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Original Article

Fun to engage or engage to have fun? Study of different teaching formats in physical education

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Abstract:
Compulsory physical education classes appear to be the cornerstone for motivating students committing to an active lifestyle. However, an essential condition must be met if physical education (PE) is to fulfill this essential mission: students must have fun. While the recent literature agrees that enjoyment is a lever of physical activity, it differs on how to define the concept: declared motivation or embodied enjoyment, and therefore how to measure it. Considering with Booth (2009) enjoyment as an *exceedingly complex concept*, we will envision it here in terms of valence (hedonic tone) and activation (physical activity).So, what pedagogical conditions must be in place for students to be motivated and more physically engaged in sport at school?
The purpose of this study was to estimate the effect of practice formats on the enjoyment experienced and the amount of physical activity of physical education students. The participants included 44 students (Mage = 13.92, SD = 2.35, 64% male, range 11-19) enrolled in three badminton tasks. We designed each task by a specific emotional focus.In the first type of task, the feeling experienced is domination or frustration because the main goal is individual victory. In the second one, designed to promote meeting, the type of emotion experienced is conviviality and cooperation because the main goal is a collective victory. In the third type of task, designed to promote personal challenge, the type of emotion experienced is transcendence.
We measured students' engagement in terms of enjoyment stated (using an approved ten-item scale) and PA level using Actigraph GT3X accelerometers. Results indicated no effect of task design on the pupils' enjoyment but showed a significant difference in terms of P.A. This confirmed that the measurement of pleasure is complex. Indeed, students (especially young males)movedmore in the meeting task than in the challenge task ($p < .05$., ES = .43). From a PA promotion perspective in PE, meeting tasks appeared to be a better way of testing the quantity of movement than challenge tasks in badminton.
Keywords:enjoyment, physical activity, motivation, exercise, pedagogy, gender

Introduction

In view of the current problems of inactivity in Western societies(Guthold, Stevens, Riley & Bull, 2018; Kubieva et al., 2019).There is an emerging focus on health education in Physical Education (PE)by promoting an active and empowered lifestyle (Tappe&Burgeson, 2004). Compulsory physical education classes in many school curricula appear to be the cornerstone for increasing PA among young people and motivating themto take responsibility for their health and well-being by committing to a sustainable and active lifestyle (Bailey, 2006; Hynynen et al., 2016). However, if certain pedagogical and didactic conditions are not established, physical education classes may fail in their main mission by not sufficiently encouraging student activity (Coe,Pivarnik, Womack, Reeves & Malina 2006).This phenomenon is especially important among students who are not interested in sports, notably girls (Garrett, 2004), or in the older age groups of secondary education (Dudley, Okely, Pearson, Caputi& Cotton, 2013).

To circumvent this, French curricula emphasize the importance of enjoyment in PE classes for all students in order to engage them in practices that are beneficial to health. In line with the hedonic framework of Ekkekakis, Hargreaves& Parfitt(2013), the challenge is then to propose practice formats that allow students to experience pleasure in order toengage with intensity in PE classes.

Enjoyment as a lever of PAEnjoyment has traditionally not been at the forefront in schools (Booth, 2009) because fun and serious activities appear to be contradictory with regard to the challenge of education (Lentillon-Kaestner&Patelli, 2016; Pringle, 2010). Although many sports teachers recognized the educative value of

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enjoyment in PE (Dishman, 1990),the main grounds for PE were based on instrumental and developmental goals (O'Connor,Alfrey& Payne, 2012).

However, several reports have highlighted the exercise-affect link and showed that enjoyment is one of the best predictors for promotingPA outside the school (Allender,Cowburn& Foster2006; Dishman, 1990; Ekkekakiset al. 2013). In a meta-analysis, Rhodes &Kates (2015) showed a significant correlation between the perception of enjoyment during practice andthe likelihood of sustainable PA. In line with the previous studies, a new health paradigm in PE has emerged:schools' programs for increasing PAargues that a high-quality PE curriculum based on games and enjoyable activities (Kim, 2017)is a key variable in promoting lifelong participation in sports (Lee & Solomon, 2007).

Measurement of enjoyable PA: Declared and/or embodied pleasure?

"Enjoyment is an exceedingly complex concept" (Booth, 2009, p. 147) withvarious definitions grounded in different theoretical backgrounds (Booth, 2009; Pringle, 2010).

