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## Economic status as a predictor of motivational and affective experiences in physical education and physical activity intentions: a cross-sectional study in six European countries

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### ABSTRACT

Lower economic status (ES) is associated with a less adaptive experience of school and physical activity. However, empirical evidence supporting the detrimental association of lower ES on the affective and motivational experience in Physical Education (PE) remains scarce. Using a large sample ( $N = 10,392$ ) of adolescents from six countries (i.e., Greece, Spain, Italy, Portugal, England, Turkey), this cross-sectional study tested whether students' family ES was associated with the satisfaction of their basic psychological needs in PE, and in turn with motivational and affective outcomes in PE and their out-of-school physical activity intention. Our secondary objective was to test whether these potential associations differed between countries. We further explored whether gender moderated the abovementioned relationship. After testing for measurement

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invariance of the different scales across countries, multigroup structural equation modelling showed that, in five of six countries (i.e., Greece, Spain, Italy, Portugal, England), a lower ES was associated with lower basic needs satisfaction with a small effect size ( $\beta = .10, p < .001$ ), which in turn was associated with lower enjoyment ( $\beta = .75, p < .001$ ), lower autonomous motivation ( $\beta = .83, p < .001$ ), and weaker out-of-school physical activity intention ( $p < .001, \beta = .36$ ), higher displeasure ( $\beta = -.51, p < .001$ ), higher controlled motivation ( $\beta = -.19, p < .001$ ) and stronger amotivation in PE ( $\beta = -.28, p < .001$ ). Additional analyses indicate that basic psychological needs mediated the relationship between ES and motivational and affective experiences. Exploratory analyses suggested that the relationship between lower ES and the less adaptative motivational and affective outcomes was amplified among girls. At the crossroad between psychology and sociology, this study provides new insights into how family lower ES and gender might interact to predict less adaptative motivational and affective experiences and outcomes in PE.

**Q3**

**Q4** Despite the well-known benefits of regular physical activity for mental, social and physical health (Bull et al., 2020), 81% of adolescents do not reach the recommended physical activity levels worldwide (Guthold et al., 2020). Crucially, physical inactivity may find its roots in socio-economic disparities. For example, in Europe, early life economic status (ES) seems to be a key determinant of physical inactivity during adolescence (Bann et al., 2019) and across the life-course (Chalabaev et al., 2022).

Although the link between ES and physical activity participation is well-documented, with lower ES being associated with less PA participation (O'Donoghue et al., 2020), the mechanisms underlying this relationship remain poorly understood. Among the potential pathways, school may play a pivotal role. Research drawing on the sociology of education (PISA, 2018) has long shown that school systems are not neutral with respect to socio-economic inequalities. School can play an active role in the reproduction of inequalities by not offering the same opportunities for all students. For instance, in some countries a lower ES was associated with fewer hours of PE in school (Bann et al., 2019; Martins et al., 2018) which may also reinforce inequities in access to physical activities participation.

However, to our knowledge, no study has investigated the psychological mechanisms at play in PE that may partly explain the reproduction of socio-economic inequalities in education and health. This work focuses only on student's family ES defined as the material and financial aspect of socio-economic status that can be measured by the degree of accessing economic goods and services (e.g., number of cars at home; Saegert et al., 2006). Here, we investigated whether the association between lower student's family ES and poorer physical activity experiences might be partly explained by adolescents' motivational and affective experiences in PE.

### **Motivational and affective experiences in PE**

How ES influence psychological processes in PE can be analysed through the lens of Self-Determination Theory (SDT; Deci & Ryan, 1985). In short, models derived from SDT considers that students' basic psychological needs (i.e., BPN; autonomy, competence, and relatedness), motivations (i.e., autonomous, controlled, amotivation), and affect (i.e., enjoyment and displeasure) during PE represent critical variables to explain out-of-school intention to engage in physical activity (Vasconcellos et al., 2020). A core assumption of SDT is that motivation can be distinguished into autonomous, controlled and amotivation (Ryan & Deci, 2020; Vasconcellos et al., 2020). Motivation is autonomous when students experience a sense of personal choice and autonomy when behaving in class. In contrast, motivation is controlled when behaviour is regulated by external cues, such as rewards or punishment or by internal pressures, such as feelings of guilt or shame. Lastly, amotivation is found in situations during which students are not motivated for the school subject, neither for autonomous nor for controlled reasons.

SDT posits that the motivational and affective experiences result from the satisfaction of three BPN: the need for autonomy (i.e., desire to feel volitional and free in engaging in actions), the need for competence (i.e., desire to feel effective and experience mastery) and the need for relatedness (i.e., desire to connect with others and feel a sense of belonging; Ryan & Deci, 2020). Extensive literature has found that the BPN satisfaction favours the most autonomous forms of motivation and adaptative affect in PE, which in turn are related to adaptative outcomes in and out of school (e.g., intention towards physical activity, physical activity engagement, well-being; Vasconcellos et al., 2020). However, the authors also noted that BPN satisfaction in PE greatly differ among students (Vasconcellos et al., 2020). Overall, these findings highlight the importance of ensuring that all students – whatever their socio-demographic status – feel supported in PE, but also suggest that this goal is not being achieved for all. Therefore, understanding which populations are most at risk of maladaptive motivational and affective experiences seems warranted to address inequalities in PE. However, at the time of writing, no study has examined whether ES predicts BPN satisfaction and, in turn, motivational or affective outcomes in PE.

### **Mechanisms underpinning the associations between ES and BPN satisfaction**

Multiple mechanisms could explain the detrimental effect of lower ES on motivational and affective experience in PE. Although not formally tested yet, we suggest that at least three pathways may undermine the BPN of students from disadvantaged family ES leading to less adaptative motivations and affective experiences regarding PA.

First, the perception that students are disengaged or amotivated in physical education – what some call “pressure from below” (Pelletier et al., 2002; Reeve, 2009) may influence the teacher's motivational style. Notably, it has been observed that a higher pressure leads to a less supportive teaching style in PE (e.g., Escrivá-Boulley et al., 2021). Crucially, a handful of studies have shown that students from disadvantaged backgrounds are more likely to be perceived by their teachers as more disengaged or disruptive (e.g., Brandmiller et al., 2020) and thus more likely to induce pressure from below. Moreover, in most European countries, teachers in disadvantaged areas are more likely to be inexperienced

teachers (PISA, 2018), which may be problematic as beginning teachers have more difficulty developing a supportive motivational style (e.g., Escrivá-Boulley et al., 2021), and therefore might be less likely to fulfil students' BPN. Second, lower ES students might be less prone to seek support and consequently participate in shaping a less supportive motivational climate. In support of this, sociological studies observed that students with lower ES were often hesitant and needed guidance on how to seek support in the classroom (e.g., Calarco, 2011). In contrast, their more advantaged counterparts were more likely to proactively transform the classroom climate by questioning their teacher, negotiating part of the class, or requesting support (Calarco, 2011; Lareau & Weinger, 2003). Consistent with this idea, SDT literature indicates that motivational experience depends (partially) on teachers, and on the extent to which students actively create a more supportive motivational climate for themselves (Reeve, 2013). Third, while peers are critical in fostering the need for relatedness (Vasconcellos et al., 2020), one study suggested that disadvantaged students feel less supported by their peers than the more advantaged ones, which in turn can explain the less adaptive emotions experienced in school (Alivernini et al., 2019). Although these three arguments support a possible link between students' family ES and BPN satisfaction, motivation, and affect, to our knowledge no study has examined these relationships.

