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1 **Effectiveness of a Creative Physical Education Intervention on Elementary**
2 **School Students' Leisure-Time Physical Activity Motivation and Overall**
3 **Physical Activity in Finland**

4
5

Abstract

6 This study investigated the effectiveness of a creative physical education (CPE) intervention on
7 students' perceptions of motivational climate in physical education (PE), leisure-time physical
8 activity (PA) motivation, and overall PA. A sample of 382 fourth to sixth grade students ($M_{age} =$
9 $10.87[.93]$) from two elementary schools were assigned to the CPE intervention ($n = 196$; $M_{age} =$
10 $10.84[.95]$) and control 'PE-as-usual' ($n = 186$; $M_{age} = 10.90[.90]$) groups. Students' perceived
11 task- and ego-supportive climate in PE, leisure-time PA motivation, and overall PA were
12 measured before and after the one-year intervention. Analyses of covariance and path analyses
13 were implemented to test the effectiveness of the intervention. The intervention had a positive
14 effect on students' perceptions of task-supportive climate in PE ($p < .001$) and a negative effect
15 on ego-supportive climate ($p < .001$). Students' perceptions of task-supportive climate had a
16 positive effect on their leisure-time PA motivation ($p < .001$), which, in turn, had a positive effect
17 on their overall PA ($p < .001$). The results suggest that CPE-based PE may increase students'
18 perceptions of task-supportive climate in PE, which predicts their later leisure-time PA
19 motivation outside the school context and overall PA.

20

21 **Keywords:** child-centered approach, motivational climate, school physical education, models-
22 based practice

23 **Introduction**

24 Physical activity (PA) is an important factor in health and well-being, and the physical
25 and mental health advantages of regular PA have been extensively documented (e.g. Janssen and
26 LeBlanc, 2010). However, in Finland, only 50% of elementary school students (7-12 yrs) meet
27 the Finnish National PA recommendations: being physically active for at least 1-2 hours daily in
28 a variety of ways appropriate to each age group (Liukkonen et al., 2014). There is a similar trend
29 seen across Europe (Currie et al., 2012). Both physically inactive (Pahkala et al., 2013) and
30 active (Telama et al., 2013) lifestyles established in the preschool years have been found to
31 persist through the school years and beyond. PA typically declines in adolescence (Dumith et al.,
32 2011) with Finnish adolescents' PA declining at a faster rate compared to other Western
33 countries (Husu et al., 2011). To reverse this trend and to promote PA and/or its determinants in
34 early childhood, interventions using theory driven practices are needed (Cardon et al., 2014).

35 Schools have been identified as a preferred intervention location for increasing children's
36 PA because they offer a cost-effective way to reach a majority of youth (Institute of Medicine,
37 2012). Schools can contribute to adolescents' PA by, for example, providing students with
38 evidence-based physical education (PE) programs, daily recess, classroom PA breaks, modifying
39 school playgrounds to promote active play, and afterschool PA programs (Bassett et al., 2013).
40 The Bassett et al. (2013) review showed PE to be the most effective school-based strategy to
41 engage students in health-enhancing PA. When daily mandatory PE was combined with a
42 standardized curriculum it contributed 29 minutes toward the daily PA recommendation.

43 The implementation of model-based PE practices has gained increasing acceptance in PE;
44 for example the comprehensive school PA program (Erwin et al., 2013), health-optimizing PE
45 (Metzler et al., 2013), teaching personal and social responsibility (Hellison, 2003), and Sport

46 Education (Hastie, 2011; Siedentop, 1998). However there is limited evidence of the ways these
47 model-based practices impact students' PA participation. Models are useful pedagogical tools
48 but should not be accepted uncritically. As Landi et al. (2016) have highlighted, citing Jewett and
49 Bain (1985, p. 81), "physical educators should be cognizant that each model 'makes assumptions
50 about human beings, the role of education in society and the nature of subject matter in physical
51 education'" (p. 402). A model developed from a theoretical position that takes these
52 considerations into direct account is Creative PE (CPE; Quay et al., 2016; Quay and Peters,
53 2008, 2012).

54 CPE is founded in an existential framework that marries phenomenological-ontological
55 and pragmatic interpretations of experience and applies this to education (Quay, 2013, 2015).
56 This existential framework enables CPE to offer a more developed conception of child-centered
57 pedagogy, one that embeds both curriculum and pedagogy in ontology. Noting that Finnish
58 teachers of PE tend to use more teacher-centered pedagogies (Jaakkola and Watt, 2011), we
59 hypothesize that CPE should positively impact students' PA participation, a hypothesis this study
60 investigated by testing the effect of a CPE intervention on Finnish elementary school students'
61 perceptions of motivational climate in PE, their leisure-time PA motivation, and overall PA.
62

63 **Motivation and physical activity**

64 This study was guided by two postulations: (1) PE students' perceptions of their
65 psychological environment (i.e. motivational climate) will impact one of the central goals of PE,
66 which is to guide pupils in adopting a physically active lifestyle (Finnish National Board of
67 Education, 2016: 294) via their PA motivation (i.e. self-determination); and (2) motivational
68 experiences at the more specific contextual level (i.e. in PE) will relate to motivational

69 experiences in more global contexts (i.e. in leisure-time) (Vallerand, 1997). The basis for the first
70 postulation is embedded in self-determination theory (SDT), a meta-theory of human motivation
71 (Deci and Ryan, 1985, 2000). The central tenet of SDT is that perception of psychological
72 environment is an important factor in either nurturing or thwarting individuals' intrinsic
73 motivation (Deci and Ryan, 2000). Hence, in SDT, intrinsic motivation, i.e. enactment of activity
74 for its own sake because the activity is enjoyable and interesting, is the motivational regulation
75 representing the most self-determined and adaptive form of motivation (Deci and Ryan, 2000).
76 In addition, in SDT, extrinsic forms of regulation can be placed on a continuum based on their
77 degree of self-determination (autonomy). The most self-determined form of extrinsic regulation
78 is integrated regulation, i.e. regulation that occurs when individuals perceive benefits of
79 participation to be in line with their personal values and goals. Next, identified regulation
80 appears when the outcomes of the behavior are individually highly valued. These are both
81 considered self-determined forms of extrinsic motivation. Another two are controlling forms of
82 extrinsic motivation: introjected regulation appears when individuals participate to avoid internal
83 pressures or feelings of guilt; external regulation appears when the activity is done because
84 external factors, such as rewards, constraints, or fear of punishment, are considered. Finally,
85 individuals may be amotivated, i.e. they may have no motivation or intention to participate (Deci
86 and Ryan, 2000). The overall measure of self-determined motivation, calculated on the basis of
87 the aforementioned forms of motivation, is known as the relative autonomy index (RAI;
88 Harwood et al., 2015).

