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1 Student Intention to Engage in Leisure-time Physical Activity: The Interplay of Task-  
2 involving Climate, Competence Need Satisfaction, and Psychobiosocial States in Physical  
3 Education

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27

## 28 Abstract

29 Grounded in achievement goal theory and basic psychological needs theory, the aim of this  
30 study was to examine the interaction of perceived motivational climate in physical education  
31 with psychological needs satisfaction (relatedness, competence, and autonomy) and  
32 psychobiosocial states, on student intention to engage in leisure-time physical activity  
33 (LTPA). Participants ( $N = 470$  Italian students, 287 boys and 183 girls, aged 16-19 years)  
34 completed the Teacher-Initiated Motivational Climate in Physical Education Questionnaire,  
35 the Psychological Needs Satisfaction Scale in Physical Education, the Psychobiosocial States  
36 Questionnaire, and a measure of intention to engage in LTPA. Structural equation modeling  
37 (SEM) analysis indicated that a perceived task-involving climate was related to intention to  
38 engage in physical activity through the serial mediation of competence need satisfaction and  
39 pleasant/functional psychobiosocial states. The findings highlight the importance of task-  
40 involving climate and competence need satisfaction in determining pleasant emotional states  
41 and, consequently, in promoting LTPA. Teachers should apply curricular and pedagogical  
42 strategies aimed to create a task-involving motivational climate, make movement experiences  
43 personally meaningful and pleasant, and therefore stimulate students to adopt an active  
44 lifestyle.

45 *Keywords:* motivation, emotion, achievement goal theory, self-determination theory,  
46 basic psychological needs theory, IZOF model

47

## 48 **Introduction**

49 Health benefits associated with a physically active lifestyle are well documented  
50 (Garber et al., 2011), but there is still a clear need for effective interventions to increase the  
51 levels of physical activity in the general population (Biddle et al., 2012). School physical  
52 education (PE) plays a critical role in promoting a healthy lifestyle, providing opportunities to  
53 encourage students to adopt physical activity as a pleasant regular habit in leisure time (Cavill  
54 et al., 2001; Shephard and Trudeau, 2000). Thus, in our study we examined the relationships  
55 among critical factors in PE, which were expected to positively influence student physical  
56 activity involvement at school and outside of school. Specifically, we investigated the  
57 relationships between perceived motivational climate in PE, individual motivation, and  
58 emotional experiences related to the intention to engage in leisure-time physical activity  
59 (LTPA). Theoretical frameworks, such as the theory of planned behavior (TPB; Ajzen, 1991)  
60 and the trans-contextual model of motivation (Hagger and Chatzisarantis, 2016), view  
61 intention as an antecedent of behavior. Intention to engage in physical activity or sport outside  
62 of school, considered a key outcome variable, is a good indicator and a strong predictor of  
63 motivation toward this behavior (Goudas et al., 1995). In a sample of Greek PE students,  
64 intention predicted actual exercise behavior 6 and 14 months later (Papaioannou, 2000).

65 Student intention to engage in physical activity outside of school has been often  
66 examined using two theoretical frameworks, achievement goal theory (AGT; Ames, 1992;  
67 Nicholls, 1984) and self-determination theory (SDT; Deci and Ryan 2000; Ryan and Deci,  
68 2017). AGT assumes two main dispositional goals named task orientation and ego orientation,  
69 which influence the individual tendency to evaluate personal success and competence (Duda  
70 and Nicholls, 1992). Task orientation involves perceiving success in a self-referenced way,  
71 being interested in personal improvements, and attributing value to effort and commitment. In  
72 contrast, ego orientation implies perceiving success as normatively referenced, being

73 interested in demonstrating superior ability, and outperforming others (Duda, 1989). AGT  
74 also highlights the role of the social environment postulated to have an impact on individual  
75 dispositional goal orientation and behavior. A task-involving climate focuses on individual  
76 improvement and cooperative learning, whereas an ego-involving climate underscores social  
77 comparison and competition (Duda et al., 2014). Research findings in PE settings showed that  
78 the social situation created by teachers can determine the likelihood of students adopting task-  
79 or ego-involved goals when participating in the activity (see Roberts et al., 2007), and that  
80 perceptions of a task-involving climate can enhance the students' intention to engage in future  
81 physical activity (Escartí and Gutiérrez, 2001; Sproule et al., 2007).

