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# Perceived teachers' behavior and students' engagement in physical education: the mediating role of basic psychological needs and self-determined motivation

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## ABSTRACT

**Background:** Although several studies that rely on self-determination theory have shown the positive interrelations among perceived need supportive learning environment, needs satisfaction, quality of motivation, and desired outcomes in the context of physical education, only few studies have tested so far the full sequence of relations within a single integrated model.

**Purpose:** The main aim of this study was to test whether indeed needs satisfaction and in turn quality of motivation mediate the relations of need supportive learning environment to physical activity engagement and intentions.

**Method:** Participants were 1120 Spanish students (49.9% males;  $M_{age} = 11.70$  years;  $SD = 1.63$ ; range = 10–17 years) from 30 classes out of 13 primary and secondary schools.

**Results:** The multilevel path model showed a positive relation of perceived need-supportive teaching to physical activity engagement and intentions by means of needs satisfaction and autonomous motivation and a negative relation of perceived need-thwarting teaching to engagement and intentions by means of needs frustration and amotivation. Although controlled motivation was found to associate with need frustration and need-thwarting teaching it was not associated with engagement and intentions.

**Conclusion:** the present findings suggest that the type of teaching style employed by the teachers is decisive to achieve positive consequences in physical education students.

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## KEYWORDS

Behavioral intentions; physical education; self-determination theory; teaching style; basics psychological needs

## Introduction

Physical education (PE) teachers and the teaching style they use has been associated with students' motivation and engagement in the PE settings (e.g. De Meyer et al. 2016). Indeed, many scholars have shown PE teachers' teaching style can largely shape a supportive motivational climate (e.g. see Haerens et al. 2015), which seems to predict students' basic psychological needs satisfaction (Haerens et al. 2015), quality of motivation (Behzadnia et al. 2018), and physical activity intentions and engagement (Jang, Kim, and Reeve 2016; Sánchez-Oliva et al. 2014). These findings are in full accordance with Self-Determination Theory (SDT; Ryan and Deci 2017) which postulates that need supportive environments predict desired motivational outcomes because they satisfy people's basic psychological

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needs which in turn enhance quality of motivation. However, only few studies (e.g. Ntoumanis 2005) have investigated in a single integrated model the sequence of autonomy, competence and relatedness supporting and thwarting instructional behaviors, the respective need satisfaction and frustration, and quality of motivation. Testing this pattern of relations in one integrated model would provide evidence that the two antecedents (i.e. need supportive and need thwarting environments) and the two sets of mediating mechanisms (i.e. needs satisfaction and frustration and quality of motivation) are needed to explain ensuing correlates (e.g. intentions and behavioral engagement). In this study we aimed to shed light on this issue by investigating, how perceived need supportive (i.e. teacher promotion of students' basic psychological needs) and need thwarting (i.e. teacher controlling of students' basic psychological needs) PE teaching behaviors (after taking out the shared variance of these perceptions due to PE classroom membership) predict students' engagement and intentions by means of needs-basic experiences and in turn by means of students' self-determined motivation.

### ***Motivational processes***

According to SDT (Ryan and Deci 2000) all people have three essential, inherent psychological needs: Research has shown that satisfaction of the need for autonomy (which refers to one's desire to feel ownership of one's acts), competence (which reflects one's preference to feel efficacious when performing an activity), and relatedness (which corresponds to one's inclination to feel accepted by others and being integrated within a group) promotes optimal functioning. Accordingly, frustration of the needs for autonomy (i.e. feeling of pressure to do an activity in a certain way), competence (i.e. sense of inefficacy), and relatedness (i.e. feeling not-integrated into a group) has been found to relate to maladjustment (Bartholomew et al. 2018).

Further, the more students satisfy their needs, the higher is their quality of motivation (Haerens et al. 2015). Specifically, high quality of motivation is reflected through autonomous motivation which is defined by more volitional reasons for putting effort into the lesson (De Meyer et al. 2016), either because they endorse the value of an activity (identified regulation) or because they find the activity enjoyable and challenging (intrinsic motivation). Conversely, low quality of motivation, is reflected through controlled motivation which people exhibit either when they participate in an activity to avoid feelings of guilt and shame or to attain contingent self-worth, such as pride (introjected regulation), or when they participate to get external contingencies, such as rewards, or to avoid punishments (external regulation). Finally, amotivation represents the absence of either autonomous or controlled motivation (Ryan and Deci 2017). Research has indicated that students' quality of motivation, as reflected through autonomous motivation, controlled motivation, and amotivation, predicts PE engagement, physical activity, and persistence (Ntoumanis and Standage 2009; Chatzisarantis and Hagger 2009). More specifically, Sánchez-Oliva et al. (2014) obtained that the more self-determined motivations predicted the enjoyment, the importance of PE, and in turn, the intention to be physically active out of school. Also, Gairns, Whipp, and Jackson (2015) showed that autonomous motivation was positively related to behavioral engagement. In the same line, Vasconcellos et al. (2019) found a positive relation between autonomous motivation and students' adaptive outcomes (i.e. enjoyment, intentions, and leisure-time physical activity). This meta-analysis divided the controlled motivation in introjected and external regulations, obtaining a negative relationship between introjected regulation and these adaptive outcomes, and a positive association of external regulation with adaptive outcomes. In contrast, Behzadnia and Ryan (2018) found that unlike external regulation, introjected regulation related positively to well-being indicators and intrinsic life goals in PE. Thus, the present study could help to clarify the consequences of controlled motivation within the PE context.

### ***Need-supportive and need-thwarting teaching style***

During PE lessons, teachers can respond in several different ways when they confront disengaged PE students (Van den Berghe et al. 2015). Some teachers tend to exhibit a more tolerant, need

supportive stance thereby trying to optimally motivate such amotivated students (Tessier, Sarrazin, and Ntoumanis 2010). A needs supportive environment involves support for autonomy, competence, and relatedness. In the education setting, supporting students' autonomy refers to nurturing their inner motivational resources by respecting their attitudes and suggestions (Vasconcellos et al. 2019), by providing meaningful choices to them, by encouraging initiative taking (Haerens et al. 2015). Also, autonomy supporting teachers display patient to allow students the time they need for self-paced learning to occur and acknowledge and accept expressions of negative affect (Reeve 2009). Previous research found a positive relation of teacher autonomy-supportive style and students' autonomous motivation to classroom engagement, skill development, future intention to exercise and academic achievement (Chen, Chen, and Zhu 2012).

