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11 Students' Perceptions of Autonomy-Supportive Versus Controlling Teaching and Basic Need
12 Satisfaction Versus Frustration in Relation to Life Skills Development in PE

13

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26 Abstract

27 Objectives: The aim of this study was to examine the relationships between perceived teacher
28 autonomy support versus control and students' life skills development in PE, and whether
29 students' basic need satisfaction and frustration mediated these relationships.

30 Design: Cross-sectional study.

31 Method: English and Irish students ($N = 407$, $M_{age} = 13.71$, $SD = 1.23$) completed measures
32 assessing perceived autonomy-supportive and controlling teaching, basic need satisfaction
33 and frustration (autonomy, competence, and relatedness), and life skills development in PE
34 (teamwork, goal setting, social skills, problem solving and decision making, emotional skills,
35 leadership, time management, and interpersonal communication).

36 Results: On the bright side of Self-Determination Theory (SDT), correlations revealed that
37 perceived teacher autonomy support was positively associated with students' basic need
38 satisfaction and life skills development in PE. On the dark side of SDT, perceived
39 controlling teaching was positively related to students' basic need frustration, but not
40 significantly related to their life skills development. Mediation analyses revealed that
41 autonomy and relatedness satisfaction mediated the relationships between perceived teacher
42 autonomy support and students' development of all eight life skills. Competence satisfaction
43 mediated the relationships between perceived teacher autonomy support and students'
44 development of teamwork, goal setting, and leadership skills.

45 Conclusions: Our findings indicate that satisfaction of the needs for autonomy, competence,
46 and relatedness are important mechanisms that in part explain the relationships between
47 perceived teacher autonomy support and life skills development in PE. Therefore, teachers
48 may look to promote students' perceptions of an autonomy-supportive climate that satisfies
49 their three basic needs and helps to develop their life skills.

50 *Keywords:* positive youth development; psychosocial skills; PE teaching.

51 Throughout the world, the personal development of students is seen as a key aim of
52 the PE curriculum (Hardman, 2011). Such personal development can be conceptualised in
53 terms of the life skills young people learn through PE (Goudas, 2010). Life skills are defined
54 as the skills required to deal with the demands and challenges of everyday life (Hodge &
55 Danish, 1999). In line with Danish, Forneris, and Wallace (2005), we viewed life skills as
56 behavioral, cognitive, interpersonal, and intrapersonal competencies that can be learned,
57 developed, and refined. Examples of life skills include teamwork, goal setting, leadership,
58 and social skills. These life skills are important for young people to develop as they are
59 viewed as individual capital which enhances people's educational attainment, quality of life,
60 and future economic prosperity (Bailey, Hillman, Arent, & Petitpas, 2013).

61 PE has been proposed as a good setting for students to develop their life skills
62 (Goudas, 2010). Such a proposition seems likely as numerous researchers have found that a
63 range of different sports (like those experienced in PE) can help young people to develop
64 their life skills (for review articles, see Holt et al., 2017; Johnston, Harwood, & Minniti,
65 2013). Like sport, it is probable that the interactive (e.g., working with others), social (e.g.,
66 socialising with peers), and emotional (e.g., dealing with frustration) nature of PE provides
67 opportunities for development (Danish, Forneris, Hodge, & Heke, 2004; Hellison, Martinek,
68 & Walsh, 2008; Fraser-Thomas, Côté, & Deakin, 2005). Supporting this idea, several
69 researchers have suggested that the demands and experiences of the sports participated in
70 during PE provide opportunities for students' life skills development (Goudas, 2010; Gould
71 & Carson, 2008). Based on the research literature (e.g., Bean, Kramers, Forneris, & Camiré,
72 2018), life skills also need to be actively taught or promoted during PE for students' life skills
73 development to be optimised. The proposition that students develop their life skills through
74 PE is also supported by some research studies. For instance, researchers have found that
75 student-centered models of learning (i.e., the Sport Education Model and Cooperative

76 Learning) help students develop the following life skills: teamwork, communication, social
77 skills, leadership, and problem solving and decision making (Dyson, Griffin, & Hastie, 2004;
78 Smither & Zhu, 2011). Common among these forms of PE are activities which allow
79 students to make decisions that affect their PE classes, organise and manage the lessons, work
80 cooperatively in small groups, help peers to learn, and take on leadership roles (Dyson et al.,
81 2004). Goudas and Giannoudis (2008) also demonstrated that life skills programs
82 implemented in PE can help students to learn goal setting and problem solving skills. In a
83 recent study, Cronin, Allen, Russell, and Mulvenna (2018) found that students' perceptions of
84 teacher autonomy support were directly related to the development of the following life skills
85 in PE: teamwork, goal setting, social skills, problem solving and decision making, emotional
86 skills, leadership, time management, and interpersonal communication. Nonetheless, when
87 compared to sport, the research on life skills development in PE is far less extensive and, as a
88 result, we know little about why students may develop particular life skills through PE.
89 Therefore, it is important that researchers conduct theory-based studies that investigate the
90 mechanisms by which young people may develop specific life skills through PE.

91 A theory that lends itself to investigating life skills development is SDT (Ryan &
92 Deci, 2017; Hodge, Danish, & Martin, 2012). Through SDT, Ryan and Deci (2017) propose
93 that people have inherent tendencies towards development and optimal functioning if certain
94 environmental conditions are present (Vansteenkiste & Ryan, 2013). One key aspect of the
95 PE environment is a teacher's interpersonal style (Liu, Bartholomew, & Chung, 2017), which
96 can be conceptualised in terms of autonomy-supportive and controlling teaching (Reeve,
97 2006). Autonomy-supportive behaviors refer to the teacher adopting a student's perspective,
98 providing choice in the activities, acknowledging students' feelings, promoting the use of
99 initiative and problem solving, encouraging students to work together and independently, and
100 providing a rationale for particular tasks (De Meyer et al., 2016; Mageau & Vallerand, 2003).

101 Conversely, controlling teaching involves the teacher instructing in a way that pressures
102 students into thinking, feeling, and behaving in teacher-prescribed ways (Reeve, 2016). Via
103 SDT, Ryan and Deci (2017) suggest that taking part in any activity can have positive effects
104 on people's development when combined with autonomy support; whereas, controlling
105 behaviors can have detrimental effects (Reeve, Deci, & Ryan, 2004). Several researchers
106 have found that students' perceptions of teacher autonomy support are positively related to a
107 range of outcomes in PE including: greater student engagement (De Meyer et al., 2016);
108 autonomous motivation (Standage & Gillison, 2007); subjective vitality (Liu et al., 2017);
109 prosocial behavior (Cheon, Reeve, & Ntoumanis, 2018); and life skills development (Cronin
110 et al., 2018). In contrast, perceptions of controlling teaching have been negatively associated
111 with PE students' engagement (De Meyer et al., 2016), autonomous motivation (Haerens et
112 al., 2015), subjective vitality (Liu et al., 2017), and prosocial behavior (Cheon et al., 2018).
113 In a recent study, Haerens et al. (2018) also showed that a combination of a high level of
114 perceived teacher autonomy support and a low level of perceived control leads to the best
115 outcomes for PE students. Based on the above findings, autonomy support is viewed as an
116 important interpersonal/communication skill for PE teachers to learn and develop (Curran &
117 Standage, 2017; Ntoumanis, Quested, Reeve, & Cheon, 2017).

118 Within SDT, Ryan and Deci (2017) highlight that a second key aspect of the PE
119 environment is the degree to which students' three basic needs for autonomy, competence,
120 and relatedness are satisfied or frustrated (Haerens, Aelterman, Vansteenkiste, Soenens, &
121 Van Petegem, 2015). Autonomy satisfaction involves the student feeling empowered and
122 self-directed in their behavior, competence satisfaction refers to the student feeling effective
123 in the PE environment, and relatedness satisfaction involves the student having warm and
124 caring relationships with fellow students and the teacher/s (Cheon, Reeve, & Song, 2016).
125 Conversely, autonomy frustration pertains to the student feeling pressured or forced to take

126 part in activities, competence frustration involves feeling ineffective or inadequate in PE, and
127 relatedness frustration refers to the student feeling rejected or excluded by fellow students or
128 the teacher/s (Cheon et al., 2016). Importantly, satisfaction of the three needs are seen as
129 necessary nutriment for young people's psychological development (Curran & Standage,
130 2017). Within their conceptual model of life skills development, Hodge et al. (2012) also
131 articulated that satisfaction of the three needs are the key underlying mechanisms that
132 contribute to people's life skills development. Specifically, these researchers outlined
133 possible relationships between the three basic needs and people's teamwork, social, problem
134 solving and decision making, and interpersonal communication skills.

