Author(s): Kokkonen, Juha; Yli-Piipari, Sami; Kokkonen, Marja; Quay, John

Title: Effectiveness of a creative physical education intervention on elementary school students' leisure-time physical activity motivation and overall physical activity in Finland

Year: 2019

Version: Accepted version (Final draft)

Please cite the original version:

Kokkonen, J., Yli-Piipari, S., Kokkonen, M., & Quay, J. (2019). Effectiveness of a creative physical education intervention on elementary school students' leisure-time physical activity motivation and overall physical activity in Finland. European Physical Education Review, 25(3), 795-815. https://doi.org/10.1177/1356336X18775009

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

Abstract

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

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

Introduction

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

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

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

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

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

Motivation and physical activity

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

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

Evidence from motivation regulation studies involving children and adolescents reveals that autonomous motivation is positively associated with leisure-time PA (Owen et al., 2013; 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 perceptive, 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-determinated motivation,
113 and with higher amotivation.

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

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

Creative physical education

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Method

Participants

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

Procedures

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

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

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

298

299 **Table 1** Lessons 1 to 4 of control and intervention schools' fourth graders at beginning of the
300 intervention
301

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			

In the control school all the PE lessons were focused primarily on achieving the movement skill aims associated with two specific traditional sports: Finnish baseball and soccer. Socio-ethical aims were planned to be achieved through the conduct of the sports, with socio-ethical and ontological goals mainly positioned in service of movement skill goals (Table 1). This represents a version of what Kirk (2013: 980) described as "traditional PE programmes" embracing a "sport-technique based, multi-activity approach". In contrast, CPE lessons in the intervention school were aimed at co-construction of being a team-member and associated ways of being, with socio-ethical education aims supporting achievement of ontological aims, and both supporting achievement of movement skill aims. In addition, the CPE intervention included student activities atypical for traditional PE lessons, such as completing workbooks, homework, and teaching physical activities to other students (Table 1). Finally, the CPE intervention included activities (e.g. team name and chant invention, recording team-mates' strengths, factors contributing to becoming a great team) which supported achievement of socio-ethical and ontological aims.

Measures

Motivational Climate in PE. Perception of motivational climate in PE was measured using the Motivational Climate in PE scale (Soini et al., 2014), which consisted of two subscales representing task- and ego-supportive climates. The individual item stem used in the measure was "*In my PE class...*". Both task-supportive (e.g. "*It is important for students to try their best in PE lessons*"), and ego-supportive (e.g. "*It is important for students to succeed better than*

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

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

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

Statistical analysis

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

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

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

Results

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

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**	-
Experimental Group Values								
M	na	4.01[a]	4.16	2.77	2.70	2.84	4.44[a]	4.13
SD	na	.79	.70	.97	1.02	.57	1.38	1.68
Range [min, max]	[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]
Control Group Values								
M	na	4.34	4.01	2.76	3.13	2.45	5.54	5.51
SD	na	.57	.76	.96	1.00	1.06	1.38	1.29
Range [min, max]	[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]

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

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

perceptions of task-supportive motivational climate in PE significantly (p = .008, 95% CI [.05, .36]; covariates adjusted means 4.19 and 3.98, intervention and control group, respectively) and decreased students' perceptions of ego-supportive motivational climate in PE (p < .001, 95% CI [-.59, -.19]; covariates adjusted means 2.70 and 3.09, intervention and control group, respectively). Moreover, grade level was significantly related to task-supportive (F[2,306] = 32.91, p < .001, η2 = .09) and ego-supportive (F[2,306] = 7.29, p = .007, η2 = .02) (no statistically significant effect on PA) motivational climates, but participants' sex was not related to the outcome variables.

Due to the statistically significant covariate effect of the grade level, we wanted to extend our examination of the role of grade level on study outcomes. Separate repeated measure analyses of covariance were conducted on each outcome variable. Sphericity was not met, thus a conservative Greenhouse-Geisser adjustment was used in all three analyses. Results showed that there was a statistically significant intervention-grade-time interaction in students' perceptions of task-supportive motivational climate in PE (F[2, 2] = 8.380, p < *.001,* $\eta^{2 =}$ .05) and ego-supportive motivational climate in PE (F[2, 2] = 1.905, p = .017, η2 = .02) but not in PA. Pairwise comparison between fourth and sixth grade students, as well as fifth and sixth, showed that they differ statistically in task- (fourth vs sixth: p = .006 CI 95% [.06,.34]; fifth vs sixth: p < .001 CI 95% [.11,.39]) and ego-supportive (fourth vs sixth: p < .001 CI 95% [-.66,-.24]; fifth vs sixth: p < .001 CI 95% [-.59,-.19]) motivational climate, estimated mean levels being 4.19(.05), 4.24(.05), and 3.99(.05) for task-supportive and 2.67(.08), 2.73(.07), and 3.12(.07) for ego-supportive climate, fourth, fifth, and sixth grades respectively.