Competence support refers to provide a clear structure during PE learning environment. This is mainly accomplished when PE teachers communicate realistic expectations to their students, by giving rationales for the rules they set, by offering constructive feedback, and by adjusting the physical activities to the levels of students' ability and progress (Jang, Reeve, and Deci 2010). Within PE context, Sánchez-Oliva et al. (2014) showed that competence support from the teacher positively predicted students' autonomous motivation, which in turn predicted enjoyment, and intention to be physically active out of the school.

Relatedness support (i.e. involvement) includes all those instructional strategies that PE teachers recruit to express enjoyment in their interactions with their students, to show their affection towards them (Vasconcellos et al. 2019), to promote cooperative and interdependent tasks; need supportive PE teachers dedicate resources to their students and use a considerate and warm approach to promote an inclusive learning environment (Cox and Williams 2008). About the importance of relatedness support, Sparks et al. (2017) showed that PE teachers who were more relatedness supportive had students who expressed more enjoyment for the PE class and higher confidence in their teacher's and their peers' ability.

Conversely, other PE teachers may tend to exert more psychological pressure towards their students to enforce participation (Van den Berghe et al. 2015); such need-thwarting teachers are more likely to recruit disciplinary measures and to rely on guilt-induction and criticism to students who fail to meet their expectations (De Meyer et al. 2016; Haerens et al. 2015). These teachers are said to adopt an autonomy-thwarting style through contingent rewards and a demanding communication style, through which they request students' compliance to their pre-determined rules (Bartholomew, Ntoumanis, and Thøgersen-Ntoumani 2009). Need thwarting PE teachers tend to endorse also a competence-thwarting style by using a critical, and normative feedback, and by ignoring students' abilities or individual differences (Sheldon and Filak 2008) or by let their classes without clear structure (Aelterman, Vansteenkiste, and Haerens 2019). Finally, need thwarting PE teachers exhibit a relatedness-thwarting style by remaining cold and distant from their students (Skinner et al. 2003; Reeve 2006). For this reason, we considered accurate to measure the three teachers' possibilities of support and thwart the basic psychological needs.

### ***Motivational outcomes in physical education***

A large body of quantitative and observational research grounded in SDT (Ryan and Deci 2017) have demonstrated the importance of students' perception of the teaching style that PE teachers adopt (Ntoumanis and Standage 2009). Most studies have exclusively focused on the 'bright side' of motivational processes – the relations between need-supportive teaching behavior, needs satisfaction, and desired motivational outcomes (Haerens et al. 2015; Reeve 2013; Taylor and Ntoumanis 2007; Van den Berghe et al. 2013; Van den Berghe et al. 2015), whereas more and more studies have started examining the 'dark side' – how need thwarting teaching practices, needs frustration, and motivational outcomes are interrelated in various settings, including sport (Bartholomew, Moeed, and Anderson 2010; Stebbings et al. 2012), work (Gillet et al. 2012), health (Verstuyf et al. 2013) and PE contexts (De Meyer et al. 2016; Haerens et al. 2015).

Specifically, it has been indicated that students who are taught by autonomy-supportive teachers report stronger intentions to exercise during leisure time and participate more frequently in leisure-time physical activities than students in the control condition (Chatzisarantis and Hagger 2009). Vasconcellos et al. (2019) also showed an indirect effect of competence support on adaptive outcomes. Likewise, Gairns, Whipp, and Jackson (2015) revealed a positive indirect relationship linking students' perceptions of their teacher's relatedness-support with their engagement. Also, Sánchez-Oliva et al. (2014) obtained positive associations between teachers need support (i.e. autonomy, competence, and relatedness) and intention to do physical activity out the school context.

Further, the relation of need supportive teaching to self-reported physical activity behavior has been found to be mediated by needs satisfaction (Cox and Williams 2008) and autonomous motivation (Chatzisarantis and Hagger 2009). Such indirect effects may also hold for the relation between need supportive teaching and physical activity intentions, given that need supportive teaching has been found to relate to autonomous motivation (Hagger et al. 2005) which has been found to predict physical activity intentions (Hein, Müür, and Koka 2004; Nurmi et al. 2016). Therefore, it can be inferred that needs satisfaction and quality of motivation may partly mediate the relation between need supportive teaching and intentions to undertake physical activities (Nurmi et al. 2016). Nevertheless, there is a dearth of studies examining the full sequence of these relations.

### *The current study*

Although several researches have included both the 'bright' and the 'dark' pathways when examining the relation between need supportive or need thwarting teaching and motivational outcomes, only few studies have examined the full sequence of relations that are presumed by SDT; specifically, to what extent perceived need supportive and thwarting teaching predict physical activity intentions and PE engagement through needs satisfaction and frustration and in turn through quality of motivation (Vasconcellos et al. 2019). We focused on physical activity intentions and PE engagement as we consider them an index of students' high-quality involvement (Skinner, Kindermann, and Furrer 2009). We assessed not only students' perceptions of PE teachers' autonomy support but also PE teachers' interpersonal style that support (or thwart) the needs for competence and relatedness. This approach is directly linked to recent research that has concomitantly considered in the sport and educational domain teaching behaviors that correspond to the support and thwart of the three needs (Aelterman et al. 2019; Delrue et al. 2019).

Next to the 'bright side' of motivation that numerous studies have examined with respect to the links among need supportive teaching, need satisfaction, quality of motivation, and physical activity intentions and engagement, we also considered the 'dark path' of motivation by assessing also PE teachers' thwarting style, and students' need frustration. Further, we aimed to analyze the full sequence of relations through multilevel analyses, to statistically controlling for the shared variance of students' perceptions regarding their PE teachers' interpersonal behavior. This is an important issue because students who belong to the same PE classroom are exposed to the same teaching behaviors and thus their reports may to some degree violate the assumption of independence of observations (Raudenbush and Bryk 2002).

Accordingly, based on prior empirical findings we formulated the hypotheses of the study. First, we expected that students' perceptions of PE teachers' need supportive style would relate positively to need satisfaction and negatively to need frustration (Hypothesis 1a); we expected the opposite pattern of relations for perceived PE teachers need thwarting style (Hypothesis 1b). Hypotheses 1a and 1b were based on prior empirical evidence which showed that (a) perceived autonomy-supportive teaching style predicts positively need satisfaction (e.g. Amoura et al. 2015; Haerens et al. 2015; Sánchez-Oliva et al. 2014; Standage, Duda, and Ntoumanis 2005) and negatively need frustration (Behzadnia et al. 2018; Haerens et al. 2015) and that (b) perceived need thwarting style predicts negatively need satisfaction (Haerens et al. 2015) and positively need frustration (Amoura et al. 2015; Bartholomew et al. 2018; Behzadnia et al. 2018; Haerens et al. 2015; Tilga et al. 2019).