135 Both the positive and negative aspects of SDT have been highlighted by several
136 researchers applying the theory to sport and PE (e.g., Bartholomew, Ntoumanis, Ryan, &
137 Thøgersen-Ntoumani, 2011; Cheon, Reeve, & Ntoumanis, 2018; Haerens et al., 2015). As
138 part of SDT, Jang, Kim, and Reeve (2016) suggested that the dual-process model illustrates
139 the 'bright' and 'dark' side of the theory which involves two parallel processes (Cheon et al.,
140 2016). The first process involves a bright pathway which indicates that teacher autonomy
141 support satisfies students' needs for autonomy, competence, and relatedness; which, in turn,
142 has positive effects on students' adaptive outcomes in PE. In other words, teacher autonomy
143 support fosters an individual's development because it nurtures their needs for autonomy,
144 competence, and relatedness (Vansteenkiste & Ryan, 2013). The second process involves a
145 dark pathway which indicates that controlling teaching frustrates students' needs for
146 autonomy, competence, and relatedness; and, in turn, has negative effects on students'
147 adaptive outcomes in PE. Supporting these propositions, researchers have shown that the
148 bright pathway is positively associated with adaptive student outcomes in PE such as
149 increased engagement (Cheon et al., 2016; Jang et al., 2016), autonomous motivation
150 (Haerens et al., 2018; Standage, Duda, & Ntoumanis, 2005), self-esteem (Standage &

151 Gillison, 2007), and subjective vitality (Liu et al., 2017). Researchers focusing on youth
152 swimming and soccer have also found positive associations between the coaching climate,
153 need satisfaction, and participants' development of goal setting, leadership, and emotional
154 skills (Coatsworth & Conroy, 2009; Taylor & Bruner, 2012). Although fewer studies have
155 been conducted on the dark pathway (Haerens et al., 2015), researchers have highlighted that
156 the dark pathway can have inverse relationships with positive outcomes in PE such as
157 students' engagement (De Meyer et al., 2016), autonomous motivation (Haerens et al., 2015),
158 and subjective vitality (Liu et al., 2017). Such findings align with Vansteenkiste and Ryan's
159 (2013) overview of SDT, which highlighted that need frustration can serve to hinder a
160 person's growth and development. More specifically, Cheon et al. (2018) proposed that the
161 dual-process model predicts mild but significant cross-over effects that include controlling
162 teaching and need frustration diminishing positive outcomes in PE.

163 Taking into account the research outlined above, the present study extended these
164 findings on the bright and dark sides of SDT into the less researched area of life skills
165 development in PE. This is an important contribution as Van den Berghe, Vansteenkiste,
166 Cardon, Kirk, and Haerens (2014) suggested in their review of the SDT in PE literature that
167 investigating a broader set of learning outcomes would be an important step forward for PE
168 research and teaching. Life skills development is a particularly novel outcome as Van den
169 Berghe et al. (2014) highlighted that most studies have focused on the following learning
170 outcomes: motor outcomes, affective outcomes, engagement, effort, and activity levels. The
171 current study is the first to investigate if the bright and dark side of SDT help explain the
172 mechanisms by which students may develop their life skills through PE.

173 **The Present Study**

174 The purpose of this study was to investigate students' life skills development in PE
175 using SDT as a theoretical framework. Our first aim was to investigate whether perceived

176 teacher autonomy support was positively related to students' basic need satisfaction and life
177 skills development in PE (i.e., to assess the bright side of SDT). Based on the propositions of
178 various researchers (e.g., Hodge et al., 2012; Vansteenkiste & Ryan, 2013) and findings from
179 youth sport (e.g., Taylor & Bruner, 2012), we hypothesized that basic need satisfaction would
180 mediate the positive relationships between students' perceptions of teacher autonomy support
181 and their life skills development in PE. Our second aim was to assess whether perceived
182 controlling teaching and basic need frustration were negatively related to students' life skills
183 development in PE (i.e., to assess the dark side of SDT). Based on previous research (e.g.,
184 De Meyer et al., 2016; Liu et al., 2017), we hypothesized that basic need frustration would
185 mediate the negative relationships between students' perceptions of controlling teaching and
186 their life skills development in PE.

187 **Methods**

188 **Participants**

189 The participants were 407 PE students ($M_{\text{age}} = 13.71$, $SD = 1.23$, range = 12–17
190 years) who completed measures of perceived autonomy-supportive and controlling teaching,
191 basic need satisfaction and frustration, and life skills development in PE. The sample
192 included male ($n = 217$) and female ($n = 189$) students (one student failed to indicate their
193 gender) from five schools in England and one school in Ireland. Participants were
194 predominantly English (70.0%) and Irish (17.0%), with a small number of other ethnicities
195 included in the sample (e.g., Indian, Pakistani, and Filipino). The students took part in PE for
196 an average of 2.05 hours per week ($SD = 0.76$) and 28.7% of the sample were taking PE as an
197 exam subject. In total, 39 teachers and 44 classes were included in the sample with an
198 average of 9.3 students per class. Although the pedagogical approach of the teachers was not
199 assessed, none of the PE departments indicated that their teachers focused on life skills in
200 their lessons. In PE lessons, the students participated in a wide range of sports including

201 soccer, cricket, Gaelic football, gymnastics, dance, basketball, volleyball, track and field,
202 swimming, tennis and badminton. Overall, 78.2% of students took part in sport outside of
203 PE, which included students participating in between 1–7 different sports ($M_{\text{sports}} = 1.5$, $SD =$
204 1.21) for an average of 4.54 hours per week. In terms of exercise, 71.8% of students engaged
205 in other forms of exercise (e.g., walking, cycling, going to the gym) for an average of 3.12
206 hours per week. Outside of PE, 19.7% of students participated solely in sport, 13.3%
207 participated solely in exercise, 58.5% participated in sport and exercise, and 8.6% did neither
208 sport nor exercise.

209 **Measures**

210 **Autonomy-supportive and controlling teaching.** Students' perceptions of
211 autonomy-supportive teaching were assessed using a 10-item scale (see supplementary
212 materials). Five items in this scale were created based on Mageau and Vallerand's (2003)
213 review article outlining the definition and components of coach autonomy support; three
214 items were drawn from Appleton, Ntoumanis, Quested, Viladrich, and Duda's (2016)
215 Empowering and Disempowering Motivational Climate Questionnaire; and two items were
216 from the Sport Climate Questionnaire (Deci, 2001). Example items in the autonomy support
217 scale included "Gives students choices and options" and "Encourages students to ask
218 questions". Students' perceptions of controlling teaching were assessed using the 10-item
219 controlling subscale of the Empowering and Disempowering Motivational Climate
220 Questionnaire (Appleton et al., 2016) which was modified for the PE setting. Example items
221 included "Is less supportive of students when they are not performing well in PE" and
222 "Threatens to punish students to keep them in line during PE classes". The item stem used
223 for both scales was "My PE teacher..." and participants responded on a scale ranging from 1
224 (*strongly disagree*) to 5 (*strongly agree*). Appleton et al. (2016) previously evidenced the
225 validity and reliability of the controlling scale with youth sport participants. After removing

226 one controlling item (“Mainly uses rewards/praise to make students complete all the tasks
227 he/she sets during PE classes”) with a poor factor loading ($< .40$), confirmatory factor
228 analysis (CFA) indicated that a two-factor model (including perceived autonomy-supportive
229 and controlling teaching) provided an adequate fit according to Marsh, Hau, and Wen’s
230 (2004) recommendations for assessing model fit (see supplementary materials). The alpha
231 values for the two scales were as follows: autonomy-supportive teaching ($\alpha = .94$) and
232 controlling teaching ($\alpha = .90$).

233 **Basic needs satisfaction and frustration.** Need satisfaction and frustration were
234 assessed using the PE version (Haerens et al., 2015) of the Basic Needs Satisfaction and
235 Frustration Scale (Chen et al., 2015). This 24-item scale has the following item stem “During
236 PE lessons...” Using four items for each factor, the scale assesses autonomy satisfaction (“I
237 feel a sense of choice and freedom in the things I undertake”), competence satisfaction (“I
238 feel competent I can do the exercises well”), relatedness satisfaction (“I feel close and
239 connected with the class members that are important to me”), autonomy frustration (“I feel
240 obligated to do certain things”), competence frustration (“I feel insecure about my abilities”),
241 and relatedness frustration (“I feel excluded from the group I want to belong to”).
242 Participants responded on a scale ranging from 1 (*not true at all*) to 7 (*completely true*).
243 Haerens et al. (2015) have provided evidence for the validity and reliability of this scale. Our
244 CFA analysis demonstrated that a model consisting of two higher-order factors (need
245 satisfaction and frustration) and six lower-order factors (autonomy, competence, and
246 relatedness satisfaction; and autonomy, competence, and relatedness frustration) provided an
247 adequate fit (see supplementary materials). The alpha values for the six subscales – along
248 with total need satisfaction and frustration – ranged from .85 to .92.

