STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH
205

Arto Gråstén

Students' Physical Activity, Physical Education Enjoyment, and Motivational Determinants through a Three-Year School-Initiated Program

JYVÄSKYLÄN YLIOPISTO

STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH 205

Arto Gråstén

Students' Physical Activity, Physical Education Enjoyment, and Motivational Determinants through a Three-Year School-Initiated Program

Esitetään Jyväskylän yliopiston liikuntatieteellisen tiedekunnan suostumuksella
julkisesti tarkastettavaksi yliopiston Liikunnan salissa L304
kesäkuun 14. päivänä 2014 kello 12.

Academic dissertation to be publicly discussed, by permission of
the Faculty of Sport and Health Sciences of the University of Jyväskylä,
in building Liikunta, hall L304, on June 14, 2014 at 12 o'clock noon.

UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2014

Students' Physical Activity, Physical Education Enjoyment, and Motivational Determinants through a Three-Year School-Initiated Program

STUDIES IN SPORT, PHYSICAL EDUCATION AND HEALTH 205

Arto Gråstén

Students' Physical Activity, Physical Education Enjoyment, and Motivational Determinants through a Three-Year School-Initiated Program

UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2014

Editors
Jarmo Liukkonen
The Department of Sport Sciences, University of Jyväskylä
Pekka Olsbo, Ville Korkiakangas
Publishing Unit, University Library of Jyväskylä

URN:ISBN:978-951-39-5714-8
ISBN 978-951-39-5714-8 (PDF)

ISBN 978-951-39-5713-1 (nid.)
ISSN 0356-1070

Jyväskylä University Printing House, Jyväskylä 2014

ABSTRACT

Gråstén, Arto
Students' physical activity, physical education enjoyment, and motivational determinants through a three-year school-initiated program
Jyväskylä: University of Jyväskylä, 2014, 122 p. (+ included articles)
(Studies in Sport, Physical Education, and Health
ISSN 0356-1070; 205)
ISBN 978-951-39-5713-1 (nid.)
ISBN 978-951-39-5714-8 (PDF)
Finnish abstract
Diss.

Patterns of physical activity in adulthood are often established during adolescence, making this an important period for promoting physical activity. To address this, the Sotkamo Physical Activity as Civil Skill Program 2010–2014 was implemented to increase Grade 5 to 9 students' physical activity on a daily basis. The purpose of this study was to examine the effects of program on students' physical activity and enjoyment. Furthermore, the relationship between motivational climate and enjoyment, and the percentages of students who engaged in 60 minutes of moderate to vigorous physical activity on the daily basis were examined.

The study comprised 847 students (422 girls, 425 boys) at the age of 12 to 14 years from two school districts, North-East and Central Finland. The program was conducted across three school years including four measurement phases. The dependent variables were self-reported and objectively measured physical activity, and physical education enjoyment. Motivational climate, goal orientation, perceived physical competence, intrinsic and extrinsic motivation, expectancy beliefs, subjective task values, and out-of-school physical activity were independent variables. Background variables were gender, grade, duration of treatments, and school district.

The program including task-involving climate and physical school environment treatment was effective in order to prohibit declining levels of students' physical activity. Students' enjoyment sustained at the same level across the program. Physically active secondary school students valued physical education classes more important than less active students. Furthermore, secondary school boys engaged in more moderate to vigorous physical activity in physical education than girls. In contrast, girls were involved in more out-of-school activity than boys. The major cause of concern arising from the current findings was that girls engaged in up to 26.2% and boys 33.6% of their weekly moderate to vigorous physical activity during only two 45-minute physical education classes. The program increased the proportion of physically active students, the latest measurement revealed that 24% of girls and 33% of boys met the current guidelines.

Taken together, increased opportunities for school day physical activities have the potential to affect large number of students and are an efficient strategy for promoting regular physical activity. A better understanding of the role of motivational climate may assist efforts to promote children's and adolescents' perceived physical competence, intrinsic motivation, and enjoyment in the school physical education setting.