### *The present study*

Drawing upon a sample of adolescents from six European countries the primary aim of the present study was to examine whether students' ES is associated with BPN and, in turn, with motivational and affective experiences in PE as well as with out-of-school PA intentions.

Further, sociological studies have shown that the link between socio-economic status and teacher's perceived support or school outcomes is sometimes country-specific (e.g., Bakchich et al., 2022; Sortkær, 2019). For instance, while lower socio-economic status was associated with less perceived teacher support in most Nordic countries (Sortkær, 2019) the relationship was reversed in France (Bakchich et al., 2023). As the relationship between ES and teacher support may vary across countries, it is likely that the association between ES and BPN will also vary. Therefore, a secondary objective of this study was to examine the extent to which the associations differed in each of the six countries included. Moreover, building on an intersectional perspective of inequalities (Eagly et al., 2012) suggesting that being a woman might amplify the associations of socio-economic status with physical inactivity (Chalabaev et al., 2022), the study also aimed to explore whether gender moderates the relationship between ES and motivational and affective outcomes in PE.

Based on the above literature, we hypothesised that, relative to students with a higher ES, students with a lower ES would show a lower level of BPN satisfaction (i.e., autonomy, competency, relatedness; H1). In turn, lower BPN satisfaction would be associated with lower adaptive outcomes (i.e., autonomous motivation, enjoyment, and intention to engage in out-of-school physical activity) and higher maladaptive outcomes (i.e., displeasure, controlled motivation, and amotivation; H2). Further, we hypothesised that BPN would mediate the relationship of ES with the motivational and affective outcomes experienced in PE (H3). We also analysed whether the overall observed association

pattern depended on the country (H4). Finally, we further explored if these associations would be globally amplified among girls relative to boys (E1).

## 185 **Methods**

### **Procedure and participants**

190 Data were gathered as part of a European project (<https://www.impactpe.eu/site/index.php/en/>). In brief, adolescents from seven European countries (i.e., Greece, Spain, Italy, Portugal, England, Turkey, and France) were asked to complete a questionnaire assessing their physical activity behaviours and motivation and affective experience in PE. The questionnaire was explained and administered by their PE teacher, who was instructed on the study's objective and procedure. During a PE lesson, adolescents completed the questionnaires on computers, tablets, or smartphones for about 30 min. All participants provided written consent for their participation and were fully debriefed after its completion. The relevant research ethics committees in the participating countries approved this project.

195 The inclusion criteria were: (1) to be in middle school or in high school, and (2) to provide complete information on the socio-demographic questionnaire (i.e., economic status, age, sex, and country). In France, parents filled out the ES questionnaire (due to restrictions of the local ethics committee). Because this feature prevents meaningful comparisons across countries and elicits a strong socio-economic selection bias (Blom-Hoffman et al., 2009), participants from France were excluded from the analysis. In total, 10,392 participants were included in the analyses ( $M_{\text{age}} = 13.94 \pm 1.99$  years, 52% girls) with  $n = 2542$  in Greece,  $n = 1160$  in Spain,  $n = 2188$  in Italy,  $n = 1003$  in Portugal,  $n = 501$  participants in England and  $n = 2998$  in Turkey.

## 205 **Measures**

### **Economic status**

210 Economic status was assessed through two indicators: the Family Affluence Scale III (FAS III; Torsheim et al., 2018) and one item measuring subjective wealth (Torsheim et al., 2018). The FAS III consists of seven items regarding the family economic status (e.g., "How many computers [PCs, Macs or laptops] does your family own?"), which has demonstrated good cross-cultural validity in previous studies (e.g., Torsheim et al., 2018). Perceived wealth was assessed using the question: "How well off do you think your family is?". Participants answered on a five-point scale ranging from 1 to 5 (1 = "not at all well off"; 5 = "very well off"). Then, to reduce ES measurement error, and in line with existing literature on large scale-databases (e.g., PISA, 2018), a composite score was built as the sum of the average FAS III score on the one hand and the perceived wealth score on the other. Each indicator in this score has the same range (0–1) and weight. Consequently, the values ranged from 0 to 2, with a higher score indicating a higher ES.

### **Gender**

225 Gender was captured by asking: "Are you a boy or a girl?". Students could answer either "boy", "girl", "other answer" or "I don't want to answer". Participants who answered "other answer" or "I don't want to answer" were excluded from the analyses ( $n = 20$ ).

### ***Self-determined motivation in PE***

Self-determined motivation in PE was measured using an adapted version of the scale developed in the PAPA project (Duda, 2013). Based on the Behavioural Regulation in Sport Questionnaire (BRSQ; Lonsdale et al., 2008) adapted for PE, this scale captures intrinsic motivation, identified regulation, controlled regulation, and amotivation. Participants answered on a Likert scale ranging from (1) "Strongly disagree" to (5) "Strongly agree". An autonomous motivation index was created as a latent variable of the intrinsic and identified regulation subscales (e.g., Gagné et al., 2015).

### ***Enjoyment and displeasure in PE***

Enjoyment and displeasure in PE were assumed to reflect affective experience in PE and were measured using the Physical Activity Enjoyment Scale (PACES; Motl et al., 2001) adapted for PE. Six items assessed enjoyment in PE (e.g., "When I'm active in Physical Education, I find it pleasurable") and six items measured displeasure in PE (e.g., "When I'm active in Physical Education, I dislike it"). Participants answered on a Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree".

### ***Intention to do out-of-school physical activity***

Intention to do out-of-school physical activity was measured using three items (e.g., "Over the next month, I am determined to exercise/play sport, at least three times a week, for 60 minutes each time"; Standage et al., 2003). Answers were reported on a seven-point scale ranging from 1 = "Very unlikely" to 7 = "Very likely".