249 **Life skills development.** The 43-item Life Skills Scale for Sport (Cronin & Allen,
250 2017) was used to measure students’ perceived life skills development. As the measure was

251 originally developed for sport, the adapted item stem was: “PE classes have taught me to...”
252 Example items included: teamwork (7 items; “work well within a team/group”), goal setting
253 (7 items; “set challenging goals”), social skills (5 items; “get involved in group activities”),
254 problem solving and decision making (4 items; “think carefully about a problem”), emotional
255 skills (4 items; “use my emotions to stay focused”), leadership (8 items; “organise
256 team/group members to work together”), time management (4 items; “manage my time
257 well”), and interpersonal communication (4 items; “speak clearly to others”). Participants
258 responded on the following scale: 1 (*not at all*), 2 (*a little*), 3 (*some*), 4 (*a lot*), and 5 (*very*
259 *much*). The factorial validity and internal consistency reliability of this scale has been
260 supported with PE students (Cronin et al., 2018). In the present sample, CFA indicated that
261 an eight-factor model including all eight life skills provided an adequate fit (see
262 supplementary materials). The alpha values for the eight subscales ranged from .90–.94.

263 **Procedures**

264 Following approval from Edge Hill University’s ethics committee (approval number
265 = SPA-REC-2016-366), schools were recruited, and the data collection took place in PE
266 lessons and form classes (i.e., classes used to take attendance and prepare for the school day)
267 during the middle of the autumn school term. Prior to students completing the survey,
268 informed consent was obtained from either the student (if > 16 years) or the student’s parent
269 or guardian (if < 16 years). Students completed the survey after the researcher gave a
270 standardised introductory statement which explained the purpose of the study, that neither
271 their name nor their teacher’s name was required, there were no right or wrong answers, and
272 all information would be kept confidential. The survey took approximately 15–20 minutes to
273 complete.

274 **Statistical Analyses**

275 SPSS Version 25.0 (IBM Corporation, 2017) was used for our preliminary analyses,
276 descriptive statistics, and to calculate correlations between the study variables. MLwiN
277 Version 3.01 (Rasbach, Steele, Browne, & Goldstein, 2017) was used to assess whether
278 multilevel analyses would be appropriate with the data. Specifically, we calculated intraclass
279 correlation coefficients (ICCs) at the school and class level for all variables. ICCs greater
280 than .10 (Preacher, Zhang, & Zyphur, 2011) indicate that a considerable portion of the
281 variance is at the school or class level and multilevel modelling is appropriate. For the
282 mediation analyses, we firstly assessed whether there were significant correlations between
283 our predictor, mediator and criterion variables before proceeding with our analyses. In line
284 with the recommendation that one “looks for mediators if there is already a strong relation
285 between a predictor and an outcome and one wishes to explore the mechanism behind that
286 relation” (Frazier, Tix, and Barron, 2004, p. 117), our main criteria for pursuing mediation
287 analyses was that the predictor variable was significantly related to our criterion variable
288 (Mathieu & Taylor, 2006). Additionally, we looked at whether the predictor variable was
289 significantly correlated with the mediator variables and the mediator variables were
290 significantly related to the criterion variables. When conducting the mediation analyses, we
291 used model number four of the PROCESS macro for SPSS (Hayes, 2013) with 20,000
292 bootstrap resamples and a 95% bias corrected confidence interval (CI). This analysis allows
293 for an estimation of direct and indirect effects in models with multiple mediators and
294 performs better than other techniques in terms of statistical power and Type I error control
295 (Hayes, 2009). In line with Mathieu and Taylor’s (2006) distinction between mediation and
296 indirect effects, we first assessed whether mediation was occurring before assessing the
297 indirect effect of each potential mediator. Full mediation occurs when a statistically
298 significant regression coefficient ($p < .05$) for the total effect reduces to a non-significant
299 regression coefficient ($p > .05$) for the direct effect when the mediators are entered into the

300 model. Partial mediation occurs when a significant regression coefficient ($p < .05$) for the
301 total effect reduces in value, but is still statistically significant for the direct effect, when the
302 mediators are entered into the model. There is an indirect effect when zero is not included
303 within the lower and upper bound CI and $p < .05$ for each potential mediator. Researchers
304 have investigated mediation in past studies using the same approach (e.g., Felton & Jowett,
305 2013) and Hayes, Montoya, and Rockwood (2017) found that the PROCESS macro and
306 structural equation modelling (SEM) programs produce results that are substantively
307 identical. In the present study, we compared our PROCESS macro results with results using
308 SEM for one complete model and found that they were practically identical (results available
309 upon request from the lead author). In terms of effect sizes within our analyses, correlations
310 were judged as small ($r = \pm .10$ to $\pm .29$), medium ($r = \pm .30$ to $\pm .49$), or large ($r > \pm .50$)
311 based on Cohen's (1988) criteria. R^2 values for each mediation model were also converted to
312 Cohen's f^2 (an effect size measure) using the following formula (R^2 divided by $1 - R^2$) and can
313 be judged as small ($f^2 \geq .02$), medium ($f^2 \geq .15$), or large ($f^2 \geq .35$) based on Cohen's (1988)
314 guidelines.

315 **Results**

316 **Preliminary Analyses**

317 Missing value analysis indicated that each individual item was left blank an average
318 of one time across the sample of 407 participants ($SD = 1.53$; range = 0–9) and the data was
319 missing at random. As the percentage of missing data was very low (0.2%) and we wanted to
320 minimise lost data, a mean substitution was performed. The main study variables were then
321 assessed for normality, with skewness values ranging from -0.59 to 0.94 and kurtosis values
322 ranging from -1.12 to 0.22, indicating reasonable normality (Tabachnick & Fidell, 2013). We
323 then assessed potential gender, age group (12–14 versus 15–17 year olds), and country
324 (England versus Ireland) differences on all variables. Results showed that there were gender

325 and country differences for the study variables, whereas there were no age group differences
326 (see supplementary materials). Therefore, we controlled for gender and country in our
327 mediation analyses. Our analyses to assess if multilevel modeling would be appropriate
328 revealed that the mean ICC at the school-level was .02 (Range = 0–.10; *SD* = .03) and at the
329 class-level was .02 (Range = 0–.06; *SD* = .02). As these values were less than the criteria for
330 multilevel analysis to be appropriate (Preacher et al., 2011), we proceeded with our analyses
331 at the individual level.

332 **Descriptive Statistics**

333 Table 1 presents the means, standard deviations, reliability coefficients, and
334 correlations for the study variables. The mean scores for perceived teacher autonomy support
335 and controlling teaching indicated that the students felt their PE teachers were displaying
336 moderately high levels of autonomy support and moderately low levels of controlling
337 behaviors. The mean scores for basic need satisfaction and frustration showed that
338 participants scored moderately high on need satisfaction and moderately low on need
339 frustration. Mean scores on the LSSS indicated that participants perceived they were
340 developing all of the life skills through PE to ‘some’ extent (3 on the response scale). The
341 correlations between perceived teacher autonomy support and students’ basic need satisfaction
342 (r range = .44–.58) and the eight life skills (r range = .45–.51) were significant and positive.
343 Satisfaction of the three basic needs and total need satisfaction were also positively related to
344 all eight life skills (r range = .42–.75). The correlations between perceived controlling
345 teaching and students’ basic need frustration (r range = .34–.44) were significant and positive.
346 However, perceived controlling teaching was not significantly related to any of the eight life
347 skills and 19 of the 24 possible correlations between autonomy, competence, and relatedness
348 frustration and the eight life skills were not significant. The exceptions were three small
349 significant positive relationships between autonomy, competence, and relatedness frustration

350 and emotional skills (r range = .11–.19), and two small significant positive relationships
351 between autonomy and competence frustration and problem solving and decision making
352 (both r coefficients = .12). Likewise, total need frustration had small significant positive
353 relationships with only emotional skills (r = .17) and problem solving and decision making (r
354 = .12). The correlational results meant that we only conducted mediation analyses on the
355 bright side of SDT. In line with the recommendations of several researchers (e.g., Frazier et
356 al., 2004; Mathieu & Taylor, 2006), we did not conduct mediation analyses on the dark side as
357 there were no statistically significant relationships between students' perceptions of
358 controlling teaching (i.e., the predictor variable) and the eight life skills (i.e., the criterion
359 variables). Of additional importance was the lack of consistent relationships between
360 frustration of the three basic needs (i.e., the potential mediating variables) and the eight life
361 skills (i.e., the criterion variables).