Keywords: physical activity, enjoyment, Achievement goal theory, Self-determination theory, Expectancy-value theory, physical education, multilevel modelling

Author's address

Arto Gråstén, MEd
Department of Sport Sciences
P.O. BOX 35 (L), 40014 University of Jyväskylä, Finland
agrasten@jyu.fi

Supervisors

Jarmo Liukkonen, PhD
Department of Sport Sciences
University of Jyväskylä, Finland

Timo Jaakkola, PhD
Department of Sport Sciences
University of Jyväskylä, Finland

Reviewers

Vassilis Barkoukis, PhD
Department of Physical Education and Sport Science
Aristotle University of Thessaloniki, Greece

Lennart Raudsepp, PhD
Institute of Sport Pedagogy and Coaching Science
Faculty of Sport and Exercise Science
University of Tartu, Estonia

Opponent

Yngvar Ommundsen, PhD
Department of Coaching and Psychology
Norwegian School of Sport Sciences, Oslo, Norway

ACKNOWLEDGEMENTS

The present study has been a huge learning process from the very beginning in 2006. Since then, ideas and plans have tremendously brightened through a great number of meetings, emails, and conversations. Many people contributed their time and guided me to choose the right track whenever problems or challenges occurred.

First of all, special thanks to my supervisors Professor Jarmo Liukkonen and Docent Timo Jaakkola for your patience, crucial ideas, and guidance in terms of implementing the study. Despite your busy schedules, you were always willing to boost this work on the next level. I thank my co-author Anthony Watt for hosting me three months in Victoria University, Melbourne. Your personal classes about reporting scientific papers, in your words "polishing", improved me as a writer and researcher. Thank you for your supportive as well as critical comments across the Australian exploration, literally.

I acknowledge co-authors Professor Martin Hagger, Curtin University, and Assistant Professor Sami Yli-Piipari, University of Memphis, for your comments and ideas that helped me to improve the quality of my articles. Professors Asko Tolvanen and Jari-Erik Nurmi, Department of Psychology at University of Jyväskylä, greatly guided the complement of the current statistical analyses. Without you, this study would have been even more challenging to complete. I thank the teachers, colleagues, and other PhD students of Department of Sport Sciences for sharing thoughts and ideas during this project and to be more precise, learning process. I would also like to acknowledge Jani Komulainen and Mikko Huotari for co-operation in data collection in Sotkamo. In addition, I am very grateful for Ministry of Education and Culture and University of Jyväskylä for providing financial support across the period of 2011-2014.

My father Heikki and brother Hartsa, you have always been there for me. Thank you for your measureless support and encouragement during all these years. My beloved wife Adialen, you have given your warm support and understanding every time I have faced challenges regarding my studies. This work would have been so much harder to complete without your love and commitment. According to our motto: "Amar, cuidar y compartir." Finally, I want to dedicate this thesis to my deceased mother. She always encouraged me to believe in myself, and taught the meaning of hard work and persistence, but never witnessed my success.

Jyväskylä, May 2014
Arto Gråstén

ORIGINAL ARTICLES

This dissertation is based on the following original papers, which are referred in the text by their roman numerals:

I Gråstén, A., Jaakkola, T., Liukkonen, J., Watt, A. & Yli-Piipari, S. 2012. Prediction of enjoyment in school physical education. *Journal of Sports Science and Medicine 11 (2)*, 260-269.

II Gråstén, A., Watt, A., Jaakkola, T. & Liukkonen, J. 2012. Directly measured and self-reported physical activity in a sample of Finnish secondary school students. *Advances in Physical Education 3 (2),* 132-138.

III Gråstén, A., Watt, A., Hagger, M., Jaakkola, T. & Liukkonen, J. 2014. Secondary school students' physical activity participation across physical education classes – The expectancy-value theory approach. *The Physical Educator 71 (4)*. (in press)

IV Gråstén, A., Yli-Piipari, S., Watt, A., Jaakkola, T. & Liukkonen, J. 2014. Effectiveness of School-Initiated Physical Activity Program on Secondary School Students' Physical Activity Participation. *Journal of School Health.* (in press)

Additionally, some previously unpublished results are presented.

CONTENTS

1 INTRODUCTION

The World Health Organization (2010) has identified physical inactivity as the fourth highest risk factor for global mortality. International guideline propose that children and youth should engage themselves in 60 minutes of daily moderate to vigorous physical activity (MVPA) to accrue necessary health benefits (World Health Organization, 2010; 2013). However, less than one third of 13-year-olds, for instance, in Canada, France, Germany, Russia, U.S. and Finland meet the recommendation and physical activity (PA) continues to decline with age (Currie et al., 2012; Dumith et al., 2011; Telford et al., 2013; Troiano et al., 2008; Veitch et al., 2010; Yli-Piipari, 2011). Thus, the promotion of health and PA has become a universal challenge (Coulter & Woods, 2011).