89 Evidence from motivation regulation studies involving children and adolescents reveals
90 that autonomous motivation is positively associated with leisure-time PA (Owen et al., 2013;
91 Owen et al., 2014), whereas controlled forms of motivation will undermine these outcomes. This

92 tendency has also been evident in SDT-based interventions (e.g. Chatzisarantis and Hagger,
93 2009; Wallhead et al., 2014).

94 SDT conceptualizes social environment from a needs-perspective, arguing that three
95 psychological needs – the need for competence, for autonomy, and for relatedness – impact one’s
96 self-determination (Deci and Ryan, 2000). This study, however, focused on mastery or success
97 oriented needs conceptualized by achievement goal theory (AGT; Nicholls, 1989). AGT
98 acknowledges two ways of defining success, namely: (1) a task- or learning-orientation; and (2)
99 an ego- or performance-orientation (Nicholls, 1989). A task-orientation attributes success to
100 effort and competence, meaning that the focus of activity involvement is mastering the tasks
101 through improvement at these tasks. In contrast, an ego-orientation ascribes success to
102 competence, meaning that the main objective of engagement in an activity is to demonstrate
103 competence by outperforming others (Nicholls, 1989). To conceptualize social environment from
104 the AGT perspective, Ames (1992) developed the concept of motivational climate, suggesting that
105 two motivational climates exist: (1) a task-supportive or task-involving climate represents hard
106 work, co-operation, personal development and effort; (2) an ego-supportive or ego-involving
107 climate represents competition, comparisons with others, success based on ability, and
108 reward/punishment for success and failure (Ames, 1992; Nicholls, 1989). Reviews conducted by
109 Rudisill (2016) and Harwood et al. (2015) have shown task-involving motivational climate to be
110 positively related to, for example, the psychological need of relatedness, intrinsic motivation, and
111 the overall self-terminated motivation, whereas ego-involving motivational climate has been
112 shown to be associated with lower relatedness and lower overall self-determined motivation,
113 and with higher amotivation.

114 The sequential model of motivation (social factors - psychological mediators -
115 consequences) proposed by Vallerand (1997) offers a viable way to conceptualize the interplay
116 of theorized relationships (Cox et al., 2008). A task-supportive climate, as opposed to an ego-
117 supportive climate, is assumed to support self-determined motivation which, in turn, is
118 associated with increased PA participation (Ames, 1992; Deci and Ryan, 2000). In accordance
119 with the second postulation of this study and the theorization of Vallerand (1997) is the tenet that
120 the sequential model of motivation operates at different hierarchical levels of motivation. For
121 instance, self-determined PE experiences are closely related to the experiences in a PA context
122 due to the similar nature of these two contexts (Vallerand, 1997). Therefore, it is assumed that
123 self-determination-related experiences in school PE influence leisure-time PA motivation and
124 PA.

125 Empirical findings support the central propositions of this study. First, evidence from
126 studies with children and adolescents on motivational regulation has shown that self-determined
127 motivation is positively associated with leisure-time PA, whereas the evidence with controlling
128 forms of motivation and leisure-time PA is mixed (see review by Yli-Piipari, 2016). Second,
129 task-supportive climate in PE has been found to be positively related with, for example, PE
130 students' intrinsic motivation, self-determined motivation, and leisure-time/overall PA, whereas
131 the findings of ego-supportive climate have been mixed (see review by Harwood et al., 2015).

132

133

Creative physical education

134 The theoretical origins of CPE suggest that it may positively influence the development
135 of a task-supportive climate, increased leisure-time PA motivation and higher levels of PA (Quay
136 et al., 2016; Quay and Peters, 2008, 2012). As mentioned earlier, CPE has been developed from

137 an existential theoretical framework applied to education (Quay, 2013, 2015). This existential
138 understanding shifts the emphasis from emulating adult conceptions of sports, games and teams,
139 to one which promotes the everyday experiences of young people, their typical ways of being,
140 thereby embracing an ontological conception of child-centeredness. We refer to ‘young people’
141 here rather than students, as this aligns with the notion of child-centeredness, which, from an
142 ontological perspective, is broader than student-centeredness: a child is ontologically more than
143 just a student or pupil.

144 The adjective ‘creative’ highlights the ongoing collaborative involvement of young
145 people in designing the various features of CPE - teams, games, seasons of games (sport), and
146 practice. Teams of young people are the heart of CPE. They are where most of the creative effort
147 is concentrated. In CPE the team remains together rather than being transitory, requiring careful
148 team selection by the teacher to balance ability, gender and friendships (Quay and Peters, 2012).
149 Traditional methods for dividing students into teams – such as random numbering into teams or
150 student leaders selecting teams – have been shown to generate negative experiences for PE
151 students in Finland, associated with feelings of humiliation, shame, and unfairness (Lauritsalo et
152 al., 2015). In traditional versions of PE how to be a team-member is an assumed skill or set of
153 skills, whereas in CPE being a team-member is a major focus for development. Expectations of
154 how to be a good team member (and thus a good team in this regard) are carefully articulated and
155 scaffolded in CPE using an adaptation of Hellison’s (2003) levels. These become team-member
156 levels, reinforcing aspects of personal and social responsibility that support team development
157 (Quay and Peters, 2008, 2012). The aim is to support ongoing team improvement.

158 In CPE, each team is tasked with game creation and development, which is a notable
159 difference to Sport Education where the focus is on teacher modified adult sports. As shown

160 previously, involvement in this creative task can lead to an increase in teachers' democratic
161 behavior and young peoples' perceptions of autonomy (Hytönen et al., 2015). To achieve this
162 task, teams manipulate nine basic game variables from which the rules of the game emerge:
163 enjoyment, participation, safety, skills, equipment, time, space, umpiring, and scoring. Each is
164 dealt with in a way specified by the teacher.