362 **Mediation Analyses**

363 Prior to conducting our mediation analyses, we assessed the structural model fit of the
364 bright side models. As can be seen in Table A of the supplementary materials, these models
365 had an adequate fit based on Marsh et al.'s (2004) recommendations for assessing model fit.
366 Figure 1 displays unstandardized regression coefficients for each of the mediation models. In
367 all models, perceived teacher autonomy support was included as the predictor variable.
368 Satisfaction of the needs for autonomy, competence, and relatedness were included as parallel
369 mediators. Teamwork, goal setting, social skills, problem solving and decision making,
370 emotional skills, leadership, time management, and interpersonal communication were
371 included as criterion variables. Results of the indirect effects of perceived teacher autonomy
372 support on each life skill through the three mediators can be seen in Table 2. From this table,
373 we can see whether there is a total indirect effect and what effect, if any, each of the mediators
374 is having. The total indirect effect also represents the indirect effect of total need satisfaction,

375 as it is the sum of the indirect effects for each mediator. Lastly, Figure 2 displays the
376 mediation models when total need satisfaction was included as a sole mediator.

377 The mediational models in Figure 1 showed that perceived teacher autonomy support
378 was positively associated with the three mediators: autonomy, competence, and relatedness
379 satisfaction. In terms of the mediators, autonomy satisfaction and relatedness satisfaction
380 were positively related to all eight life skills. Competence satisfaction was only positively
381 associated with teamwork, goal setting, and leadership skills.

382 The total effect of perceived teacher autonomy support on teamwork was significant
383 (Model A). When the mediators were entered into the model, the direct effect of perceived
384 teacher autonomy support on teamwork was still significant although reduced, suggesting
385 partial mediation. The indirect effects of perceived teacher autonomy support on teamwork,
386 via autonomy, competence, and relatedness satisfaction, were positive and significant.

387 The total effect of perceived teacher autonomy support on goal setting was significant
388 (Model B). When the mediators were entered into the model, the direct effect of perceived
389 teacher autonomy support on goal setting was still significant although reduced, suggesting
390 partial mediation. The indirect effects of perceived teacher autonomy support on goal setting,
391 via autonomy, competence, and relatedness satisfaction, were positive and significant.

392 The total effect of perceived teacher autonomy support on social skills was significant
393 (Model C). When the mediators were entered into the model, the direct effect of perceived
394 teacher autonomy support on social skills was still significant although reduced, suggesting
395 partial mediation. The indirect effects of perceived teacher autonomy support on social
396 skills, via autonomy and relatedness satisfaction, were positive and significant.

397 The total effect of perceived teacher autonomy support on problem solving and
398 decision making was significant (Model D). When the mediators were entered into the
399 model, the direct effect of perceived teacher autonomy support on problem solving and

400 decision making was still significant although reduced, suggesting partial mediation. The
401 indirect effects of perceived teacher autonomy support on problem solving and decision
402 making, via autonomy and relatedness satisfaction, were positive and significant.

403 The total effect of perceived teacher autonomy support on emotional skills was
404 significant (Model E). When the mediators were entered into the model, the direct effect of
405 perceived teacher autonomy support on emotional skills was not significant, suggesting full
406 mediation. The indirect effects of perceived teacher autonomy support on emotional skills,
407 via autonomy and relatedness satisfaction, were positive and significant.

408 The total effect of perceived teacher autonomy support on leadership was significant
409 (Model F). When the mediators were entered into the model, the direct effect of perceived
410 teacher autonomy support on leadership was still significant although reduced, suggesting
411 partial mediation. The indirect effects of perceived teacher autonomy support on leadership,
412 via autonomy, competence, and relatedness satisfaction, were positive and significant.

413 The total effect of perceived teacher autonomy support on time management was
414 significant (Model G). When the mediators were entered into the model, the direct effect of
415 perceived teacher autonomy support on time management was still significant although
416 reduced, suggesting partial mediation. The indirect effects of perceived teacher autonomy
417 support on time management, via autonomy and relatedness satisfaction, were positive and
418 significant.

419 The total effect of perceived teacher autonomy support on interpersonal
420 communication skills was significant (Model H). When the mediators were entered into the
421 model, the direct effect of perceived teacher autonomy support on interpersonal
422 communication skills was still significant although reduced, suggesting partial mediation.
423 The indirect effects of perceived teacher autonomy support on interpersonal communication
424 skills, via autonomy and relatedness satisfaction, were positive and significant.

425 Finally, we analyzed models which had total need satisfaction as the sole mediator
426 (Figure 2, Models A–H). These models showed that perceived teacher autonomy support
427 was positively associated with total need satisfaction and total need satisfaction was
428 positively related to all eight life skills. For all models, when total need satisfaction was
429 entered as a mediator, the direct effect of perceived teacher autonomy support on all eight life
430 skills was reduced but still significant. Furthermore, the results from Table 2 indicate total
431 indirect effects for each model (which represents total need satisfaction). Combined, these
432 results showed that total need satisfaction partially mediated the relationships between
433 perceived teacher autonomy support and students' life skills development in PE.

434 **Discussion**

435 The purpose of the present study was to assess students' life skills development in PE
436 using SDT (Ryan & Deci, 2017) as a theoretical framework. On the bright side of SDT, our
437 correlational results indicated that students' perceptions of teacher autonomy support were
438 positively associated with their basic need satisfaction and development of all eight life skills.
439 Additionally, satisfaction of the three basic needs was positively related to students' life skills
440 development. Such findings are similar to past research showing that perceptions of
441 autonomy-supportive teaching and basic need satisfaction are positively associated with PE
442 students' engagement (Cheon et al., 2016), autonomous motivation (Haerens et al., 2018),
443 self-esteem (Standage & Gillison, 2007), and subjective vitality (Liu et al., 2017). Given that
444 researchers interested in SDT in PE have focused primarily on motor outcomes, affective
445 outcomes, engagement, effort, and activity levels, our positive findings in relation to life
446 skills development addresses the call for an examination of a wider range of outcomes (Van
447 den Berghe et al., 2014) and provides an impetus for future research in this area.

448 On the dark side of SDT, our correlational results indicated that students' perceptions
449 of controlling teaching were only associated with basic need frustration and had no

450 significant relationships with students' life skills development. Thus, our hypothesis that the
451 negative relationships between students' perceptions of controlling teaching and their life
452 skills development would be mediated by basic need frustration could not be supported.
453 Interestingly, the only significant relationships between need frustration and the eight life
454 skills were small positive relationships between frustration of the three basic needs and
455 students' emotional skills, and between autonomy and competence frustration and students'
456 problem solving and decision making skills. Similarly, total need frustration had small
457 positive relationships with both emotional skills and problem solving and decision making.
458 An explanation for these unexpected positive relationships comes from the coping literature,
459 where numerous researchers have shown that two methods that adolescents use to cope with
460 negative experiences, stressful situations, or frustrations are problem and emotion-focused
461 coping (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Hampel &
462 Petermann, 2005; Zimmer-Gembeck & Skinner, 2011). As such, it is possible that students
463 learn to cope with need frustration in PE by utilizing and developing their emotional and
464 problem solving skills. The proposition that negative experiences can lead to positive
465 outcomes is also supported by Dworkin and Larson (2007) who suggested that negative
466 experiences in organized youth activities (including sport) can lead to positive development,
467 if the student learns to confront the emotion or solve the problem that created the negative
468 experience. Additionally, when outlining their principles of need satisfaction and frustration,
469 Vansteenkiste and Ryan (2013) expressed the idea that need frustration can sometimes lead
470 to positive outcomes such as resilience in people. Overall, the general lack of associations
471 we found between students' perceptions of controlling teaching/need frustration and the eight
472 life skills contrasted with previous studies which showed that perceptions of controlling
473 teaching/need frustration can have negative relationships with adaptive student outcomes in
474 PE such as increased engagement (De Meyer et al., 2016), autonomous motivation (Haerens

475 et al., 2015), and subjective vitality (Liu et al., 2017). This may have been due to differences
476 between the life skills measured in the current study and the positive outcomes measured in
477 previous studies. Specifically, students' perceptions of controlling teaching and need
478 frustration may have greater effects on behaviors, cognitions, or feelings directly experienced
479 during PE lessons such as student engagement, autonomous motivation, and subjective
480 vitality, as compared to students' life skills development in PE which may occur in a more
481 subtle or implicit manner. Future research is needed to further investigate this proposition
482 and test possible indirect effects between students' perceptions of controlling teaching, needs
483 frustration, and emotional skills and problem solving and decision making. Additionally, we
484 must note that researchers have found positive relationships between perceptions of
485 controlling teaching/need frustration and negative outcomes in PE such as amotivation
486 (Cheon et al., 2016), antisocial behavior (Cheon et al., 2018), oppositional defiance (De
487 Meyer et al., 2016), and negative affect (Behzadnia, Adachi, Deci, & Mohammadzadeh,
488 2018; Liu et al., 2017;). Such findings indicate that despite having no negative associations
489 with life skills development in the present study, negative effects may still result from
490 students' perceptions of controlling teaching and need frustration in PE.