Patterns of activity in adulthood are often established during adolescence (Telama et al., 2005), making this an important period for promoting PA. School physical education (PE) is the only structured setting with a possibility to ensure that all children can engage in activities to meet the recommendations, as these institutions are capable of providing knowledge and skills to the target population at minimal additional cost to the community (McKenzie, 2007). Previous research has found that PE motivation is a key factor underlying PA (Chen, 2001; Hagger et al., 2003; Ntoumanis et al., 2004) and corresponds to transfer of behavior across contexts for greater total PA (Ferrer-Caja & Weiss, 2000; Hagger, 2014; Kalaja, 2012; Yli-Piipari, 2011). Several scholars have advocated that schools should place a higher priority on encouraging young people to engage greater daily physical activity, especially out-of-school (e.g., Flohr, Todd, & Tudor-Locke; 2006; Hagger et al., 2009; Lytle et al., 2009). Furthermore, a number of interventions have shown school-based PA interventions to be successful in terms of health related outcomes (Dobbins et al., 2013; Strong et al., 2005) and PA engagement (e.g., Carrell et al., 2005; Schneider Jamner et al., 2004; Simon et al., 2004; Ward, 2011; Webber et al., 2008). However, multilevel interventions including the most widely used social-cognitive motivational theories have not been implemented in school PE settings.

To address this, the European Union funded Sotkamo Physical Activity as Civil Skill Program (2010-2014) was implemented to prevent long-term effects

of inactivity on children's and youth's wellness and health. Grade 5 to 9 students' PA participation was enhanced during school days. This study was designed to examine the effects of the current program. The present study extends the previous findings by investigating the associations of students' PE motivation and MVPA using the essential features of the Achievement goal theory (Nicholls, 1989), the Self-Determination theory (Deci & Ryan, 1985; 1991; 2000), and the Expectancy-value theory (Eccles et al., 1983) in order to understand exercise motivation in a way that a single perspective may not be completely able to capture (Hulleman et al., 2008). The study, therefore, yields important information about the development of MVPA from childhood to early adolescence and the social-cognitive motivational processes behind MVPA engagement. Such information can be utilized in various practical applications, as PE teacher education and supplement training by giving better understanding of the development of adolescents´ MVPA patterns and their motivational determinants.

2 REVIEW OF THE LITERATURE

2.1 Physical Activity

PA levels of children and youth are declining in many countries with major implications for overweight, obesity and the general health (Currie et al., 2004; 2008; 2012). *Physical activity* is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (Caspersen, Powell, & Christenson, 1985; World Health Organization, 2013) and includes exercise as well as other activities which are done as part of playing, working, active transportation, house chores, and recreational activities (World Health Organization, 2010; 2013). Regular and adequate levels of PA in children and youth improves cardiorespiratory and muscular fitness, bone health, coordination and movement control, maintenances of a healthy body weight, and has been associated with cognitive skills in academic learning processes (Bates, 2006; World Health Organization, 2010; 2013). Amounts of PA greater than 60 minutes on a daily basis provide additional health benefits (World Health Organization, 2013). In addition, PA participation can assist in the social development of young people by providing opportunities for self-expression, building self-confidence, social interaction and integration (World Health Organization, 2013). In turn, it has been suggested that physically inactive young people more readily adopt unhealthy behaviors (World Health Organization, 2013).

PA occurs over four dimensions, which are frequency, intensity, duration, and type (Dale, Welk, & Mattews, 2002). During the school years, the opportunities for PA consists mainly of physically active commuting to school, school physical education, and activities during recess and leisure time, participation in sports, and unorganized PA (World Health Organization, 2013). Previous studies highlighted that level of daily MVPA declines particularly during adolescence as they transfer from childhood into adulthood (e.g., Corbin, Pangrazi, & Le-Masurier, 2004; Currie et al., 2008; Liukkonen et al., 2014). In addition to the descending PA patterns, gender differences are widely recognized. Recently, boys have scored higher than girls based on self-reports (Currie et al., 2004;

2008; 2012; Duncan et al., 2007; Tammelin, Laine, & Turpeinen, 2013; Yli-Piipari, 2011) and objective measures (Tammelin, Laine, & Turpeinen, 2013; Troiano et al., 2008). For instance, the self-reported Finnish data (Currie et al., 2012) showed that 24% of Finnish 11 to 15 years old (n = 6 678) met the national PA guideline recommending at least 60 minutes PA daily (Ministry of Education and Culture & Nuori Suomi, 2008). Gender differences were evident with 30% of boys, but only 18% of girls meeting the recommendation. Therefore, comprehensive school years represent the most important period for promoting PA in children and youth, particularly among girls.