Second, we hypothesized (Hypothesis 2a) need satisfaction will be positively related to autonomous motivation (Sánchez-Oliva et al. 2014; Vasconcellos et al. 2019), whereas (Hypothesis 2b) need frustration positively predicted controlled motivation and amotivation (Haerens et al. 2015). We avoided formulating any hypothesis between need satisfaction and amotivation, and between need frustration and autonomous motivation given prior inconsistent findings in these relations (Haerens et al. 2015; Sánchez-Oliva et al. 2014; Vasconcellos et al. 2019).

Third, we expected (Hypothesis 3a and 3b) that autonomous motivation would relate positively and that amotivation would relate negatively to behavioral intentions and PE engagement (e.g. Gairns, Whipp, and Jackson 2015; Standage, Duda, and Ntoumanis 2005; Vasconcellos et al. 2019). We expected no relation between controlled motivation and either behavioral engagement or intentions because controlled motivation may energize students on the one hand (Vansteenkiste et al. 2005) but put them under psychological strain on the other hand.

Subsequently, in line with SDT (Ryan and Deci 2017) and relevant empirical evidence (e.g. Amoura et al. 2015), we expected (Hypothesis 4) that needs satisfaction and frustration and in turn types of motivation (i.e. autonomous motivation, controlled motivation, and amotivation) to mediate the relations of perceived need supportive and need thwarting PE teaching to behavioral intentions and PE engagement. Finally, in a more exploratory fashion, we tested for gender differences given that some studies found some gender differences (Carroll and Loumidis 2001; Lyu and Gill 2011; Sánchez-Oliva et al. 2020; Oliver and Kirk 2016), though others did not (e.g. De Meyer et al. 2016; Haerens et al. 2015). In this sense, this study can inform future meta-analytic research whether teachers adopting a specific interpersonal style relates to motivational outcomes in a similar or a dissimilar way among boys and girls.

## Method

### Participants

The participants were 1,120 students with a mean age of 11.70 years ( $SD = 1.63$ ; range = 10–17 years; 559 boys and 561 girls) from 53 classes out of 13 primary and secondary schools (from 5th to 11th grade) located in the district of Extremadura, Spain. The students were randomly selected by the 13 schools which were also randomly selected after securing from the school principals their consent to participate in the current study. Class sizes ranged from 7 to 31 students per class and the topics of the PE lessons during the academic year were determined by each class PE teacher, based on the local educational guidelines. Teacher-participants were 35 full-time with a mean age of 41.84 years ( $SD = 9.21$ ; range = 36–56 years; 23 men and 12 women). All participating teachers have a degree in sport sciences and master degree in teacher education and an average of 18.51 years of teaching experience ( $SD = 8.52$ ; range = 12–31 years). Participants filled out a set of questionnaires at the end of the school year to make sure that they had a solid perception of the variables under investigation. The original sample consisted of 1168 students but 48 (4.11%) were excluded because they returned blank questionnaires.

### Instruments

*Perceived teaching behavior.* Teaching Interpersonal Style Questionnaire in Physical Education (TISQ-PE), as developed by Leo et al. (2020), was used to assess perceived teaching behavior. This 24-item, 6-factor instrument starts with a stem phrase (i.e. ‘In Physical Education lessons, my teacher ...’) and consists of six, four-item factors measuring autonomy support (e.g. ‘... attempts to give us some freedom when it comes to performing the tasks’), competence support (e.g. ‘... encourages us to trust our ability to carry out the tasks well’), and relatedness support (e.g. ‘... promotes good relationships between classmates at all times’) teaching style as well as autonomy thwarting (e.g. ‘... requires that I do things in certain manner’), competence thwarting

(e.g. ‘... proposes situations that make me feel incapable’) and, relatedness thwarting (e.g. ‘... creates an atmosphere that I do not like’) teaching style. The three need-support sub-scales were averaged to form a perceived need support teaching style composite score, and on the same basis, the three need-thwarting sub-scales were averaged to form a perceived need thwarting teaching style. Students responded to all items on a 5-point scale ranging from strongly disagree (1), to strongly agree (5). A confirmatory factor analysis (CFA) with two second-order latent factors (i.e. perceived need supporting and thwarting) being defined by their respective first-order latent factors (i.e. autonomy, competence, and relatedness), defined by their respective items, showed acceptable model fit,  $\chi^2 = 470.705$ ,  $df = 245$ ,  $p < .001$ , CFI = .957, TLI = .952, RMSEA = .038 (95% CI [.032, .043]), SRMR = .042. Furthermore, Cronbach’s alpha and omega values were deemed acceptable for the need support and need thwarting styles factors ( $\alpha = .91$ ,  $\omega = .91$ , and  $\alpha = .89$ ,  $\omega = .88$ , respectively).

*Perceived need satisfaction.* The Spanish version of the Basic Psychological Needs in Exercise Scale (BPNES; Vlachopoulos and Michailidou 2006), developed for the context of PE by Moreno et al. (2008) was used to assess perceived need satisfaction of the students. This instrument starts with a stem phrase ‘In my Physical Education classes ...’ and has a total of 12 items divided into three factors represented each of the basic psychological needs: autonomy satisfaction (e.g. ‘... we carry out exercises that are of interest to me’), competence satisfaction (e.g. ‘... I carry out the exercises effectively’), and relatedness satisfaction (e.g. ‘... my relationship with my classmates is friendly’). Students responded to all items on a 5-point scale ranging from strongly disagree (1), to strongly agree (5). The three sub-scales were averaged to form a perceived need satisfaction composite in this study. The CFA of the data offered support for higher-order one-factor structure as it showed acceptable model fit:  $\chi^2 = 136.349$ ,  $df = 51$ ,  $p < .001$ , CFI = .927, TLI = .904, RMSEA = .060 (95% CI: [.048, .073]), SRMR = .043. Cronbach’s alpha and omega values showed acceptable internal reliability for full scale ( $\alpha = .86$  and  $\omega = .86$ ).

