

ABSTRACT

BACKGROUND: The study examined the development of children's moderate to vigorous physical activity (MVPA) and physical education (PE) enjoyment through the Physical Activity as Civil Skill Program 2012-2014.

METHODS: Participants were 661 (265 intervention, 396 control) elementary school children in Central and North-East Finland. The program was implemented across two years with three measurement phases using self-reported MVPA and PE enjoyment, and accelerometer-determined MVPA of a random subsample (n = 76).

RESULTS: The proportion of children meeting the current MVPA guidelines declined from 38% to 22% (intervention) and 14% to 9% (control), whereas PE enjoyment was stable in both groups. Boys were more physically active than girls only within control group children. Teachers' feedback indicated that violence and bullying among intervention students reduced during the program, which can be considered as an additional benefit.

CONCLUSIONS: It may be that both MVPA and PE enjoyment may require more tailored actions to be increased across a long-term program. It is important to ensure that school-based physical activity programs, especially including transition from elementary to middle school level, provide all children positive experiences, and thus, may improve their motivation, and MVPA participation during school days and leisure time.

Keywords: Achievement Goal Theory, Social Ecological Model, intervention, latent growth curve model

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3 Physical activity of children and youth in many developed countries has declined^{1,2} with
4 major implications to population health, such as overweight and obesity up to type 2 diabetes, and
5 cardiovascular disease.³ The causal pathways between moderate to vigorous physical activity
6 (MVPA) and cognitive performance have also highlighted the important role of childhood physical
7 activity in the development of brain functioning.⁴ In addition, schools are an attractive venue for
8 childhood physical activity promotion, since the decisions in terms of physical activity can be
9 controlled⁵ and adherence to the intervention can be improved.⁶ School-based interventions have
10 shown to be effective in promoting children's short-term health behaviors, for instance MVPA
11 participation.⁷⁻¹⁰ Although it has been shown that, at a minimum, a combination of school-wide
12 education with changes to school day structure or curriculum will contribute to positive effects, the
13 examination of the school-based physical activity interventions has identified a lack of follow-up
14 data of psychological outcomes (motivation towards physical activity, enjoyment).⁸ Therefore, the
15 aim of the current study was to investigate the longitudinal development of MVPA and physical
16 education (PE) enjoyment in elementary school children across a two-year school-based program.

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33 The Physical Activity as Civil Skill Program¹¹ was a European Union funded program to
34 improve school-aged children MVPA participation across communities in Central and North-East
35 Finland. The program was grounded in the Achievement Goal Theory¹² and the Social Ecological
36 Model.^{13,14} The Achievement Goal Theory provides a framework to understand the relationships
37 between the psychological environment and intended outcomes, such as the relationship between
38 psychological school environment and PE enjoyment and total MVPA. The achievement is defined
39 to be the attainment of a personally or socially valued goal in a PE context. For instance, positive
40 development of PE motivation is most likely to occur when task-involving teaching practices are
41 emphasized through enhancing self-referenced learning experiences and reducing social
42 comparison. The Social Ecological Model, in turn, guides effective health promotion efforts to
43 understand multilevel relations including individual behavior and physical environment, such as
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3 MVPA participation and opportunities for in-school physical activities. Based on this, the central
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5 assumption of the program was that children's total MVPA and PE enjoyment could be
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7 concurrently increased by implementing a school-based program including (1) *physical activity*
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9 *support* during school days and (2) *task-involving motivational climate support* in PE classes.