82         In SDT, social-contextual factors are thought to be fundamental to self-motivated  
83 actions and psychological health (Ryan and Deci, 2017). Within the broad framework of SDT,  
84 basic psychological needs theory (BPNT) has been proposed as a mini-theory aimed to  
85 underline the role of social and environmental support (Deci and Ryan, 2000; Ryan and Deci,  
86 2017). BPNT assumes that three psychological needs (i.e. relatedness, competence, and  
87 autonomy) underpin self-determined motivation, that is, the engagement in activities for the  
88 feelings of pleasure and satisfaction that derive directly from participation. According to  
89 BPNT (Ryan and Deci, 2017), relatedness is defined as the need to be connected and accepted  
90 by significant others in a specific context, competence reflects the need to effectively interact  
91 with the environment and to experience a sense of accomplishment or achievement, and  
92 autonomy refers to the individual need to experience choice and freedom in action. These  
93 basic psychological needs are viewed as essential nutrients for growth, integrity, and well-  
94 being. Using BPNT in the PE context, Standage et al. (2005) found that a need-supporting  
95 environment predicted self-determined motivation, which in turn, predicted adaptive PE-  
96 related outcomes. Self-determined motivation has been related to student optimal  
97 motivational functioning, wellbeing, and intentions to engage in physical activity outside of

98 school (Chatzisarantis et al., 1997; for reviews, see Curran and Standage, 2017; Van den  
99 Berghe et al., 2014).

100 Standage et al. (2003) provided an integrative approach to examine student intention  
101 to engage in physical activity incorporating constructs from both AGT and SDT in the setting  
102 of PE. They demonstrated that a task-involving climate fostered self-determined motivation,  
103 with the latter positively predicting LTPA intentions. AGT and SDT have been examined  
104 together to study the relationships between motivational factors and emotional states in the PE  
105 context. For example, Baena-Extremera et al. (2015) found that a task-involving climate  
106 created by teachers predicted student self-determined motivation, and this, in turn, predicted  
107 pleasant emotional states in PE classes. Pleasant states such as enjoyment, satisfaction,  
108 pleasure, and fun, have been found to be important affective variables linked to increased  
109 physical activity participation outside PE lessons (Bengoechea et al., 2010; Biddle et al.,  
110 2005; Papaioannou et al., 2006).

111 Emotions in achievement settings are fundamental for student motivation, learning,  
112 performance, and well-being (Pekrun and Linnenbrink-Garcia, 2014). Pekrun's (2006)  
113 control-value theory provides an integrative approach to the study of emotions experienced in  
114 academic, sport, and professional contexts. In this view, emotions are seen as multi-  
115 component, and entail a set of interrelated affective, cognitive, motivational, and  
116 physiological processes. Achievement environments, goals, and outcomes shape individual  
117 appraisals and emotions, while emotions are expected to reciprocally influence engagement  
118 and achievement (Pekrun, 2017). Pleasant emotions, in particular, can boost self-regulatory  
119 motivational and cognitive processes relevant to academic achievement and personal growth  
120 (Pekrun et al., 2009). Empirical evidence supports the predictions of the control-value theory  
121 (for a meta-analysis, see Huang, 2011).

122 A theoretical framework that shares some features with Pekrun's (2006) theory is the  
123 individual zones of optimal functioning (IZOF) model (Hanin 2000, 2007). The IZOF model  
124 is one of the most widely applied models to the study of subjective experiences related to  
125 performance in sport and PE settings (for a review, see Ruiz et al., 2017). Similar to the  
126 control-value theory, the IZOF model advocates a multi-component conceptualization of  
127 emotion emphasizing affective, cognitive, motivational, physiological, and relational  
128 components underlying individual experiences. The IZOF model, however, takes a more  
129 holistic approach to incorporate a wide range of idiosyncratic emotion and emotion-related  
130 psychobiosocial states. Specifically, emotional experiences are conceptualized as part of  
131 psychobiosocial states, which can be manifested through a range of eight interactive  
132 components including psychological (i.e. emotional, cognitive, motivational, volitional),  
133 biological (i.e. bodily, motor-behavioral), and social (i.e. performance, communicative)  
134 components (Hanin, 2010; see Robazza et al., 2016; Ruiz et al., 2016).

