Original Article

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Could an intermittent Physical Education-based fitness teaching unit affect secondary school students' motivation, autotelic experience, and physical self-concept? A cluster-randomized controlled trial

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Abstract

Objective: The purpose of the present study was to compare the effects of traditional and intermittent physical fitness-based teaching units on secondary school students' motivation toward Physical Education, autotelic experience, and physical self-concept. *Methods*: Six classes [126 students (57.9% females) aged 13-15 years], balanced by grade, were cluster-randomly assigned into control (n = 40), traditional (n = 34) and innovative (n = 52) groups. The traditional group performed a physical fitness teaching unit twice a week for nine weeks (35-40 minutes of the main part of each session). The innovative group worked during the first half of the sessions' main part (18-20 minutes) similarly to the traditional group, and during the second half they worked on invasion sports. Before and after the intervention, students' motivation toward Physical Education and physical self-concept were measured through the Perceived Locus of Causality-II Scale and the short form of the Physical Self Description Questionnaire. *Results*: The Multilevel Linear Model showed that the control group students decreased statistically significantly in the integrated, introjected, and controlled motivation compared to those from the innovative and traditional groups (p < 0.05; d = 0.17-0.51). However, no statistically significant differences in the other motivational dimensions, nor on the autotelic experience and physical self-concept dimensions were found between the three groups (p > 0.05). *Conclusion*: Regardless of the teaching unit structure applied (i.e., traditional or intermittent), it could be necessary that Physical Education teachers apply specific strategies for improving these psychological variables of the students.

Keywords: innovative intervention; motivation toward Physical Education; satisfaction; physical self-perceptions; high school students

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INTRODUCTION

Health is a state of complete physical, mental, and social well-being, and not just the absence of disease or injury [1], and physical fitness is considered one of the fundamental health indicators for adolescents (i.e., males and females between the ages of 11 and 17) [2]. Schools, through the Physical Education (PE) subject, are an ideal setting to make students aware of the benefits that having good fitness levels can have on their physical and psychological well-being [3]. For example, during the educational years, having good physical fitness levels is positively associated with better mental health and quality of life [4].

Likewise, physical fitness has also shown to be positively associated with students' motivation toward PE [5]. Motivation has been defined as a psychological feature that encourages a person to act toward a desired goal [6]. According to the Self-Determination Theory (SDT) motivation is conceptualized as a multidimensional construct that may be ordered in a *continuum* according to the extent to which motivation is self-determined (or autonomous): amotivation (non-intentional), extrinsic motivation or intrinsic motivation (self-determined) [6]. Amotivation is characterized by no intention of a student to act due to different reasons such as a lack of knowledge or certain skills necessary to act. Extrinsic motivation refers to external reasons why people take part in a certain activity such as to avoid punishments, achieve tangible rewards, or attain recognition/approval. SDT also identifies four types of extrinsic motivation which vary in degree of self-determination: external regulation, introjected regulation, identified regulation, and integrated regulation. In contrast, intrinsic motivation refers to the inherent satisfaction and pleasure provided by an activity [6].

Students' motivation toward PE has shown to be positively associated with their physical activity (PA) levels during PE sessions [7]. When students have high motivation toward PE, they tend to be more active during PE sessions [8]. Additionally, higher levels of autonomous motivation in students during PE sessions have been positively associated with the experience of flow state [9]. According to Csikszentmihalyi [10], flow is an enjoyable psychological state that students experience when they are completely absorbed in an activity without being aware of the time. One of the most important elements of the flow state is autotelic experience [10,11]. Autotelic experience is defined as the intrinsic satisfaction produced by a task [10,11]. The SDT postulates that a task is easier to perform when you feel satisfy simply by doing it, without the need of receiving any external reward [6]. In this sense, Moreno-Murcia et al. [12] found that students experienced less autotelic experience in PE in comparison to other contexts such as non-competitive physical exercises or voluntarily chosen competitive sports. This could be because the compulsory nature of the participation in PE, leads to less enjoyment than in other contexts [12]. This is especially important with physical fitness-related contents, where the intensity should be high and students' motivation may be negatively affected from a particular moment of the teaching unit due to the compulsory nature of their participation, consequently lowering their enjoyment more so than in other contexts [12].

Additionally, physical fitness has shown positive associations with physical self-concept among students [13]. Physical self-concept, which is also an important aspect for students' health [1], refers to a judgment a person has about his or her own physical abilities when interacting with the environment [14]. During the educational years, physical self-concept acquires more importance, because of the significative physiological and psychological changes that take place during this stage [15]. Unfortunately, physical self-concept decreases from childhood to adolescence [16]. Therefore, one of the main national standards in PE curriculums is the promotion of a good psychological status among students [3].