165 The game creation process requires multiple points of feedback provided by other teams
166 as well as the teacher, directed by the game variables mentioned above. The team games that
167 eventuate can be played multiple times over numerous lessons. Alternatively, the team games
168 can contribute to construction of one class game by repeating the same process – create-review-
169 feedback-create – focusing on achieving one game with the whole class. This class game may
170 then be incorporated into the “primary features of sport”; notably “seasons” but also including
171 “affiliation, formal competition, record keeping, culminating events, and festivity” (Hastie, 2011:
172 2).

173 This process highlights how adult developed sports, or modified versions of same, do not
174 necessarily have to be the focus in PE. In other words, achieving increased PA in adulthood does
175 not of necessity mean training students to participate in adult sports. CPE engages with the
176 premise that instilling the capacity to create games in a social context may be another legitimate
177 way to support increasing PA.

178 In CPE, the game is not an adult developed sport modified for children, as is the case in
179 Sport Education. This contrast highlights how, in Sport Education, there is a conflation of sport
180 and game: sometimes sport refers to the cultural features of sport (sport as a cultural
181 phenomenon), while at other times it refers to *a* sport – one amongst other sports – which are
182 actually games, such as badminton, football and tennis (see Hastie, 2011). Hence there is a subtle

183 but important conceptual difference between sport as a cultural phenomenon and various sports,
184 which are games subsumed within the broader cultural phenomenon of sport. In CPE, sports and
185 games are clearly differentiated. A game is created by young people in teams and may be
186 enculturated via the cultural features of sport. In this way, CPE brings team development, game
187 creation and sport together in one meaningful package.

188 Unlike Sport Education, CPE does not begin by assuming a game (a sport in the language
189 of Sport Education), nor does it promote “students taking roles other than player” in an explicit
190 way, such as by being “coaches, referees, trainers, safety officials, scorekeepers, managers,
191 publicists and broadcasters” (Hastie, 2011: 2). We agree with Landi et al. (2016), who argue that
192 “the allocation of roles ... in Sport Education reflects a neoliberal agenda” (p. 407); such may
193 also be the case when beginning with a recognised adult sport. In CPE these roles disappear as
194 they are subsumed in being a team-member and facilitated in terms of responsibility via the
195 adapted use of Hellison’s (2003) levels. For example, no team leader (such as coach or manager)
196 is discerned; rather, leadership is distributed across the whole team and occurs as an emergent
197 function in each particular circumstance, motivated by team-members’ care for their team and its
198 goals.

199 With the primary emphasis on team improvement, teams analyze aspects of the game
200 (e.g. skills and strategies) as these pertain to team performance, and students design practice
201 activities to support the team’s development (Quay and Peters, 2008, 2012). This collaborative
202 creative work foregrounds practices that are designed to enhance a task-supportive climate and
203 concomitantly diminish an ego-supportive climate.

204 An underlying assumption of CPE is that learning to create and play games in a social
205 context may generate opportunities for engagement in PA outside of PE classes – particularly

206 when those opportunities are not regulated by adults (Quay and Peters, 2008, 2012). Students
207 learn not only how to be a game player, but also how to manipulate contextual features that
208 enable PA. These include the nine basic game variables from which the rules of the game
209 emerge: enjoyment, participation, safety, skills, equipment, time, space, umpiring, and scoring.
210 Thus, the implementation of CPE in school PE may help PE teachers to overcome some of the
211 shortcomings of more traditional versions of PE (see Kirk, 2013) which tend to substantiate an
212 ego-supportive climate emphasizing individualistic success at the expense of a collaborative
213 capacity to achieve certain tasks. The intention of CPE is to foreground this collaborative
214 capacity focused on task achievement, as this may engender a more task-supportive climate,
215 contributing to learning in the way of hard work, co-operation, personal development, and effort.

216 In arguing for CPE as an alternative multi-model pedagogical approach this study was
217 designed to test, for the first time, the hypothesized impact of a CPE intervention so as to source
218 “hard evidence” (Casey, 2014) of the effect of a CPE intervention. In this study the particular
219 effect investigated pertained to elementary students’ perceptions of task- and ego-supportive
220 climate in PE, their leisure-time PA motivation, and overall PA. Based on the aforementioned
221 theoretical justifications, we hypothesized that the CPE intervention would have a positive effect
222 on students’ perceptions of task-supportive climate and an inverse effect on their perceptions of
223 ego-supportive climate in PE. Secondly, based on Standage et al. (2003), we expected that
224 students’ leisure-time PA motivation mediated the relationship between task- and ego-supportive
225 climate in PE and overall PA.

226

227

Method

228

Participants

229 Participants were recruited from two primary schools located in one city in the region of
230 Central Finland and sourced through direct contact with the school principal. The original sample
231 consisted of 382, fourth ($n = 126$), fifth ($n = 126$), and sixth ($n = 130$) grade students ($M_{age} =$
232 $10.87[.93]$) from the school allocated to the intervention (school size: 481 students and 32
233 teachers; average class size: 19.3 students [ranged 14-27]) and the control school (school size:
234 384 students and 29 teachers; average class size: 15.5 students [ranged 11-19]). The intervention
235 group consisted of 103 boys and 93 girls ($n = 196$; $M_{age} = 10.84[.95]$), whereas the control group
236 comprised 109 boys and 77 girls ($n = 186$; $M_{age} = 10.90[.90]$). In total, of 439 students who were
237 asked to participate in the study (all fourth, fifth, and sixth-graders in both schools), 382 (87%)
238 returned student and parental consent and 311 (81.4%) participated in the both data collection
239 phases.

240

241 **Procedures**

242 This quasi-experimental intervention study with a non-equivalent control design was
243 implemented between two data collection points that took place in November 2011 (pretest) and
244 in March 2013 (posttest). The posttest for all sixth graders, however, was carried out in April
245 2012 before they ended primary school and transferred to secondary school. In consequence, the
246 fourth and fifth grade students participated in an average of 88 national PE curriculum based, 45-
247 minute PE classes whereas sixth grade students participated in an average of 40 PE classes of 45
248 minutes each. We used two methods of data collection, web-based and paper-and-pencil, at the
249 convenience of the participating schools. The control school preferred paper questionnaires; thus
250 students in the control school group completed questionnaires during their 45-minute PE classes,
251 supervised by the primary investigator (PI; first author). The PI informed students about the

252 voluntary nature of their participation, and the option to interrupt or withdraw from the study at
253 any time without consequence. Data collection guaranteed anonymity and confidentiality. In the
254 intervention school the data collection was based on the same ethical principles but utilized
255 electronic questionnaires via the SPSS® MrInterview™ software in their computer class under
256 the supervision of their particular PE teacher; this was managed across two weeks. Use of these
257 strategies meant the students' teachers had no access to the responses.