### ***Basic psychological needs satisfaction in PE***

The scale developed in the PAPA project (Duda, 2013) was used to assess satisfaction of student's needs for autonomy (5 items), competence (5 items) and relatedness (4 items). This scale has been validated in five languages capturing feelings and experiences in PE classes across the last 3–4 weeks. Participants answered on a Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree". Evidence for the validity of this scale has been provided in previous studies with data from participants similar to those recruited in this project (e.g., Quested et al., 2013). A global BPN satisfaction variable was created as a latent factor by combining the autonomy, competence, and relatedness subscales (Quested et al., 2013).

## ***Statistical analyses***

### ***Invariance testing of measurement model***

Given the cross-cultural nature of the study and the use of multi-language scales, we first tested measurement invariance between countries (i.e., configural, metric and scalar invariance) of the different scales across the six countries (Chen, 2007). The specifications of this measurement model are available in supplementary material. Further, to ensure comparability of scores, gender invariance was also tested. After specifying the measurement models, the goodness of fit was estimated based on the comparative fit index (CFI) and the root mean square errors of approximation (RMSEA), with  $CFI \geq .90/.95$ ,  $RMSEA \leq .08/.05$ , being indicative of an acceptable and good fit, respectively (Chen,

2007). Then, a cut-off of  $\Delta CFI \leq .01$ ,  $\Delta RMSEA \leq .015$ , indicating an acceptable invariance, was applied to test the different forms of invariance (Chen, 2007).

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### *Statistical strategy*

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Structural equation modelling was used to test the hypothesised models using the lavaan package (Rosseel, 2012) of the R software (version 4.4). All models were specified using a full information maximum likelihood (FIML) approach to account for missing data. Variables were standardised and all motivational or affective variables were computed as latent variables (Rosseel, 2012). We computed a series of six models with ES as a predictor, BPN satisfaction as a mediator, and autonomous motivation (model 1), enjoyment (model 2), intention towards physical activity (model 3), displeasure (model 4), controlled motivation (model 5) and amotivation (model 6) as outcomes. To formally assess mediation, we adopted the component approach (Yzerbyt et al., 2018). According to this approach, a significant indirect effect is supported when the two paths of the indirect effect (i.e., from the independent variable to the mediating variable [a path] and from the mediating variable to the dependent variable [b path]) and their product are significant ( $p < .05$ ). In comparison with only bootstrapped approaches, this approach has been shown to reduce risks of Type 1 errors, while preserving statistical power (Yzerbyt et al., 2018). The total effect (c path) as well as the direct effect (c' path) were also estimated. As the associations between variables could differ between countries (Bakchich et al., 2023; Sortkær, 2019), and to account for the non-independency of students ES with countries wealth, we computed multigroup analysis allowing path regression coefficients to vary across countries for each outcome. This unconstrained approach allowed to uncover potential differences in the subgroups within the entire population that are not always visible when examining the entire sample (Cheah et al., 2023). Provided that the regression paths were similar across countries, a last step was to assess the overall strength of the relationships between the variables in the model, by constraining the regression paths to be equal in each country and including all outcomes in the same model (model 7).

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To test the moderating role of gender, we ran a model for each outcome, resulting in six additional models. In this set of global moderation models, which constrain the regression paths to be the same in each country (model 8a, 8b, 8c, 8d, 8e, 8f), we assessed the moderation of the overall relationship between ES and the six outcomes.

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### *Sensitivity analysis*

We conducted a sensitivity analysis on the global constrained model, with all outcomes, in which we only included participants who had no missing data, relatively to main analyses (model 9). In a second global constrained sensitivity model (model 10), with all outcomes, we controlled for school affiliation in the analyses, using the lavaan.survey package (Oberski, 2014). Students were clustered according to the school they attended in a two-level multilevel model (level 1 = students, level 2 = school; Oberski, 2014). Only participants who correctly filled in their school's name were included in these analyses.

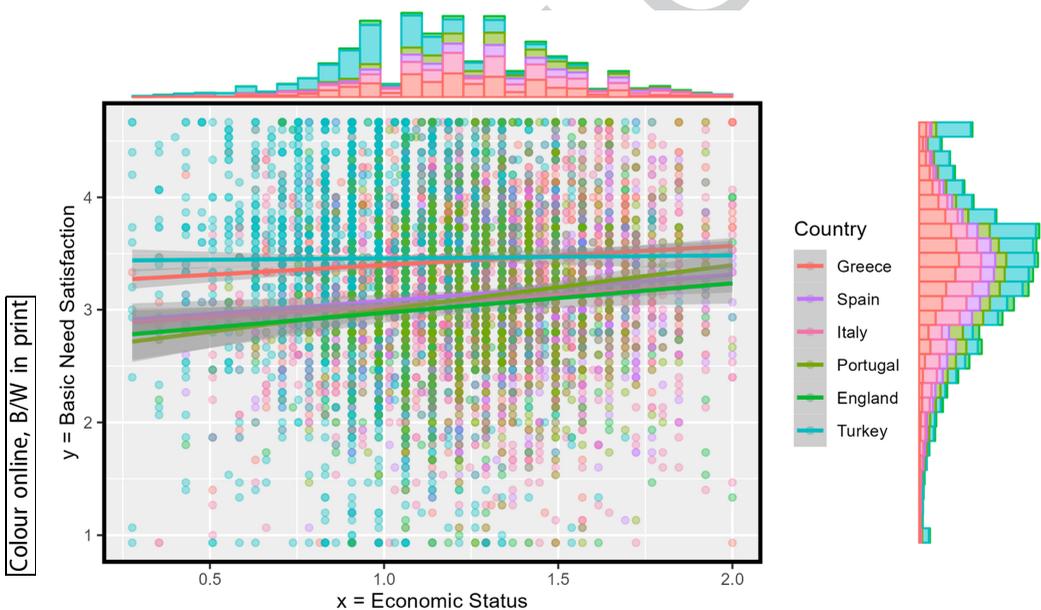
## Results

### Descriptive analysis

Descriptive statistics were reported for the overall sample in Table 1 and bivariate correlations are reported by country in Tables S1–S6. For descriptive purposes, scatter plots between ES and BPN satisfaction (Figure 1) and between ES and the six outcomes (Figures S1–S6) are also reported.

### Measurement invariance

As shown in Tables S7 and S8, our models showed both acceptable configural ( $RMSEA \leq .08$ ,  $CFI \geq .90$ ) and metric ( $\Delta CFI \leq .01$ ,  $\Delta RMSEA \leq .015$ ) invariance across countries, and good configural ( $RMSEA \leq .05$ ,  $CFI \geq .95$ ), metric and scalar ( $\Delta CFI \leq .01$ ,  $\Delta RMSEA \leq .015$ ) invariance across gender. However, the scalar invariance (i.e., intercepts) was not supported across countries ( $\Delta CFI > 0.01$ ), indicating that the intercepts of the items composing the latent variables substantially differed between countries. To make comparisons between countries possible (Putnick & Bornstein, 2016), partial invariance was tested by sequentially releasing the load factors and/or intercepts of the items, relying upon of modification indices (Putnick & Bornstein, 2016). By releasing 19 out of



**Figure 1.** Relationships between composite economic status and basic need satisfaction. Note: Relationships between non-invariant, non-standardised and composite basic need satisfaction (i.e., mean score of autonomy, competency, and relatedness) and non-standardised composite economic status are displayed. Histograms of basic need satisfaction distribution by country and economic status distribution by country are also displayed in ordinate and abscissa, respectively. Each colour represents a different country, whether in scores, slopes or histograms. The confidence intervals shown should be treated with caution, as this graph uses non-invariant, non-standardised and non-latent scales.