Considering all of the above-mentioned positive relationships between physical fitness and psychological aspects, together with the physical fitness decline observed in students during the last years [2], the improvement of students' physical fitness levels is one of the main objectives in the educational context [3]. In this sense, a systematic review and meta-analysis found that carrying out physical fitness activities in PE sessions is one of the most effective strategies for increasing students' moderate-to-vigorous PA levels during said sessions [17] and therefore, improving students' physical fitness [2,18]. However, practicing fitness activities during the entire PE session (i.e., as performed in traditional teaching units' sessions) may negatively impact students' motivation toward PE and enjoyment [19]. Additionally, changes in students' physical self-concept as a result of a traditional PE-

based physical fitness teaching unit are still contradictory [13,20,21]. Therefore, it seems necessary to carry out more studies applying new teaching unit approaches to better understand how PE sessions could improve students' physical fitness levels without negatively influencing their motivation toward PE and autotelic experience, and without decreasing their physical self-concept. In this sense, Viciana and Mayorga-Vega [22] proposed the intermittent teaching units as a novel teaching unit structure to facilitate the achievement of the PE curricular objectives. This innovative teaching unit structure consists of working a few minutes of each PE session for several sessions focused on one curricular objective, letting PE teachers divide the session into several parts (e.g., two) and develop two or more related curricular objectives in the same session. For instance, an intermittent teaching unit could consist of the development of students' physical fitness during several minutes of the PE session, and then develop invasion sports' learning (i.e., basketball and soccer) for the rest of the session. Working sports in the second part of PE sessions would allow for achieving high levels of moderate-to-vigorous PA [23], as well as making them more attractive and participatory for students [24]. These may positively influence their motivation toward PE and autotelic experience, as well as improve their physical self-concept as they would not be so monotonous. Unfortunately, to our knowledge there are no previous studies examining the effect of an intermittent teaching unit on these psychological variables. Consequently, the main purpose of the present study was to compare the effect of the intermittent and traditional PE-based physical fitness teaching units on motivation toward PE, autotelic experience, and physical self-concept in secondary school students.

METHOD

Study design

The CONSORT guidelines for cluster randomized trials was followed to report the present study [25]. The protocol conforms to the Declaration of Helsinki statements (64th WMA, Brazil, October 2013). The Ethical Committee for Human Studies of the University of Granada provided ethical approval for the present study protocol. Recruitment of participants was performed in June of 2017, and the intervention was done from September to December of 2017. For practical reasons and because of the nature of the present study (i.e., natural groups from an educational setting) a cluster-randomized controlled trial was used (i.e., randomization was per classes not per individuals) [20,26]. This study was non-blinded (treatments were not masked from the teachers or students) and parallel-group(ed) (study with three different treatments), with two evaluation phases. The only knowledge that students from the study groups had was that they were going to participate in a study, and because of the objective of the study some classes started the scholar year working one PE content and other classes another PE content. However, none of the participants, regardless of the study group to which they belonged, were informed of the specific objective of the study in order to prevent subject-expectancy effects on study outcomes.

Participants

First, the principals and the PE teachers of two similar state secondary schools chosen by convenience of the province of Ciudad Real (Castilla-La Mancha Region, Spain) were contacted. Both school centers were informed about the project and the permission to conduct the study was requested. After the approval of the schools was obtained, students and their legal tutors were completely informed about the characteristics of the study. A sample of 126 students (57.9% females) from the eighth and ninth grade of secondary education (i.e., 13-15 years old) were invited to participate in the present study. According to the center's reports, all the students' families had a middle socioeconomic level.

The inclusion criteria were: a) being enrolled in the eighth to ninth grades of the secondary education level (grades in which approval of the school was obtained); b) participating in normal PE classes; c) being free of any health disorder causing students to not undergo PA, d) presenting the corresponding signed written consent by their legal tutors, and e) presenting the corresponding signed written assent by the students. The exclusion criterion was not having completed correctly the motivation toward PE, autotelic experience, and physical self-concept questionnaires in each measured moment (i.e., pre-intervention and post-intervention).

Sample size

Based on the main dependent variables (i.e., motivation toward PE, autotelic experience, and physical self-concept) and assuming independency of observations as previous personal related (unpublished) studies have shown, a priori sample size calculation was estimated with the G*Power Version 3.1.9.4 for Windows. Parameters were set in a conservative manner as follows: effect size f = 0.10, significance level $\alpha = 0.05$, statistical power $(1 - \beta) = 0.80$, and correlation among repeated measures $r = 0.8$. A minimum final sample size of 102 participants was estimated for this study.

Randomization

Randomization was conducted at the class-level, using a computerized random number generator. Before the pre-intervention evaluation was administered, the six established classes, with their students, balanced by grade (i.e., eighth- and ninth-grade classes) were randomly assigned following a 1:1:1 ratio to one of the two intervention arms [traditional (TG) or innovative group (IG)] or to the control group (CG) by an independent researcher blinded to the study objectives. However, according to the education rules, prior to the start of the scholar year the students who composed each of these six classes had been assigned randomly by the school center following the criterion that the classes should be balanced between males and females (i.e., each class should have the same proportion of males and females).