Traditionally, the enjoyment derived from an activity unit in PE can be defined as a pleasant emotional state conveyed by a positive emotional response declared after PA. It can be measured by questionnairesor scale (Delignières& Perez, 1998; Lentillon-Kaestner&Patelli, 2016).

However, some authors consider the level of enjoyment measuredafter the action (*a posteriori*) asinsufficient to apprehend the complexity of engagement (Ekkekakis et al.2013; Récopé, Lièvre & Rix-Lièvre,2010)because the answers are given outside the context of practice. According to Récopéand collaborators (2010), enjoyment expressed by an actor refers to feelings. But unlike feelings, emotional states often develop in no relation consciousness and are incorporated into the action that makes them appear and disappear and can therefore be referred to as "embodied.".Thus, authors make distinction between motivation expressed outside the context of action (the motive) and actual mobilization in situations (referring to a moving cause inside the action: the mobile). In sport the concept of mobile is called sensibility (Récopé et al., 2010) or conatus (Vanhelst,Béghin, Fardy, Bui-Xuan&Mikulovic,2012),which is "the unconscious faculty of tending towards or desiring and consequently feeling pleasure and pain" (Spinoza, 1677, cited by Récopé et al., 2010, p.53). Ryan and Deci's work on motivation focused on such a moving, mobilizing force imposing itself on the motivated person: "To be motivated means to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as amotivated, whereas someone who is energized or activated toward an end is considered motivated" (Ryan&Deci, 2000, p.54). Thus,motivation is manifested through behaviour that demonstrates exertion in order to accomplish a goal of the behaviour. In other words, motivation is inferred by the extent to which an individual is engaged in an activity or task.

In the study of interest(Chen& Wang 2017), in which engagement is considered as a stronger indicator of motivation than other measures, the previous distinction between motive and mobile is explored.Authors distinguish motivation from individual interest,with the latter being characterized by repeated, voluntary, independent, and conscious engagement in an activity. Similarly,motivationdiffers from situational interest which can be characterized by spontaneous yet intensive engagement (Renninger&Hidi, 2016). In PE studies using the frameworks of interest, engagement is often operationalized as the student's PA levels measured using accelerometers (Ding,Sun& Chen 2013).

Finally, to understand complexity of engagement, Ekkekakis&Petruzello (2002),using the circumplex model,pointed to the importance of distinguishing between activation, on the one hand, and positivity-negativity effect on the other.For authors, measuring pleasure affective valence (or hedonic tone) is not sufficient, activation is very important too. Measurement of the movement energy can be a predictor of this activation factor (Zhang, Song, Cui, Liu & Zhu, 2016).

In line with the aforementioned authors whohighlight differences between motives (knowingly engagement, expressed by words) and mobile (spontaneous engagement, expressed by body),engagementcan be conveyed in two manners in this study: (a) by increased levels of affective valence (measured with scale),(b) by increasedlevels of physical movement (measured by an accelerometer) in a game task without external constraints imposed by the teacher (feedback).

Effects on enjoyment experienced in PE

Enjoymenttaken from PE can be influenced by students' characteristics.

Studies have highlighted the impact of gender on the level of enjoyment in PE. Most of them showed that (a) male students appreciated PE more than females (Caroll&Loumidis, 2001); (b) PE disappointed female students (Garrett, 2004) with an overall decline in enjoyment during the first two years of secondary school compared with males (Dudleyet al., 2013); (c) depending on their gender, students had different expectations of PE (Azzarito&Solmon, 2009), which partly determines their involvement. Boys tend torate highly sports that involve more physical confrontation and competition, while girlstend to value sociability and commitment (Scraton, 1990).

These results have to be discussed in light of recent research on Situational Interest which indicated that gender was not a factor in determining students' motivational responses to situational interest (Chen & Darst,

2001; Shen,Chen, Tolley&Scrabis, 2003).Age also had an impact on enjoyment in PE (Dudley et al., 2013). In the adult population, it is well established that PA participation decreases significantly as age increases (Guthold et al., 2018) and motivation forPA may also vary with age: for example, children enjoy in games and fun, teenagers exhibit greater concern for interpersonal attraction outcomes, whereas older individuals exhibit greater concern for health outcomes (Molanorouzi, Khoo & Morris, 2015). A student's physical ability may also affect the enjoyment taken from PE (Caroll&Loumidis, 2001; Fairclough, 2003). Chen & Darst (2001) found that skill level was a factor in determining students' motivational responses to situational interest: students with higher levels of skill ability were more likely to be triggered by situational interest in content that matched their skill level.