**Table 1.** Socio-demographic and motivational and affective variables for the full sample stratified by country.

	Full sample	England	Greece	Spain	Italy	Portugal	Turkey
<i>N</i>	10392	501	2542	1160	2188	1003	2998
Age (mean, SD)	13.94 (1.99)	13.03 (1.96)	13.03 (1.96)	14.55 (1.25)	14.56 (2.10)	14.53 (1.75)	13.92 (2.03)
Economic status (mean, SD)							
Composite ES	1.19 (0.29)	1.26 (0.30)	1.23 (0.26)	1.31 (0.26)	1.27 (0.29)	1.29 (0.24)	1.00 (0.24)
FAS III (range 1–13)	6.87 (2.42)	7.32 (2.49)	6.75 (2.15)	8.20 (2.31)	7.99 (2.25)	7.73 (2.07)	5.28 (1.94)
Subjective wealth (range 1–5)	3.31 (0.83)	3.48 (0.91)	3.51 (0.81)	3.43 (0.73)	3.30 (0.97)	3.47 (0.67)	3.03 (0.74)
Gender							
Girls ( <i>n</i> )	5451	261	1321	599	1213	550	1507
Boys ( <i>n</i> )	4941	240	1221	561	975	453	1491
Motivational and affective variables (mean, SD)							
BPN satisfaction (range 1–5)	3.28 (0.71)	3.25 (0.80)	3.69 (0.58)	3.39 (.63)	3.33 (0.72)	3.35 (0.73)	3.76 (0.84)
Enjoyment (range 1–5)	4.02 (0.82)	3.52 (0.94)	4.21 (0.67)	3.93 (.71)	3.91 (0.82)	3.97 (0.78)	4.23 (0.84)
Autonomous motivation (range 1–5)	4.00 (0.82)	3.64 (0.92)	4.27 (0.63)	3.85 (.83)	3.82 (0.75)	3.95 (0.76)	4.16 (0.85)
Intention (range 1–7)	4.46 (1.91)	4.13 (1.75)	4.97 (1.83)	4.79 (1.91)	4.61 (1.96)	4.44 (1.66)	3.92 (1.94)
Displeasure (range 1–5)	1.98 (0.88)	2.46 (0.96)	1.69 (0.69)	2.01 (.82)	1.95 (0.84)	2.09 (0.97)	1.95 (0.88)
Controlled motivation (range 1–5)	2.16 (0.95)	2.60 (0.93)	1.84 (0.81)	2.13 (.88)	2.16 (0.88)	2.23 (1.06)	2.25 (0.99)
Amotivation (range 1–5)	2.22 (1.02)	2.52 (1.03)	1.75 (0.82)	2.21 (.93)	2.01 (0.98)	2.22 (1.08)	2.61 (0.97)

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45 paths of the measurement model, and no more than half of the paths per scale, corresponding to an acceptable ratio keeping the consistency of each scale (Putnick & Bornstein, 2016), we obtained a model achieving partial scalar invariance ( $\Delta CFI \leq .01$ ,  $\Delta RMSEA \leq .015$ ) which was retained as our measurement model in subsequent analyses.

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### **Structural equation modelling**

Full results for all unconstrained mediation models (model 1–6) were reported in supplementary material (Tables S9–S14) and summarised in Figure S7. The unconstrained models provided almost acceptable fit for each of the six outcomes (CFIs > .899, RMSEAs < .077). We first present the unconstrained models (1, 2 and 3) on the adaptative outcomes (i.e., autonomous motivation, enjoyment, and physical activity intention), and then we describe results for the maladaptive outcomes (i.e., amotivation, controlled motivation and displeasure; model 4, 5 and 6). Finally, we present the constrained global model testing all outcomes conjointly (model 7, Table S14).

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### **Adaptative outcomes**

In model 1 (autonomous motivation), model 2 (enjoyment) and model 3 (physical activity intention), we found patterns of mediation in five countries (Greece, Spain, Italy, Portugal, England). Specifically, relative to lower ES, higher ES was positively associated with a higher BPN satisfaction (path a,  $\beta$ s between .07 and .18,  $ps < .034$ ) which, in turn, was associated with higher autonomous motivation (path b,  $\beta$ s between .76 and .87,  $ps < .001$ ), enjoyment (path b,  $\beta$ s between .60 and .74,  $ps < .001$ ), and stronger intention towards physical activity (path b,  $\beta$ s between .21 and .43,  $ps < .001$ ). The mediation of relations between ES and adaptative outcomes by BPN was also confirmed by significant indirect effects ( $\beta$ s between .02 and .12,  $ps < .039$ ) and total effects ( $\beta$ s between .06 and .17,  $ps < .010$ ) on these three outcomes. It should be noted that the results in England are slightly different from those of Greece, Spain, Italy, and Portugal. Although the indirect effect was significant, the total effects of ES on both autonomous motivation ( $\beta = .07$ ,  $p = .14$ ) and enjoyment ( $\beta = .05$ ,  $p = .25$ ) were not significant, suggesting inconsistent mediation on these outcomes.

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Finally, the results of model 3 show that mediation is only partial for Greece, Spain, Italy and Portugal insofar as ES remains significantly and positively related to physical activity intentions after controlling for BPN ( $\beta$ s between .08 and .14,  $ps < .001$ ).

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### **Maladaptive outcomes**

In model 4 (displeasure) and 6 (amotivation), we found evidence of mediation in five countries (England, Greece, Spain, Italy, Portugal). ES was significantly associated with BPN satisfaction (path a,  $\beta$ s between .07 and .17,  $ps < .029$ ) which, in turn, was significantly associated with displeasure (path b,  $\beta$ s between  $-.35$  and  $-.55$ ,  $ps < .001$ ) and amotivation (path b,  $\beta$ s between  $-.09$  and  $-.31$ ,  $ps < .006$ ). Except for a slight difference in model 6 in the England sample ( $\beta = -.02$ ,  $p = .056$ ), the mediation of relations between ES and maladaptive outcomes by BPN was also confirmed by significant indirect effect ( $\beta$ s between  $-.01$ ,  $-.06$ ,  $ps < .03$ ). However, we found no or only marginally significant total effects ( $\beta$ s between .00 and  $-.07$ ,  $ps > .07$ ).