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

model fit: χ^2 (10) = 59.57, $p < .001$, CFI = .94, TLI = .94, RMSEA = .069, CI 90% [.04, .09]. Next, a treatment variable was added to the a priori model. The path analysis (see Figure 1) demonstrated acceptable fit with the data based on the multiple criteria adopted (χ^2 (12) = 54.17, $p < .001$; CFI = .96; TLI = .95; RMSEA = .057, 90% CI 90% [.03, .08]). The analysis showed that the intervention had a positive effect on students' perceptions of task-supportive climate (β = .14) in PE and negative effect on their perceptions of ego-supportive climate (β = -.18). Students' perceptions of task-supportive climate had a positive effect on their leisure-time PA motivation (β = .15). The effect sizes were small-to-moderate, with experimental effect (together with pretest values) explaining 16% of the variance in students' perceptions of task-supportive climate in PE, 25% of ego-supportive climate in PE, and 8% of the variance in their leisure-time PA motivation. The path analysis showed that students' leisure-time PA motivation had a positive effect (β = .17) on their overall PA. The effect sizes were small-to-moderate, students' leisure-time PA motivation together with their previous overall PA explaining 20% of the variance in their overall PA. As for the indirect effect, the analysis showed that neither task- nor ego-supportive climate in PE had a statistically significant effect (β_{task} = .05; β_{ego} = -.06, CI 95% [-.17, .12]) on students' overall PA.

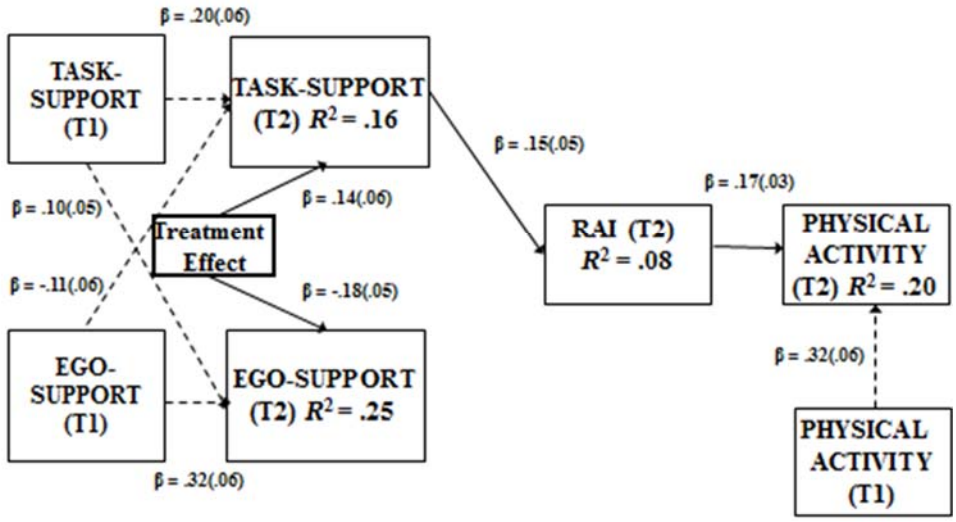

Figure 1. A path model visualization of the established and hypothesized relationships. *Note. T1= Time 1; T2 = Time 2. Solid arrows represent statistically significant relationships, a dashed the non-significant hypothesized relationship, and dash-dotted the covariate effects.*

Discussion

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

First hypothesis

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

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

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

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

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

Possible negative impacts of competition are mitigated in CPE through emphasis on team improvement, and the structured employ of the team itself in generating that improvement, with the aim being to de-emphasize the impact of comparative judgments by positioning these as 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

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

Second hypothesis

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

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

Limitations

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

Intervention strengths

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

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

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

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

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

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