258 Both schools followed the National Core Curriculum for Basic Education (Finnish
259 National Board of Education, 2004). Finnish teachers have autonomy to determine curricular
260 content, assessment, and instruction, being allowed to plan their own classes with independently
261 chosen activities and teaching methods as long as they adhere to the national core curriculum
262 (Kokkonen, 2011: 113; Yli-Piipari, 2014). Neither the students nor the teachers of the control
263 school had any training or professional development related to CPE, whereas intervention school
264 PE classes were based on the principles of the CPE model (Quay et al., 2016; Quay and Peters,
265 2008, 2012).

266 **Intervention and Fidelity**

267 Prior to the intervention, the developer of the CPE model (fourth author) presented, in a
268 two day seminar, the theoretical principles of the model together with practical demonstrations to
269 the entire intervention school PE faculty. After the presentation, six teachers showed personal
270 interest and volunteered to participate in the CPE intervention. Two PE teachers were selected as
271 teacher champions of the intervention (see Quay et al., 2016) by the research team. The teacher
272 champions organized a supplemental workshop for the remaining intervention school teachers
273 aimed at: (1) reinforcing the theoretical principles of the CPE model, and (2) applying these
274 principles to PE as practiced in Finnish schools by demonstrating their own teaching in hands-on

275 practice sessions. Furthermore, the original English CPE student workbook was translated into
276 Finnish, and educational materials, such as PowerPoint slides, were provided to all teachers.
277 During these supplementary teacher training sessions, teachers together extended and developed
278 their current teaching practices in a process of adaptation which reflects both the professionalism
279 of Finnish teachers and the philosophical orientation of CPE as a set of ideas requiring
280 interpretation and not merely a pedagogical prescription able to be applied without alteration in
281 any context (see Quay et al., 2016). The intention of CPE as a pedagogical model is for teachers
282 to be both architects and builders of units of work (cf. Landi et al., 2016: 402): a reflexive
283 adapting and shaping of ideas and practices.

284 These prior to intervention procedures, together with discernable application of the
285 principles of CPE, are essential intervention fidelity indicators, such as rich description of both
286 the curricular elements and program context, and validation of the model implementation,
287 suggested by Hastie and Casey (2014). Details of the programme context, curricular elements,
288 and the planning and implementation phases of the CPE over the school-year are published in
289 our previous paper (Quay et al., 2016). In addition, Table 1 details the way CPE was interpreted
290 and implemented by teachers for the fourth grade students in the intervention school during a 2-
291 week period in August 2011, contrasting this with the classes conducted in the control school
292 during the same period. Formal validity checks, such as the video recording lessons and their
293 systematic analyses or subjective check-list, were not used to validate the implementation for the
294 financial, logistic, and time-restrictions reasons. Instead, a retrospective inquiry was emailed to
295 the intervention school teachers after the intervention to gather data about teacher fidelity to the
296 CPE model.

297

OVERALL LESSON AIMS	LESSON ACTIVITIES	MOVEMENT SKILL AIMS	SOCIO-ETHICAL AIMS	ONTOLOGICAL AIMS
Control school: Lessons 1-4: Weeks of 15-19 and 22-26 August – conducted on outdoor field				
*co-operation and fair play *motor-perceptual skills *coordination, stamina, agility *game idea *relevant skills in different ball games	*explaining rules of sports: Finnish baseball and soccer *playing games in sports: Finnish baseball and soccer	*overarm throwing *catching the ball, rolling/bouncing the ball *batting the ball *roles of infield/outfield players, etc. *dribble, kick and receive in soccer *simple game tactics *age adapted game forms	*avoiding harmful physical contact *encouraging prosocial behaviour *taking responsibility *preventing selfish play	*being a student *being a player of Finnish baseball and soccer
Intervention schools: Lessons 1 and 2: Week of 15-19 August – conducted in classroom and gymnasium				
*understanding of the CPE unit *collaboration skills	*formation of CPE teams with the help of Finnish CPE-workbook *team name, chant and logo development *sharing of team name/logo/chant with others *activities promoting team cohesion	*locomotor skills *balance *manipulative skills	*familiarizing students with each other *supporting team feeling of togetherness *strengthening team feeling of social relatedness	*being a student *being a team-member *being a name/logo/chant creator (in a team)
Intervention schools: Lessons 3 and 4: Week of 22-26 August – conducted in classroom and gymnasium				
*perceived physical competence *autonomy in planning and implementing created activity *responsibility for content and teaching of the PE lesson under teacher supervision *perceived physical competence and autonomy	*contemplation of factors contributing to becoming a socially responsible team *presentation of essential factors to other teams *homework: inventing a game based on CPE principles *team organization of games *sharing of team games *playing games	*locomotor skills *balance *manipulative skills	*understanding of factors affecting team cohesion *co-operation within teams *respecting other teams' accomplishments *supporting and giving of positive feedback considering team goals	*being a student *being a team-member *being a game designer (in a team) *being a game player *being a game teacher

	*discussing improvement of games			
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In the control school all the PE lessons were focused primarily on achieving the

305 movement skill aims associated with two specific traditional sports: Finnish baseball and soccer.

306 Socio-ethical aims were planned to be achieved through the conduct of the sports, with socio-

307 ethical and ontological goals mainly positioned in service of movement skill goals (Table 1).

308 This represents a version of what Kirk (2013: 980) described as “traditional PE programmes”

309 embracing a “sport-technique based, multi-activity approach”. In contrast, CPE lessons in the

310 intervention school were aimed at co-construction of being a team-member and associated ways

311 of being, with socio-ethical education aims supporting achievement of ontological aims, and both

312 supporting achievement of movement skill aims. In addition, the CPE intervention included

313 student activities atypical for traditional PE lessons, such as completing workbooks, homework,

314 and teaching physical activities to other students (Table 1). Finally, the CPE intervention

315 included activities (e.g. team name and chant invention, recording team-mates’ strengths, factors

316 contributing to becoming a great team) which supported achievement of socio-ethical and

317 ontological aims.