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Regarding model 5 (controlled motivation), we found patterns of mediation only in Greece, Spain and Italy, with significant path a ( $\beta$ s between .07 and .17,  $ps < .001$ ) and path b ( $\beta$ s between  $-.13$  and  $-.28$ ,  $ps < .001$ ), and an indirect effect also significant ( $\beta$ s between  $-.01$  and  $-.03$ ,  $ps < .005$ ). Nevertheless, the total effect was only significant for Spain ( $\beta = .07$ ,  $p = .044$ ). No mediation pattern has been found for England and Portugal, where only path a is significant, but not path b ( $\beta$ s between  $-.01$  and  $-.04$ ,  $ps > .37$ ).

Finally, we found no evidence of mediation for any outcomes in Turkey. Indeed, in all models, ES was never significantly linked to BPN satisfaction (path a,  $\beta$ s between .00 and  $-.01$ ,  $ps > .822$ ), although associations between BPN and outcomes (path b) were significant for all outcomes ( $\beta$ s between  $-.37$  and  $.34$ ,  $ps < .001$ ) except controlled motivation and amotivation ( $\beta$ s between  $-.03$  and  $.04$ ,  $ps > .07$ ). Finally (while controlling for BPN) ES appears directly and negatively related to autonomous motivation ( $\beta = -.05$ ,  $p < .001$ ) and enjoyment ( $\beta = -.03$ ,  $p < .05$ ), and directly and positively related to physical activity intentions ( $\beta = .08$ ,  $p < .001$ ).

### Global model

Since we found no significant relationships between ES and BPN in Turkey, we choose to compute the global model, constraining regression paths to be similar in each country (model 7), with only the five remaining countries (i.e., Greece, Spain, Italy, Portugal, England;  $n = 7394$ ) and all outcomes. This model (Table 2; excluding Turkey) showed good fit indexes (CFI = .95, RMSEA = .037) and revealed patterns of mediation for the six outcomes, with significant a path ( $\beta = .10$ ,  $p < .001$ ), significant b paths ( $\beta$ s between .36 and .83 for adaptative outcomes and between  $-.19$  and  $-.51$  for Maladaptative outcomes,  $ps < .001$ ) and significant indirect effects for all outcomes ( $\beta$ s between .04 and .08 for adaptative outcomes and between  $-.02$  and  $-.05$  for maladaptative outcomes,  $ps < .001$ ). Total effects were significant for adaptative outcomes ( $\beta$ s between .03 and .15 for adaptative outcomes,  $ps < .011$ ) but non-significant for amotivation and displeasure ( $ps > .378$ ).

For autonomous motivation ( $\beta = -.03$ ,  $p < .001$ ), enjoyment ( $\beta = -.02$ ,  $p = .08$ ), displeasure ( $\beta = .04$ ,  $p < .001$ ), controlled motivation ( $\beta = .05$ ,  $p < .001$ ) and amotivation ( $\beta = .04$ ,  $p = .004$ )  $c'$  paths (i.e., direct effects) were significant or marginally significant but on the opposite sign of total and indirect effect, which might suggest a suppressing effect. For controlled motivation, it should be noted that total effect was significant ( $\beta = .03$ ,  $p = .011$ ) but on an opposite sign of indirect effect ( $\beta = -.02$ ,  $p < .001$ ) which also corroborate a suppressing effect.

### Gender moderation

We ran moderation analysis with data gathered from the five countries of the global model (i.e., Greece, Spain, Italy, Portugal, England). In models 8a, 8b, 8c, 8d, 8e, 8f (Table S15), we found a significant ES  $\times$  gender interaction term on all outcomes ( $\beta$ s between  $-.16$  and  $-.20$  for adaptative outcomes and  $\beta$ s between .15 and .24 for maladaptative outcomes,  $ps < .005$ ) suggesting that being a girl amplified the relationship between ES and the outcomes (Figure S8). Further exploration of single slope indicate that ES was significantly associated with autonomous motivation or enjoyment for girls ( $\beta$ s between .07 and .09,  $p < .001$ ) but not for boys ( $\beta$ s  $< .01$ ,  $ps > .739$ ). ES was positively associated with intention with a steeper slope for girls ( $\beta = .17$ ,  $p < .001$ ) relative to boys ( $\beta = .10$ ,  $p < .001$ ).

**Q7 Table 2.** Results from the constrained regression path model (model 7; Greece, Spain, Portugal, Italy, and England).

Autonomous motivation				Enjoyment				Physical activity intention						
Predictors	b	95CI	p	β	Predictors	b	95CI	p	β	Predictors	b	95CI	p	β
Dependent variable: autonomous motivation				Dependent variable: enjoyment				Dependent variable: intention						
BNS	1.45	1.37; 1.52	<.001	.83	BNS	1.12	1.07; 1.17	<.001	.75	BNS	.39	.36; .42	<.001	.36
FAS composite	-.05	-.08; -.02	.003	-.03	FAS composite	-.03	-.06; .00	.08	-.02	FAS composite	.12	.10; .14	<.001	.11
R <sup>2</sup>	.70			.56	R <sup>2</sup>	.56			.15	R <sup>2</sup>	.15			.11
Dependent variable: basic need satisfaction				Dependent variable: basic need satisfaction				Dependent variable: basic need satisfaction						
FAS composite	.10	.07; .12	<.001	.10	FAS composite	.10	.07; .12	<.001	.10	FAS composite	.10	.07; .12	<.001	.10
R <sup>2</sup>	.009			.009	R <sup>2</sup>	.009			.009	R <sup>2</sup>	.009			.009
Indices of mediation				Indices of mediation				Indices of mediation						
Indirect effect	.14	.10; .18	<.001	.08	Indirect effect	.11	.08; .14	<.001	.07	Indirect effect	.04	.03; .05	<.001	.04
Total effect	.09	.05; .13	<.001	.05	Total effect	.08	.05; .12	<.001	.06	Total effect	.16	.13; .18	<.001	.15
Displeasure				Controlled motivation				Amotivation						
Predictors	b	95CI	p	Predictors				Predictors						
Dependent variable: displeasure				Dependent variable: controlled motivation				Dependent variable: amotivation						
BNS	-.59	-.62; -.60	<.001	BNS	-.20	-.20; -.17	<.001	BNS	-.29	-.32; -.26	<.001	-.28	<.001	-.28
FAS composite	.05	.02; .07	.001	FAS composite	.05	.05; .08	<.001	FAS composite	.04	.01; .06	.004	.04	.004	.04
R <sup>2</sup>	.26			R <sup>2</sup>	.04			R <sup>2</sup>	.08			.08		.08
Dependent variable: basic need satisfaction				Dependent variable: basic need satisfaction				Dependent variable: basic need satisfaction						
FAS composite	.10	.07; .12	<.001	FAS composite	.10	.07; .12	<.001	FAS composite	.10	.07; .12	<.001	.10	<.001	.10
R <sup>2</sup>	.009			R <sup>2</sup>	.009			R <sup>2</sup>	.009			.009		.009
Indices of mediation				Indices of mediation				Indices of mediation						
Indirect effect	-.06	-.07; -.04	<.001	Indirect effect	-.02	-.03; -.01	<.001	Indirect effect	-.03	-.04; -.02	<.001	-.03	<.001	-.03
Total effect	-.01	-.04; .02	.378	Total effect	.03	.01; .06	.011	Total effect	.03	-.02; .03	.534	.01	.534	.01

CFI = .95; RMSEA = .037; n = 7394.