Intervention

Both TG and IG students carried out a physical fitness-based teaching unit during the PE sessions twice a week for nine weeks. Due to educational contingencies (e.g., meteorological problems), in the end the TG and IG students completed a total of 16 sessions. The sessions were designed and delivered by experienced PE teachers (15 years of experience) of the participating schools, with the supervision of the main researcher, and according to the approved curriculum established by the centers.

Each session lasted 50 minutes and consisted of: a 5-to-10-minute warm-up, a 35-to-40 minute main part, and a 5-minute cool-down. During the warm-up, students performed low-to-moderate aerobic exercises followed by some joint mobility and stretching exercises. In the main part, the TG students performed traditional PE-based physical fitness sessions during the whole period (e.g., interval training, circuit training, skipping rope, fartlek or running games). For example, in the interval training session students performed five series of three minutes of sprints with two minutes of rest between series followed by the game of tag in pairs for 10 minutes. Finally, during the five-minute cool-down students performed low intensity exercises such as walking slowly around the sports court.

Regarding the IG students' sessions, the warm-up and cool-down phases were identical to the TG. However, the main part of this study group's sessions was divided into two halves, approximately 18-20 minutes each. In the first half, the IG students performed PE-based physical fitness exercises similar to the TG students (i.e., three series of three minutes of sprints with two minutes of rest between series, followed by five minutes of the game of tag in pairs). Nevertheless, in the second half, in order to make the sessions more participatory and motivating [24], IG students carried out invasion sports tasks with the objective of learning technical and tactical elements of the developed sports (basketball and soccer). The PE teacher placed special emphasis on reaching a moderate-to-vigorous intensity during the whole main part (i.e., 35-40 minutes) in the TG sessions, and only during the first half of the main part (i.e., 18-20 minutes) in the IG sessions. To control the intensity, five students of each class wore a heart rate monitor (Polar® RS300X, Finland), shifting those five students in each of the following sessions. Additionally, according to previous studies that have shown that feedback positively influences physical self-concept [13,21] each student of the TG and IG received affective positive feedback (e.g., "well done" or "continue working as well as now") at least once per session during the teaching units.

Regarding the CG students, they also performed two PE sessions twice a week during the intervention period, with a similar structure to the TG and IG (i.e., 5-to-10-minute warm-up, 35-to-40-minute main part, and 5-minute cool-down). The warm-up and cool-down phases were similar to the intervention groups. However, the content (outdoor PA and body expression) and methodology followed during the main part of the sessions (focused on the recreation and without any special focus

on PA intensity) were different. For example, during the outdoor PA sessions students performed different activities in the natural environment (e.g., track games or orientation races), while during the body expression sessions, students had to learn different acrosport figures to make an acrosport choreography.

Measures

Data collection was carried out during the PE session time at the beginning (pre-intervention) and at the end (post-intervention) of the teaching unit. Each evaluation was performed during one PE session in a controlled manner, that is, under the same conditions, with the same instruments, by the same tester and during the same day of the week. General characteristics of the participants (i.e., age, gender, grade, body height, body mass, and habitual PA) were registered at the beginning of the study. Body height and body mass (and body mass index) were measured following the *International Standards for Antrophometric Assesment* procotol [27]. Habitual PA was estimated by the Spanish version of the PACE questionnaire for adolescents [28]. Students' motivation toward PE and physical self-concept were assessed inmediately before and after the intervention, while autotelic experience only after the intervention as the objective with this variable was to evaluate students' satisfaction experienced especifically during the teaching units given.

Motivation toward Physical Education

Participants' self-determined motivation toward PE was measured by the Spanish version of the *Perceived Locus of Causality-II Scale* (PLOC-II) [29]. This questionnaire was preceded by the statement "I participate in PE lessons…" and is comprised of a total of 24 items spread over six dimensions (four items each) that measure intrinsic motivation (e.g., "Because PE is stimulating"); integrated regulation (e.g., "Because I consider PE to be part of me"); identified regulation (e.g., "Because I want to learn sport skills"); introjected regulation (e.g., "Because I want the teacher to think I am a good student"); external regulation (e.g., "Because that is the norm"), and amotivation (e.g., "But I do not understand why we should have PE"). The autonomous (i.e., averaging intrinsic motivation, integrated regulation, and identified regulation), and controlled motivations (i.e., averaging introjected, and external regulations) were also calculated [30]. The Spanish version of the PLOC-II has shown adequate psychometric properties among secondary school students (CFI = 0.92; TLI = 0.91; IFI = 0.92; SRMR = 0.065; RMSEA = 0.065; Cronbach's alpha = 0.69-0.93) [29].