Enjoyment taken from PE can also be influenced by situational factors.

In a recent study, Lentillon-Kaestner&Patelli (2016)indicatedthat the enjoyment experienced in PE units appears to bemore related to instructional factors (grouping forms) than student characteristics. Regardless of the students' gender or ability, authors demonstrated that alternating between ability-based groups and mixed-ability groups had a positive effect on the enjoyment experienced.

In addition, other authors highlighted the impact of learning task design on student involvement in PE (Singh & Yogesh, 2011). Chen and Darst's study on a basketball unit(2001) shows that high cognitive and physical demands are key factors in encouraging student involvement when designing learning tasks. Recently, Roure and Pasco's study (2018) compared two learning tasks in a badminton unit in PE: "banco task" and "three in a row task". They demonstrated that the first task, which is based on "instant enjoyment" and "exploration intention," generates ahigher overall interest score in comparison to the other, which is based on "novelty" and "challenge".

This result suggests that the typology of practices could have an impact on the level of enjoyment in PE.Therefore, in PE, classifications exist to categorize physical activities and sports by modifying their traditional designsin order to generate positive emotions (Jeu, 1977). Derived from theoretical framework of emotion in sport (Jeu, 1977), the classification byGagnaire&Lavie (2010) defines three forms of task design that elicit various emotions: the competition, which confronts students with a one-on-one competition, inducing emotions such as exultation, or, on the other hand, disappointment; the meeting, where friendliness prevails around a common project; the challenge, inducing a feeling of pushing one's own limits or exceeding a personal best. To our knowledge, the aforementioned classifications have not been the subject of scientific studies.

Although some authors have highlightedthe effects of student or teaching characteristics on the stated enjoyment of PE (Delignières& Perez, 1998; Dudley et al., 2013; Lentillon-Kaestner&Patelli, 2016), (a) few of them (Roure& Pasco, 2018) have focused on the effect of task design on the stated enjoyment of PE. (b) Even fewerhavemeasured concomitantly enjoyment stated after the task and the PA during the task itself.

The purpose of this study was to estimate the effect of task design on the enjoyment experienced and the amount of physical activity of physical education students.It was hypothesized that: (a) the meeting task based on conviviality would generate higher scores for students, particularly female students, in comparison to the other tasks; (b) depending on the student's level of ability, there was a specific type of task that generate higher scores.

Material & Method

Participants

Forty-four students (16 females, 28 males, aged 11-19 years (mean= 13.92, SD= 2.35) fromten PE classes taken from six middle schools and four highschools located in the north of France participated in the study. The ten teachers involved in this study includedsevenmales and three females, who are full-time certified PE teachers in their first year of teaching.

Five students per class deemed to belong to different levels of abilityin badminton according to conative stage levels(Dieu,Vanhelst, Bui-Xuân, Blondeau, Fardy&Mikulovic, 2014) were informed of the option to participate in this study. Volunteers were given an information letter and a consent form.

The protocol was as follows: (a) participate in a badminton unit (minimum of three sequences made up of three types of task with different emotional focuses, without missing school); (b) wear an actimetric belt equipped with a GT3X ActiGraph; (c) fill out an approved French-language scale of ten items just after the sequence. Permission to conduct the study was granted by the ethical board of the university. Students' parents were informed about the scope of the study and consent was obtained from all of them.

Design of badminton tasks

PE teachers were both teachers and researchers. They designed the type of taskon the basis of the framework of emotion in sport (Gagnaire&Lavie, 2010). To avoid bias and limit any influence on the design and presentation of the three tasks, the supervisor researcher and the ten PE teachers worked together with the sole aim of developing motivating tasks for their students, regardless of their emotional orientation.

The first type of task, referred to throughout the manuscript as the"Montante–descendante" is often used in the French PE curriculum. During this task, students were placed in a singles match and played an 11-pointgame. The goal of the task, designed to promote competition, was to win matches against different opponentsso as to reach the first court (the best) and avoid the last one (the worst). For example, the student who wins the match at

court number 3 goes up to court number 2, and the student who loses the match goes down to court number 4, etc. In this competitive task, the feeling experienced is superiority or frustration because the main goal is individual victory. At the end of this task, there is a ranking of all players in the class: three ability-based groups were then established: highly skilled players, intermediate players, and less skilled players.

