larger samples are needed to be able to generalize the outcomes uncovered. The fact that the study was conducted in Spain, where students, teachers and the curriculum build a culturally particular context, could be considered a limitation. Similar studies should be conducted in other countries to find out if the framework is suitable for different cultures and contexts. A third limitation could be the length of the intervention program since it lasted only nine weeks and included just one learning unit. Future research should be conducted in longer units and/or consecutive units. A fourth limitation could be that the same teacher conducted both study groups. Some researchers see this framework as possibly biased (the teacher could favour one study group to obtain better results). A final limitation was that only intrinsic motivation was assessed. Future research should explore the other motivational regulations in gamified contexts.

Conclusion

The results from the present study provide support for the use of gamification in physical education. This pedagogical approach was associated with increased levels of students' basic psychological needs, intrinsic motivation, and intention to be physically active more than a traditional approach. Although some teachers may be reluctant to employ new pedagogical approaches to teach physical education, the results from the present study indicate that gamification could be a positive pedagogical framework for secondary physical education. The present study contributes to deepening our knowledge on gamification, showing that when rewards are awarded based on the students' performance (performance contingent), individually or as a group and they are linked to choice and decisions (informative), that is, they are presented in a non-controlling manner (e.g. without

scoreboards), they can significantly increase students' basic psychological needs, intrinsic motivation and positive behaviours (intentions to become physically active). Nevertheless, more studies with larger variability in contexts, participants and content are needed to confirm or reject the results obtained in the present study.

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Notes

1. *Dragon Ball Z* is a Japanese anime television series created in 1989 by Akira Toriyama. It was broadcast in at least 81 countries worldwide. *Dragon Ball Z* portrays the adventures of *Son Goku* and his friends, who defend the Earth against villains (e.g. aliens, magical creatures).

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