Further, ES was positively associated with displeasure for boys ( $\beta = .05, p = .011$ ) but was negatively associated for girls ( $\beta = -.06, p < .001$ ). Finally, ES was positively associated with controlled motivation and amotivation for boys ( $\beta$ s between .04 and .06,  $ps < .014$ ) but not for girls ( $ps > .075$ ).

545 Of note, when running the set of models 8 in the Turkish subsample ( $n = 2998$ ), we found no evidence of gender moderation on the relationship between ES and the six outcomes ( $ps > .501$ ; Table S16).

### **Sensitivity analysis**

550 A first sensitivity analysis was carried out by retesting model 7 with only those participants who reported complete data (model 9,  $n = 6060$ , Table S17). The results are consistent with those observed in the main analyses. A second sensitivity analysis was carried out by retesting model 7 while controlling for school affiliation (model 10,  $n = 5245$ , number of schools = 230, Table S18). Here again the results are consistent with those of  
555 the main analyses.

### **Discussion**

560 The main purpose of the present article was to examine whether BPN satisfaction mediated the relationship of ES with motivational and affective outcomes in PE and out-of-school physical activity intention. This large-scale study revealed that, in five of the six European participating countries (i.e., Greece, Spain, Italy, Portugal, England), students with a lower ES showed a lower BPN satisfaction during PE, which was in turn associated with lower autonomous motivation, lower enjoyment in PE, stronger amotivation, controlled motivation and displeasure in PE, and with a weaker intention to practice  
565 out-of-school physical activity. In global constrained model (i.e., model gathering participants from Greece, Spain, Italy, Portugal, England), results for adaptative outcomes (i.e., autonomous motivation, enjoyment and physical activity intention) suggested consistent mediation. In contrast, results for maladaptive outcomes (i.e., displeasure, controlled motivation and amotivation) displayed inconsistent mediation. Our study supports the proposition that lower ES relates to a less adaptative motivational and affective experiences in PE and intention to practice physical activities outside of school. With few specificities in the English sample and no significant mediation in Turkey, these findings were highly congruent between countries. Finally, our exploratory analysis suggests  
570 that the deleterious associations between lower ES and less adaptative affective and motivational outcomes were amplified among girls.  
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### **Comparison with previous studies**

#### **ES and BPN satisfaction**

580 Our results showed for the first time that, compared with students with higher family ES, students with lower family ES exhibited lower BPN satisfaction during PE lessons – although the effect size was of small magnitude. As student PBN depends partially on teacher support, these findings are consistent with existing sociological studies that suggest a lower perceived teacher support among disadvantaged students in school in  
585 some European countries (e.g., Sortkær, 2019). Our results also align with the SDT

literature that observed a weaker peer relatedness satisfaction in school (Alivernini et al., 2019). Our findings confirm and extend existing literature by demonstrating that the quality of the motivational experience during PE may also depend on students' ES background. Building on the idea that understanding inequalities is a first step to reducing them (e.g., Piketty, 2019), future studies could seek to formally investigate why students with lower ES report weaker BPN satisfaction. Although speculative, we proposed that teachers who feel pressure from below (Pelletier et al., 2002) and inexperienced teachers (PISA, 2018) in disadvantaged schools may adopt a teaching style that is less supportive of students' BPN. Another possible explanation is that disadvantaged students perceive less support from their peers or feel less supported by their teachers for the same amount of support. As such, future studies are needed to analyse whether student's family ES could influence teachers or peer support in the SDT perspective".

Further, the magnitude of the effect size of the relationship between ES and BPN (i.e.,  $\beta = .10$ ) appears to be consistent overall with the small effect sizes from studies examining the relationship between socio-economic status and motivational processes or teacher support at school in general (e.g., Guo et al., 2023; Sortkær, 2019). Our study suggests, for the first time in PE context, that BPN satisfaction may be linked, albeit modestly, to socio-economic factors. Importantly, although small in the short run, this association can be particularly problematic in terms of social equity. Indeed, small changes in pervasive and cumulative causes such as ES can lead to significant differences in the medium or long term (Funder & Ozer, 2019; Sieber et al., 2022).

### *Associations of BPN with motivational and affective outcomes*

In line with SDT proposals (Ryan & Deci, 2020) and previous work (Hagger & Chatzisarantis, 2016; Vasconcellos et al., 2020) our results indicate significant associations between BPN satisfaction in PE and the type of motivation, affective experiences, and intention to engage in physical activity in the future. More precisely, relationships appear to be positive and strong for autonomous motivation (e.g.,  $\beta = .83$ ) and enjoyment (e.g.,  $\beta = .75$ ), positive but low to moderate for physical activity intention (e.g.,  $\beta = .36$ ), negative and moderate for displeasure (e.g.,  $\beta = -.51$ ) and negative and low for controlled motivation (e.g.,  $\beta = -.19$ ) and amotivation (e.g.,  $\beta = -.28$ ). In other words, in a cross-cultural context, our results contribute to the robust evidence about the essential role of BPN in shaping student's motivational and affective outcomes in PE.

### *BPN as a mediator of the association of ES with motivational and affective experience during PE*

Our analysis revealed that BPN satisfaction mediated the relationship of ES with the affective and motivational outcomes. This finding aligns with studies revealing that a lower ES may predict less adaptive affective and motivational experience in school (e.g., Manganelli et al., 2021). Our results are also congruent with the only study (to our knowledge) that has revealed lesser peer relatedness satisfaction as a mediator of the relationship between lower socio-economic status and lower adaptive affect in school (Alivernini et al., 2019). Here, we extend these results in the context of PE, drawing on a multi-country and large sample and adopting a broader approach to motivational and affective processes.