The second type of task, referred throughout the manuscript as the "Italian rotation",was actually less frequently used in the French PE curriculum. In this task, students had the choice to set groups of one highly skilled player, one intermediate player, and one lessskilled player, which ledto heterogeneous teams of three players. The composition of each team ensures that each player had the chance to win the match (best player of team 1 plays against best player of team 2, then intermediates play together and finally, less skilled players play together).Students were placed in a single match and played a cumulative score of 15 points one after the other (for example, score of the first match was 10-5, second match: 6-9, last match: 13-2).The goal of the task, designed to promote meeting, was to addthe score of the three players into a final team score. In this collective task, the type of emotion experienced is conviviality and cooperation because the main goal is a collective victory. In the third type of task, referred throughout as"Challenge", lessskilled students could challenge a higher-ranked player in asingles 11-pointgame started with a positive handicap. The handicap depended on the level of difference between the opponents. If the challenge was between players who have a single level of difference, the handicap is 4 points; if there was two levels of difference, the handicap is 7 points (e.g., if a lessskilled player challenges an intermediate player,the game starts with a score of 4-0 to the less skilled player; if a lessskilled player challenges a player from the best group, the game starts with a score of 7-0 to the less skilled player). The goal of the task, designed to promote personal challenge, was to improve. In this task, the type of emotion experienced is transcendence.

Standardization of interventions

Prior to conducting the study, training sessions were organized for the ten teachers.

First, videos of students playing badminton were used to trainteachersto classify students in the fiveconative levels according to the criteria proposed byDieu et al. (2014): if the macroscopic indicators were identified, the individual was classified at the corresponding level.They were evaluated after the training session and showed the abilityto recognize the first three conative stages (stages 4 and 5 were rare in school) with an error margin of 5%. Furthermore, teachers were not alone in classifying their students. All participants of the study were video recorded and two analysts (the teacher and an expert) classified the players according to the conative stages individually. When the analysts disagreed, the video was viewed again jointly. If a consensus could be reached, the participant was classified according to the conative level. If not, the participant was removed from the analysis. Secondly, to ensure content accuracy, teachers' contributions were evaluated with the same task benchmarks: student goals, activity description, material, duration of sequences, student organization. To avoid any influence of teacher activity on enjoyment experienced by students, teachers were forbidden from providing feedback (positive or corrective) to participating students during the task.

Data measurement

Ability to perform in sport activity (conative stages)

To "classify" study participants, we used the conative curriculum, which has been applied to the practice of sports (Vanhelst,Béghin, Fardy, Bui-Xuan&Mikulovic, 2012) and, more recently, specifically to badminton (Dieu et al., 2014).The participants were observed and classified into a conative stage: (1) structural, (2) functional, (3) technical, (4) contextual, and (5) expertise, according to the criteria given in Table I.

Table I. Description of conative classification criteria for badminton player according to Dieu et al., 2014

Conative Stage	Behaviour Description	Classifying Indicators
Stage 1 Criterion: Structural Conation = Returning the shuttle- cock	The player is the returner. He/she will return the shuttlecock to the other side of the net regardless of where it lands. The shuttlecock is seen as an obstacle.	Long sending central axis. No status differentiation between opponent and defender. Only concern: to send shuttlecock the other side of the net.
Stage 2 Criterion: Functional Conation = Directing the shuttlecock	The player is a dispatcher, seeking for free space to send the shuttlecock.	Trajectory variations. It forces the opponent to run after the shuttlecock.
Stage 3 Criterion: Technical Conation = Making a winning stroke	Technical application. The player seeks to find himself in a favourable position for smashing the shuttlecock but does not re-position him/herself after hitting.	Smash or drop-in attack. Pause in re-positioning to observe the result of action.
Stage 4 Criterion: Contextual Conation = Tactical sequence	Technical-tactical sequence. The player develops tactical plans, strategies of attack and defence that combines the search for free space and opportunities to spike the shuttlecock powerfully.	Re-positioning directed after hitting (sequence). Playing in interception.
Stage 5 Criterion: Expertise Conation = Force your game on the opponent	In addition, players at this stage are capable of adapting their game-power balance and the playing style of their opponent.	Mobilises his/her own structure and techniques according to his/her own playing style.