491 Following on from the correlational results on the bright side, our mediational
492 analyses showed that both autonomy and relatedness satisfaction mediated the positive
493 relationships between perceived teacher autonomy support and the development of all eight
494 life skills. Competence satisfaction only mediated the relationships between perceived
495 teacher autonomy support and the development of teamwork, goal setting, and leadership
496 skills. In other words, when teachers are perceived as providing autonomy support in PE,
497 students are likely to develop teamwork, goal setting, and leadership skills because their
498 needs for autonomy, relatedness, and competence are satisfied. In addition, when teachers
499 are perceived as providing autonomy support in PE, students are likely to develop social

500 skills, problem solving and decision making, emotional skills, time management, and
501 interpersonal communication skills, because their needs for autonomy and relatedness are
502 satisfied. These findings indicated that despite being viewed as crucial to a PE teacher's role
503 (Curran & Standage, 2017; Ntoumanis, 2012), satisfaction of students' competence plays less
504 of a part in students' development of certain life skills as compared to autonomy and
505 relatedness satisfaction. In PE classes with students possessing a wide range of abilities, it
506 may be the case that feeling autonomous in PE and relating well with one's peers and the
507 teacher is more important in terms of developing social skills, problem solving and decision
508 making, emotional skills, time management, and interpersonal communication skills as
509 compared to competence satisfaction. This may be the case as there are close parallels
510 between autonomy and relatedness satisfaction and these specific life skills. For example,
511 there are clear links between relatedness satisfaction and the development of social skills and
512 between autonomy satisfaction and the development of problem solving and decision making
513 skills. This being said, our findings also provided support for the idea that perceptions of
514 autonomy-supportive teaching fosters students' life skills development through the nurturing
515 of the three basic needs combined (Hodge et al., 2012). Future qualitative research should
516 explore in greater detail how perceptions of specific autonomy-supportive teaching behaviors
517 (e.g., encouraging students to work together) leads to the development of particular life skills
518 (e.g., social skills) through the satisfaction of specific needs (e.g., relatedness satisfaction).

519 **Practical Implications**

520 In practical terms, our findings indicated that the provision of autonomy support is a
521 particularly important skill for PE teachers to develop. Should PE teachers wish to promote
522 students' perceptions of teacher autonomy support, they could look to exhibit the following
523 autonomy-supportive behaviors in their lessons: (a) listening carefully, (b) creating
524 opportunities for curiosity and initiative, (c) providing opportunities for peer learning and

525 cooperation, (d) arranging learning environments that encourage active participation, (e)
526 encouraging effort, (f) praising development and mastery, (g) offering progress-enabling
527 feedback, (h) responding consistently to students' questions and queries, and (i)
528 communicating a clear acknowledgement of students' perspectives (Reeve, 2006). Based on
529 our findings, such behaviors should help students to develop specific life skills in PE. For
530 instance, a teacher could create opportunities for curiosity and initiative in their lessons to
531 promote students' autonomy satisfaction; and, in turn, help students to develop their problem
532 solving and decision making skills. Research also suggests that teachers could endeavor to
533 exhibit behaviors that promote students' needs for competence and relatedness (Standage et
534 al., 2005). For example, suitably challenging learning activities and constructive feedback
535 could promote students' competence satisfaction; whereas, peer-learning groups (e.g.,
536 students demonstrating skills to each other) or cooperative games may promote students'
537 relatedness satisfaction. Needs-supportive teaching is not only likely to satisfy the three
538 basic needs, but may also develop students' life skills through role modelling particular life
539 skills (e.g., interpersonal communication and social skills), facilitating the practice of specific
540 life skills (e.g., goal setting and teamwork), and supporting the development of other life
541 skills (e.g., time management and leadership).

542 **Limitations and Future Directions**

543 One limitation of the present study is that all data was collected via student self-
544 report, which has limits in terms of memory recall, response accuracy, social desirability, and
545 common method variance (Brenner & DeLamater, 2014; Donaldson & Grant-Vallone, 2002).
546 As such, future studies could assess autonomy-supportive and controlling teaching using
547 trained classroom observers – an approach used successfully in recent research (Cheon et al.,
548 2018) – and assess life skills development via alternative parent, peer, or teacher ratings. A
549 second limitation was that we did not assess other aspects of SDT which may be important

550 for students' life skills development. For example, future studies could assess how PE
551 teachers' provision of structure and interpersonal involvement (Ntoumanis, 2012) influence
552 the extent to which students' needs for competence and relatedness are satisfied and, in turn,
553 impact upon students' life skills development. A third limitation of our cross-sectional study
554 is that it does not allow for causal interpretations of the findings. Additionally, some
555 researchers (e.g., García-Bengoechea & Johnson, 2001) propose that youth development can
556 be further understood if studied over time. As such, building on our initial positive findings,
557 future SDT research investigating life skills development in PE should look to utilize both
558 longitudinal and experimental research designs. Moreover, given the success of interventions
559 designed to help PE teachers become more autonomy supportive and less controlling (e.g.,
560 Cheon et al., 2016), future research could investigate the effect of such an intervention on
561 students' life skills development in PE. A fourth limitation of our research is that we focused
562 solely on positive outcomes within our study (i.e., the development of eight life skills). In
563 this regard, it is likely that students' perceptions of teacher autonomy support and basic need
564 satisfaction are related to positive outcomes in PE; whereas, their perceptions of controlling
565 teaching and need frustration are associated with negative outcomes. Given that other
566 researchers have included both positive and negative outcomes when investigating the bright
567 and dark side of SDT in their studies (e.g., De Meyer et al., 2016; Behzadnia et al., 2018),
568 future research could investigate potential negative outcomes alongside life skills
569 development in PE.

570 **Conclusion**

571 Within the present study, our findings indicated that English and Irish students
572 perceived that to some extent they are developing teamwork, goal setting, social skills,
573 problem solving and decision making, emotional skills, leadership, time management, and
574 interpersonal communication skills through PE. Grounded in SDT (Ryan & Deci, 2017), our

575 novel findings showed that students' perceptions of teacher autonomy support are related to
576 their life skills development in PE through the satisfaction of the needs for autonomy,
577 competence, and relatedness. These findings demonstrate the potential for future studies to
578 investigate PE students' life skills development via the bright side of SDT. In practice, our
579 findings indicate that PE teachers seeking to foster students' life skills development may
580 endeavor to create an autonomy-supportive climate that satisfies students' three basic needs.