Our results show that only out-of-school physical activity intentions remain positively associated with ES after controlling the BNS satisfaction mediation. This finding suggests that a substantial part of the association between lower ES and less adaptive PE outcomes could be explained by BPN satisfaction. In addition, it highlights how other factors besides BPN may also explain why a lower ES is associated with lower out-of-school physical activity intentions. For example, subjective norms, perceived behavioural control, attitudes (Balla et al., 2024) or parental support (Seabra et al., 2013) could play a significant role in explaining why students with lower ES have weaker intentions to engage in physical activity. In sum, congruent with theoretical models derived from SDT (Vasconcellos et al., 2020), BPN satisfaction appear as a substantial predictor of affective and motivational experiences in PE, but a more distal determinant of out-of-school physical activity intentions.

Further, as observed in the literature (Ntoumanis, 2023), the associations between BPN satisfaction and maladaptive outcomes (i.e., controlled motivation, displeasure, amotivation) were weaker compared to those observed for the adaptive motivational outcomes (i.e., autonomous motivation, enjoyment). This finding may be explained by the suggestion that basic need satisfaction and basic need frustration are distinct constructs (Bartholomew et al., 2011) that sometimes co-occur in PE class (Warburton et al., 2020). As such, low levels of BPN satisfaction are not equivalent to BPN frustration. While BPN satisfaction is more likely to be associated with adaptive outcomes, BPN frustration is more strongly associated with maladaptive outcomes (Warburton et al., 2020). This feature may explain the weaker (i.e., controlled motivation displeasure and amotivation in the global model) or non-significant (i.e., controlled motivation for Portugal and England) indirect effects between ES, BPN satisfaction and maladaptive outcomes. Thus, in line with recent SDT directions (Ntoumanis, 2023) future studies on socio-economic determinants of motivational processes might look not only at "bright" pathways (i.e., supportive teaching style, BPN satisfaction) but also at the "dark" (i.e., thwarting teaching style, BPN frustration), or the "grey" (i.e., non-supportive and non-thwarting teaching style, BPN unfulfilment) side of motivational processes. This perspective might be especially relevant to understand maladaptive outcomes (Warburton et al., 2020). Secondly, the non-significant total effects for amotivation and displeasure might be complementary explained by the greater power of the indirect effect test compared to the total effect test. This methodological explanation is especially relevant when the  $c'$  path (i.e., direct effect) is non-significant or on the opposite sign of indirect effect, when effect sizes are modest and when  $b$  paths are larger than  $a$  path (e.g., Kenny & Judd, 2014) – as observed in our sample. While the sample size was relatively smaller in England ( $n = 501$ ) compared to other countries ( $n \geq 1003$ ), the less congruent results in examining the total effect in this subsample could also be explained by this lack of statistical power.

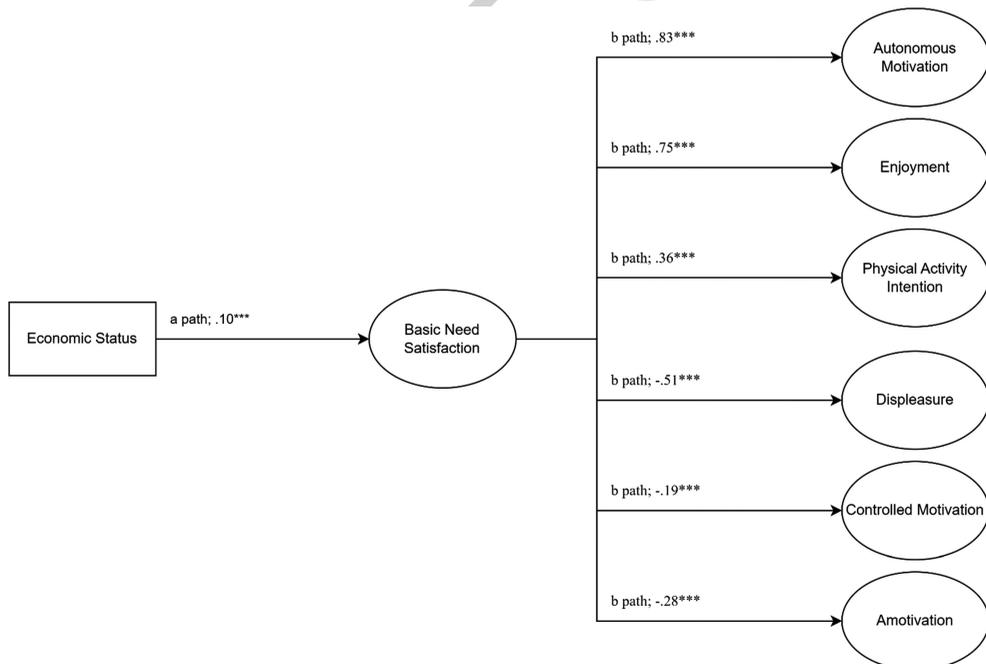
### Country heterogeneity

Our results showed that BPN satisfaction mediated the association between ES and adaptive outcomes, displeasure and amotivation in five countries (i.e., England, Greece, Spain, Italy, Portugal) and controlled motivation in three countries (i.e., Greece, Spain, Italy). However, these patterns were not observed in Turkey. Although highly speculative, at least three factors may explain these unexpected findings. First, school systems differ considerably across countries (PISA, 2018), including different types of pedagogy,

curriculum, teacher experience or training in PE (e.g., Tannehill et al., 2021). This type of difference has already been suggested as an explanation for the country specificity in the analysis of the relationship between socio-economic status and teacher support (Bakchich et al., 2023; Sortkær, 2019). Second, Turkey appears to be a less wealthy country than the others, as suggested by lower FAS III scores (see Table 1 and Figure 2). Considering the relationship between a lower ES and less physical activity was found to be less conclusive in lower income countries (O'Donoghue et al., 2020), hence the detrimental association between ES and motivational and affective experiences in PE may be reduced when the population is on average less wealthy. Third, while psychological and sociological mechanisms were generally considered as “universal”, numerous studies showed that robust phenomena in Western Europe and North America are not always replicable in other settings or populations (Chalabaev et al., 2023). Because any of these features could explain the non-significant associations between ES and BPN in Turkey, future studies are needed to understand how ES interacts with school systems or country income to explain socio-economic inequalities in PE and should be conducted in more diverse countries.

### Moderation by gender

Our exploratory analysis provides preliminary evidence that these deleterious associations between lower ES and lower affective and motivational outcomes were



**Figure 2.** Results from the latent structural models for joint significance test for five countries (i.e., England, Greece, Italy, Spain, and Portugal) in model 7. Note: Range of standardized beta coefficients ( $\beta$ ) are displayed. (a) Effect of the independent variable on the mediator and (b) effect of the mediator on the dependent variable. To improve the clarity of the figure, specification of latent variables, indirect, direct and total effects are not displayed but are available on Table 2.