Measuring engagement

Enjoyment stated. —The level of enjoyment was assessed at the end of each activity sequence using an approved French-languagescale of ten items rated on a six-point Likert scale from "strongly disagree" (1) to "strongly agree (6) (Delignières& Perez, 1998). This one-dimensional questionnaire was validated and adapted from the English version of the "PA Enjoyment Scale" (PACES) (Kendzierski& DeCarlo, 1991) and recently used in the field of research in education and sport (Lentillon-Kaestner&Patelli, 2016).

PA in situ. —Recent studies on engagement used accelerometers(Dinget al., 2013) because they are non-invasive.In our study, each participant wore an accelerometer while playing one set of badminton (an 11- point "tie breaker" without overtime in the"Montante-descendante" and "Challenge"task, a 15-point "cumulated score" in the"Italian rotation" task). The only instruction given was to play "like it is a match," while wearing an elastic belt to which a GT3X had been attached so that it would sit on the lower back, at the spine, and would be in contact with the skin. We used accelerometer technology to quantify the amount of PA. The quantity of PA is calculated in terms of vector magnitude (VM), which is the square root of the sum of the squares of each axis (X, Y and Z) of data (counts). Results are expressed in "counts."

Data collection

This study took place during the students' regularly scheduled PE class, which is held once a week in the French school system. The badminton unit was made up of at least six lessons. In the first two, students were observed and classified in conative classification stages and participants became familiar with wearing the actimetric belt. After this evaluationphase, students participated with a one-week interval between tasks. They started with the "Montante-descendante" task during the third lesson, followed by the "Italian rotation" task during the fourth lesson, and finally, they finished with the "Challenge" task during the fifth lesson.

The amount of PA (counts) was collected by the accelerometers.The results of all matches were recorded to distinguish between balanced matches and unbalanced matches (when the loser's score does not exceed half the points needed to win the match).Immediately after practicing each task, students responded to the French SI scale (Delignièresand Perez, 1998). To minimize students' tendency to give socially desirable responses, all students (even if only five participants wore accelerometers) were encouraged to answer honestly and were assured that their responses would remain anonymous and confidential.

Statistical analysis

Qualitative variables (sex,age, conative level) were described in terms of frequency and percentage. Numeric variables: enjoyment score (EnjS) and PA were described in terms of mean and standard deviation. The normality and sphericityof the data were verified by the Shapiro-Wilk's andMauchley'stests.

The effectof the type of task on PA and ES was measured using a mixed linear model including PA or EnjS as a variable to explain, the type of task, ability levels, age, sex andbalanced/unbalanced match as explanatory variables (fixed effect), the student and the interaction term: student * type of task as random effects.

These random effects make it possible to consider the correlation between each student's matches and between matches in the same type of task played by the same student. Post-hoc comparisons between the type of task were performed by correcting the risk of type I error using the Bonferroni method. The influence of the balance of power during the match (balanced, unbalanced) on the previous associations was evaluated by adding the balance of power as a covariate inthe models described above.Bilateral tests were performed with a significance level of 5%. Statistical analyses were performed using SAS software (SAS Institute version 9.4). Magnitudes of all the significant differences were examined using effect size (ES) calculations.

Results

Pre-intervention data collected during the first lesson revealed that the participants were categorized in the three first stages of the conative model:21 were novices (first conative stage), 16 were at an intermediate level (second stage) and 7 were more skilled (third conative stage). Results showed no significant effect of task design on the level of enjoyment stated in the badminton unit.

A significant effect of task design was showed for the PAwith random effect of age, gender and ability level (Table II). In the meeting task,students reported a higher PA level than in the challenge task (105.8 ± 33.5 counts *vs*. 92.5 ± 28.4 counts, for meeting and challenge tasks respectively, $p < .05$, ES = .43). Balance of power variation (balanced, unbalanced) had no impact on this result.