135 Within the IZOF model, valence or hedonic tone and functionality of psychobiosocial  
136 states are distinguished. Thus, the emotional component of a psychobiosocial state is assumed  
137 to be pleasant or unpleasant and to exert functional or dysfunctional effects on performance,  
138 while the remaining non-emotion components can be categorized as functional or  
139 dysfunctional for performance (Bortoli et al., 2009, 2011; Robazza et al., 2016; Ruiz et al.,  
140 2016). Extensive empirical evidence supports this conceptualization (see Ruiz et al., 2017).  
141 Drawing on both AGT and SDT, in the present study we assumed emotions to be a function  
142 of antecedent motivational processes. We also applied the IZOF-based conceptualization of  
143 individual experiences to the study of the interplay between perceived motivational climate in  
144 PE, individual motivation, emotional experiences, and the intention to engage in LTPA.

145 **Study purpose and hypotheses**

146           The aim of our study was to determine whether student pleasant/functional  
147 psychobiosocial states and psychological needs satisfaction (i.e. relatedness, competence, and  
148 autonomy) mediated the linkage between PE teacher-created task-involving climate and the  
149 intention to engage in LTPA. In Italian high schools, PE is compulsory for mixed-gender  
150 group classes, which are taught indifferently by female or male teachers. Students with  
151 disabilities are included in regular classes. Teachers take account of diversity by promoting  
152 equality and inclusion in their teaching methods. Individual performance improvements are as  
153 important as student enjoyment and commitment. Previous study findings within Italian high-  
154 school PE settings showed that both girls and boys reported higher scores in perceived task-  
155 involving climate and pleasant/functional psychobiosocial states, compared to ego-involving  
156 climate and unpleasant/dysfunctional psychobiosocial states (Bortoli et al., 2014, 2015, 2017).  
157 These results are in accordance with the aims of the national curriculum, which are  
158 emphasized in the PE teacher education (Italian Ministry of Education, University, and  
159 Research, 2009).

160           Based on this evidence, in the current study we focused on student perception of task-  
161 involving climate, basic psychological needs satisfaction, and pleasant/functional  
162 psychobiosocial states. In particular, we tested two alternative hypotheses through two  
163 mediation models. A first model (hypothesis 1) builds upon previous findings showing task-  
164 involving climate to be a significant positive predictor of (a) pleasant psychobiosocial states  
165 (Bortoli and Robazza, 2007) and (b) satisfaction of basic psychological needs (Bortoli et al.,  
166 2014). Therefore, we expected task-involving climate to predict individual intention to engage  
167 in physical activity directly and indirectly through the mediation of pleasant/functional  
168 psychobiosocial states and satisfaction of basic psychological needs (i.e. relatedness,  
169 competence, and autonomy). We conducted parallel mediation analysis (Figure 1, upper part),  
170 of the effects of task-involving climate on individual intention to engage in physical activity



171 directly as well as indirectly through pleasant/functional psychobiosocial states and  
172 satisfaction of basic psychological needs. In parallel mediation, no mediator causally  
173 influences another (Hayes, 2013).

174 [insert Figure 1.]

175 A second mediation model (hypothesis 2) was informed by the results of Bortoli et  
176 al.'s (2011) study involving adolescent athletes, in which actual and perceived competence  
177 interacted with motivational climate perceptions in the prediction of psychobiosocial states.  
178 Aligned with these results, the parallel mediation model was modified to include  
179 pleasant/functional psychobiosocial states as mediators of the relationship between  
180 psychological needs satisfaction and individual intention (Figure 1, lower part). Thus, a serial  
181 mediation model was conducted examining the effects of task-involving climate on individual  
182 intention to engage in physical activity, with a sequence in which psychological needs  
183 satisfaction were assumed to be predicted by task-involving climate, and then served as  
184 antecedents to psychobiosocial states, which in turn predicted individual intentions. In  
185 particular, we expected task-involving climate to predict the individual intention to engage in  
186 physical activity (a) directly and (b) through the serial mediation of competence and  
187 pleasant/functional psychobiosocial states.

## 188 **Method**

### 189 **Participants and procedure**

190 The study involved 478 students (final sample, 287 boys and 183 girls), aged 16-19  
191 years ( $M = 17.4$ ,  $SD = 1.3$ ) from two high schools in Central Italy. During the academic year,  
192 participants were involved twice a week in mandatory PE classes (Italian Ministry of  
193 Education, University, and Research, 2009). The development of physical, emotional, and  
194 cognitive skills of students was a main goal according to the Italian PE curriculum. Based on  
195 this curriculum, PE activities were usually aimed to develop student postural control,

196 flexibility, endurance, speed, fitness, and agility. Tasks were individualized based on the  
197 students' ability level. Girls and boys were involved together in preparatory skills for  
198 acrobatic gymnastics, track and field, and team sports (e.g. basketball, volleyball, handball,  
199 and soccer), whereas competitive events took place separately. Teachers also provided  
200 students with information regarding physical fitness and living a healthy lifestyle.