Autotelic experience. Students' satisfaction regarding the teaching units was measured by the autotelic experience dimension of the Spanish version of the *Flow State Scale* [11], which is composed of four items (e.g., "I found the experience very valuable and comforting"). The Spanish version of the *Flow State Scale* has shown adequate psychometric properties among secondary school students (CFI = 0.91; TLI = 0.90; RMSEA = 0.054; SRMR = 0.051; Cronbach's alpha = 0.73) [11].

Physical self-concept. The Spanish version of the short form of the *Physical Self-Description Questionnaire* (PSDQ-S) [31] was used to measure physical self-concept. This questionnaire consists of 40 items that measure nine specific, and two global components of physical self-concept. Due to the purpose of the present study (i.e., teaching units focused on cardiorespiratory fitness improvement), only the endurance (three items; e.g., "I can run a long way without stopping"); global physical self-concept (three items; e.g., "Physically, I am happy with myself"), and self-esteem (five items; e.g., "Overall, I am no good") dimensions were used. The Spanish version of the PSDQ-S has shown adequate psychometric properties among secondary school students (TLI = 0.975; CFI = 0.978; RMSEA = 0.046; Cronbach's alpha = 0.80, 0.88 and 0.70 for endurance, global physical self-concept, and self-esteem dimensions, respectively) [31].

To adapt the scale of the three aforementioned questionnaires to the Spanish students' school grades, a 10-point Likert-type scale from 1 ("Totally disagree") to 10 ("Totally agree") was used according to previous studies [20].

Statistical analysis

Descriptive statistics (mean ± standard deviation or percentage) for the general characteristics of the included participants and dependent variables were calculated. All the statistical tests assumptions were first checked and met for each dependent variable by common procedures (e.g.,

histograms and normal Q-Q plots for normality). The one-way analyses of variance (ANOVA) (continuous variables) and the chi-squared test (categorical variables) were conducted to examine potential differences in terms of general characteristics between the three groups. The internal consistency of the dependent variables measured was examined with the Cronbach's alpha.

All the participants were included in the statistical analyses regardless of adherence to the protocol (i.e., intention-to-treat approach). All the participants that did not follow protocol had failed to sustain a 100% attendance rate. Because the unit of intervention was the class, the effect of the physical fitness-based teaching units on motivation toward PE and physical self-concept variables was examining using a Multilevel Linear Model (MLM) with participants nested withing classes and measures withing participants as random effects, and with the between-subjects factor *group* (CG, TG, IG) an the withing-subject factor time (pre-intervention, post-intervention) as fixed effects [i.e., two-way mixed nested ANOVA and two-way mixed nested analyses of covariance (ANCOVA)] [32]. The maximum likelihood estimation method was used. All the potential confounding variables (i.e., gender, age, body mass, body height, body mass index, habitual PA, and intervention attendance) were explored and used as covariables when necessary (see Tables 2-3 notes). Then, the *post-hoc* with the Bonferroni adjustment was used for pairwise comparisons. Similarly, for the autotelic experience variable a MLM with participants nested within classes as random effects, and with the between-subjects factor *group* (CG, TG, IG) as fixed effect (i.e., one-way mixed nested ANCOVA with age as covariable), followed by the *post-hoc* with the Bonferroni adjustment for pairwise comparisons, was carried out. Effect sizes were estimated using the Cohen's *d* for pairwise comparisons. Finally, as a sensitivity analyses, all the above-mentioned analyses were also carried out with a per-protocol approach (i.e., including only the TG/IG participants with an attendance rate to the intervention equal to the 100%). All statistical analyses were performed using the SPSS version 25.0 for Windows (IBM® SPSS® Statistics). The statistical significance level was set at $p < 0.05$.

RESULTS

Final sample and general characteristics

Figure 1 shows the flow chart corresponding to the participants included in the present study. Out of the 126 students (57.9% females) who agreed to participate and met the inclusion criteria, definitively 123 students (58.1 % females) satisfactorily passed the exclusion criterion and were analysed. No participant was lost because of the rejection to continue in the study or the change of school. Table 1 shows the general characteristics of the included participants and the differences between the three groups. The one-way ANOVA results did not show statistically significant differences in terms of body height, body mass, and body mass index between the three groups ($p > 0.05$). However, the one-way ANOVA results showed statistically significant differences in terms of habitual PA levels ($p < 0.05$). Additionally, the chi-square analysis showed that the three groups had a balanced representation of eighth-/ninth-grade students, as well as of females and males ($p > 0.05$). The TG and IG participants obtained an average attendance of 96% and 98%, respectively. The internal consistency of the measured dimensions with data of the present study was adequate (Cronbach's alpha: intrinsic motivation = 0.84; integrated regulation = 0.86; identified regulation = 0.78; introjected regulation = 0.75; external regulation = 0.73; amotivation = 0.76; autotelic experience = 0.95; endurance = 0.92; global physical self-concept = 0.94; self-esteem = 0.73).