Student age had no significant effect on the enjoyment stated in any of the tasks (Table II), but a significant effect was identified for the students of middle-school age (age < 16) in the meeting task with a reported higher PA level than in the challenge task (100.0 ± 35.2 counts vs. 84.4 ± 27.8 counts, for meeting and challenge tasks respectively, $p < .05$, ES = .50). In highschool (age > 16), no significant difference was observed in PA between competition, meeting or challenge task.There was no significant effect of gender on the level of enjoyment stated in any the tasks, but a significant effect was identified for PA. Male students in the meetingtask and in the competition task reported significantlyhigher PA levels than in the challenge task (91.8 ± 23.7 counts/sec in challenge taskvs. 108.1 ± 39.7 counts/sec ($p < .05$, ES = - .02) and 108.7 ± 31.2 counts/sec ($p < .05$, ES = .62), for competition and meeting tasks respectively. With regard to female students,there is no significant difference observed in PAaccording to task design. There was no significant effect of ability level on the enjoyment stated

in any type of task. There was no significant effect of ability level on the PA in any of the task types for players belonging to the structural stage (level 1) and the functional stage (level 2). A significant effect was identified for the PA of the students belonging to the technical stage (high ability level). In the competition task, they reported a higher PA level than in the challenge task (141.4 ± 44.3 counts vs.93.9 ± 24.3 counts/sec, for the competition and challenge tasks respectively, $p < .05$, ES = .67).

Table II. Impact of task design on PA (P.A) and enjoyment stated (EnjS)

	Type of task			ANOVA	Effect Size *(ES)*		
	Competition	Meeting	Challenge	*p-value*	Competition vs Meeting	Competition vs Challenge	Challenge vs Meeting
All participants							
PA (count/sec)	102.8±37.2	105.8 ± 33.5	92.5 ± 28.4 [a]	**0.012**	-0,08	-0,09	0,43
EnjS	5.3 ± 1.2	5.3 ± 1.1	5.2 ± 1.1	0.74	0,00	0,00	0,09
<16 years							
PA	95.1 ± 34.8	100.0 ± 35.2	84.4 ± 27.8 [a]	**0.014**	-0,14	-0,16	0,50
EnjS	5.4 ± 1.3	5.2 ± 1.2	5.1 ± 1.2	0.54	0,16	0,16	0,08
≥16 years							
PA	117.2 ± 37.5	119.4 ± 24.5	107.4 ± 22.8	0.43	-0,06	-0,07	0,53
EnjS	5.3 ± 0.9	5.4 ± 1.0	5.5 ± 1.0	0.59	-0,11	-0,11	-0,10
Girls							
PA	93.2 ± 30.0	100.7 ± 36.8	94.2 ± 37.2	0.47	-0,22	-0,22	0,18
EnjS	5.4 ± 1.1	5.4 ± 1.1	5.1 ± 1.2	0.50	0,00	0,00	0,26
Boys							
PA	108.1 ± 39.7	108.7 ± 31.2	91.8 ± 23.7 [a,b]	**0.004**	-0,02	-0,02	0,62
EnjS	5.4 ± 1.2	5.2 ± 1.2	5.3 ± 1.1	0.50	0,17	0,17	-0,09
Level 1 (structural)							
PA	82.1 ± 30.1	91.6 ± 36.8	84.8 ± 29.7	0.11	-0,28	-0,32	0,20
EnjS	5.3 ± 1.4	5.4 ± 1.1	5.1 ± 1.4	0.82	-0,08	-0,07	0,24
Level 2 (Functional)							
PA	109.2 ± 22.9	114.9 ± 24.2	101.2 ± 25.9	0.13	-0,24	-0,23	0,55
EnjS	5.7 ± 0.7	5.0 ± 1.2	5.4 ± 1.0	0.15	0,74	0,82	-0,36
Level 3 (Technical)							
PA	141.4 ± 44.3	122.3 ± 28.5	93.9 ± 24.3 [b]	**0.009**	0,67	0,79	1,08
EnjS	4.9 ± 1.5	5.5 ± 1.1	5.2 ± 1.1	0.052	-0,46	-0,46	0,27

[a]significantdifference between the meeting and the challenge tasks, $p<0.05$
[b]significant difference between the competition and the challenge tasks, $p<0.05$

Discussion

The purpose of this study was to estimate the effects of practice formats. on the students' enjoyment.in a PE badminton unit.In accordance with previous studies, two assumptions were made: (a) the meeting task based on conviviality would generate higher PA and EnjS scores in comparison with the other tasks, especially forfemale students; (b) depending on thestudent's ability level, there was a specific type of task that generated higher PA and EnjS scores.Firstly, our results demonstrated that all previous variables had no influence on the enjoyment stated (EnjS) but influenced the student PA.