201       Permission to conduct the study was obtained from the headteacher and four PE  
202 teachers (two women and two men, aged 48-55 years) after the general purpose of the study  
203 and procedures were explained. The students and their parents signed an informed consent  
204 form in accordance with the Declaration of Helsinki. Ethical approval for the study was  
205 gained from the university's ethics committee with anonymity and confidentiality being  
206 assured for all the participants. The assessments were conducted in groups of four or five  
207 students two months after the start of the academic year, without the presence of the teacher.  
208 Participants were assured confidentiality of individual results, and then asked to complete the  
209 questionnaires thinking about their current experience in PE classes. Emphasis was placed on  
210 the importance of being honest while responding the questionnaires. The entire assessment  
211 took approximately 20-30 minutes to complete.

## 212 **Measures**

213       **Perceived motivational climate.** Student perception of motivational climate was  
214 assessed using the Italian version of the Teacher-Initiated Motivational Climate in Physical  
215 Education Questionnaire (TIMCPEQ; Bortoli et al., 2008). The scale was comprised of 12  
216 items measuring task- and ego-involving climates. In this study we used the task-involving  
217 climate subscale consisting of six items that measure student perception of teacher emphasis  
218 on skill mastery and effort (e.g. "the physical education teacher is most satisfied when every  
219 student learns something new"). Following the stem question "In this physical education  
220 class..." students assessed the typical environment as created by their PE teacher. Responses

221 were rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).  
222 Previous research has demonstrated acceptable internal consistency of the Italian version of  
223 the TIMCPEQ (i.e. Cronbach's  $\alpha = .71$  for task-involving climate; Bortoli et al., 2008).

224 **Psychological needs satisfaction.** The Psychological Needs Satisfaction Scale in  
225 Physical Education (PNSSPE; Liu and Chung, 2014) comprised a 4-item subscale gauging  
226 autonomy (e.g. "I participate in PE classes based on my personal preference"), a 3-item  
227 subscale measuring competence (e.g. "I have the ability to perform well in my physical  
228 education classes"), and a 3-item subscale assessing relatedness (e.g. "I interact friendly with  
229 the people in my physical education classes"). The PNSSPE was adapted to Italian for the  
230 purpose of this study using the back-translation procedure. Responses were indicated on a  
231 7-point scale ranging from 1 (*not at all*) to 7 (*very, very much*). Previous research has  
232 demonstrated adequate factor structure, CFI = .98, SRMR = .03, RMSEA (90% CI) = .06  
233 (.05–.07), good internal consistency reliabilities, with composite reliability values ranging  
234 from .817 to .839, and good construct validity (Liu and Chung, 2014).

235 **Psychobiosocial states.** A 20-item questionnaire was developed in the PE context to  
236 assess pleasant/functional (10 items) and unpleasant/dysfunctional (10 items) psychobiosocial  
237 states in students (Bortoli et al., 2012) including emotional, cognitive, motivational,  
238 volitional, bodily, motor-behavioral, performance, and communicative modalities. Each item,  
239 representing a psychobiosocial state modality, included two or more descriptors of an  
240 emotional related experience (for more details, see Robazza et al., 2016). In this study, we  
241 used the pleasant/functional subscale comprised of 10 items. Examples of items assessing the  
242 affective modality are: "enthusiastic, confident, carefree, joyful". Examples of volitional  
243 components are: "purposeful, determined, persistent, decisive" (functional/pleasant state).  
244 Students were asked to rate each item on a 5-point scale ranging from 1 (*not at all*) to 5 (*very,*  
245 *very much*), while thinking of how they usually feel in their PE classes. Previous research

246 yielded acceptable results, GFI = .90, CFI = .93, RMR = .04, RMSEA (90% CI) = .07 (.06–  
247 .08), for a 2-factor structure of the 20-item inventory as administered in youth sport settings  
248 (Bortoli et al., 2012).