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11 *Physical activity support* focused on enhancements to schools' physical environment in order
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13 to increase MVPA opportunities during school days. The Social Ecological Model can be divided
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15 into individual, interpersonal, organizational, community, and society levels of human behavior.¹³
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17 The present study focused on the individual and interpersonal levels. The individual level identifies
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19 children's individual beliefs, attitudes, and behavior, whereas the interpersonal level recognizes the
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21 settings such as school environment and social norms. School-based activities at the individual level
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23 could be improving motivation toward physical activities, whereas changes at the interpersonal
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25 level could be implemented by providing opportunities and facilities as well as equipment for
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27 activities to increase MVPA participation. Research has shown that middle school students' daily
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29 MVPA will increase when activities are organized and access to equipment are provided during
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31 school days.¹⁵ In addition, several school-based interventions have shown to be effective in
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33 increasing students' in-school MVPA,^{5,7,9,10,16-22} but evidence on students' total MVPA has not been
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35 assessed or it has been scarce.²³⁻²⁷ Dobbins et al.⁸ reviewed the available evidence of school
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37 physical activity promotion efforts up to June 2007 reporting positive intervention effects on
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39 school-day physical activity, but they found no or minimal evidence of increases on out-of-school
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41 physical activity. In the updated literature review from years 2007 to 2010, however, Kriemler et al
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43 found the majority of the studies establishing positive changes not only in students' physical
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45 activity during school hours but five studies out of reported sixteen established changes also in total
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47 physical activity.²⁵ These previous reviews concluded that interventions were more likely to be
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49 successful if they were multi-component, relatively long in duration, and based on the theory.²⁵
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51 Among the three studies documenting a longer follow-up (6 to 12 months), all reported maintained
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2 effects in at least one measure of physical activity.^{23,27,28} This study extends the previous findings
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4 by following the effects of school-based program on children's MVPA participation and PE
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6 enjoyment across two years including transition from elementary to middle school.
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9 *Task-involving climate support* was designed to help PE teachers to create task-involving
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11 climate during their PE classes to increase children's perceptions of enjoyment and MVPA based on
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13 the features of the Achievement Goal Theory.¹² Based on Ames, two types of motivational climate
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15 are suggested to exist: a task-involving climate (psychological climate that supports self-referenced
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17 learning and effort) and an ego-involving climate (supports normative evaluation, such as
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19 competition and defeating others).²⁹ Previous studies have revealed that task-involving climate in
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21 school PE correlated with increased MVPA engagement^{30,31} and PE enjoyment,³²⁻³⁴ whereas an ego-
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23 involving climate in PE has shown either to uncorrelate with PE enjoyment³⁴ and MVPA³⁰ or
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25 correlate with low levels of enjoyment.³³ The recent meta-analysis examining the effectiveness of
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27 motivational climate interventions in PE showed task-involving interventions to have small to
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29 moderate effects in enhancing school students' affective (enjoyment), behavioral (MVPA), and
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31 cognitive (knowledge) outcomes.³⁵ The methods included training seminars, designed lessons,
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33 video analysis, or combinations of the various strategies. However, only three studies used follow-
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35 up measures to determine treatment effects. The present study tested the fidelity of task-involving
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37 climate support in addition to MVPA and PE enjoyment data in order to examine the psychological
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39 effects of school-based program.
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44 Taken together, previous research has consistently shown that daily MVPA participation
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46 declines particularly during adolescence as children transfer from elementary to middle school
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48 level.^{1,2,36-38} Similarly, PE enjoyment has been reported to decline across school years^{36,39-41} and
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50 even during school-based physical activity interventions.⁴² This may be explained by the fact that
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52 enjoyment has not been monitored with sufficient accuracy or there might be deficiencies in
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54 previous programs being implemented.⁴² If school-based programs are enjoyable for children, they
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3 may be encouraged to become more active also in different contexts, for instance after-school or
4 weekends.^{43,44} Acknowledging age-related declines, the close relationship between school PE
5 enjoyment and MVPA, the unique position of PE teachers to impact students PE enjoyment,^{35,40,45}
6 and finally, a need of interventions to examine psychological variables (motivation, enjoyment) in
7 addition to MVPA data,⁸ school-based physical activity programs to improve both MVPA and PE
8 enjoyment are well warranted. The present study implemented a multi-component, theory-based,
9 and longitudinal school physical activity program, including physical activity support and task-
10 involving climate support, to reverse the declining patterns in both MVPA and PE enjoyment.
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20 The first aim of the study was to examine the longitudinal development of MVPA and PE
21 enjoyment in the program and control schools with an expectation that an increase in PE enjoyment
22 would reciprocally enhance students' MVPA participation. It was expected that MVPA and PE
23 enjoyment among children in the program would increase,^{31,45,46} whereas control group children's
24 MVPA and PE enjoyment would decline over time.^{36,39,40} Second, the cross-lagged relationship
25 between the development of MVPA and PE enjoyment was examined with the hypothesis that total
26 MVPA would reciprocally relate with PE enjoyment in both groups.^{35,45,40,46} The differences
27 between girls and boys were also examined, since boys have previously been reported to be more
28 physically active^{1,2} and perceive higher PE enjoyment than girls.^{33,47}
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41 **METHODS**

42 **Participants**

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44 The current sample comprised 661 children aged 11- to 13-years divided to program (N =
45 265, 55% girls, M = 12.23 ± .42 years) and control groups (N = 396, 51% girls, M = 12.04 ± .21
46 years). Participants were recruited from 30 elementary schools located in the Central and North-
47 East Finland. All Grade 6 students were invited to participate through the contact with the school
48 principals. Approximately 30% of children in this age group from the region participated in the
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3 study. The approval of the study protocols was obtained from the ethics committee of the local
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5 university, and written consent to participate in the study was obtained from all participants and
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7 their parents. Participation in this study was voluntary and no extra credit was awarded for
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9 participation. Schools were not randomized, fourteen schools decided voluntarily to organize the
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11 intervention activities and sixteen participated in the study as control schools. Forty-six teachers (22
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13 program group, 24 control group) aged from 30 to 60 years participated in the study. All teachers of
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15 the program schools contributed their time to organize the school break activities and eight PE
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17 teachers were in charge of implementing the task-involving climate support in PE classes.
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22 **Measures**