318

319 **Measures**

320 **Motivational Climate in PE.** Perception of motivational climate in PE was measured

321 using the Motivational Climate in PE scale (Soini et al., 2014), which consisted of two subscales

322 representing task- and ego-supportive climates. The individual item stem used in the measure

323 was “*In my PE class...*”. Both task-supportive (e.g. “*It is important for students to try their best*

324 *in PE lessons*”), and ego-supportive (e.g. “*It is important for students to succeed better than*

325 *others in PE lessons*”) motivational climate dimensions consisted of four items with acceptable
326 internal consistency (Cronbach’s alpha of .88 and .86, respectively). Responses were indicated
327 on a five-point Likert-scale ranging from *strongly disagree* (1) to *strongly agree* (5). Soini et al.
328 (2014) have demonstrated acceptable construct validity (confirmatory factor analysis [CFA] root
329 mean squared error of approximation [RMSEA] was .037 for the hypothesized model) and
330 internal consistency of the sub-scales among Finnish students (Cronbach’s alpha .78 and .80).

331 **Leisure-time PA motivation.** Students’ leisure-time PA motivation was assessed with
332 the Finnish version of the Sport Motivation Scale (Pelletier et al., 1995). The instrument has 7
333 subscales, comprising three types of intrinsic motivation (IM) (IM to-accomplish things, IM to-
334 know, and IM to experience stimulation), three forms of extrinsic motivation (identified,
335 introjected, and external regulation) and amotivation. Each dimension consists of four items. The
336 students rated the reasons for their current participation in PA activities outside the school
337 context on a 5-point Likert scale. Subscale scores were calculated for each subscale by summing
338 12 items for intrinsic motivation and four for each dimension of the external regulation. This
339 scale has been previously shown to be valid and reliable across different cultures and ages
340 including PE students (CFA RMSEA = .040 and Cronbach’s alpha ranging from .72 to .91;
341 Granero-Gallegos et al., 2014). For this study, internal consistency of the scale was acceptable
342 (Cronbach’s alpha ranging from .71 to .86). As an indicator of students’ leisure-time PA
343 motivation, the RAI (Vallerand, 1997) was calculated using subscale scores of each dimension
344 by weighting these scores so as to derive a single score: intrinsic motivation (+2) and identified
345 regulation (+1) were weighted positively; introjected regulation and external regulation were
346 summed up and weighted negatively (-1); amotivation was also weighted negatively (-2). A
347 positive RAI value reflects increased autonomy motivation.

348 **Overall physical activity.** The Health Behavior in School-aged Children Research
349 Protocol was used to assess elementary school students' overall PA participation (Currie et al.,
350 2012). The stem was: "*In the next two questions PA means all activities which raise your heart*
351 *rate or momentarily get you out of breath, for example, doing exercise, playing with your*
352 *friends, going to school, or in school PE. Sport also includes, for example, jogging, intensive*
353 *walking, roller skating, cycling, dancing, skating, skiing, soccer, basketball, and Finnish*
354 *baseball*". The scale consisted of two items: "*Think about your typical week. How many days did*
355 *you exercise for at least 60 min. during which you got out of breath*" and "*Think about your last*
356 *7 days. How many days did you exercise for at least 60 min during which you get out of breath?*"
357 that students rated using an 8-point response scale (0–7 days of the week). A sum scale of overall
358 PA participation was formulated by adding the response scores for the two items to assess
359 students' self-report in moderate-to-vigorous PA. Previously, Vuori et al. (2005) has shown this
360 scale to be valid (CFA RMSEA = .021) and reliable (Pearson's product-moment correlation
361 coefficients .89) in Finnish school students. In the current study, the Pearson's product-moment
362 correlation coefficients between two items (Time 1, $r = .93$ and $.92$; Time 2, $r = .92$ and $.94$;
363 intervention and control group values, respectively) indicated good internal consistency.

364 **Statistical analysis**

365 Firstly, normality of the data was checked, and means, standard deviations, and Pearson's
366 product-moment correlation coefficients for all study variables were tabulated. Secondly, to test
367 the intervention effect, we conducted analyses of covariance, separately for all variables. The
368 post-intervention score was set as a dependent variable, the pretest score as a covariate, and the
369 intervention condition as an independent variable. In addition, sex and grade were controlled in
370 the analyses by adding sex as a fixed factor (categorical variable) and grade as a covariate

371 (continuous variable). To test the hypotheses, a path analysis strategy was used (Mulaik and
372 Millsap, 2000) and an a priori model was tested.

373 The treatment effect was included in the equation as a dichotomous covariate (dummy
374 variable; 0 = control condition, 1 = experimental condition). To control for participants' previous
375 PA, the pretest score was included in the model as a covariate. All analyses were performed
376 using SPSS (version 21) and Mplus statistical packages (Version 6.1; Muthén and Muthén,
377 1998–2013). Alpha was set at $p < .05$ for all tests. Standardized mean changes (Cohen, 1988)
378 were calculated, with values of 0.2 (small), 0.5 (moderate), and 0.8 (large) used as guidelines for
379 interpreting analyses of covariance effect sizes. A complex option with maximum likelihood
380 estimation with robust standard errors was used in path models to correct a possible non-
381 independence of the observations based on students being nested within their classes
382 (Asparouhov, 2005). A path model fits the data well when the p value associated with the chi-
383 square test is non-significant. Additionally, if the values of the Bentler comparative fit index
384 (CFI) and Tucker-Lewis index (TLI) are above .95 and the values of the RMSEA are below .06,
385 a good fit between the hypothesized model and the observed data exists (Hu and Bentler, 1999).
386 To determine the statistical significance of possible mediation or indirect effects, bootstrapped
387 asymmetric confidence intervals were calculated based on 5,000 bootstrapped samples (Hayes,
388 2009). A mediation or indirect effect is supported if the confidence interval (CI) does not contain
389 0, which suggests that the independent variable significantly influences the mediator, which in
390 turn influences the dependent variable.

391

392

Results

393 Students' overall PA participation in both intervention and control schools was statistically
 394 significant in relation to their perceptions of a task-supportive climate in PE (Time 1, $r = .20$;
 395 Time 2, $r = .31$) and leisure-time PA motivation (Time 1, $r = .28$; Time 2, $r = .15$), but it was
 396 not associated with an ego-supportive climate in PE (see Table 2).