249 **Intention to engage in physical activity or sport in leisure time.** Dupont et al.  
250 (2009) administered the single item “PE makes me want to practice (continue to practice) a  
251 physical activity outside of school” to gauge student intention to engage in physical activity  
252 outside of school. We used the same item as a stem to measure five specific purposes  
253 associated with student intention to engage in physical activity. Specifically, students  
254 responded on a 5-point scale ranging from 1 (*not at all*) to 5 (*very, very much*) to “...to keep  
255 me fit”, “...to practice sport in a club”, “...to learn new skills”, “...to practice different  
256 sports”, and “...to keep me healthy”.

### 257 **Data analysis**

258 Data were screened for missing data, potential outliers, and departures from normality  
259 (Tabachnick and Fidell, 2013). Mean scores were computed for each subscale, namely,  
260 perceived task-involving climate, relatedness, competence, and autonomy need satisfaction,  
261 and pleasant/functional psychobiosocial states. Descriptive statistics, Pearson product-  
262 moment correlation coefficients, Cronbach’s alpha values, and composite reliability values of  
263 the latent variables were then computed. Multivariate analysis of variance (MANOVA) was  
264 executed to ascertain possible gender differences on the study variables. Stepwise regression  
265 analysis was conducted to determine which modality of psychobiosocial states predicted  
266 individual intention to engage in physical activity. This analysis was based on the expected  
267 positive relationship between psychobiosocial state modalities (i.e. emotional, cognitive,  
268 motivational, volitional, bodily, motor-behavioral, performance, and communicative) and  
269 individual intention to engage in physical activity (Bortoli et al., 2017).

270 Prior to conducting the main analysis, confirmatory factor analysis (CFA) was  
271 performed to examine the factorial validity of the measurement model using *Mplus* version  
272 7.31 (Muthén and Muthén, 2012). For both CFA and SEM we used the maximum likelihood  
273 (MLM) parameter estimator and a mean-adjusted chi-square test statistic, which is robust to  
274 non-normality (Byrne, 2012). According to commonly accepted suggestions (Hu and Bentler,  
275 1999; MacCallum and Austin, 2000), acceptable fit is inferred when values for comparative  
276 fit index (CFI) and Tucker Lewis fit index (TLI) are close to .95, root mean square error of  
277 approximation (RMSEA) is smaller than .06, and standardized root mean square residual  
278 (SRMR) is smaller than .08. Furthermore, a  $\chi^2/df$  value less than 5 indicates an acceptable  
279 model fit (Schumacker and Lomax, 2004).

280 We performed structural equation modeling (SEM) analyses to test two hypothesized  
281 models of expected relationships between perceptions of task-involving climate,  
282 psychological needs satisfaction, functional/pleasant and dysfunctional/unpleasant states, and  
283 intentions to engage in LTPA (Figure 1). The first hypothesized model (parallel mediation)  
284 tested the relationships between task-involving climate and intentions to engage in physical  
285 activity through needs satisfaction and psychobiosocial states. A second hypothesized model  
286 (serial mediation) tested the mediation of needs satisfaction, assumed to be predicted by task-  
287 involving climate, and acting as antecedent of psychobiosocial states, which in turn predicted  
288 individual intentions to engage in physical activity.

## 289 **Results**

290 Eight multivariate outliers were identified using Mahalanobis' distance criterion, and  
291 subsequently removed. There were no missing data. Thus, the final sample consisted of 470  
292 participants. Descriptive statistics, Cronbach's alphas, composite reliabilities, and Pearson's  
293 correlation coefficients are presented in Table 1. As the table shows, students reported  
294 moderately high perception scores of task-involving climate, needs satisfaction,

295 pleasant/functional psychobiosocial states, and intention to engage in physical activity.  
296 Notably, mean scores of all variables were positively related to each other. A task-involving  
297 climate was positively correlated with the satisfaction of all needs, and autonomy in  
298 particular. All basic needs positively correlated with pleasant/functional psychobiosocial  
299 states. These results are consistent with the educational goals emphasized in school PE  
300 programs, and reflect the common attitude of physical educators to provide their students  
301 with a supportive and pleasant motivational climate (Italian Ministry of Education,  
302 University, and Research, 2009). Acceptable internal consistency scores (with alphas values  
303  $> .78$ ) and composite reliability values were found, suggesting reliability of the measures.

304 [insert Table 1.]

305 MANOVA by gender yielded significant results, Wilks'  $\lambda = .824$ ,  $F(6, 463) = 16.474$ ,  
306  $p < .001$ ,  $\eta_p^2 = .176$ . ANOVA univariate follow-up showed that boys reported significantly  
307 higher mean scores on all study variables compared to girls. Regression analysis results are  
308 contained in Table 2. The adjectives pertaining to motivational, bodily, volitional, and motor-  
309 behavioral modalities were significant predictors of individual intention to engage in physical  
310 activity.