*Perceived need frustration.* The Spanish version of the Psychological Needs Thwarting Scale (PNTS; Bartholomew, Ntoumanis, and Thøgersen-Ntoumani 2010), developed for the context of PE was used to assess perceived need frustration of the students. This scale starts with a stem phrase ‘In my Physical Education classes ...’ and has a total of 12 items divided into three factors represented each of the basic psychological needs: autonomy frustration (4 items, e.g.: ‘I feel pushed to behave in certain ways’), competence frustration (4 items, e.g.: ‘There are situations where I am made to feel inadequate’), and relatedness frustration (4 items, e.g.: ‘I feel other people dislike me’). The three sub-scales were averaged to form a perceived need frustration composite in this study. Students responded to all items on a 5-point scale ranging from strongly disagree (1), to strongly agree (5). The CFA offered support for this higher-order one-factor structure showing acceptable model fit,  $\chi^2 = 95.211$ ,  $df = 51$ ,  $p < .001$ , CFI = .983, TLI = .979, RMSEA = .030 (95% CI [.021, .040]), SRMR = .026. Furthermore, Cronbach’s alpha and omega values were deemed acceptable for full scale ( $\alpha = .90$  and  $\omega = .90$ ).

*Motivation.* The Questionnaire of Motivation in Physical Education Classes (CMEF; Sánchez-Oliva et al. 2012) was used to assess motivation. This questionnaire starts with a stem phrase ‘I take part in this Physical Education class ...’ and has a total of 20 items divided into three factors: autonomous motivation (e.g. ‘Because Physical Education is fun’), controlled motivation (e.g. ‘Because I want the teacher to think that I am a good student’) and amotivation (e.g. ‘But I think that I’m wasting my time with this subject’). Students responded to all items on a 5-point scale ranging from strongly disagree (1), to strongly agree (5). The CFA of the data offered support for this three-factor structure showing acceptable model fit:  $\chi^2 = 455.986$ ,  $df = 131$ ,  $p < .001$ , CFI = .926, TLI = .913, RMSEA = .055 (95%-CI [.049, .060]), SRMR = .044. Furthermore, Cronbach’s alpha and omega values were deemed acceptable:  $\alpha = .86$  and  $\omega = .88$  for autonomous motivation,  $\alpha = .83$  and  $\omega = .85$  for controlled motivation, and  $\alpha = .74$  and  $\omega = .74$  for amotivation.

*Engagement.* To assess students’ perception of engagement in PE lessons, the Spanish version of the Engagement part of the Engagement Versus Disaffection with Learning Scale (EVDLS; Skinner,

Kindermann, and Furrer 2009). This instrument has 10 items divided into two factors: behavioral engagement (5 items, e.g. 'I try hard to do well in training';  $\alpha = .83$ ;  $\omega = .82$ ) and emotional engagement (5 items, e.g. 'In training, I do just enough to get by';  $\alpha = .86$ ;  $\omega = .86$ ). The two sub-scales were averaged to form a perceived engagement composite in this study. Students responded to all items on a 5-point scale ranging from strongly disagree (1), to strongly agree (5). For reasons of model parsimony, and in line with previous research (e.g. Aelterman et al. 2012; Van den Berghe et al. 2015; Wilson et al. 2012), we created a composite score of overall engagement. Our decision was supported by the moderate to high correlation between behavioral and emotional engagement ( $r = .74$ ). Further, a CFA with the respective items loading on a behavioral and emotional engagement latent factors, loading on a higher-order overall engagement latent factor offered support for this single higher-order one-factor structure:  $\chi^2 = 137.966$ ,  $df = 33$ ,  $p < .001$ , CFI = .958, TLI = .943, RMSEA = .053 (95% CI: [.044, .063]), SRMR = .035. The Cronbach's alpha and omega values for the overall scale were deemed acceptable ( $\alpha = .87$  and  $\omega = .90$ ).

*Physical Activity Intentions.* One item was included to measure students' intention to participate in physical activity outside of the school curriculum: 'In the coming years, I intend to participate in sport/ physical activity'. The questionnaire specified that 'sport participation' referred to participating in physical activity or a sport on a regular basis (at least twice a week). Participants responded using a 5-point Likert scale anchored by 1 (*Strongly disagree*) to 5 (*Strongly agree*). Previous research has implemented single-item scales effectively (Sánchez-Oliva et al. 2017).

## Procedure

The study received ethical approval from the University of the first author. All participants were treated according to the American Psychological Association ethical guidelines regarding consent, confidentiality, and anonymity of responses. A cross-sectional design was carried out, taking a measurement in the last third of the academic year to ensure that the students had enough time to generate a stable opinion of the variables that were under investigation. To carry out the data collection, an action protocol was developed so that the obtaining of data was similar across all the participants. The teachers were informed about the aims and the purpose of the study. Likewise, a letter of consent was designed for the parents, mothers or guardians of the participants, who had to return it signed to authorize the collaboration in the study. The return rate of consent forms was 95.8% (1168 of 1219 students).

Once the permits and informed consent were obtained, data were taken. The participants filled out the questionnaires in a class in the PE schedule, individually and in a suitable climate that allowed them to concentrate without having any type of distraction. A research assistant was present to provide help and answer to any of the questions that students might have. The completion process lasted approximately 10–12 minutes.

## Data analysis

All statistical analyses were performed with Mplus version 7.1 (Muthén and Muthén 1998-2018) with maximum likelihood estimators. Preliminary analyses consisted of descriptive analyses, reliability and bivariate correlations between all study variables. To test our hypotheses we took into account the nested structure of our data, (given that students belonged to classrooms) and set up a multilevel path model where need satisfaction and frustration, followed by self-determined motivation, mediated the relation of students' perceptions of their teachers' need supportive and need thwarting teaching behaviors to behavioral engagement and intentions. For reasons of model parsimony and computational efficiency all the slopes (i.e. relations at the student level) were modeled as fixed (i.e. as non-randomly varying from class to class). Further, to properly identify the model, no predictors were entered at the classroom level and no model was tested at that level. Specifically, the relatively small number of classrooms (i.e.  $n = 53$ ; average number of students



per classroom = 21.13; SD = 5.26; range: 7–31) did not allow us to test the sequence of the same relations at the classroom level as the model would require more degrees of freedom than the available clusters (i.e. classrooms). In any case, the multilevel path model allowed us to examine the sequence of hypothesized relations after partialling out the shared variance due to classroom membership. In that multilevel path model, the two antecedences (i.e. perceived need supporting and need thwarting) teaching behaviors were group-mean centered (i.e. centered around the classroom mean). The very same model was tested first for the full sample, and then for each gender separately (i.e. one for males, and another one for females). Models fit were assessed using chi-square ( $\chi^2$ ), degrees of freedom (df), comparative fit index (CFI), Tucker Lewis Index (TLI), root mean square error approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and TLI values equal to or greater than .90 are indicative of good fit (Schumacker and Lomax 1996). As well, RMSEA and SRMR scores equal to or less than .08 and .06, respectively, were considered acceptable (Hu and Bentler 1999). Age was not included as a covariate because preliminary analyses showed that the model did not converge with age as a full covariate and because partial testing of its relation to the two motivational correlates first (i.e. intentions and engagement) and then with the two sets of intervening variables (i.e. need satisfaction and frustration, and autonomous and controlled motivation and amotivation) yielded null relations.