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24 The perceptions of task-involving climate implementation was determined using the
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26 Motivation Climate in PE Scale (MCPES).⁴⁸ The individual item stem was *“In my PE classes.”* The
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28 task-involving climate dimension consisted of five items (*“It is important for students to try their*
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30 *best in PE classes”*) and the ego-involving climate dimension included four items (*“It is important*
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32 *for students to succeed better than others in PE classes”*). Responses were indicated on a five-point
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34 Likert-scale ranging from strongly disagree (1) to strongly agree (5). Recently, the confirmatory
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36 factor analysis (TLI = 0.96, CFI = 0.98, RMSEA = 0.06) and composite reliability (0.86) supported
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38 the construct validity of the scale for Finnish middle school students.³⁶
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42 MVPA was assessed using the Health Behavior in School-aged Children Research Protocol
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44 (HBSC).¹ The introduction preceding the items was: *“In the next two questions physical activity*
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46 *means all activities which raises your heart rates or momentarily get you out of breath for example*
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48 *in doing exercise, playing with your friends, going to school, or in school PE. Sport also includes*
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50 *for example jogging, intensive walking, roller skating, cycling, dancing, skating, skiing, soccer,*
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52 *basketball and baseball.”* The items required students to summarize their time spent in MVPA each
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54 day in the following way: *“When you think about your typical week, on how many days are you*
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3 *physically active for a total of at least 60 minutes per day?”* and *“Over the past 7 days, on how*
4 *many days were you physically active for a total of at least 60 minutes per day?”* Both items rated
5 on an eight-point response scale (0 to 7 days). The mean score of two items were used as children’s
6 MVPA value. Prochaska, Sallis, and Long investigated that for a sample of 138 US children with a
7 mean age of 12.1 years, the particular items were reliable (ICC = .77) and had moderate correlation
8 ($r = .40$) with accelerometer data in a study based on a five-day data collection period.⁴⁹ Validity of
9 the self-reported MVPA data was examined by asking a random subsample (N = 76) to wear
10 Actigraph GT3X+ accelerometers (small, easy to use, and waist-worn monitors) for two seven-day
11 periods. The electronic monitors detected the intensity of the movements and displayed minutes
12 spent in MVPA. The original Troiano⁵⁰ settings were adopted in order to determine non-wear time
13 of accelerometers across the measurements. Only daytime activity (8 am to 10 pm, beside when
14 engaging in water-based activities) was included into the analyses. Data were considered valid if a
15 student had at least three days including one weekend day with at least 480 minutes of activity
16 recorded per day, a protocol adopted in the earlier study of Bergh et al.⁵¹ Seventy-six of ninety-six
17 children who received accelerometers provided valid data by wearing accelerometers without
18 interruptions across their waking hours of seven days with the exception of engaging in water-based
19 activities. Twenty children were excluded because they were not achieving at least three days of
20 recorded activity. The lower threshold for moderate-intensity was 3581 counts per minute, which
21 was validated for children aged 12 years (as in this study) by Mattocks et al.⁵²

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44 PE enjoyment was measured using the PE Enjoyment Scale,³³ which adopted the protocol of
45 Sport Enjoyment Scale.⁵³ The item stem was: *“In my PE classes.”* The subscale consists of four
46 items: *“I like PE classes”*, *“PE classes are fun”*, *“PE classes bring me joy”*, and *“I enjoy PE*
47 *classes.”* The responses were indicated on a five-point Likert-scale ranging from strongly disagree
48 (1) to strongly agree (5). The mean of four items were used as children’s physical enjoyment score.

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3 Previously, the construct validity (TLI = 1.00, CFI = 1.00, RMSEA = .031) and internal consistency
4 ($\alpha > .90$) of the scale were strongly supported in a sample of Finnish Grade 7 students.³⁴
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8 9 **Procedure**

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11 The data were collected across two years in spring 2012 (T0), spring 2013 (T1), and spring
12 2014 (T2). The principals and teachers preferred this schedule. Children responded to the online
13 questionnaires under the supervision of the teachers during classes held in the computer labs. The
14 participants were advised to ask for help if needed. To minimize tendency to give socially desirable
15 responses, children were encouraged to answer honestly and were assured that their responses were
16 confidential. Participants were told that their involvement was voluntary and they were allowed to
17 terminate their participation at any time. The comparative accelerometer-determined MVPA scores
18 were collected at T0 and T2 during the same week as self-reports.
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31 **The Physical Activity as Civil Skill Program 2012-2014**

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33 The European Union funded Physical Activity as Civil Skill Program¹¹ (ESF/2012-2014/6)
34 comprised activities to increase students' MVPA and PE enjoyment. A team possessing relevant
35 expertise including program staff, teachers, school healthcare personnel, policy-makers, school PE
36 and sport experts from the university, and local sport clubs designed the content of the program.
37 The team had regular meetings approximately once in a month starting fall 2011 through spring
38 2014. The features of the Achievement Goal Theory and Social Ecological Model were used as
39 practical tools to establish more opportunities for daily physical activities and to improve task-
40 involving teaching practices in school PE in order to foster greater levels of MVPA and PE
41 enjoyment. In the beginning, teachers were asked to give suggestions to implement the program in
42 practical terms. The purpose was to list useful teaching practices together in order to help program
43 schools to improve their school day activities. The program staff organized the teacher education. In
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3 addition, experts were involved in the practical sessions, for instance, the functional demonstration
4 of apparatus gymnastics. In total, twenty-six 90 to 120-minute practical education sessions were
5 completed during two years 2011-2013. The teachers participated in the supplemental training
6 sessions voluntarily or in the minority of cases as a part of teachers' collective bargaining
7 agreement for supplemental training. Sixty-one percent of teachers participated in the supplement
8 training at least once. In particular, all PE teachers from the program schools participated in four
9 90-minute workshops to extend and develop their current PE teaching practices. The teachers were
10 also given written material on PE motivation and task-involving teaching practices. The program
11 was operationalized between program staff-teachers and between teachers-students. Two full-time
12 employees were responsible for organizing the teacher consultation including practices, teacher
13 training, public communication, and supervision. The task of the researchers was to implement
14 systematic follow-up study for the key variables. Researchers did not attempt to control the program
15 either at staff-teacher or teacher-student level. It was solely based on the teachers' written feedback
16 and notes. In addition, the project employees monitored the school breaks twice a month.
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18 Participants in both groups participated in 90-minute of PE per week. The control schools followed
19 the national of PE curriculum⁵⁴ delivered in the normal way by the teachers. The program group
20 received *physical activity support* and *task-involving climate support* through two years from Grade
21 6 to 8, starting in spring 2012 after the baseline measurements.