Motivation toward Physical Education

Table 2 shows the effect of the intermittent and traditional physical fitness-based teaching units on motivation toward PE levels in secondary school students. The MLM results showed a statistically significant interaction effect between the *group* and *time* variables for integrated, introjected and controlled motivation ($p < 0.05$). Subsequently, the *post-hoc* within-group pairwise comparisons showed that the CG decreased statistically significantly from pre-intervention to post-intervention ($p < 0.05$). However, for the IG and TG no statistically significant differences were found from pre-intervention to post-intervention ($p > 0.05$). Regarding the intrinsic, identified, external, and amotivation dimensions and autonomous motivation, statistically significant interaction effects were not found ($p > 0.05$).

Table 1. General characteristics of the included participants and differences between the three groups.

Indicator	Total (n = 123)	CG (n = 40)	IG (n = 50)	TG (n = 33)	p^a
Age (years)	13.6 (0.7)	13.6 (0.6)	13.8 (0.8)	13.5 (0.7)	-
Gender (females/males)	58.1/41.9	70.0/30.0	58.0/42.0	44.1/55.9	0.080
Grade (8^{th}/9^{th})	44.4/55.6	45.0/55.0	40.0/60.0	50.0/50.0	0.660
Body height (cm)	162.0 (7.7)	160.9 (7.4)	162.7 (7.6)	162.5 (8.2)	0.516
Body mass (kg)	53.9 (11.0)	53.8 (8.9)	55.0 (13.0)	52.5 (10.0)	0.596
Body mass index (kg/m^2)	20.5 (3.5)	20.8 (3.4)	20.7 (4.0)	19.8 (3.0)	0.407
Habitual PA (days/week)	3.0 (1.8)	2.3 (1.6)	3.0 (1.6)	3.6 (2.0)	0.006

Data are reported as mean (standard deviation) for age, body height, body mass, body mass index and habitual PA, or percentage for gender and grade; CG = Control group; IG = Innovative group; TG = Traditional group; PA = Physical activity. [a] Significance level from the one-way analysis of variance for body height, body mass, body mass index and habitual PA, and from the chi squared test for the grade and gender ratios.