## Results

### *Descriptive statistics and correlations between study variables*

Means, standard deviations, internal reliability coefficients (Cronbach's alpha), intraclass correlation coefficients (ICC), and correlations among the study variables are presented in Table 1, whereas the respective information of the constituent parts of each of these factors is available in Supplemental Table 1. Self-reported measures showed acceptable levels of reliability, exceeding Nunnally's (1978) criterion of .70. As can be noticed also, the ICC – which shows the degree of shared variance due to classroom membership – was relatively high, for almost all variables but need frustration and physical activity intentions. This finding underscores that students who belonged to the same classroom somewhat agreed to the extent to which they were need supportive (as 33% of the variance was lying between classrooms). Also, students belonging to the same classroom appeared to report relatively similar levels of autonomous motivation (as 33% of the variance was between classrooms) needs satisfaction (26.6% of the variance was between classrooms), and engagement (21.0%), followed by amotivation (17%), controlled motivation (16.2%), needs frustration (6.0%), and physical activity intentions (4.6%). In sum, these findings emphasize the necessity to undertake a multilevel approach especially when hypotheses involve students' perceptions of

**Table 1.** Descriptive statistics and correlations between study variables.

	1	2	3	4	5	6	7	8	9
1. Perceived need support	–								
2. Perceived need thwarting	–.40**	–							
3. Needs satisfaction	.64**	–.27**	–						
4. Needs frustration	–.28**	.48**	–.31**	–					
5. Autonomous motivation	.55**	–.30**	.59**	–.25**	–				
6. Controlled motivation	.23**	.03	.29**	.07	.49**	–			
7. Amotivation	–.26**	.34*	–.18**	.32**	–.41**	.05	–		
8. Engagement	.49**	–.32**	.57**	–.24**	.70**	.37**	–.35**	–	
9. Physical activity intentions	.18**	–.10*	.30**	–.19*	.39**	.25**	–.22**	.49**	–
<i>M</i>	3.79	1.73	3.80	1.93	4.03	3.30	1.86	4.29	4.32
<i>SD</i>	.89	.98	.74	.87	.91	1.05	1.02	.74	1.11
$\alpha$	.91	.89	.86	.90	.86	.83	.74	.87	–
$\omega$	.91	.88	.86	.90	.88	.85	.74	.90	–
ICC	.33	.16	.27	.06	.33	.30	.17	.21	.05

Note: \* $p < .05$ , \*\* $p < .01$ ; ICC = Intraclass Correlation Coefficient.

their PE teachers' teaching style. As for the bivariate correlations, inspection of Table 1 shows that intentions and engagement related positively to perceived need supporting teaching style, needs satisfaction, and autonomous and controlled motivation and negatively to perceived need thwarting teachings style, needs frustration, and amotivation.

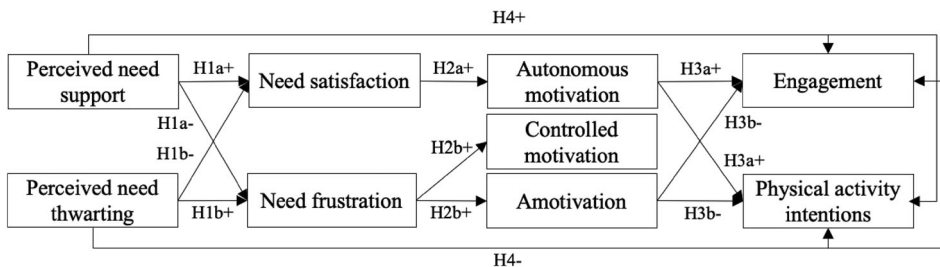
**Main analysis**

The hypothesized multilevel path model for the full sample, is shown in Figure 1. The model yielded the following fit  $\chi^2(35) = 190.96, p < .001, CFI = .897, TLI = .832, SRMR (within) = .031, RMSEA = .063$ , provided that three additional paths were also included to get acceptable fit: A direct path linking perceived need support with autonomous motivation, and another two paths linking needs satisfaction with engagement and intentions. At first glance, some of the fit indices seem poor. However, they are considered acceptable given that the multilevel model included estimated paths at the student level only.<sup>1</sup>

As can be seen in Figure 1, two sets of paths emerged, the one reflecting the bright side of motivation and the other the dark one. Regarding the bright side, perceived need supportive teaching was found to positively predict needs satisfaction and autonomous motivation, which they both positively predicted both behavioral engagement and intentions. Also, in support of Hypothesis 1a, 2a, and 3a perceived need support was found to negatively predict need frustration, whereas need satisfaction was found to predict positively autonomous motivation; rather unexpectedly however, controlled motivation was found to predict positively intentions as well. The variance explained at the student level of all the endogenous variables ranged between 15.1% (for amotivation) and 40.6% for engagement (see  $R^2$ s in Figure 1).

With respect to the dark side of motivation the results showed that perceived need thwarting teaching predicted positively needs frustration which in turn predicted positively both controlled motivation and amotivation with the latter negatively predicting both engagement and intentions. Also, perceived need thwarting was found to directly, and positively, predict amotivation. A series of tests of indirect effects showed that all the indirect relations were statistically significant, except the negative relations of perceived need support to outcomes through need frustration and amotivation (see Table 2). These indirect relations implied a mediating role of needs satisfaction and frustration as well as quality of motivation in the relation of need supportive and need thwarting teaching style to engagement and behavioral intentions.

Next, we examined whether the relations were gender invariant. Because including gender as a covariate and as a moderator made the model impossible to converge, we opted for two different models – one for males, and another one for females. The fit indices for the model for males was  $\chi^2(35) = 188.13, p < .001, CFI = .811, TLI = .693, SRMR (within) = .049, RMSEA = .088$  and for



**Figure 1.** #The hypothesized model for the full sample and for males (first coefficient in brackets) and females (second coefficient in brackets).