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42 *Physical activity support* focused on developing the physical environment of the school and
43 providing equipment for MVPA. The activities were organized during regular and extended breaks.
44 Children were given a lot of autonomy when selecting activities. The recess activities included the
45 following actions: (1) *Long breaks*; daily extended break of 30 minutes in addition to the 30-minute
46 lunch break and 5 to 10-minute regular breaks, (2) *Access to fitness hall*; children were allowed to
47 use fitness facilities during the extended and regular breaks in order to exercise or play games, all
48 schools had similar fitness halls with basic facilities (baskets and goals), (3) *Supervised ballgames*
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3 (floor hockey, basketball, indoor soccer, table tennis); students were responsible for setting up
4 ballgames and refereeing during extended breaks (5 days x 30 minutes x 12 weeks) under the
5 teachers' supervision, (4) *Equipment supply* (dance pads, floor hockey sticks, volleyballs,
6 basketballs, jumping ropes); exercise equipment was available to children during the extended and
7 regular breaks, students were responsible for setting up equipment.

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13 *Task-involving climate support* comprised supplementary teacher training to improve task-
14 involving motivational support across regular PE classes. Teachers participated in four 90-minute
15 workshops to develop and reflect their teaching practices. First teacher workshops were organized
16 prior to the first data collection phase. Teachers were informed about the goals, methods and
17 procedures of the program. The workshops and class activities had the following features: (1) *Task-*
18 *involving teaching practices*; students work together within a small cooperative group structure,
19 students are responsible for setting up equipment, during lesson time students dictate the rate of
20 progression through specific practices, (2) *Self-referenced learning and effort*; evaluation
21 emphasizes individual improvement, (3) *Improving students personal skills*; students choose
22 practices from a range of offered practices with the different skill requirements, more activity and
23 less waiting during PE classes, and (4) *Positive feedback and encouragement*; recognition and
24 feedback is based on the individual progress. For a more detailed description of the program, the
25 thorough report should be consulted.³⁶

43 **Data Analyses**

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46 Prior to modeling, normal distribution, outliers, and missing values of the data were
47 examined. No modifications due to normality were required. Neither statistically significant outliers
48 were detected through the covariance matrix based on the on the Mahalanobis distance test ($p <$
49 $.001$) of standardized values (± 3.00).⁵⁵ The data included 28% of missing values, which were due
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3 the follow-up measurements. Little's missing completely at random (MCAR) test ($\chi^2 = 86.542$, $df =$
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5 51, $p < .001$) and frequencies indicated that the missing values did not represent any particular
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7 school or group. Additionally, independent sample t-tests were used to test if participants who
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9 provided complete data through three time points differed from participants who provided the
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11 incomplete data. The tests showed no differences ($p > .05$) between the participants who provided
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13 complete and incomplete data. Thus, the missing values were assumed to be missing at random
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15 (MAR).⁵⁶

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18 Preliminary analyses, such as correlations, descriptive statistics, and Cronbach's alphas of
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20 internal consistency for each variable were tabulated. Next, the t-tests were conducted to test the
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22 differences between standardized self-reports and objective MVPA scores. Hedges' g was used to
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24 measure the effect sizes between the scales, as the method provides a measure of effect size
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26 weighted according to the relative size of each sample. The task-involving climate support
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28 implementation was examined by assessing students' perception of their motivational climate based
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30 on the Achievement Goal Theory. Finally, to answer to the research questions, that is to examine
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32 (1) longitudinal development and (2) cross-lagged relationships of MVPA and PE enjoyment, a
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34 series of latent growth models were implemented. The latent variables (Level₁, Slope₁, Level₂,
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36 Slope₂) based on the observed variables with residuals (ϵ) were estimated. Level₁ (MVPA) and
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38 Level₂ (enjoyment) refer to the initial mean values at the baseline. Slope₁ and Slope₂ referred to the
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40 growth pattern when the initial levels were accounted for. The default models for longitudinal
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42 development were constructed by fixing the loadings of latent variables to 1 on the initial level, to
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44 0, 1, 2 on the growth variable separately for both variables and both experimental conditions. In
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46 case of poor data fit, alternative non-linear models were fitted. Sex was added into the models as a
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48 covariate. To test the cross-lagged relationships between MVPA and PE enjoyment, two models
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50 was estimated (one for program group and one for control), in which paths from Level₁ to Slope₂
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52 and Level₂ to Slope₁ were estimated. In addition, Level and Slope constructs were allowed to
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3 correlate with each other. Two-group tests were used to analyze differences between program and
4 control group models. Figure 1 presents the theorized parallel latent growth curve model of MVPA
5 and PE enjoyment through three time points (T0, T1, T2).
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9 Chi-square test (χ^2) was used as a test of the model's overall goodness-of-fit to the data. A
10 non-significant difference between observed and theoretical distribution had an acceptable fit to the
11 data. To determine the appropriateness of the model the standardized root mean square residual
12 (SRMR) and the root mean square error of approximation (RMSEA), the comparative fit index
13 (CFI), the Tucker-Lewis index (TLI) were also examined.⁵⁷ A value of .05 or less for SRMR
14 indicate the reasonable magnitude of a varying quantity, a value of .05 or less for the RMSEA
15 indicate an acceptable fit of the model in the relations to the degrees of freedom. The CFI and TLI
16 indices greater than .95 are indicative for an excellent model fit.⁵⁸ The missing value analysis was
17 performed using SPSS Version 22.0 and all subsequent analyses using Mplus Version 7.11.
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31 **RESULTS**