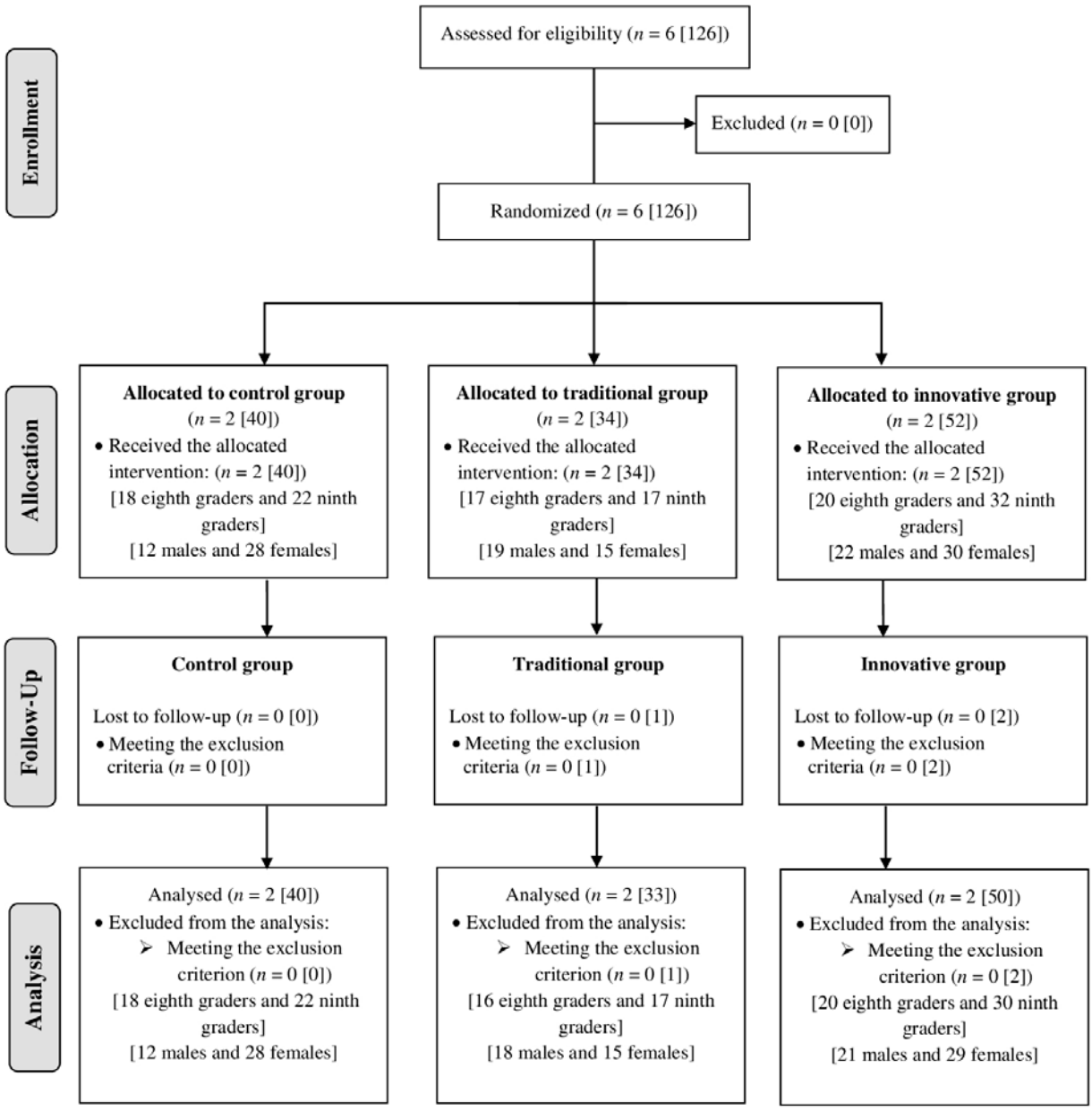

Figure 1. Flow chart of the school classes and students of the present study. All numbers are school classes [students].

Table 2. Effect of the intermittent and traditional physical fitness-based teaching units on motivation toward Physical Education in secondary school students.

Indicator	Pre-intervention	Post-intervention	Multilevel Linear Model[a]			Effect size	
	M (SE)	M (SE)	-2LL	*F*	*p*	Comp.	*d*
Intrinsic motivation[bc]			814.448	1.403	0.250		
CG (*n* = 40)	7.8 (0.2)	7.4 (0.2)				IG-CG	0.27
IG (*n* = 50)	7.1 (0.2)	7.1 (0.2)				TG-CG	0.26
TG (*n* = 33)	7.1 (0.3)	7.1 (0.3)				TG-IG	-0.01
Integrated motivation[bcd]			862.477	3.135	0.047		
CG (*n* = 40)	7.4 (0.3)	6.9 (0.3)*				IG-CG	0.34
IG (*n* = 50)	6.7 (0.2)	6.8 (0.2)				TG-CG	0.31
TG (*n* = 33)	6.3 (0.3)	6.4 (0.3)				TG-IG	-0.03
Identified motivation[bcd]			809.040	0.461	0.632		
CG (*n* = 40)	7.9 (0.2)	7.6 (0.2)				IG-CG	0.16
IG (*n* = 50)	7.2 (0.2)	7.1 (0.2)				TG-CG	0.07
TG (*n* = 33)	6.9 (0.3)	6.7 (0.3)				TG-IG	-0.09
Introjected motivation			965.268	4.421	0.014		
CG (*n* = 40)	6.3 (0.3)	5.6 (0.3)*				IG-CG	0.51
IG (*n* = 50)	4.6 (0.3)	5.0 (0.3)				TG-CG	0.17
TG (*n* = 33)	4.5 (0.3)	4.2 (0.3)				TG-IG	-0.34
External motivation			963.805	2.470	0.089		
CG (*n* = 40)	5.8 (0.3)	5.1 (0.3)				IG-CG	0.38
IG (*n* = 50)	4.4 (0.3)	4.5 (0.3)				TG-CG	0.20
TG (*n* = 33)	4.4 (0.3)	4.2 (0.3)				TG-IG	-0.17
Amotivation[bc]			902.733	0.251	0.778		
CG (*n* = 40)	2.8 (0.3)	2.7 (0.3)				IG-CG	0.13
IG (*n* = 50)	2.7 (0.2)	2.8 (0.3)				TG-CG	0.05
TG (*n* = 33)	2.3 (0.3)	2.2 (0.3)				TG-IG	-0.08
Autonomous motivation[bcd]			756.311	2.040	0.134		
CG (*n* = 40)	7.7 (0.2)	7.3 (0.2)				IG-CG	0.29
IG (*n* = 50)	7.0 (0.2)	7.0 (0.2)				TG-CG	0.24
TG (*n* = 33)	6.8 (0.2)	6.7 (0.2)				TG-IG	-0.05
Controlled motivation			899.038	4.532	0.013		
CG (*n* = 40)	6.0 (0.3)	5.4 (0.3)**				IG-CG	0.48
IG (*n* = 50)	4.5 (0.3)	4.7 (0.2)				TG-CG	0.20
TG (*n* = 33)	4.5 (0.3)	4.2 (0.3)				TG-IG	-0.28

M = Adjusted mean; SE = Standard error; - 2LL = -2 log-likelihood; CG = Control group; IT = Innovative group; TG = Traditional group. [a] Multilevel Linear Model with participants nested within classes and measures within participants (i.e., two-way mixed nested ANOVA/ANCOVA) with the *post hoc* analysis with Bonferroni adjustment from pre-intervention to post-intervention (*$p < 0.05$, **$p < 0.01$). Covariables: Age[b]; habitual physical activity[c]; body mass index[d].