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Table 1
 Mean Scores, Standard Deviations, Reliability Coefficients and Intercorrelations for All Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1. Autonomy support	–																		
2. Controlling teaching	-.11*	–																	
3. Autonomy satisfaction	.58***	.03	–																
4. Competence satisfaction	.45***	.02	.70***	–															
5. Relatedness satisfaction	.44***	.09	.60***	.47***	–														
6. Total need satisfaction	.58***	.05	.90***	.85***	.82***	–													
7. Autonomy frustration	-.12*	.35***	.004	-.04	.13*	.04	–												
8. Competence frustration	.02	.34***	.04	-.22***	.12*	-.02	.59***	–											
9. Relatedness frustration	-.03	.41***	.02	-.13**	-.08	-.07	.46***	.68***	–										
10. Total need frustration	-.05	.44***	.02	-.16**	.06	-.02	.80***	.89***	.85***	–									
11. Teamwork	.50***	-.07	.64***	.57***	.53***	.68***	-.04	-.02	-.09	-.06	–								
12. Goal setting	.46***	-.04	.58***	.54***	.47***	.62***	.02	-.01	-.02	-.003	.69***	–							
13. Social skills	.46***	.01	.60***	.49***	.56***	.64***	.04	.05	.01	.04	.68***	.65***	–						
14. Problem solving	.47***	.07	.59***	.44***	.53***	.61***	.12*	.12*	.07	.12*	.61***	.65***	.75***	–					
15. Emotional skills	.45***	.06	.63***	.42***	.56***	.63***	.11*	.19***	.13**	.17**	.54***	.53***	.68***	.68***	–				
16. Leadership	.51***	.02	.68***	.58***	.64***	.75***	.06	.06	-.02	.04	.75***	.70***	.74***	.72***	.69***	–			
17. Time management	.48***	.01	.67***	.54***	.58***	.70***	.06	.05	.01	.05	.61***	.65***	.66***	.69***	.68***	.76***	–		
18. Communication	.48***	-.06	.64***	.51***	.57***	.67***	.04	.02	.001	.03	.62***	.55***	.72***	.66***	.61***	.72***	.70***	–	
Mean score	3.54	2.46	3.06	3.45	3.22	3.24	2.84	2.45	2.09	2.46	3.51	3.27	3.11	2.98	2.66	3.22	2.94	3.21	
Standard deviation	0.95	0.97	1.04	1.01	1.08	0.89	1.12	1.14	1.19	0.97	0.88	1.04	1.12	1.07	1.22	1.05	1.18	1.18	
Alpha value	.94	.90	.88	.89	.87	.92	.85	.85	.91	.91	.90	.94	.90	.91	.92	.94	.92	.92	

Note. $N = 407$. Problem solving = problem solving & decision making; Communication = interpersonal communication skills. All variables were measured on a 1–5 response scale.

* $p < .05$, ** $p < .01$, *** $p < .001$.

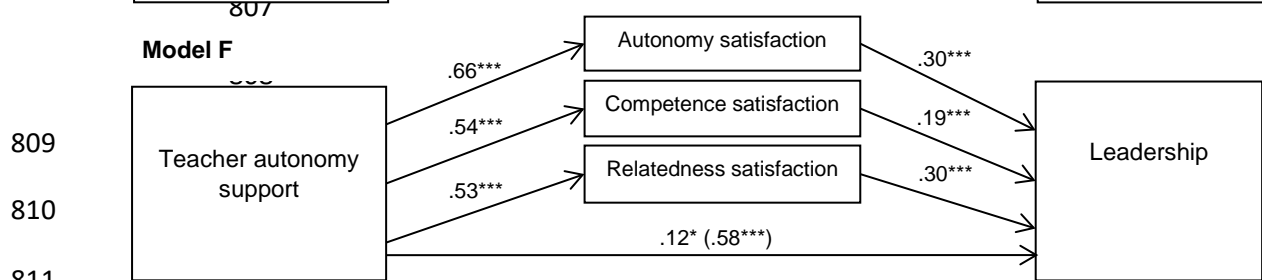
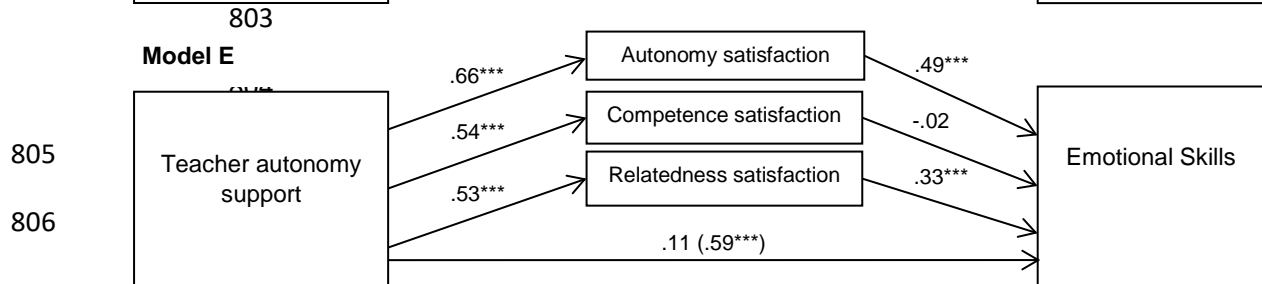
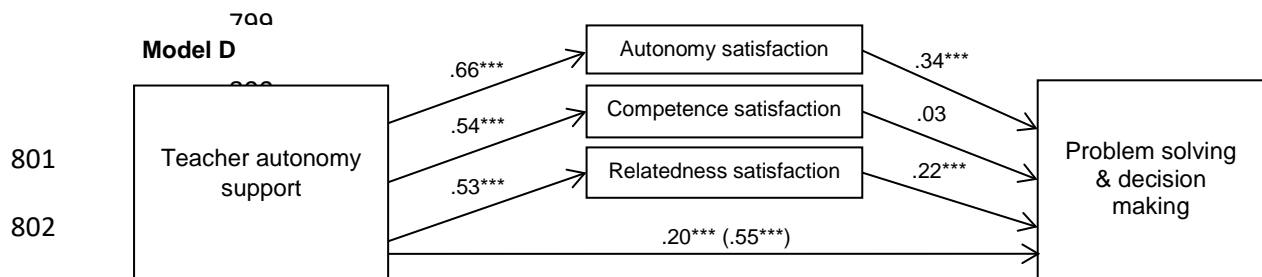
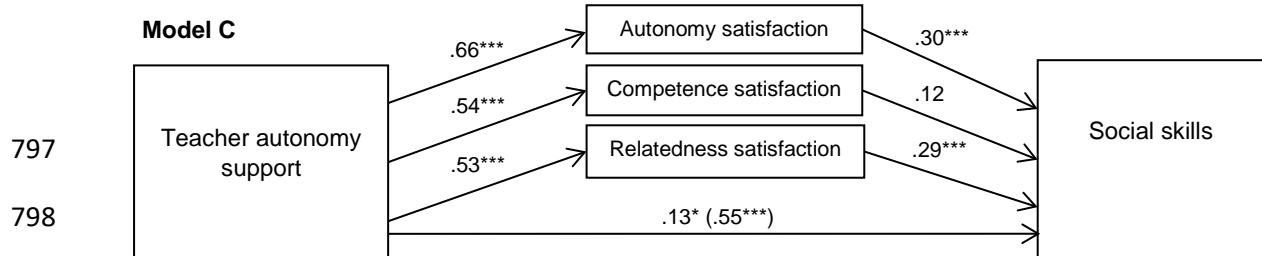
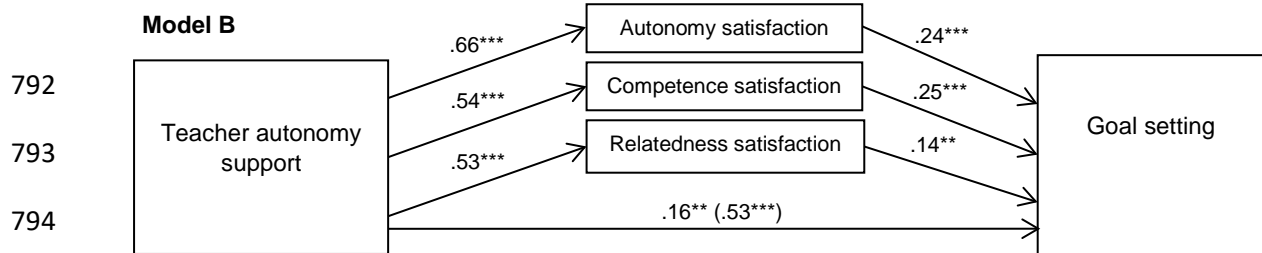
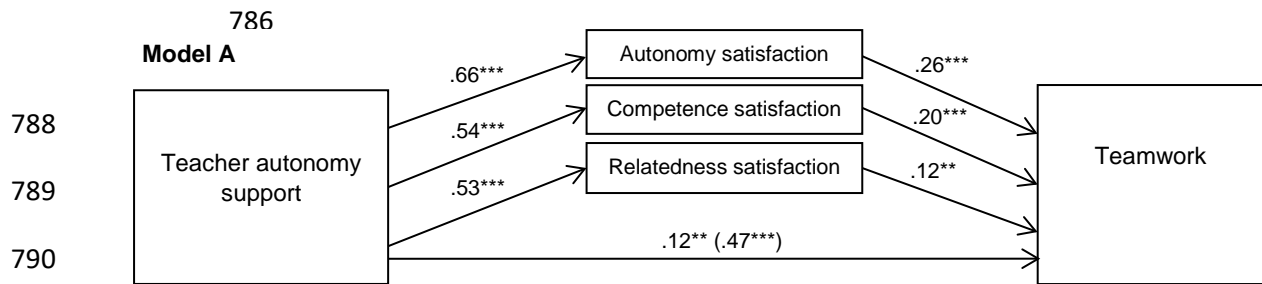
Table 2
Indirect Effects of Perceived Teacher Autonomy Support on Students' Life Skills Development Through Each Mediator