397 **Table 2** Summary of Descriptive Statistics for All Variables

Variable list	1	2	3	4	5	6	7	8
1 Experimental condition	-							
2 Task support (Time 1)	-.21**	-						
3 Task support (Time 2)	.10	.18*	-					
4 Ego support (Time 1)	.08	-.03	-.11*	-				
5 Ego support (Time 2)	-.21**	.13*	-.12*	.31**	-			
6 RAI (Time 2)	-.22**	.33**	.15*	-.17*	.02	-		
7 Physical activity (Time 1)	-.07	.20**	.09	.01	.00	.28**	-	
8 Physical activity (Time 2)	.05	.04	.31**	-.03	.07	.15*	.33**	-
<u>Experimental Group Values</u>								
<i>M</i>	na	4.01 ^a	4.16	2.77	2.70	2.84	4.44 ^a	4.41
<i>SD</i>	na	.79	.70	.97	1.02	.57	1.38	1.08
<i>Range [min, max]</i>	[0, 1]	[1.50, 5.00]	[1.50, 5.00]	[1.00, 5.00]	[1.00, 5.00]	[-6.75, 11.75]	[2.00, 7.00]	[1.00, 7.00]
<u>Control Group Values</u>								
<i>M</i>	na	4.34	4.01	2.76	3.13	2.45	5.54	5.51
<i>SD</i>	na	.57	.76	.96	1.00	1.06	1.38	1.21
<i>Range [min, max]</i>	[0, 1]	[1.25, 5.00]	[1.25, 5.00]	[1.00, 5.00]	[1.00, 5.00]	[-9.83, 13.50]	[2.00, 7.00]	[1.50, 7.00]

422 Note. $P * < .05$; $** < .001$; and $a =$ experiment group baseline values statistically higher compared to the control
 423 groups baseline values. RAI = relative autonomy index; 0 = control condition and 1 = experimental condition.
 424
 425

426 In addition, the intervention school had higher pretest values in the perception of a task-
 427 supportive climate in PE ($t = 4.19, p < .001$). Analysis of covariance tests revealed that there
 428 was, after controlling for the effect of sex and grade level, a significant intervention effect on
 429 perception of task-supportive ($F[2,306] = 7.01, p = .008, \eta^2 = .02$) and ego-supportive ($F[2,306]$
 430 $= 14.95, p < .001, \eta^2 = .06$) climates in PE, but not on overall PA ($F[2,306] = 1.55, p = .213, \eta^2 <$
 431 $.01$). Pairwise comparisons showed that being in the intervention group increased students'

432 perceptions of task-supportive motivational climate in PE significantly ($p = .008$, 95% CI [.05,
433 .36]; covariates adjusted means 4.19 and 3.98, intervention and control group, respectively) and
434 decreased students' perceptions of ego-supportive motivational climate in PE ($p < .001$, 95% CI
435 [-.59, -.19]; covariates adjusted means 2.70 and 3.09, intervention and control group,
436 respectively). Moreover, grade level was significantly related to task-supportive ($F[2,306] =$
437 32.91 , $p < .001$, $\eta^2 = .09$) and ego-supportive ($F[2,306] = 7.29$, $p = .007$, $\eta^2 = .02$) (no
438 statistically significant effect on PA) motivational climates, but participants' sex was not related
439 to the outcome variables.

440 Due to the statistically significant covariate effect of the grade level, we wanted to extend
441 our examination of the role of grade level on study outcomes. Separate repeated measure
442 analyses of covariance were conducted on each outcome variable. Sphericity was not met, thus a
443 conservative Greenhouse-Geisser adjustment was used in all three analyses. Results showed that
444 there was a statistically significant intervention-grade-time interaction in students' perceptions of
445 task-supportive motivational climate in PE ($F[2, 2] = 8.380$, $p < .001$, $\eta^2 = .05$) and ego-
446 supportive motivational climate in PE ($F[2, 2] = 1.905$, $p = .017$, $\eta^2 = .02$) but not in PA.
447 Pairwise comparison between fourth and sixth grade students, as well as fifth and sixth, showed
448 that they differ statistically in task- (fourth vs sixth: $p = .006$ CI 95% [.06,.34]; fifth vs sixth: $p <$
449 $.001$ CI 95% [.11,.39]) and ego-supportive (fourth vs sixth: $p < .001$ CI 95% [-.66,-.24]; fifth vs
450 sixth: $p < .001$ CI 95% [-.59,-.19]) motivational climate, estimated mean levels being 4.19(.05),
451 4.24(.05), and 3.99(.05) for task-supportive and 2.67(.08), 2.73(.07), and 3.12(.07) for ego-
452 supportive climate, fourth, fifth, and sixth grades respectively.

453 A series of path analyses were conducted to test the research hypotheses. First, the default
454 model (without a treatment variable) was estimated. The model fit indices showed an acceptable

455 model fit: $\chi^2 (10) = 59.57, p < .001, CFI = .94, TLI = .94, RMSEA = .069, CI 90\% [.04, .09]$.

456 Next, a treatment variable was added to the a priori model. The path analysis (see Figure 1)

457 demonstrated acceptable fit with the data based on the multiple criteria adopted ($\chi^2 (12) = 54.17,$

458 $p < .001; CFI = .96; TLI = .95; RMSEA = .057, 90\% CI 90\% [.03, .08]$). The analysis showed

459 that the intervention had a positive effect on students' perceptions of task-supportive climate ($\beta =$

460 $.14$) in PE and negative effect on their perceptions of ego-supportive climate ($\beta = -.18$). Students'

461 perceptions of task-supportive climate had a positive effect on their leisure-time PA motivation

462 ($\beta = .15$). The effect sizes were small-to-moderate, with experimental effect (together with

463 pretest values) explaining 16% of the variance in students' perceptions of task-supportive climate

464 in PE, 25% of ego-supportive climate in PE, and 8% of the variance in their leisure-time PA

465 motivation. The path analysis showed that students' leisure-time PA motivation had a positive