Note: All slopes are fixed; slope path coefficients are standardized and statistically significant at .05 level. Not shown for reasons of parsimony the relations of autonomous motivation to controlled motivation ( $r = .42, p < .01; r = .48$  for males, and  $r = .21$  for females) and amotivation ( $r = -.22, p < .01; r = -.27$  for males, and  $r = -.12$  for females) and the relation of controlled motivation to amotivation ( $r = .15, p < .01; r = .13$  for females).

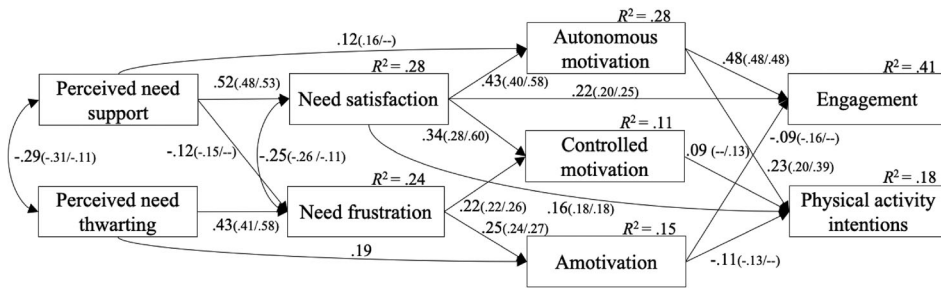


Figure 2. Hypothesized model.

females  $\chi^2(35) = 158.71, p < .001, CFI = .867, TLI = .783, SRMR(\text{within}) = .035, RMSEA = .079$ . Again, these fit indices seem problematic, but they are mainly driven by the fixed paths at the classroom level. The model coefficients for males and females is shown in Figure 1 (first and second coefficient in brackets, respectively). As can be noticed, all the paths (with few exceptions) were statistically significant across the two genders. Specifically, the negative relation between perceived need support and need frustration that we found in the full sample was significant among males but not among females. The same was true for the positive direct relation between perceived need support and autonomous motivation and the negative relations between amotivation and behavioral engagement and intentions as these three paths were nonsignificant among females. In contrast, the positive relation between controlled motivation and intentions that we found in the full sample, was statistically significant among females but not among males.

Table 2. Indirect path coefficients of the hypothesized model shown in Figure 2.

Perceived context	Needs	Self-determined motivation	Outcomes	B	(SE)
<i>From context to needs to motivation</i>					
Supporting	→ NS	→ Autonomous	--	0.230***	(0.034)
//	→ //	→ Controlled	--	0.218***	(0.034)
//	→ NF	→ //	--	-.034*	(0.015)
//	→ //	→ Amotivation	--	-.039*	(0.016)
Thwarting	→ NF	→ Controlled	--	0.131***	(0.028)
//	→ //	→ Amotivation	--	0.151***	(0.029)
<i>From context to needs to Outcomes</i>					
Supporting	→ NS	→ --	→ Engagement	0.105***	(0.021)
//	→ //	→ --	→ Intentions	0.122***	(0.031)
<i>From context to needs to Motivation to Outcomes</i>					
Supporting	→ NS	→ Autonomous	→ Engagement	0.100***	(0.017)
//	→ //	→ //	→ Intentions	0.078***	(0.018)
//	→ //	→ Controlled	→ Engagement	0.095***	(0.018)
//	→ //	→ //	→ Intentions	0.074***	(0.016)
Supporting	→ NF	→ Amotivation	→ Engagement	0.002	(0.001)
//	→ //	→ //	→ Intentions	0.005	(0.003)
Thwarting	→ //	→ //	→ Engagement	-.009**	(0.004)
//	→ //	→ //	→ Intentions	-.019*	(0.008)
<i>From Needs to Motivation to Outcomes</i>					
--	NS	→ Autonomous	→ Engagement	0.223***	(0.029)
--	//	→ //	→ Intentions	0.173***	(0.038)
--	//	→ Controlled	→ Engagement	0.211***	(0.034)
--	//	→ //	→ Intentions	0.164***	(0.032)
--	NF	→ Amotivation	→ Engagement	-.017*	(0.007)
--	//	→ //	→ Intentions	-.034*	(0.014)

Note: \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ . NS = Needs satisfaction; NF = Needs frustration.

## Discussion

In this study we aimed at testing the sequence of relations postulated by SDT within the PE context (Ryan and Deci 2017). Specifically, we examined how perceived PE teachers' teaching style is associated with engagement and physical activity intentions through motivational processes (i.e. psychological needs, and quality of motivation). Briefly, this research provides support to the importance of teaching supportive style to promote the satisfaction of psychological needs and autonomous motivation, and consequently to encourage behavioral engagement during PE classes and physical activity intentions after school time.

The first hypothesis evaluated the associations between students' perceptions of their PE teaching style and their basic psychological needs. Perceived need supportive teaching style was associated positively with needs satisfaction (and autonomous motivation) and negatively with needs frustration; in contrast, perceived need thwarting teaching style related positively to needs frustration but not negatively to needs satisfaction. These findings confirmed three out of four parts of Hypothesis 1, and they are in line with previous studies which also found that students who perceived a need supportive teaching style from the teacher tend to report higher levels of satisfaction of psychological needs (De Meyer et al. 2014; Haerens et al. 2015; Jang, Kim, and Reeve 2016; Sánchez-Oliva et al. 2014) and lower levels of frustration of autonomy, competence, and relatedness needs (Haerens et al. 2015). Further, the present findings are in line with the few studies which have focused on the dark side of motivation (i.e. thwarting style-psychological needs-motivation) and which have shown need thwarting teaching style to relate positively to needs frustration (Haerens et al. 2015; Jang, Kim, and Reeve 2016). They also complement these few studies which have indicated an association between need thwarting style and amotivation (De Meyer et al. 2014; cf. Haerens et al. 2015). As for the null relation between perceived needs thwarting teaching style and needs satisfaction, this may be due to statistical reasons, given the moderately high intercorrelations among perceived need supporting and thwarting teaching style, and needs satisfaction and frustration.