725 amplified among girls in five countries (i.e., Greece, Spain, Italy, Portugal, England). Further analysis of single slope also suggests that the relationship between ES and out-comes might even be reversed in boys compared to girls. In line with an intersectional perspective (Eagly et al., 2012), this finding suggests that ES and gender influence PE motivational and affective experience in a multiplicative manner rather than in additive one. As found for adult physical activity (Chalabaev et al., 2022), disadvantaged girls may pay the price of inequalities in PE more than disadvantaged boys. Although specu-  
730 lative, one possible explanation relates to the gender norm that physical activity is more socially acceptable for men than women, especially from disadvantaged backgrounds (Chalabaev et al., 2022). Girls with lower ES may face this additional barrier, which may explain why the relationships between ES and motivational and affective experiences in PE were stronger for girls.

735 Previous SDT literature has found that girls report less adaptative motivational and affective experience in PE (Vasconcellos et al., 2020) but did not consider how gender and ES might interact to amplify inequalities. Accordingly, more research on this relationship is needed. However, studies have found that girls in PE showed a stronger association between perceived less supportive teacher motivational style and less adaptative motivation (e.g., Koka & Sildala, 2018), which may help explain why lower need satisfaction among disadvantaged students may be particularly problematic for girls.

### 740 *Practical and theoretical implications*

745 The present study suggests that PE may participate in the reproduction of the economic inequalities in physical activity. Indeed, the most economically disadvantaged students might live less adaptative motivational and affective experiences in PE. We confirm the conceptual relevance of considering the interaction if psychological and sociological processes from a multidisciplinary framework. In line with recent arguments in psychology (Chalabaev et al., 2023; McKinley et al., 2020), our results support the idea that classic socio-cognitive models of physical activity engagement should not consider only individ-  
750 ual psychological variables, and would benefit from incorporating socio-economic factors as target variables. Parallely, the sociological perspective has regularly been criticised as a relative “black box” when analysing precisely how lower ES negatively influences school experience and broader outcomes (e.g., Schmidt & Burroughs, 2013). In this regard, our analysis provides first evidence that basic BPN could be one of the mediating pathways underlying the link between ES and school-related outcomes.

755 At a time of increasing structural socio-economic inequalities (Piketty, 2019) and pervasive health inequalities (Sieber et al., 2022) in Europe, the ES gap seems destined to remain a long term issue. As such, a short term and practical (partial) solution may lie in identifying modifiable factors that could buffer the effects of socio-economic inequalities on health or education and that could be immediate targets for interventions. Moti-  
760 vational processes are one of these factors (McKinley et al., 2020). Our findings underscore the importance of promoting the BPN among the most economically disadvantaged students, especially girls. Fulfilling these psychological nutrients emerges as a central lever to ensure that all children and adolescents, regardless of their ES or gender, benefit from adaptative motivational and affective experiences in PE, and in turn may ultimately practice more physical activity in their adult life. Such empowering PE experiences may be  
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critical in shaping an active and lifelong active lifestyle (Martins et al., 2018). In this respect, abundant literature has shown that theory-based teacher trainings helps teachers to adopt more supportive motivational styles, ultimately fostering students' BPN satisfaction (Vasconcellos et al., 2020).

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### **Strengths and limitations**

Some limitations deserve to be acknowledged. First, our study focused on ES which is only a facet of socio-economic status (e.g., economic status, occupational status, educational status; Saegert et al., 2006). It is worth noting that, in Europe, cultural status during childhood (e.g., number of books at home) is more predictive of school achievement (Eriksson et al., 2021) or of future physical activity (Chalabaev et al., 2022) and interact more with gender to predict physical activity (Chalabaev et al., 2022) than ES. Adopting a broader, multidimensional perspective on socio-economic status remains needed. Second, we relied on cross-sectional data which cannot ensure causal links between variables (e.g., Yzerbyt et al., 2018). However, it appears highly likely that family ES (e.g., number of cars at home) has a temporal precedence on BPN satisfaction in PE. Still, future longitudinal studies are needed to formally assess temporal precedence between our constructs. Further, the causal pathway between BPN and outcomes is based on strong theoretical foundation and empirical evidence (e.g., Vasconcellos et al., 2020). Moreover, as the correlation between autonomy, competency and relatedness was strong and rising collinearity problems – as already observed (Quested et al., 2013; Vasconcellos et al., 2020), we could not disentangle the distinct effects of ES on the three needs separately. Similarly, we did not measure the BPN frustration, which didn't allow us to disentangle the bright, the grey and the dark sides of the motivational process at play (Bartholomew et al., 2011; Ntoumanis, 2023). Furthermore, additional variables, such as immigrant status, ethnicity or type of schools or of classes (e.g., class size and composition, type of school segregation) could also explain the link between ES, BPN and outcomes. As such, future studies with extensive indicators of school and demographic variables are needed to fully uncover the relationship between socio-economic status facets and experience in PE. Finally, the research was conducted only with teachers and schools who volunteered to participate in the research in the regions where the researchers were based during the project. Thus, in line with previous databases (e.g., PISA, 2018), future studies may benefit from using more representative national samples.

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While this study has limitations, it also has important strengths. At the theoretical level, our study extends existing literature by testing the associations between ES and multiple motivational and affective outcomes in school (i.e., enjoyment and displeasure, autonomous motivation, controlled motivation, amotivation, intention), by analysing the three BPN satisfaction (i.e., autonomy, relatedness, competency) as a mediator, by integrating sociological literature (i.e., economic status and teacher support) alongside with motivational literature (i.e., self-determined motivation) and by examining the cross-cultural validity of observed associations. Methodologically, other strengths include a large cross-cultural sample, the consistency of results across sensitivity analyses and five countries, and its statistical approach combining structural equation modelling, measurement invariance, multigroup analyses and mediation models.

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## Conclusion

Our findings revealed that lower BPN satisfaction may partly explain the association between lower ES and less adaptative motivational and affective experiences in PE among European adolescents. Moreover, the associations were consistent across all the countries, except for Turkey, where no significant associations were observed. Our exploratory analysis also suggests that being a girl might exacerbate the association between lower ES and less adaptative motivational and affective outcomes in PE. Our study confirms that the quality of adolescent's experiences in PE is socio-economically and gender patterned and sheds new light on the potential motivational mechanisms at work. Overall, our results highlight the conceptual interest of considering how psychological concepts might explain the sociological reproduction of inequalities and underline the practical relevance of paying particular attention to BPN satisfaction of lower ES adolescents, especially girls. The reduction of intersectional inequalities in PE and physical activity, and ultimately in health and education, might depend on it.

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## Disclosure statement

Q13 No potential conflict of interest was reported by the author(s).

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## Ethics statement

This study was part of the IMPACT study, approved by the relevant research ethics committees in the participating countries.

## Informed consent

All participants provided written informed consent.

## Data availability statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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