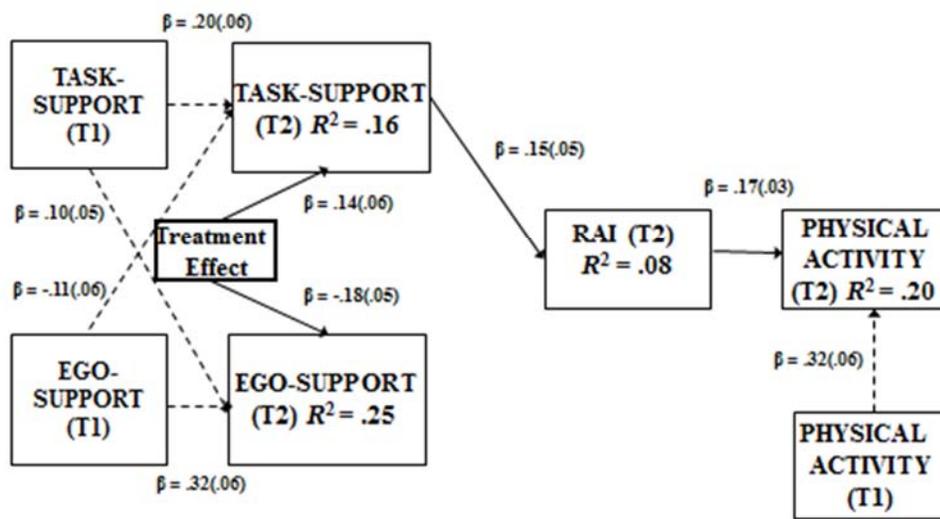
466 effect ($\beta = .17$) on their overall PA. The effect sizes were small-to-moderate, students' leisure-

467 time PA motivation together with their previous overall PA explaining 20% of the variance in

468 their overall PA. As for the indirect effect, the analysis showed that neither task- nor ego-

469 supportive climate in PE had a statistically significant effect ($\beta_{\text{task}} = .05; \beta_{\text{ego}} = -.06, CI 95\% [-$

470 $.17, .12]$) on students' overall PA.



471

472 **Figure 1.** A path model visualization of the established and hypothesized relationships.
 473 *Note.* T1= Time 1; T2 = Time 2. Solid arrows represent statistically significant relationships, a
 474 dashed the non-significant hypothesized relationship, and dash-dotted the covariate effects.

475

476

477

Discussion

478 This study aimed to investigate the impact of a CPE model-based intervention (Quay et al.,
 479 2016), implemented in a Finnish elementary school PE context, on students' leisure-time PA
 480 motivation and overall PA. After controlling for sex and grade level, this CPE intervention was
 481 found to be beneficial to increasing students' perceptions of a task-supportive climate in PE and
 482 decreasing their perceptions of an ego-supportive climate, although the causal effect was
 483 relatively weak, with treatment effect explaining 16% (task-supportive climate) to 25% (ego-
 484 supportive climate) of the changes in students' perceptions. No mediating effect of leisure-time
 485 PA motivation between motivational climate in PE and overall PA was found to occur during
 486 this CPE intervention.

487 **First hypothesis**

488 This CPE intervention had a positive effect on students' perceptions of their task-
489 supportive climate and a negative effect on their concurrent ego-supportive motivational climate
490 in primary school PE, thus supporting our first hypothesis. The level of change in perception of
491 motivational climate revealed in our findings is considered reasonable because it aligns with
492 other recent model-based studies conducted in PE settings with slightly older secondary school
493 students (e.g. Bortoli et al., 2015; García-González et al., 2017).

494 One possible reason for this finding is the way in which CPE embraces a child-centered
495 pedagogy that embeds curriculum and pedagogy in ontology, in being – specifically those ways
496 of being expressed in team membership, game play and game teaching (Table 1). As Jaakkola
497 and Watt (2011) argue, there is a need to promote student-centered teaching styles in Finnish PE
498 in order to counter the current emphasis on teacher-centered styles directed at the learning of
499 motor skills.

500 In CPE child-centered means involving young people in the creative design processes
501 associated with their teams, their games (created by teams), the cultural aspects of sport which
502 will structure the playing of their game between teams, and the practicing of teamwork, *game*
503 skills and *game* strategies (noting that these are not necessarily *sport* skills and strategies) (Quay
504 et al., 2016; Quay and Peters, 2008, 2012). In contrast, more traditional versions of PE prioritise
505 sport skills and strategies, meaning the skills and strategies needed to play adult developed sports
506 (or modified versions of same), closely connected with the practice of these skills and strategies
507 (Kirk, 2013). The teams are short lived because the emphasis is chiefly on sport skill
508 development, which is considered best facilitated through practice, not playing a game (see Quay
509 and Peters, 2008).

510 A second possible reason is that CPE shares some principles with the TARGET-model
511 (Epstein, 1989), widely used in motivational climate interventions, in which teachers apply
512 specific environmental structures in terms of meaningful tasks (T), shared authority (A),
513 recognition (R), meaningful grouping (G), individual evaluation (E), and a sufficient amount of
514 time (T) for learning. The structural characteristics in terms of team, working method, and
515 pedagogical principles shared by these models emphasize co-operation, effort, and stress
516 students own responsibility in action enabling their meaningful perception of a task-supportive
517 motivational climate.

518 A third possible reason is that CPE encouraged intervention school teachers to explicitly
519 and consciously rethink their teaching practices (e.g. what activities to use, when to teach skills,
520 and where lessons take place), and to visualize the curriculum aims, objectives and goals, thus
521 enabling achievement of a task-supportive motivational climate as supported by our findings.
522 This is in line with Yli-Piipari's (2014) suggestion of assessing teaching practices and curricula
523 to identify disparities in PE quality and quantity in Finnish PE. Similarly, Sport Education
524 (Siedentop, 1998) has also succeeded in increasing perceptions of task-supportive motivational
525 climate compared to more traditional PE teaching (Spittle and Byrne, 2009). While CPE and
526 Sport Education differ, this may reflect how competition is experienced in both Sport Education
527 and CPE as an incentive for team improvement across a season of games, which is a common
528 feature of both and which does not normally exist in traditional PE.

529 Possible negative impacts of competition are mitigated in CPE through emphasis on team
530 improvement, and the structured employ of the team itself in generating that improvement, with
531 the aim being to de-emphasize the impact of comparative judgments by positioning these as
532 formative motivational factors which can be addressed by the team. This is very different to the

533 situation in traditional PE classes where, according to Soini et al., (2014), the “teaching process
534 in PE is often evaluative in nature, and can be considered as an outcome-oriented activity, the
535 goals being primarily defined in terms of success and failure” (p. 138). In these cases,
536 comparisons are often perceived to be summative and individual in character (see Redelius and
537 Hay, 2009) because the broader social and motivational context which supports improvement has
538 not been adequately put in place, instead relying on the traditional academic context of
539 individual achievement. This is important because an ego-supportive climate in a PE context
540 leads to maladaptive PA behaviours (see review Rudisill, 2016).