	Bootstrap effect	Normal effect	Normal theory tests			95% CI
			SE	z	p	
Teamwork						
Total indirect effect	.34	.34	.03	9.91	<.001	[.27, .41]
Autonomy satisfaction	.17	.17	.04	4.78	<.001	[.09, .26]
Competence satisfaction	.11	.11	.03	3.95	<.001	[.05, .18]
Relatedness satisfaction	.06	.06	.02	2.86	.004	[.02, .11]
Model	$F(10, 396) = 40.63^{***}, R^2 = .51, \text{Cohen's } f^2 = 1.04$					
Goal setting						
Total indirect effect	.36	.36	.04	8.88	<.001	[.29, .45]
Autonomy satisfaction	.16	.16	.04	3.52	<.001	[.05, .27]
Competence satisfaction	.13	.13	.04	3.78	<.001	[.05, .23]
Relatedness satisfaction	.07	.07	.03	2.61	.01	[.01, .14]
Model	$F(10, 396) = 27.45^{***}, R^2 = .41, \text{Cohen's } f^2 = .69$					
Social skills						
Total indirect effect	.41	.41	.04	9.36	<.001	[.32, .52]
Autonomy satisfaction	.20	.20	.05	4.15	<.001	[.10, .31]
Competence satisfaction	.07	.07	.04	1.83	.07	[-.004, .14]
Relatedness satisfaction	.15	.15	.03	4.82	<.001	[.09, .23]
Model	$F(10, 396) = 31.36^{***}, R^2 = .44, \text{Cohen's } f^2 = .79$					
Problem solving						
Total indirect effect	.35	.35	.04	8.47	<.001	[.26, .44]
Autonomy satisfaction	.23	.23	.05	4.83	<.001	[.13, .33]
Competence satisfaction	.02	.02	.03	0.44	.66	[-.05, .08]
Relatedness satisfaction	.12	.12	.03	3.92	<.001	[.06, .18]
Model	$F(10, 396) = 29.38^{***}, R^2 = .43, \text{Cohen's } f^2 = .75$					
Emotional skills						
Total indirect effect	.46	.46	.05	9.61	<.001	[.36, .57]
Autonomy satisfaction	.32	.32	.05	6.11	<.001	[.20, .45]
Competence satisfaction	-.01	-.01	.04	-0.35	.72	[-.09, .06]
Relatedness satisfaction	.17	.17	.03	5.05	<.001	[.10, .25]
Model	$F(10, 396) = 36.73^{***}, R^2 = .48, \text{Cohen's } f^2 = .92$					
Leadership						
Total indirect effect	.46	.46	.04	11.13	<.001	[.38, .55]
Autonomy satisfaction	.20	.20	.04	5.05	<.001	[.12, .29]
Competence satisfaction	.11	.11	.03	3.50	<.001	[.04, .18]
Relatedness satisfaction	.16	.16	.03	5.74	<.001	[.11, .22]
Model	$F(10, 396) = 53.71^{***}, R^2 = .58, \text{Cohen's } f^2 = 1.38$					
Time management						
Total indirect effect	.49	.49	.05	10.45	<.001	[.40, .59]
Autonomy satisfaction	.30	.30	.05	6.15	<.001	[.20, .42]
Competence satisfaction	.05	.05	.03	1.56	.12	[-.02, .14]
Relatedness satisfaction	.15	.15	.03	4.82	<.001	[.09, .22]
Model	$F(10, 396) = 42.64^{***}, R^2 = .52, \text{Cohen's } f^2 = 1.08$					
Communication						

Total indirect effect	.47	.47	.05	10.06	<.001	[.36, .58]
Autonomy satisfaction	.26	.26	.05	5.23	<.001	[.15, .37]
Competence satisfaction	.05	.05	.04	1.46	.14	[-.02, .13]
Relatedness satisfaction	.17	.17	.03	5.22	<.001	[.10, .25]
Model	$F(10, 396) = 38.72^{***}, R^2 = .49, \text{Cohen's } f^2 = .96$					

Note. $N = 406$. Bootstrap generated confidence intervals. Gender, country, controlling teaching, and autonomy, competence, and relatedness frustration were entered as covariates in all models. One participant was omitted as they did not provide their gender. The mediation analyses were not conducted for the dark side due to the non-significant correlations between controlling teaching and the eight life skills, along with the lack of consistent relationships between need frustration and the eight life skills. CI = confidence interval; Problem solving = problem solving & decision making; Communication = interpersonal communication skills.

*** $p < .001$.



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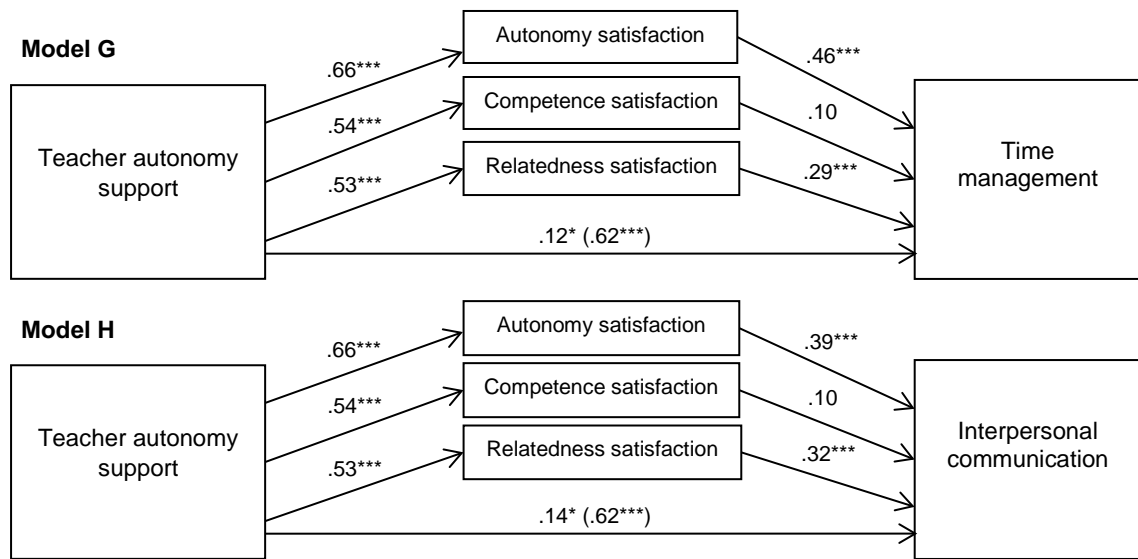
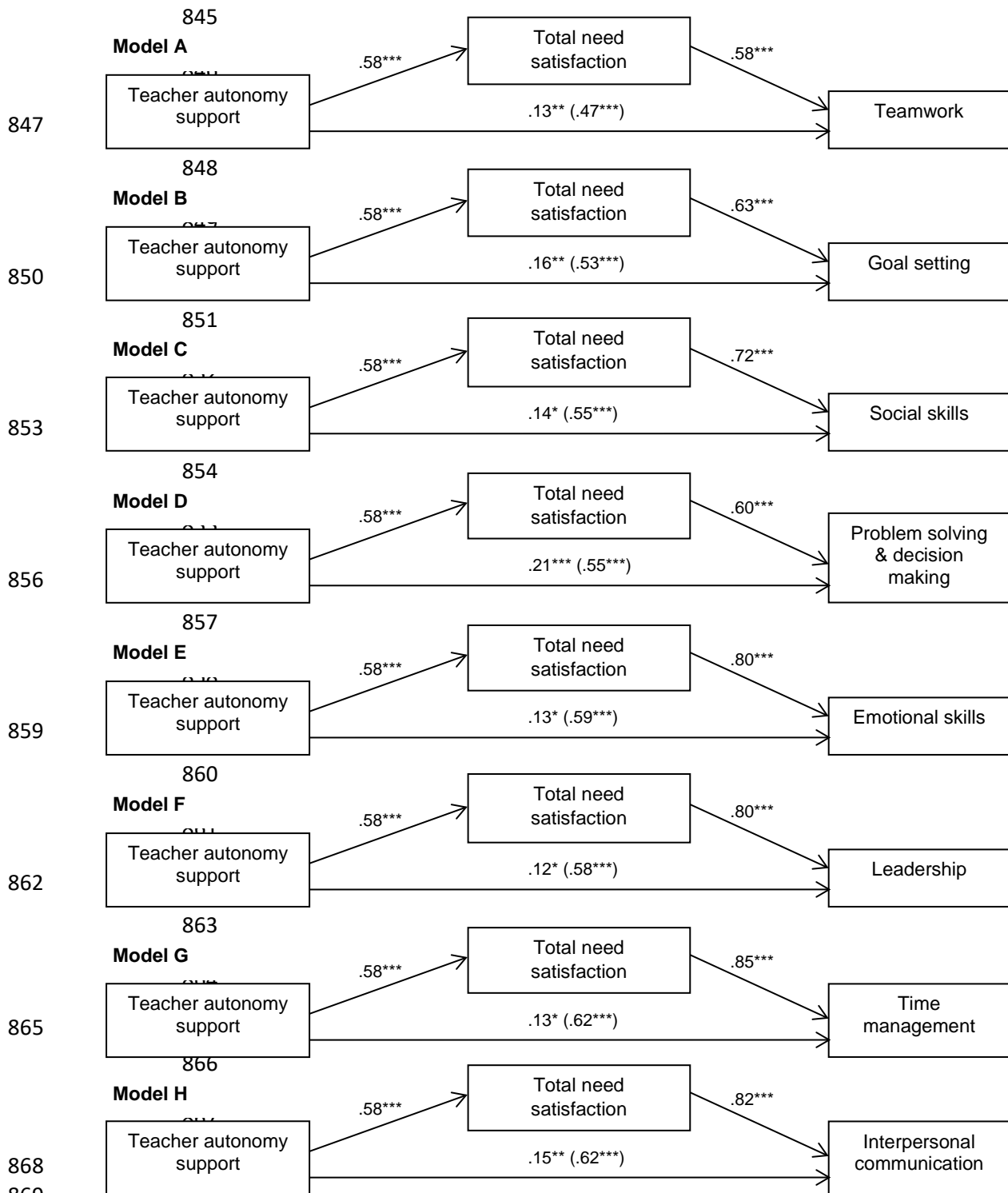