311 [insert Table 2.]

312 CFA of the measurement model yielded acceptable fit indices for the hypothesized  
313 factor structure of the measures,  $\chi^2/df = 2.129$ , CFI = .932, TLI = .925, RMSEA (90% CI) =  
314 .049 (.045 – .053), SRMR = .054. Examination of the modification indices on task-involving  
315 climate, autonomy, and intentions to engage in physical activity suggested correlating two  
316 errors on each factor. Moreover, four errors were correlated on psychobiosocial states  
317 following suggestions based on modification indices. The fit of the measurement model  
318 including such re-specifications was further improved,  $\chi^2/df = 1.95$ , CFI = .944, TLI = .937,  
319 RMSEA (90% CI) = .045 (.040 – .050), SRMR = .051.

320 With regard to the structural models, gender was entered as a covariate in the analyses  
321 due to the significant gender differences on all variable scores emerging from MANOVA.  
322 SEM on the first model including parallel mediation (Figure 1, upper part) resulted in a barely  
323 acceptable fit,  $\chi^2/df = 2.390$ , CFI = .914, TLI = .904, RMSEA (90% CI) = .054 (.050 – .059),  
324 SRMR = .097. The second model including serial mediation (Figure 1, lower part) showed  
325 better fit with the data,  $\chi^2/df = 1.970$ , CFI = .941, TLI = .933, RMSEA (90% CI) = .045 (.041  
326 – .050), SRMR = .051. As shown in Figure 2, the positive effect of task-involving climate on  
327 intention to engage in physical activity was partially mediated by the competence and  
328 pleasant/functional psychobiosocial states sequence, with all paths significant at  $p < .001$ .

329 [insert Figure 2.]

### 330 Discussion

331 The aim of this study was to examine the impact of a task-involving motivational  
332 climate, needs satisfaction, and pleasant/functional psychobiosocial states on student intention  
333 to engage in LTPA. Our study extends past research on motivational climate and related  
334 emotional responses typically limited to the study of enjoyment, fun, satisfaction, anxiety, and  
335 boredom.

336 Findings showed that a task-involving climate had significant direct and indirect  
337 effects on students' intention to engage in physical activity in their leisure time. A recent  
338 review of sport and physical activity studies confirmed task-involving climate to be  
339 consistently associated with many adaptive motivational outcomes, such as perceived  
340 competence, self-esteem, intrinsic forms of motivation, pleasant affective states, and moral  
341 attitudes (Harwood et al., 2015). In a number of IZOF-related studies in PE, a task-involving  
342 climate was associated with pleasant/functional psychobiosocial states (Bortoli et al., 2014,  
343 2015, 2017; Bortoli and Robazza, 2007). Aligned with previous research findings (Escartí and  
344 Gutiérrez, 2001; Sproule et al., 2007), our results indicated a direct effect of task-involving

345 motivational climate also on student intention to engage in LTPA. This suggests that a task-  
346 involving climate might be an important environmental motivational factor in the promotion  
347 of an active lifestyle.

348         The present study also provided clear support for the positive role of competence need  
349 satisfaction in determining intention to engage in LTPA in high school students. Indeed, the  
350 serial mediation results indicated task-involving climate to predict competence need  
351 satisfaction. This basic psychological need then served as antecedent to pleasant/functional  
352 states, which in turn predicted individual intention to engage in physical activity (hypothesis  
353 2). Interestingly, regression analysis showed motivational/volitional psychological modalities  
354 and bodily/motor-behavioral biological modalities, as conceptualized in the IZOF model  
355 (Hanin, 2010), to be predictive of individual intention to engage in LTPA. These findings  
356 highlighted the distinctive information and contribution deriving from the assessment of  
357 emotion and emotion-related psychobiosocial states in the PE context.