Autotelic experience

The MLM results did not show a statistically significant effect for autotelic experience (M ± SE, CG = 6.7 ± 0.3, IG = 7.4 ± 0.3, TG = 7.5 ± 0.3; -2LL = 481.972; F =2.320; p = 0.103).

Physical self-concept

Table 3 shows the effect of the intermittent and traditional physical fitness-based teaching units on physical self-concept levels in secondary school students. The MLM results did not show a statistically significant interaction effect between the *group* and *time* variables for physical self-concept ($p > 0.05$).

Table 3. Effect of the intermittent and traditional physical fitness-based teaching units on physical self-concept in secondary school students.

Indicator	Pre-intervention	Post-intervention	Multilevel Linear Model[a]			Effect size	
	M (SE)	M (SE)	-2LL	*F*	*p*	Comp.	*d*
Global physical self-concept[cd]			974.480	0.759	0.470		
CG (*n* = 40)	7.0 (0.3)	6.9 (0.3)				IG-CG	0.19
IG (*n* = 50)	6.7 (0.3)	7.0 (0.3)				TG-CG	0.16
TG (*n* = 33)	7.6 (0.4)	7.8 (0.4)				TG-IG	-0.02
Endurance[bcd]			913.736	2.144	0.122		
CG (*n* = 40)	7.0 (0.3)	6.6 (0.3)				IG-CG	0.18
IG (*n* = 50)	6.6 (0.3)	6.6 (0.3)				TG-CG	0.31
TG (*n* = 33)	6.1 (0.3)	6.4 (0.3)				TG-IG	0.13
Self-esteem[d]			830.929	0.574	0.565		
CG (*n* = 40)	7.2 (0.2)	7.0 (0.3)				IG-CG	0.19
IG (*n* = 50)	7.0 (0.2)	7.0 (0.2)				TG-CG	0.15
TG (*n* = 33)	7.7 (0.2)	7.7 (0.3)				TG-IG	-0.05

M = Adjusted mean; SE = Standard error; - 2LL = -2 log-likelihood; CG = Control group; IT = Innovative group; TG = Traditional group. [a] Multilevel Linear Model with participants nested within classes and measures within participants (i.e., two-way mixed nested ANCOVA) with the *post hoc* analysis with Bonferroni adjustment from pre-intervention to post-intervention. Covariables: Age[b]; habitual physical activity[c]; body mass index[d].

Sensitivity analysis

The sensitivity analysis (i.e., per-protocol approach) found the same outcomes as the main analysis (i.e., intention-to-treat approach) in 11 out of 12 variables. Specifically, for the integrated regulation statistically significant differences in the CG were not found ($p = 0.047$ vs. $p = 0.065$) (data not reported due to the page limit).

DISCUSSION

The purpose of the present study was to compare the effect of the intermittent and traditional PE-based physical fitness teaching units on motivation toward PE, autotelic experience, and physical self-concept in secondary school students. Results of the present study showed that students' motivation toward PE was not negatively affected by traditional or intermittent physical fitness-based teaching units. To our knowledge this is the first study that compares the effect of intermittent and traditional physical fitness-based teaching units on students' motivation toward PE. Previous studies in the PE setting have examined the effect of aerobic dance teaching units on students' intrinsic motivation [33]. Unlike in the present study, in both above-mentioned studies students increased their intrinsic motivation after the intervention. This could be due to several reasons such as the content used (i.e., dance) or the use of music during the sessions. According to Hassandra et al. [19], the session content is an important factor that can influence students' motivation toward PE. In this sense, dance has shown to be an entertaining and pleasant way to improve physical fitness among secondary school students [33]. Secondly, the use of music during PE sessions has also been shown to be another important factor that can enhance students' motivation toward PE [34,35].

On the other hand, physical fitness activities have been shown as being effective for achieving good moderate-to-vigorous PA levels during PE sessions [17]. Nevertheless, these traditional physical fitness exercises carried out with high intensity during the whole teaching unit could have produced a lack of interest for the contents taught in both experimental groups. This lack of interest may lead students to perceive PE sessions as less motivating [36]. However, the reason why motivation was not negatively affected after the intervention could be the continuous affective feedback given to the students to keep the intensity during the sessions [37]. Additionally, although the IG worked invasion sports during the second half of the sessions in order to make them more participatory and motivating [24], the worked sports (basketball and soccer) are two of the most common in secondary PE [38]. Therefore, their novelty for students was low and it could have influenced their motivation toward PE [19]. In this sense, González-Cutre and Sicilia [39] suggest that introducing novel contents in the PE sessions can contribute to enhancing students' motivation. Further research should investigate further

into this issue (using alternative sports for instance at the second part of the session) in order to clarify if an intermittent teaching unit could positively affect the motivation toward PE due to the change of content during the sessions in contrast to a traditional physical fitness teaching unit.