Overall, these findings demonstrate that students who perceived that their PE teacher allocates resources to them and who tries to develop strategies to support their autonomy, competence, and relatedness, expressed more fulfillment of these psychological needs, and were more likely to report that they are involved in PE classes because of self-determined reasons (such as enjoyment, personal importance, and challenge-seeking). On the contrary, students who perceived a need thwarting teaching style from their PE teacher were more likely to report higher levels of frustration of autonomy (e.g. pressure), competence (e.g. incapacity), and relatedness (e.g. rejection). Furthermore, cross-paths showed that male students belonging to need-supportive environment were less needs frustrated, whereas no such association was found for females. This result suggests that for males the perceived teaching environment (e.g. need supportive) is more relevant to avoid needs frustration feeling than for females. In addition, the perception of a thwarting style from the teacher did not affect the satisfaction of psychological need, that is, those students with higher perceived need thwarting did not show less need satisfaction.

The second hypothesis aimed at testing the association between satisfaction and frustration of psychological needs and different types of motivation. Needs satisfaction was positively associated with autonomous motivation and controlled motivation, whereas needs frustration was positively associated with controlled motivation and amotivation. The positive association between need satisfaction and autonomous motivation is consistent with previous studies (Amoura et al. 2015; Haerens et al. 2015; Sánchez-Oliva et al. 2014; Zhang et al. 2011), and demonstrates that students with greater autonomy, stronger perception of ability, and greater feelings of group relatedness are more likely to report self-determined reasons to be involved during the PE classes. A similar positive association was found between needs frustration and amotivation, something which seems to replicate prior findings (Haerens et al. 2015). Our results confirm the hypothesis 2 and are in line with SDT tenets, as students with feelings of autonomy frustration (e.g. feel prevented from choosing or

under pressure the way to carry out tasks), competence frustration (e.g. feel incapable of succeeding the tasks and challenges), and relatedness frustration (e.g. feel rejected and alone with classmates) are expected to admit more amotivation during PE classes.

It should be noted however, that both needs satisfaction and needs frustration were positively associated with controlled motivation; that is, not only students with greater needs frustration, but also with greater needs satisfaction seem to engage in PE classes because of controlled reasons. Although these results are not theoretically in line with SDT tenets (Ryan and Deci 2017), they are similar to some previous researches in PE context which also found positive associations between overall needs satisfaction and controlled motivation (Behzadnia et al. 2018; Haerens et al. 2015; Sánchez-Oliva et al. 2014). This pattern has been also identified by a recent systematic review conducted by Vasconcellos et al. (2019) who revealed an inconclusive pattern of associations between basic needs satisfaction and controlled forms of motivation. In their correlational analysis, Vasconcellos et al. (2019) showed external regulation to relate negatively to autonomy and competence but positively to relatedness need satisfaction. Nevertheless, more research, preferably with longitudinal or long-term experimental designs is needed to delineate when need satisfaction relate, if so, to controlled motivation. Furthermore, special attention should be put on the moderator role of gender on these associations, given the results found in the current study. Such research will help us better understand under what conditions any of the three needs may in particular predict controlled motivation, either introjected or external.

On another hand, a finding which the current study has found and which is in accordance with SDT (Vasconcellos et al. 2019) and with previous cross-sectional (De Meyer et al. 2016; Jang, Ryan, and Kim 2009; Sánchez-Oliva et al. 2014; Wilson et al. 2012), longitudinal (Jang, Kim, and Reeve 2016) and experimental studies (Aelterman et al. 2014; Sánchez-Oliva et al. 2017) concerns the role of needs satisfaction as a positive predictor of physical activity engagement and intentions. As our study points out, students who satisfied their needs for autonomy, competence and relatedness within the PE class were those who reported a better engagement during the PE classes, and also stronger intentions to undertake physical activities outside school.

The third hypothesis evaluated the relation between the three different types of self-determined motivation – autonomous motivation, controlled motivation, and amotivation – and engagement and physical activity intentions. Our findings confirmed our hypothesis and replicated past findings (Aelterman et al. 2012; Sánchez-Oliva et al. 2014; Wilson et al. 2012), as autonomous motivation was a positive and amotivation was a negative predictor of engagement and physical activity intentions. These results are also in line with the trans-contextual model (Hagger and Chatzisarantis 2015), as they confirm that students who are involved in PE classes for self-determined forms of motivation (enjoyment, pleasure, benefits of PE classes, importance of PE subject), display not only better engagement during the PE classes, but also greater intention to practice sport outside school in the following years. Furthermore, although controlled motivation was found not to predict engagement, it emerged as a positive antecedent of physical activity intentions. Was this particular, unexpected, association driven by introjected regulation? This is a viable possibility given that the systematic review from Vasconcellos et al. (2019) showed that introjected regulation could be a positive correlate of various behavioral outcomes, including physical activity intentions. Unfortunately, in our study we could not separate the two forms of controlled motivation (as well as of the two forms of autonomous motivation) because a multilevel model with five regulations (i.e. intrinsic, identified, introjected, external, and amotivation) could not converge. However, our correlational analysis highlighted both introjected and external regulations as positive correlates of physical activity intentions (see Supplemental Table 1). The reasons of this finding could be the multidisciplinary of PE subject. During an academic year, students are involved in a wide range of sports and disciplines. In this way, there could be students who are not self-determined motivated towards these disciplines (e.g. collective

sports, body expression and dance) but they intend to continue practicing the sport that they like (e.g. running, cycling, gym, etc.). Nevertheless, this finding underscores the need of further research to clarify the role of controlled motivation within the PE context.

Most of the associations discussed so far are well in line with previous findings. Perhaps one of the least researched evidence that this study brings concerns the multiple mediating role of psychological needs and self-determined motivation in the relations of perceived teacher teaching style and physical activity engagement and intentions (hypothesis 4). As our integrated multilevel model demonstrated, the more students perceive a need supportive teaching style from their PE teacher, the more likely they were to report higher levels of needs satisfaction, and autonomous motivation, and eventually higher levels of engagement during PE classes and more physical activity intentions in the following years. Our research complements previous studies (Behzadnia et al. 2018; Vasconcellos et al. 2019), which also found need satisfaction and autonomous motivation as mediators of the relation between perceived teaching style and adaptive outcomes as it shows a concurrent sequence of relations between perceived controlling behaviors and outcomes by means of need frustration and amotivation. The current study showed how the more students perceived a need thwarting teaching style from their PE teacher, the more likely they were to report higher levels of need frustration and controlled motivation and amotivation, and eventually lower levels of engagement during PE classes and less physical activity intentions in the following years. Overall, the test of our integrated model provides supports to the hypothesis of the sequence of theoretically expected relations according to SDT: Adaptive outcomes are more likely to take place in need supportive contexts because in such contexts people become more autonomous motivated and less amotivated because they satisfy their basic psychological needs. As such, the present findings confirm the hypothesis 4 and highlight the importance of endorsing need-supportive (and avoiding thwarting) teaching strategies because such strategies seem to enhance students' need satisfaction (and confine their need frustration), which in turn seem to increase self-determined motivation, and in turn physical activity engagement and intentions.