Influence of task design on the amount of PA

Results showed a significant effect of task designs on the amount of PA between the meeting and the challenge tasks. The first hypothesis is partially valid because the meeting task based on conviviality did not generate higher PA scores in comparison with the competition task for students. We observed that in the challenge task, students moved less than in the meeting task. The results were slightly different to the study by Gagnaire&Lavie (2010) that argues: "all students, regardless of age and gender, expected friendliness, play, and the sharing of emotions in and around actions, and competition was a secondary expectation."

Moreover, the lowest amount of PA in the challenge task could be congruent with the results of Roure and Pasco regarding the theoretical model of Situational Interest (Roure& Pasco, 2018): "challenge is the only dimension of situational interest that relates negatively to instant enjoyment" (2018, p.32). Since challenge is defined as the level of difficulty relative to one's ability, the negative relationship between challenge and enjoyment has to be interpreted with regard to students' perception of ability or competence. In the challenge task, students had the choice to compete against an opponent in the best group or the intermediate group, according to their perception of competence. Children experience enjoyment and motivation when a task they are involved in is comparable to their perceived level of ability (Fairclough, 2003), so, the challenges in this study were likely to sometimes not be optimal. It could be possible that some students perceived the challenge

task as too challenging, resulting in a decline of their engagement. Nevertheless, our results suggest that this perceived ability effect fades with age: the oldest student's (> 16 years) activity did not decline in the challenge task (Table I).

The second part of hypothesis is invalidated by the results: the meeting task based on conviviality did not generate higher PAscores for female students in comparison to the other tasks. These results are slightly different to studies that showed that depending on their gender, students had different expectations of PE (Azzarito&Solmon, 2009;Moral-Garcia et al., 2019), especially in badminton (Bebetsos& Antoniou, 2012), which partly determines their involvement. Boys tended to praise sports that involve more physical confrontation and competition, such as soccer and rugby, while girls tended to value sociability and engagement into games and sport activities (Scraton, 1990). Recently, a study by Soares, Antunes&Van den Tillaar (2013) on a total of 722 boys and 595 girls showed very positive difference in scores with regard to the motives: "to be a sports star or sports champion," "to be popular," and "I like competition" for boys than girls. Girls stated a preference for friendship, fitness, and sociability. The authors concluded that fun, enjoy playing, and making friends should be objectives to focus on in school sports in order to increase girls' motivation during PE.

Our results varied slightly in the field of motivation and gender: if it is true that boys and girls have different motivations and needs for sports, our results were not in line with the stereotypical idea that girls tend to favor physical activities that promote social experiences, rather than competition or victory. Although it is traditionally expected that girls will prefer the meeting task and boys will prefer the competition task, some boys participating in the study also enjoyed the meeting task and, likewise, some girls also enjoyed the competition task.

Lastly, is there a specific type of task that generates a higher PA score, depending on the student's ability level? This hypothesis is not valid, according to our results: with regard to students at stages 1 (novice) and 2 (intermediate), there is no significant difference observed in PA between the competition, meeting, or challenge tasks. For students at stage 3, we noted that they reported a higher PA level in the competition task than in the challenge task. Therefore, in line with our previous discussion, this result can be explained by a non-optimal challenge that decrease the engagement of the most skilled students(Caroll&Loumidis, 2001; Chen & Darst, 2001;Fairclough, 2003). In the challenge task, students in the best ability group were constrained to accept the challenges proposed by students in the less skilled group and it may therefore be the case that some students perceived the task as not sufficiently challenging, resulting in a lower PA score.

Difficulties in measuring engagement in PE

In the second part of this discussion we would like to point out that our study reinforced the idea that measuring engagement in sport is complex (Chen & Wang 2017, Ekkekakis&Petruzello, 2002).

Our resultsshowed that students could declare*a posteriori*the same enjoyment in doing three types of task while their PAincreased or decreased significantly*in situ*during one of them. These results were in agreement with the theoretical frameworks of Récopé et al.(2010)that highlighted the distinction between motives (conscious engagement, expressed after the action) and mobile (spontaneous engagement, expressed by body during the action). Considering being motivated *a posteriori* is not to be mobilized *in situ*, we had to distinguish the actors' "declared" motivations from what actually mobilizes them in the situation.

As such, enjoyment scales (Lentillon-Kaestner&Patelli, 2016) or total interest score in interest scales (Reiniger&Hidi, 2016) had to be used with caution when measuring enjoyment experienced in PE classes. Those toolsare likelyinsufficient for understanding the complexity of involvement in PE, forthe followingreasons: Interest is multidimensional (Garn, 2017), short-lived and context specific (Reiniger&Hidi, 2016) soit cannot only be measured *a posteriori,* but instead during the action.