358         Of note, while no significant results were found for autonomy and relatedness,  
359 competence need satisfaction showed a significant influence on the intention to engage in  
360 LTPA. According to several theoretical approaches in the study of motivational processes  
361 (e.g. Bandura, 1997; Deci and Ryan, 2000; Harter, 2012; Nicholls, 1984), competence is  
362 reflected in almost all aspects of life as a general desire to feel effective in the interactions  
363 with the environment (Conroy et al., 2007). Numerous AGT studies in physical activity and in  
364 PE settings have shown task-involving climate and perceived competence to be positively  
365 related (e.g. González-Cutre et al., 2009; for a review, see Ntoumanis and Biddle, 1999).  
366 Papaioannou et al. (2006) found that perceived athletic competence both at the beginning and  
367 at the end of the academic year predicted sport and exercise participation seven and 14  
368 months later. These authors suggested that high perceptions of competence facilitate positive  
369 expectations for achievement behaviors, such as persistence, choice of challenging tasks, and



370 high effort. Similarly, SDT proponents contend that individual level of intrinsic motivation  
371 toward a particular activity vary as a function of perceived competence on that activity (see  
372 Ryan and Deci, 2017). In PE settings, Ntoumanis (2001) found perceived competence to be a  
373 strong predictor of self-determined motivation, while Taylor et al. (2010) showed higher  
374 levels of competence need satisfaction to be related to more effort and higher intention to  
375 engage in LTPA. In a sample of high school students, Hein et al. (2004) also found two  
376 dimensions of self-determined motivation in PE (i.e. intrinsic motivation to experience  
377 stimulation and intrinsic motivation to accomplish) to be significant predictors of the intention  
378 of being physically active after graduation. Aligned with the findings of previous studies,  
379 competence need satisfaction in our investigation was found significantly related to  
380 pleasant/functional psychobiosocial states and intention to engage in LTPA. According to  
381 Elliot et al. (2017), "...competence motivation is broadly and deeply applicable to  
382 psychological functioning: It is ubiquitous in everyday life, it has an important influence on  
383 emotion and well-being, it is operative and integral throughout the lifespan, and it is relevant  
384 to individuals across cultures." (p. 3)

385       Together with competence need satisfaction, our results highlighted the important role  
386 of pleasant/functional psychobiosocial states in the relationship between a teacher-created  
387 task-involving climate and individual intention to engage in physical activity. Our results,  
388 indeed, supported a serial mediation model in which task-involving climate predicted the  
389 individual intention to engage in physical activity both directly and through the mediation of  
390 competence need satisfaction and pleasant/functional psychobiosocial states. Findings concur  
391 with the recent growing interest in the study of emotions in educational settings. Linnenbrink-  
392 Garcia and Pekrun (2014) consider the classroom as an emotional place and teachers  
393 responsible not only for imparting knowledge, but also for inspiring passion for the discipline  
394 and excitement about learning experiences. Within the broad debate on the value of PE and

395 related curriculum objectives, beside instrumental or developmental goals (e.g. skills learning,  
396 health, social responsibility/equity, and leadership), many sport pedagogues and physical  
397 educators argue for movement and play pleasure as the prime intrinsic value (Devine and  
398 Telfer, 2013; see Pringle, 2010, for a review). However, a crucial role has been ascribed  
399 nowadays to PE in preventing chronic disease and improving health (Sallis et al., 2012).  
400 Providing motivating and enjoyable experiences that facilitate student participation in  
401 physical activity at school and outside of school has become a goal of outmost relevance.  
402 Previous studies have shown pleasant emotions in PE, such as enjoyment and fun, to be  
403 important psychosocial variables linked with increased participation in physical activity  
404 (Jaakkola et al., 2017; Yli-Piipari et al., 2012, 2013). Bengoechea et al. (2010) suggested that  
405 pleasant emotional states in PE may have a protective effect against situations that place  
406 adolescents at risk of becoming physically inactive. Fredrickson (2001) proposed that pleasant  
407 emotions predict positive outcomes because these emotions help individuals build enduring  
408 physical, psychological, and social resources, with long-term adaptive benefits.

409         From an applied perspective, our findings provide some insight into how PE teachers  
410 could foster student intention to engage in physical activity outside of school. They should  
411 carefully consider the way they structure and conduct lessons, because adopting a task-  
412 involving climate, strengthening perceived competence, and favoring pleasant emotional  
413 states may lead to enhanced student motivation and intention to be more active in leisure time.  
414 Previous research findings showed that a clear-cut task-involving climate intervention  
415 influenced student climate perceptions, even overriding the individual dispositional goal  
416 orientation, and had different behavioral, emotional, and cognitive consequences (Barkoukis  
417 et al., 2008; Bortoli et al., 2015, 2017; Weigand and Burton, 2002). A useful basis to promote  
418 a task-involving climate in classroom settings is the TARGET model (Ames, 1992; see  
419 Braithwaite et al., 2011, for a meta-analysis). Competence perception also plays a central role