32 **Preliminary Analyses**

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35 Correlations, means, standard deviations, and Cronbach alphas for MVPA and PE enjoyment
36 at T0, T1 and T2 were determined (Table 1). For both program and control group, correlation
37 coefficients showed weak to moderate positive associations (ranging from .08 to .37) between PE
38 enjoyment and MVPA across two years of program. Internal consistencies of the scales were also
39 acceptable in both groups ($\alpha > .88$). Mean differences between self-reports (T0: 5.14 ± 1.77 , T2:
40 5.07 ± 1.79) and objective scores (T0: $.84 \pm 1.14$, T2: $.73 \pm 1.17$) were found at T0 ($t(259) = 12.18$,
41 $p < .001$, Hedges' $g = .25$) and T2 ($t(188) = 12.87$, $p < .001$, Hedges' $g = .25$), with children
42 accumulating higher self-reported than objective scores. Based on the effect sizes, children
43 modestly over-estimated their daily MVPA participation. The proportion of students who met the
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3 current MVPA guidelines declined from 38% to 22% in intervention and 14% to 9% in control
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5 group across T0 to T2 measurement phases.
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9 10 **The Perceptions of Task-Involving Climate Implementation**

11 The t-tests between T0 and T2 measurements phases revealed no changes in the program
12 group students' perception of task-involving climate ($t(360) = 1.515, p = .131$) from T0 ($4.27 \pm .71$)
13 to T2 ($4.15 \pm .76$) nor ego-involving climate ($t(360) = 1.403, p = .162$) from T0 (2.76 ± 1.02) to T2
14 ($2.91 \pm .92$). In contrast, the control group's perceptions of task-involving climate decreased
15 ($t(1081) = 3.952, p < .001$) from T0 ($3.73 \pm .91$) to T2 ($3.52 \pm .83$) and perceptions of ego-involving
16 climate increased ($t(1081) = 14.581, p < .001$) between T0 ($2.26 \pm .91$) and T2 ($3.04 \pm .83$).
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26 27 **The Developmental Trajectories of MVPA and PE Enjoyment**

28 First, the developmental trajectories of MVPA and PE enjoyment were separately examined.
29 A linear latent growth curve model revealed a poor model fit for the MVPA data ($\chi^2(4) = 17.106, p$
30 $< .01, CFI = .92, TLI = .75, RMSEA = .100, 90\% CI [.05, .15], SRMR = .042$). Based on the model
31 results, the model was established as a non-linear latent growth curve model by allowing the last
32 parameter of slope to be freely estimated. The non-linear model showed an excellent model fit for
33 the data ($\chi^2(3) = 1.948, p = .583, CFI = 1.00, TLI = 1.00, RMSEA = .000, 90\% CI [.00, .08], SRMR$
34 $= .031$). The standardized results highlighted that both program ($Level_1 = 3.39, p < .001; Slope_1 = -$
35 $1.05, p < .01$) and control group ($Level_1 = 5.10, p < .001; Slope_1 = -.98, p < .05$) were moderately
36 physically active and their MVPA decreased over time. Two-group tests confirmed a significant
37 difference between program and control groups' MVPA level ($\chi^2(1) = 4.544, p < .05$), but similar
38 decrease across two years of program ($\chi^2(1) = 1.354, p = .244$). A difference between girls and boys
39 was found only among control group children in the MVPA level ($Level_1 = .26, p < .05$) with boys
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3 Similarly, a linear latent growth curve model showed a non-acceptable model fit for PE
4 enjoyment data ($\chi^2(4) = 14.999$, $p < .01$, CFI = .96, TLI = .88, RMSEA = .091, 90% CI [.05, .14],
5 SRMR = .043). Based on the model results, a non-linear model was conducted. The alternative
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7 model yielded a good model fit for the data ($\chi^2(4) = 7.998$, $p = .092$, CFI = .99, TLI = .96, RMSEA
8 = .055, 90% CI [.00, .11], SRMR = .030). The standardized results showed that the program group
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10 (Level₂ = 8.09, $p < .001$; Slope₂ = -.18, $p = .633$) and control group (Level₂ = 4.70, $p < .001$; Slope₂
11 = -.98, $p = .182$) perceived enjoyment in PE as high and stable over time. No differences between
12
13 groups were found in PE enjoyment level ($\chi^2(1) = .921$, $p = .337$) or development over time ($\chi^2(1) =$
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15 1.179, $p = .278$). No differences between girls and boys were detected.