Regarding autotelic experience, results of the present study showed that neither traditional nor intermittent physical fitness-based teaching units negatively affected the autotelic experience, but there were no differences between students from the IG and TG. Moreno-Murcia et al. [12] found that students tend to experience less autotelic experience in the PE setting than in other contexts such as non-competitive physical exercises or voluntarily chosen competitive sports, mainly because they have to do something compulsory instead of for pleasure. In this sense, not only did the PE setting suppose a compulsory context for the two groups of students in this research, but also the positive feedback delivered by the teacher during the PE sessions was administered in a similar way to both groups in order to achieve a high level of PA during the PE classes. Another factor that could influence the level of autotelic experienced by students from the IG and TG is their interest for the delivered PE contents [36], unfortunately, this was not measured. Possibly, comparable initial levels of interest and predisposition to action of students in regard to PE delivered contents might influence on the similar autotelic experience registered after the intervention in both groups. Future research studies should control this initial predisposition of students toward a specific content in order to register all possible factors that could affect the outcomes. Also, future research should apply some methodological strategies (e.g., autonomy support, small sided games, or involvement) at the second part of the session with the aim of showing if they could positively affect students' autotelic experience [40].

National standards of PE curriculums also require the promotion of a good psychological status among students [3]. Consequently, improving students' physical self-concept should also be an important target in the PE setting. Unfortunately, the results of this study showed that both traditional and intermittent physical fitness-based teaching units did not improve students' physical self-concept variables. Previous literature shows that the effects of PE-based physical fitness teaching units on physical self-concept are still contradictory [13,20,21]. Similarly, previous studies with short-term physical fitness teaching units did not find any influence on students' physical self-concept [20]. On the contrary, Spruit et al. [21] showed that physical fitness interventions are effective for improving students' physical self-concept. However, these authors pointed out that the effect of physical fitness teaching units on physical self-concept is moderated by the type of PA carried out during the sessions and the focalization of the students' attention to the improvement of the execution of these activities. In this sense, the absence of differences in physical self-concept after both types of teaching units (i.e., traditional and intermittent) could be because students were more focused on the competitive element of the tasks performed (e.g., making more repetitions than my classmates) instead of perceiving their physical improvements in the performed tasks [21]. Additionally, the values in both experimental groups were moderately high from the beginning, which were at least maintained after the intervention, similar to other short-term teaching units carried out in previous studies in the PE context [20]. Regarding the magnitude of the effects of the teaching units on students' physical self-concept, the present study showed similar results (d = 0.08-0.31) to previous studies that have performed a short-term physical fitness teaching unit (d = -0.03-0.24) [20]. Therefore, short-term teaching units, independently of their structure, seem not to have a negative influence on students' physical self-concept. Future interventions should incorporate other strategies such as using semi-structured diaries focused to register the process in which the students are involved, and encouraging self-reflection about their improvement process [13].

The main strength of the present study was that, to our knowledge, this is the first study that compares the effect of the intermittent and traditional PE-based physical fitness teaching units on motivation toward PE, autotelic experience, and physical self-concept in secondary school students. Secondly, because of the nature of the context (i.e., school) and with the objective of keeping the ecological validity, the use of a cluster-randomized controlled trial design (balanced by grade) was more appropriate for the present research objective [25]. Furthermore, the use of this research design with three different groups adds quality to the present study. Apart from allowing for the comparison of the obtained outcomes from the intermittent teaching unit with the CG, it also allows for comparing them with the TG that works the physical fitness improvement objective in a traditional way. Nevertheless, this study also has some limitations that should be acknowledged. Firstly, due to human,

time, and material resource restrictions, a probability and larger sample could not be examined. This fact could limit the generalizability of the obtained outcomes to the particular studied setting and population. Additionally, the study was not balanced by gender. However, when gender had an effect, it was statistically controlled.

In conclusion, results of this study suggest that both intermittent and traditional physical fitness teaching unit seem not to negatively influence students' motivation toward PE and autotelic experience. Moreover, neither of the two types of short-term teaching units applied in the present study improved students' physical self-concept. These findings suggest that regardless of the teaching unit structure applied (i.e., traditional or intermittent), it could be necessary that PE teachers apply specific strategies for improving students' psychological variables. Finally, it would be interesting for future studies to examine the influence of other variables such as students' preferences, perception of competence, and personality which could act as mediators of students' motivation [41-43]. The relation of these variables with the obtained outcomes in the present study and future similar studies, may help PE teachers and the scientific community to understand the complex framework of psychological variables that can affect student's motivation and therefore their learning acquisition process.

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CONFLICT OF INTEREST

The authors declare that they have no competing interest.

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