420 in PE, and the satisfaction of the need for competence can lead to positive motivational  
421 consequences. For instance, the emphasis that PE teachers place on individual improvement  
422 criteria is an important social factor that may result in student competence need satisfaction  
423 (Ntoumanis, 2001). In response to student performance, teachers should provide motivational  
424 and informational feedback, containing positive statements about effort, reference to  
425 personally relevant goals, and information about competence. Feedback that contains  
426 competence information is likely to have a relevant effect on competence need satisfaction  
427 and motivation (Hein and Koka, 2007). A task-involving climate and competence need  
428 satisfaction are expected to nurture pleasant/functional emotion-related states in PE and foster  
429 student intention to engage in LTPA.

#### 430 **Limitations and future directions**

431         The present study has some limitations that should be addressed in future research.  
432 The first limitation is related to the fact that we did not examine possible mediation effects of  
433 behavioral regulations, which according to SDT (Deci and Ryan, 2000) lie on the continuum  
434 from intrinsic to extrinsic motivation. A number of studies applying the SDT framework,  
435 indeed, found that the relationship between psychological need satisfaction and adaptive  
436 outcomes was mediated by motivational regulations, reflecting varying levels of self-  
437 determined motivation (e.g. Standage et al., 2003). The cross-sectional nature of the study is  
438 an additional limitation that precludes inferences about long-lasting effects of motivational  
439 climate, psychological needs satisfaction, and psychobiosocial states on the individual  
440 intention to engage in physical activity. Thus, future research employing longitudinal or  
441 experimental designs should investigate long-term effects, as well as the extent to which  
442 student intention to engage in LTPA is predictive of actual practice and translates into stable  
443 behavior.

444

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686

Table 1

*Descriptive Statistics, Pearson Correlation Coefficients, Alpha Coefficients, and Composite Reliability Values (N = 470)*

Measure	Boys		Girls		1	2	3	4	5	6
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>						
1. Task-involving climate	3.51	0.78	3.28	0.80	(.87, .88)					
2. Relatedness need satisfaction	5.73	1.12	5.21	1.15	.24	(.86, .86)				
3. Competence need satisfaction	5.09	1.17	4.28	1.30	.28	.54	(.85, .86)			
4. Autonomy need satisfaction	4.47	1.39	3.41	1.49	.56	.34	.44	(.87, .87)		
5. Pleasant/functional psychobiosocial states	3.27	0.69	2.78	0.73	.43	.43	.69	.48	(.90, .90)	
6. Intention to engage in physical activity	2.93	1.00	2.72	0.95	.39	.28	.46	.34	.53	(.78, .79)

*Note.* Alpha coefficients and composite reliability values are in parenthesis on the diagonal. All correlations are significant at  $p < .01$ .

Table 2

*Psychobiosocial States as Predictors of Intention to Engage in Physical Activity*

Psychobiosocial States (Modality)	$\beta$	R <sup>2</sup>	R <sup>2</sup> change	F change	F sig. change
Motivated, committed, inspired (motivational)	.186	.206	.195	114.889	.001
Vigorous, energetic, physically-charged (bodily)	.207	.264	.057	36.223	.001
Purposeful, determined, persistent, decisive (volitional)	.159	.283	.019	12.498	.001
Relaxed-, coordinated-, powerful-, effortless- movement (motor-behavioral)	.137	.295	.012	7.966	.005

*Note.* Gender was entered as a covariate in the analysis.



**Figure captions**

Figure 1.

Hypothesized models of mediation effects of the interrelationships between task-involving climate, psychological needs satisfaction (i.e. relatedness, competence, and autonomy), pleasant/functional psychobiosocial states, and intentions to engage in physical activity. Model 1 depicts a parallel mediation model of the indirect effects of task-involving climate on intention to engage in physical activity through relatedness, competence, autonomy, and psychobiosocial states. Model 2 portrays a serial mediation model of the indirect effects of task-involving climate on intention to engage in physical activity through relatedness, competence, autonomy, and psychobiosocial states.

Figure 2.

Serial mediation model of the effects of task-involving climate on intention to engage in physical activity through relatedness, competence, autonomy, and pleasant/functional psychobiosocial states. Standardized factor loadings derived from structure equation modeling, with gender entered as a covariate in the analysis. Item indicators (loadings were  $> .40$ ) are not included for simplicity. All paths are standardized and significant at  $p < .001$  (two-tailed). Nonsignificant paths are omitted.