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22 The parallel process model for MVPA and PE enjoyment were estimated in order to detect
23 reciprocal relationship between MVPA and PE enjoyment. The parallel model including non-linear
24 growth curve models of MVPA and PE enjoyment revealed an excellent model fit for the data
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26 ($\chi^2(10) = 7.302$, $p = .697$, CFI = 1.00, TLI = 1.00, RMSEA = .000, 90% CI [.00, .05], SRMR =
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28 .031). The standardized model results showed that MVPA level (Level₁) negatively correlated with
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30 MVPA trend (Slope₁) only in the program group (standardized estimate = -.44, $p < .05$). No other
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32 significant relationships were detected.

33 34 35 36 37 38 39 40 **DISCUSSION**

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42 The central assumption of the Physical Activity as Civil Skill Program¹¹ was that children's
43 total MVPA and PE enjoyment could be increased by implementing the school-based program
44 including additional physical activities during school days and task-involving motivational climate
45 support during PE classes. The present study examined the longitudinal development of MVPA and
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47 PE enjoyment using a quasi-experimental study design, with the opposing hypotheses of positive
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49 development in MVPA and PE enjoyment among program group and negative development among
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51 control group. In addition, the cross-lagged relationship between the development of MVPA and PE
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3 enjoyment was examined with the hypothesis that total MVPA and PE enjoyment would be
4 reciprocally related in both groups. Based on the previously established relationships, differences
5 between girls and boys were also analyzed.
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9 First, students' perceptions of task-involving climate was checked by examining their
10 experiences of motivational climate in PE classes. To establish the changes in program group
11 teachers' teaching practices, it was assumed that program group children's development in their
12 perceptions should be more positive in task-involving climate and more negative in ego-involving
13 climate compared to children in the control group. The present study showed that task-involving
14 climate support in PE did not increase during the program nor did the decline in ego-involving
15 climate occur. However, the findings established some evidence that task-involving support
16 activities were successful in prohibiting the previously demonstrated decline of task-involving
17 climate and incline of ego-involving climate in school PE classes.^{44,59} Additionally, teachers'
18 written feedback indicated that violence among children and bullying reduced during the program,
19 which can be considered as additional benefits of the program.
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33 The results showed that the program was ineffective in enhancing children's total MVPA
34 across two years. This was not expected, since the particular program was effective in increasing
35 middle school students' MVPA across one school year.³⁰ Several previous school-based
36 interventions have also been effective in promoting students' MVPA.^{5,7,9,10,16-22} However, many of
37 these interventions reviewed can be considered as short-term programs or were missing total
38 MVPA data. Metcalf, Henley, and Wilkin found that physical activity interventions have generally
39 had only a small effect on children's overall objectively measured activity levels.⁶⁰ On this basis, it
40 seems that many previous studies used to overestimate the positive intervention effects on
41 children's total MVPA. It may be that behavioral outcomes such as total MVPA are challenging to
42 develop across a long-term "real life" program. In fact, the present actions covered transition from
43 elementary to middle school level, when children met remarkable changes in their lives. These
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3 changes included transitions to another schools, transforms in their social networks, and different
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5 teaching methods by middle school teachers. It was difficult to identify actual changes what
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7 occurred in schools, although the project staff visited the intervention schools twice a month and
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9 asked teachers and children about the implementation. The program group's perceptions of task-
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11 and ego-involving climate in PE classes remained stable during the program, when the control
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13 groups' perceived task-involving climate decreased and ego-involving climate increased. Perhaps,
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15 task-involving climate support should have been more intensive in order to achieve a significant
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17 change in the perceptions of task-involving climate across the measurements. From this perspective,
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19 the current MVPA outcomes were not uncommon. It can also be possible that during school-based
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21 interventions children's total MVPA may actually decrease, if they reduce their out-of-school
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23 activities at the same time.⁶¹ The present program, perhaps, could have showed positive changes in
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25 children's MVPA, if segmented physical activity during PE classes, recess breaks, and leisure time
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27 would have been possible to measure following the procedures of Brooke et al.⁶² and Gråstén⁶³ or
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29 qualitative measurement tools. The present accelerometer-determined data supported the differences
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31 between measurement tools in the current sample. This could be seen as concerning, especially
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33 among less physically active children.
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38 Nevertheless, an interesting finding was that previous MVPA showed to have a significant
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40 effect on current MVPA participation only among control group children. With this in mind, if
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42 negative perceptions of previous MVPA can also be reduced by providing additional physical
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44 activities and task-involving support in PE, positive MVPA experiences may be successfully
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46 enhanced. Finally, in line with many previous studies, a difference between girls and boys in the
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48 MVPA level was found only between control group's girls and boys.^{1,2} This may indicate that
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50 provided additional activities and task-involving climate support had some positive effects,
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52 especially on program group girls' psychological or social outcomes, as the difference between girls
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54 and boys in total MVPA level did not materialize. School PE are not limited to training physical
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3 activity or skills, but also knowledge, rules, fair play, respect, tactics, bodily and social awareness,
4 and personal interaction linked to social effort.⁶⁴ Despite, the higher level of MVPA in program
5 group than control group through the program can be seen as positive, particularly for children with
6 low MVPA levels. Therefore, it is important to ensure that all children receive positive physical
7 activity experiences in school PE and recess activities.
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13 The results also revealed that children perceived PE enjoyment was relatively high and it
14 stayed high across the program in both groups. Although previous studies have been contradictory,
15 as PE enjoyment have been shown to decline through childhood into adulthood,^{36,39-41} the present
16 intervention was not effective in increasing children's perceptions of PE enjoyment. It is possible
17 teachers kept going their old teaching practices, to some extent at least, although workshops were
18 provided to develop and reflect their teaching practices. This was difficult to control as the
19 supplementary training was voluntary. The stable development of PE enjoyment was not that
20 surprising, since task-involving teaching methods have been considered through the Finnish PE
21 curriculum and teacher training for at least 20 years.⁵⁴ Perhaps, to achieve a noticeable increase in
22 PE enjoyment, more additional classes or specific actions would have been required. For example,
23 if changes in attitudes or efforts toward physical activities require more time, the positive effects
24 such as enjoyment could be seen after a number of years. Although an increase in PE enjoyment
25 was not achieved through the current program, all efforts to enhance enjoyment in PE are valuable.
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27 An emphasis on enjoyment may also have significant positive outcomes in other areas of students'
28 life, for example countering stress and facilitating positive psychological health.⁶⁵ According to
29 previous papers, school PE could be most effective if based on the features of task-involving
30 motivational climate.³²⁻³⁴ Since the quantity of PE classes including recess activities cannot be
31 dramatically increased, the focus should be on providing positive learning experiences through
32 classes in which both behavioral and affective objectives are considered, and thus, to increase
33 perceptions of enjoyment.
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3 Finally, the parallel process model highlighted that the initial level of MVPA negatively
4 related to the trend of MVPA only among the intervention group students. In other words, the
5 higher students' MVPA levels were at the baseline, the greater was the decrease in MVPA over
6 time. The non-significant relationships between MVPA and PE enjoyment levels were not expected,
7 as previous studies that have demonstrated positive associations between PE motivation and
8 MVPA.^{41,46} The current findings did not find any support for the hypothesized cross-lagged
9 relationship between MVPA and PE enjoyment. In fact, the findings partly conflicted with the
10 findings of Yli-Piipari et al., which have shown PE enjoyment and MVPA participation to develop
11 at similar rates during middle school years.⁴¹ It may be that the middle school transition occurring
12 during this study may have confounded the relationship between PE enjoyment and MVPA. In
13 addition, research has shown that adolescents' physical activity behavior is influenced by multiple
14 determinants, for instance sedentary after school and weekends, that may hinder their MVPA
15 participation.^{66,67} The present study makes a unique contribution examining the parallel
16 development in MVPA and PE enjoyment across two school years, as most of the previous studies
17 can be considered as short-term interventions. No international studies were found that have
18 examined the parallel patterns of MVPA and PE enjoyment in a similar way as in the current study.
19 Therefore, the results provided important insights into the authentic association of developmental
20 growth in activity and enjoyment across the school-based program without additional PE classes or
21 before- and after-school activities. Coulter and Woods suggested that to elicit change in children's
22 physical activity behavior, it is important to know their current behavior patterns are and also their
23 enjoyment levels for the physical activities in which they are involved.⁶⁷ It is possible that
24 behavioral (MVPA) and affective (enjoyment) outcomes⁶⁸ are challenging to develop using similar
25 methods without any additional PE classes. In the current program, the actions, task-involving
26 teaching practices and additional physical activities, however, were more likely directed to promote
27 MVPA than PE enjoyment. At the same time, it must be considered that children's perceptions of
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3 PE enjoyment were relatively high at all times. Perhaps, both MVPA and PE enjoyment may
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5 require more tailored actions in order to be increased across a long-term program.
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8 9 **Limitations and Future Directions**