Another finding that deserves some attention has to do with the within-class agreement about students' perceptions of their PE teachers' instructional style. Setting aside that students showed that they agreed less about their teachers' need-thwarting behaviors than about their need-thwarting ones, the fact that such agreement was at best less than one-third of the total variability says something about the individualized way that each student may perceive his or her PE teachers' instructional behavior. On a broader issue, the relatively high ICC across most of the measured variables highlight two further issues. First, the need to adopt a multilevel approach when examining issues related to motivational contexts. Second, that many of the issues that are supposed to be 'personal' such as needs satisfaction, autonomous motivation, or amotivation may be partly explained by (unexamined in this study) classroom effects.

With respect to the analysis of gender differences, we found no big differences between boys and girls with respect to the regression coefficients. Only, the perception of a supportive style for girls was not positive associated with autonomous motivation, and not negatively associated with need frustration. So, results showed that girls' perceptions of supportive style only affect to need satisfaction. Furthermore, girls showed a higher degree of association between need satisfaction and autonomous motivation (.58 vs .40) and between need satisfaction and controlled motivation (.60 vs .28), that is, girls who satisfied their basic needs were those who reported more involvement within the PE class for autonomous reasons (i.e. enjoyment, satisfaction, learning other abilities for life, etc.) but also for controlled reasons (i.e. guilty, ashamed if quit, satisfy people, others will not be pleased, etc.). Additionally, the amotivated girls did not show lower engagement during PE classes or lower physical activity intentions outside school. That is, although girls feel amotivated toward PE subject, this feeling does not affect the involvement during classes or the intention to practice sport in the following years at the extracurricular time. Additionally, for boys, controlled motivation was not significantly associated with physical activity intentions; that is, boys involved for external or introjected forms of motivation did not show more or less physical activity intentions.

### ***Practical implications***

Overall, these previous findings are consistent with SDT postulates (Ryan and Deci 2017) and highlight the importance of developing autonomy, competence, and relatedness support strategies with the aim of promoting an adequate satisfaction of psychological need, as well as to getting self-determined forms of motivation during the PE classes. Examples of autonomy support strategies include teachers' taking perspective of their students' feelings (e.g. talk to students privately and take an interest in their life – extracurricular hobbies, how are going other subjects, etc. –), encouraging their active participation initiative taking, providing them choices and options (e.g. asking preferences for teaching a specific collective sport – within the curricula program –), and transferring some freedom and responsibility to them when they perform in-class tasks (e.g. using constructivist teaching models rather than teaching models based on instruction). With the aim of promoting competence satisfaction, PE teachers can adapt their teaching by offering tasks that are adjusted to the students' actual level of skills (e.g. offer task with an adequate balance between task difficulty and students' capacity). Further, their feedback must focus on progress by providing task-focused feedback (rather than normative-based) and by acknowledging their students' effort and improvement (e.g. using a positive feedback when success and not only negative feedback when failed). Also, PE teachers should provide sufficient time to all students to achieve the objectives set by themselves in collaboration with their PE teacher (e.g. start the following task once all students have achieved success in the previous task). In order to promote relatedness satisfaction, PE teachers are recommended to use a warm and positive communication style; they need to encourage collaborative working, support and respect students' individuality, and behave in a friendly way. Additionally, PE teachers can use an all-inclusive strategy when groups are formed and might do well if they promote role-playing or trust activities to improve all students' feeling of belongingness.

### ***Strengths, limitations and directions for future research***

To our knowledge, this is perhaps among the first studies that include the complete set of variables proposed by SDT (i.e. social factors-mediators-motivation-outcomes), as well as the bright (supportive style-need satisfaction) and dark (thwarting style-need frustration) side of motivation (Ryan and Deci 2017; Vasconcellos et al. 2019). Furthermore, this study solves one of the gaps highlighted by Vasconcellos et al. (2019), that there are few studies based on SDT have examine the relation of competence and relatedness support/thwarting from the teacher in physical education context.

Nevertheless, this study is not without limitations. First, no causal relations can be claimed, given the cross-sectional nature of the study. Future studies should employ longitudinal and quasi-experimental designs to complement the current findings. Second, the teachers' teaching style was evaluated through students' perceptions, so future studies could overcome these problems, thereby using ratings from external observers. Further, the number of classes were rather limited, a fact that prevented us from testing for any classroom effects over and above students' personal perceptions and for the presence of heterogeneous relations across classrooms (as we were forced to fix the slopes at the student level). Moreover, although we measured teachers' autonomy, competence and relatedness support and thwarting, we considered them as a global factor (i.e. need support vs need thwarting) to make the model converge. The same applies for need satisfaction and need frustration and autonomous motivation, controlled motivation, and amotivation. Therefore, future research could try to carry out a more detailed analysis testing one by one the basic psychological needs as well as one by one the five types of self-regulated motivation (i.e. intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation). Likewise, as consequences, only positive behaviors were used (i.e. engagement and physical activity intentions), so future studies could include negative consequences in this model (e.g. disengagement or drop out intention). Finally, it should be acknowledged that intentions were not thoroughly assessed, given that we used a single item to measure it.

## Conclusion

The current study extends previous researches by testing a motivational model including both the dark and bright sides of motivation. Specifically, our paper demonstrates the importance of students' motivational processes within the PE context to explain and predict engagement during PE classes and physical activity intentions outside the school. Thus, the current study confirms the widely documented bright side of motivation, but also extending the less studied dark side of motivation. Specifically, the bright pathway is composed by a positive association between a supportive style, the satisfaction and psychological need, and self-determined motivation, and also a dark pathway composed of positive association between a controlling style, the frustration and psychological need, and amotivation. Furthermore, these findings also demonstrated the importance of both needs satisfaction and types of motivation to predict engagement during PE classes and physical activity intentions.

## Note

1. Indeed, including at the classroom level just two paths (which was the maximum number of paths that we could add to get the model identified) – for example the path linking needs satisfaction with autonomous motivation and the path linking the latter with engagement, yielded an acceptable fit:  $\chi^2(33) = 93.41$ ,  $p < .001$ , CFI = .960, TLI = .931, SRMR (within) = .031, RMSEA = .040.

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