541 Competition is a typical element of PE teaching in Finland (Heikkinen et al., 2012);
542 however, during CPE it is downplayed, with the stress placed on socio-ethical and ontological
543 aims associated with team and game creation, which do not ignore movement skill aims.
544 Individuals constantly compare themselves with others (for elucidation of the concept of social
545 comparison, see Corcoran et al. 2011); however, during the collaborative creative work of game
546 creation and development, the aim was to learn from others instead of beating them. Focusing on
547 socio-ethical and ontological goals in terms of learning about group cohesion or reflecting the
548 strengths of team mates (Table 1), is a process in which success is based on team
549 accomplishments, not on individual ability.

550 After controlling for the effects of sex and grade levels, only grade had a weak role in
551 explaining the changes in students’ perceptions of task- and ego-supportive motivational
552 climates. The fourth and fifth graders held similar perceptions of their motivational climate,
553 whereas sixth graders had lower perceptions of task-supportive motivational climate and higher
554 perceptions for ego-supportive motivational climate. This finding is in line with those of earlier
555 research which shows that students grow to perceive their motivational climate increasingly as

556 ego-supportive and decreasingly as task-supportive (Ntoumanis et al., 2009). This may reflect
557 the fact that school sports teams become more selective as children grow older (Digelidis and
558 Papaioannou, 1999) or it may be due to reasons related to growth and development (Wigfield
559 and Eccles, 2002).

560 **Second hypothesis**

561 The second hypothesis concerning leisure-time PA motivation acting as a mediator
562 between task- and ego-supportive motivational climates in PE and overall PA was not supported
563 by our data. As for the direct effects, the path from task-supportive motivational climate in PE to
564 leisure-time PA motivation was statistically significant, supporting previous findings (e.g.
565 Standage et al., 2003). Similarly, there was a statistically significant path from leisure-time PA
566 motivation to overall PA (e.g. Chatzisarantis and Hagger, 2009). Although Jaakkola et al. (2013)
567 showed that intrinsic motivation towards PE mediated the relationship between task-involving
568 motivational climate in PE and physical activity, the indirect effect in our model was not
569 statistically significant. This might be due to the fact that Jaakkola et al. (2013) studied only two
570 forms of self-determined motivation in PE context, whereas we used the whole RAI index in the
571 leisure-time context.

572 In general, our findings are fundamentally linked to how the motivational strategy
573 adopted by the teacher may connect with student outcomes not only in a school context but in a
574 leisure-time context. Our finding is in line with the meta-analysis of Braithwaite et al. (2011)
575 showing that school-based motivational task-supportive climate interventions produce small-to-
576 moderate positive treatment effects on cognitive and behavioral outcomes. Similarly, Wallhead
577 et al. (2014) provide limited support for this path by indicating direct transfer of motivation from
578 Siedentop's (1998) Sport Education model to increased leisure-time PA behavior.

579 **Limitations**

580 All measures, including the outcome measure of overall PA, were based on self-reports.
581 This is an obvious limitation, given that children mature at different rates which may impact their
582 ability to think abstractly and perform detailed recall (Brown, Hume, Pearson, and Salmon,
583 2013). Objective PA measures would have strengthened our intervention, providing more
584 accurate data and thus a more realistic picture of the students' PA (Downs et al., 2014).
585 Similarly, observations would have increased our understanding of the teachers' use of
586 implementation strategies during the intervention and of the interactions between teachers, as
587 well as between teachers and students. A further limiting factor is that students' RAI was used as
588 a one-time mediator variable at T2 and, thus, no conclusions about the changes in students
589 motivation can be drawn. Additionally, there is no knowing how a slightly different data
590 collection protocol between intervention (online questionnaires) and control schools (paper-and-
591 pencil questionnaires), due to different survey administration preferences, affected pupils'
592 responses, resulting in possible survey format based variance. Finally, the study lacked a
593 validated observation instrument or a subjective check-list to collect data about how closely the
594 teachers implemented the CPE model. However, we used a retrospective inquiry to gather data
595 about teacher fidelity to the CPE model. Two teachers of the intervention school reported
596 implementing the CPE model only occasionally; this variation in teacher fidelity as previously
597 reported by our research team (Hytönen et al., 2015) is an acknowledged limitation of the present
598 study.

599 **Intervention strengths**

600 Despite the limitations of this study, we believe that this CPE intervention exhibits a
601 range of strengths. Firstly, instead of delineating PE via a focus on particular sports, this

602 intervention highlighted an educational integration built on the theoretical complementarity of
603 the Finnish national curriculum with a pedagogical model. This theory-driven intervention,
604 guided by ontological concerns, took into consideration the educational aspects of PE in terms of
605 diverse aims (motor, socio-ethical, ontological) and supported teacher design of a modified
606 program that incorporated both the demands of the Finnish national curriculum and the
607 principles emanating from CPE (Quay et al., 2016; Quay and Peters, 2008, 2012). This is in line
608 with the recommendation from Kriemler et al. (2011) that favors use of multicomponent
609 interventions – including educational, curricular, and environmental manipulations – over
610 isolated interventions. In this CPE intervention, the whole intervention procedure was cost-
611 effective because teachers’ themselves combined educational and curricular aspects and
612 organized possible manipulations without the need for any additional PE lessons.

613 Secondly, as noted by Wallhead et al. (2014), transfer of motivation from a school
614 context to a leisure-time context is difficult, particularly when PE is seen exclusively as a core
615 foundation for prospective participation in (adult-developed) sports, not overall PA itself. In
616 these cases, teaching and learning are decontextualized and well-intentioned PE aims might be
617 overridden by goals stressed by organized leisure-time sports. With an emphasis on social
618 capacity and ontological concerns, aligned with the possibility of students creating and
619 developing games in PE lessons, the CPE approach managed to increase the likelihood of PA
620 participation both within and outside the school context.

621 Overall, the present study contributes to extant knowledge on the effect of school-based
622 PA interventions (e.g. Kriemler et al., 2011) and other model-based PA interventions (Spittle and
623 Byrne, 2009; Wallhead et al., 2014) on students’ motivation in PE and their overall PA.
624 Particularly in Finland, there have not been studies that directly examine the effects of school PE

625 – different curricula, instructional models, teaching styles – on school students’ PA (Yli-Piipari,
626 2014). From a practical viewpoint, this study offers a potential pedagogical approach to PE that
627 can be presented to qualified PE teachers, generalist primary school teachers and pre-service
628 teachers promoting students’ PA both in-school and out-of-school.

629

630

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