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11 This study was a “real life” school physical activity program trying to intervene on declining
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13 levels of MVPA and PE enjoyment in elementary school children across the transition to the middle
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15 school. A strength of the study was that the data were collected through several time points
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17 including both behavioral and affective outcomes. However, the study was not free from
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19 limitations. First, the researchers did not have possibility to implement qualitative measures of
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21 teacher workshops to determine the changes what occurred in schools. For instance, it would have
22
23 been beneficial to have detailed information about actual changes in PE teachers’ teaching
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25 practices. Second, children or schools participating in the study were not possible to randomize
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27 depending on practical reasons, as some schools were not willing to take part as intervention but
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29 control schools. Finally, the study would have benefitted from segmented MVPA measures,
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31 however, it was not possible due to the financial limitations.
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36 Future studies could include children’s perceptions of teaching practices using several
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38 methods in order to standardize the practices as accurately as possible. It would be highly beneficial
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40 to have schools collaborate with research institutions to complete with these assessments without
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42 compromising teaching practices. In line with previous proposals, more studies with larger number
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44 of contextual outcomes are still needed.^{69,70} This reinforces the potential for substantial
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46 methodological variation to be introduced in the literature regarding health related outcomes in PE
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48 settings.
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52 **Conclusions**

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3 The Physical Activity as Civil Skill Program¹¹ was ineffective in increasing children's MVPA
4 and PE enjoyment. MVPA decreased in a similar way and PE enjoyment was stable in both groups
5 over time. The outcomes did not support the assumption that the higher enjoyment children attached
6 to PE classes, the higher total MVPA scores they reported. It may be that behavioral and affective
7 outcomes were challenging to enhance using similar methods through a "real life" program,
8 especially when the present program covered transition from elementary to middle school level. It
9 may be that both MVPA and PE enjoyment may require more tailored actions or specific measures
10 (objective and qualitative measurement tools) to be increased across a long-term program. In
11 addition, psychological changes, for example, motivation and attitudes towards physical activity³⁰⁻³⁴
12 or even a decrease in violence or bullying¹ among children are more difficult to determine than
13 MVPA enhancement or PE enjoyment, but are clearly additional benefits of school-based physical
14 activity programs. This may have positive effects not only in children's physical activity behavior
15 but also cognitive skills⁴ and general health.³