Furthermore, recent theoretical frameworkson situational interest (SI)also highlighted this point. For authors, involvement in sport is assumed to be transitory, environmentally activated, and context-specific: "It is a kind of spontaneous interest that appears to fade as rapidly as it emerges and is almost always place-specific. Triggered by situational conditions or information, situational interest elicits and, at times, maintains focused attention and a positive affective reaction to the content" (Roure& Pasco, 2018, p.24).According to Chen and Wang (2017), triggered situational interest (first of the four phases of the Hidi&Renninger Model of Interest Development), usually does not last. The psychological state is in the "fleeting" mode, which means when the stimulus disappears, the interest may go away, although the positive emotions (enjoyment, liking) may continue.

Thus, situational interest scores measured after students experienced each task could be biased.Understandinginvolvement in PE, involvesprobably measuring not just one, but two aspects: valence and activation (Ekkekakis&Petruzello, 2002), which can pertain to the energy of movement (Dinget al., 2013).

Limitations,future perspectives and practical implications

First, the chronological order of presentation of the tasks was always the same. Similar results may not have been recorded if we had started with the "challenge"task instead of the "montantedescendante" task.Second, the emotion-oriented design of the three tasks used in this research was not exclusive. In the meeting task, designed to promote conviviality and cooperation, the goal was finally to win the match. Therefore, there is a competitive element, even if the task was designed to add the scores of the three players into a final team score. Moreover, regardless of the task design, students could redefine the task as a way of viewing their goals, judging

theirability, and subjectively defining success in the sport domain(Fairclough, 2003). For example, in the same task,one student may be concerned about competition because he/she was focused on ego involvement, whereas another student may have redefined the task as a personal challenge, because he/shewas focused on by task involvement.Third, even if we wanted to neutralize the impact of the balance of power in our results, the definition of this variable could be discussed because it is only quantitative. We decided to exclude from the sample all matches where the loser's score did not exceed half the score that won the match. Our future research could benefit for a more qualitative assessment of the balance of power using videotaped analysis.Fourth, students' perceived physical ability was not measured in this study. This variable may also affect the enjoyment experienced in PE (Caroll&Loumidis, 2001; Fairclough, 2003). Fifth, conclusions concerning differences between boys and girls should be taken with caution because we had not distinguished physiological and psychological processes, such as gender and gender orientation.Finally, using the amount of PA as the sole criterion for enjoyment experienced was as objectionable as declarative measures. In fact, even if the task is a game task designed without external constraints (teachers' feedback), there is no guarantee that the student will move solely for intrinsic reasons related to his/herenjoyment of the action. Therefore, a combined method including quantitative P.A measurement (by accelerometry) and a more qualitative enjoyment declaration measurement, such as a multi-dimensional situationalinterest scale (Chen & Darst, 2001; Roure& Pasco, 2018) could be relevant in future research.

Although it presents some limitations, this study leads to practical implications for physical education classes in general and specifically forteaching badminton.With regard to the importance of enjoymenton the development of students' PA habits, this study encourages teachersto be aware of the impact of task design on their students' enjoyment with a view to increase the body movement quantity in PE.First, the stereotypical idea that girls tend to favour physical activities that promote social experiences, rather than competition or victory was discussed here. Introducing girl-only PE classes based on the meeting task would be counter-productive because some girls also enjoyed the competition task, demonstrating that socializing is not the focus of their involvement in sport. Second, in terms of managing varying ability levels in the class, applying score handicaps to restore equality between boys and girls does not work because it does not increase girls' body-movement quantity and, on the other hand, it reduces boys' body-movement quantity (equality from below).

Conclusion

Badminton is relevant in PE because it is a multi-format sport (singles, doubles, mixed) and unlike soccer, it is a little-known sport that can be modified in many ways without affecting the interest of students, who have only a few references of the sport. Testing alternative means of competing and creating different meeting tasks appear to be a better solution than the challenge task in badminton for, in the sametime,maintaining student motivation and physical engagement. This would subsequently be a benefit to the public, due to the aforementioned increasing sedentary lifestyle.

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Conflicts of interest :
No potential conflict of interest was reported by the authors. The present study complies with the current laws of the country in which it was performed.

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