Figure 1. Regression models predicting all eight life skills. Values signify unstandardized regression coefficients. The direct effect of perceived teacher autonomy support on each of the life skills are outside the parentheses. The total effects are inside the parentheses. Gender, country, controlling teaching, and autonomy, competence, and relatedness frustration were entered as covariates in all models. The random number generator was seeded in all eight models to ensure that the bootstrap resamples were the same for each model.

* $p < .05$, ** $p < .01$, *** $p < .001$.

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870 *Figure 2.* Regression models predicting all eight life skills. Values signify unstandardized regression coefficients. The direct
 871 effect of perceived teacher autonomy support on each of the life skills are outside the parentheses. The total effects are inside
 872 the parentheses. Gender, country, controlling teaching, and autonomy, competence, and relatedness frustration were entered
 873 as covariates in all models. The random number generator was seeded in all eight models to ensure that the bootstrap
 874 resamples were the same for each model.

875 * $p < .05$, ** $p < .01$, *** $p < .001$.

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Supplementary Materials878 **Autonomy-Supportive Teaching Scale**879 **Your PE Teacher**

880 Directions: PE teachers have different styles of working with young people and we would
 881 like to know more about how your teacher works with you. This survey contains items that
 882 are related to your experience with your main PE teacher (the person who teaches you most
 883 often).

884

885 Using the scale below, indicate how much you agree or disagree with each item by circling
 886 the appropriate answer.

887

My PE teacher...	Strongly disagree					Strongly agree
1. Gives students choices and options	1	2	3	4	5	
2. Encourages students to ask questions	1	2	3	4	5	
3. Provides opportunities for students to work independently or in small groups	1	2	3	4	5	
4. Listens to how students would like to do things	1	2	3	4	5	
5. Give students a chance to input into class content	1	2	3	4	5	
6. Tries to understand how students see things	1	2	3	4	5	
7. Encourages students to use their initiative	1	2	3	4	5	
8. Encourages students to solve problems for themselves	1	2	3	4	5	
9. Ensures students are involved in decision making	1	2	3	4	5	
10. Explains why it is good to do what we have been asked to do	1	2	3	4	5	

888 *** Please note that these autonomy-supportive items were created/modified based on**
 889 **Mageau and Vallerand's (2003) definition and components of coach autonomy support**
 890 **and several measures of autonomy support that have been used in sport/PE (e.g.,**
 891 **Appleton, Ntoumanis, Quested, Viladrich, & Duda, 2016; Deci, 2001). Items 1, 2, and 10**
 892 **came from Appleton et al. (2016), items 4 and 6 came from Deci (2001), and items 3, 5,**
 893 **7, 8, and 9 were based on Mageau and Vallerands (2003) article reviewing the**
 894 **definitions and components of coach autonomy support.**

895 Gender, Age Group and Country Differences

896 Three multivariate analysis of variances (MANOVAs) were conducted to test for any
897 gender, age group, or country differences on the main study variables. For gender, results
898 revealed some differences for the study variables, $F(16, 389) = 3.86$, Wilk's $\lambda = .86$, $p <$
899 $.001$. As our participants ranged in age from 12–17 years, participants were split into
900 younger (12–14 years, $n = 286$) and older (15–17 years, $n = 109$) age groups (two participants
901 failed to provide their age). Participants were split into these age groups based on Steinberg's
902 (1993) classification of early (11–14 years) and middle (15–18 years) adolescence. Our
903 results revealed no significant age group differences for the study variables, $F(16, 388) =$
904 1.03 , Wilk's $\lambda = .96$, $p = .43$. When comparing Irish versus English students, our results
905 revealed some differences for the study variables, $F(16, 389) = 2.39$, Wilk's $\lambda = .91$, $p =$
906 $.002$. Based on the above results, gender and country were included as covariates in all
907 mediation analyses.

908 Confirmatory Factor Analysis (CFA)

909 Confirmatory factor analysis was conducted in Amos Version 25 (Arbuckle, 2017) to
910 assess the factorial validity of the measurement scales, the complete measurement model, and
911 the bright side structural models. The following fit indices were used to assess model fit:
912 Root Mean Square Error of Approximation (RMSEA; Stieger & Lind, 1980), Comparative
913 Fit Index (CFI; Bentler, 1990), and the Tucker Lewis Index (TLI; Tucker & Lewis, 1973). In
914 line with Marsh, Hau, and Wen's (2004) recommendations, an RMSEA value of less than .08
915 or .05 represented a reasonable or close fit to the data respectively; whereas, CFI and TLI
916 values greater than .90 or .95 indicated acceptable and excellent fit respectively. The results
917 of our CFA analyses are contained within Table A on the next page.

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Table A
Indices of Model Fit for the Measurement and Structural Models

Scale	χ^2 (df)	χ^2/df	RMSEA	CFI	TLI	FL Range
Autonomy-supportive & controlling teaching scale						
Two-factor model	566.30*** (151)	3.75	.08	.92	.90	.40–.89
Basic need satisfaction & frustration scale						
Higher-order model	775.01*** (245)	3.16	.07	.92	.91	.61–.89
Life skills scale for sport						
Eight-factor model	1671.75*** (832)	2.01	.05	.95	.94	.69–.90
Complete measurement model						
Sixteen-factor model	6220.07*** (3449)	1.80	.04	.90	.90	.40–.90
Bright side structural models						
Teamwork	1163.12*** (421)	2.76	.07	.91	.90	
Goal setting	1226.31*** (421)	2.91	.07	.91	.90	
Social skills	1108.93*** (364)	3.05	.07	.90	.89	
Problem solving & decision making	1011.31*** (337)	3.00	.07	.91	.90	
Emotional skills	991.49*** (337)	2.94	.07	.91	.90	
Leadership	1175.67*** (421)	2.79	.07	.91	.90	
Time management	1003.10*** (337)	2.98	.07	.91	.90	
Interpersonal communication	1015.13*** (335)	3.03	.07	.91	.90	

Note. $N = 407$. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; FL = factor loading.

*** $p < .001$.