32 33 **IMPLICATIONS FOR SCHOOL HEALTH**

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35 Although the present study did not reach visible changes in children's MVPA and PE
36 enjoyment, all efforts to enhance MVPA and PE enjoyment are of great value. To increase MVPA
37 participation and enjoyment in PE through the long-term school-based program, actions that are
38 more specific may be required. For instance, to provide positive learning experiences through
39 activities in which both behavioral and affective objectives are considered, school-based actions
40 could include:
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- 47 • Supervised before- and after-school activities
 - 48 • Additional PE classes and time
 - 49 • Intensive task-involving teaching practices
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3 Since the quantity of PE classes and recess activities cannot be dramatically increased, it is
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5 important to ensure that school-based physical activity programs provide all children positive
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7 learning and physical activity experiences, and thus, may improve their motivation towards physical
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9 activities, and MVPA participation during school days and leisure time.
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11 12 13 **Human Subjects Approval Statement**

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15 The Ethical Committee of the University of Jyväskylä approved the current study protocol
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17 (ESF/2012-2014/6).
18

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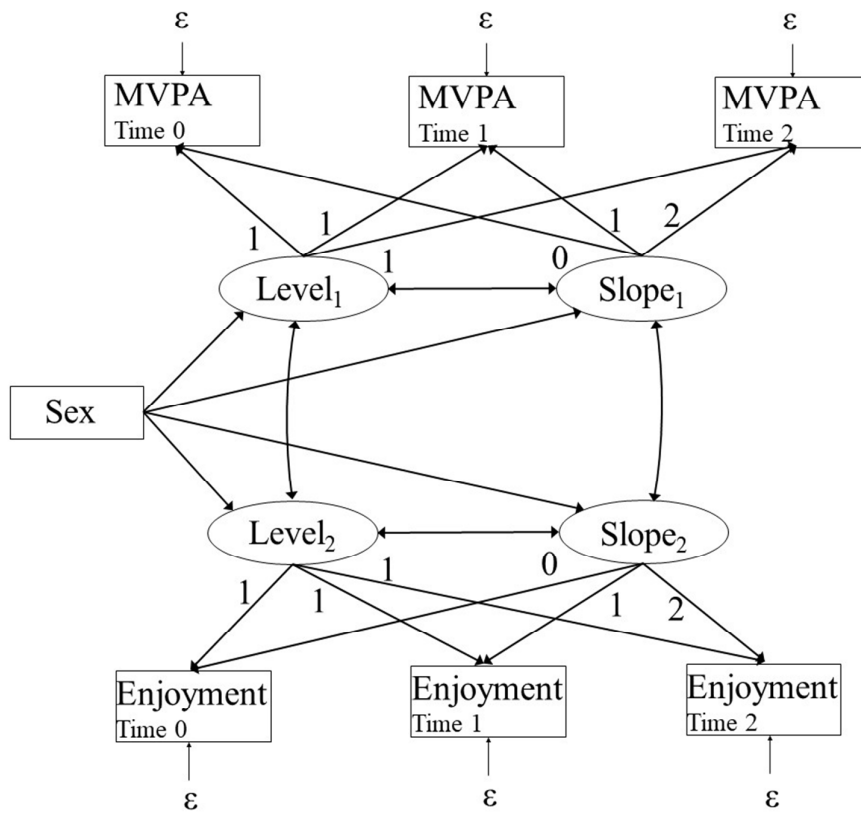


Figure 1. The Theorized Latent Growth Curve Model of MVPA and PE Enjoyment

Table 1. Correlations, means, standard deviations, and Cronbach alphas of the observed variables

	MVPA T0	MVPA T1	MVPA T2	Enjoyment T0	Enjoyment T1	Enjoyment T2	M	SD	α
MVPA T0	-	.63***	.30	.10	.33	.27	5.38	1.58	.88
MVPA T1	.32***	-	.57***	.09	.24	.19	4.54	1.75	.89
MVPA T2	.31**	.52***	-	.30	.33	.37**	4.50	1.86	.92
Enjoyment T0	.19*	.23	.23	-	.18	.26*	4.00	.97	.91
Enjoyment T1	.09	.25	.33**	.48***	-	.67***	3.72	1.09	.96
Enjoyment T2	.08	.24	.30*	.47***	.60***	-	3.93	1.03	.95
M	5.07	4.28	3.96	3.57	3.44	3.50			
SD	1.36	1.69	1.67	1.08	1.00	1.03			
α	.89	.89	.91	.93	.95	.99			

Note 1. Correlations for the intervention group (N = 265) are presented above the diagonal and for the control group (N = 396) below the diagonal.

Note 2. The measures covered 74-89% of control students (T0: 396; T1: 351; T2: 319) and 41-63% of intervention students (T0: 168; T1: 134; T2: 108).

Note 3. Means, standard deviations, and Cronbach alphas for the intervention group are presented in vertical columns and means, standard deviations, and Cronbach alphas for the control group are presented in horizontal columns. ***p < .001, **p < .01, *p < .05.