2.1.1 School-based Physical Activity Interventions

Previous studies have shown that school-based PA interventions increased students' PA participation during school days (Kriemler et al., 2010; Loucaides, Jago, & Charalambous, 2009; Tammelin, Laine, & Turpeinen, 2013) out-of-school (Lytle et al., 2009; Nemet et al., 2005; Nilsson et al., 2009), physical capacity (Sollerhed & Ejlertsson, 2008; Kalaja, 2012), active commuting to school (Tammelin, Laine, & Turpeinen, 2013), total daily PA (de Bourdeaudhuij et al., 2010; Harrison et al., 2006; Jurg et al., 2006; McManus et al., 2008; Metcalf et al., 2012; Schneider, Dunton, & Cooper, 2008; Pate et al., 2005), perceived PA effort in PE (Wallhead & Ntoumanis, 2004), and positive attitudes toward physical activities (Christodoulos et al., 2006; Digelidis et al., 2003). For instance, in a school-based PA program involving a sample of 498 Grade 1 and 5 children in Switzerland, in-school MVPA increased from 38 minutes to 45 minutes per day, while out-of-school activity decreased from 67 minutes to 61 minutes per day during one school year. The intervention included structuring the three existing PE classes each week and adding two additional classes a week, daily short activity breaks, and PA homework (Kriemler et al., 2010). In a Finnish report of 85 elementary and secondary school students, daily MVPA increased from 69 minutes to 71 minutes in elementary school and remained at 44 minutes in secondary school students across two school years. Specifically, the program was targeted to all students from Grade 4 to 9 and included several operations, for instance, longer school breaks, games during breaks, equipment supply, and an extra 45-minute PE class after school days (Tammelin, Laine, & Turpeinen, 2013). In the Irish intervention of 312 elementary school children, self-reported PA increased from 3.1 to 5.9 blocks of 30-minutes on a daily basis. Children received ten 30-minute health education classes during a 16-week period (Harrison et al., 2006). In the sample of 146 U.S. sedentary adolescent girls, among the intervention participants, participation in vigorous activity significantly increased from 51% at baseline to 83% at nine months, whereas the proportion of comparison group participants reporting some vigorous activity showed no significant change. Intervention participants engaged in supervised activity four times per week and received didactic instruction one day per week promoting activity outside of school (Schneider, Dunton, & Cooper, 2008). The review of previous school-based PA interventions revealed that most of the studies have been targeted to specific groups of elementary or secondary school

students or they can mainly be considered as short-term interventions, ranging from three weeks to 12 months. This study extends the previous findings by investigating PA patterns adopting the whole school approach and promoting PA using a multilevel program (motivational and environmental treatments) over school days across a period of three years.

2.1.2 Methodology of Physical Activity Measuring

School is a key context in which to target children and youth with PA interventions, as the majority of young people spend significant amounts of time in the school environment (Bates, 2006). However, based on previous findings, it is difficult to construct a reliable picture of children and youth's PA behavior, since studies have used different devices, procedures, scores, and reported data in various ways (Dale, Welk, & Mattews, 2002; Dencker & Andersen, 2008). Although a number of Finnish (National Board of Education, 2011; Ministry of Social Affairs and Health, 2013; National Institute for Health and Welfare, 2010; Yli-Piipari, 2011) and international studies (Moore, Maloney, & Yin, 2007; Shiely & MacDonncha, 2009; Slootmaker et al., 2012; Currie et al., 2004; 2008; 2012) detail, there is an increasing number of physically inactive children and youth, most findings are derived from self-reported data. For instance, in a study of World Health Organization (Currie et al., 2012), only 32% of Finnish 11-year-old and 14% of 15-year-old students met the current recommendations when using self-reports across a seven-day period. In contrast, Tammelin, Laine, and Turpeinen (2013) reported that 50%of Finnish elementary school children and 17% of secondary school students achieved at least one hour of MVPA per day when PA was measured using accelerometers during at least three consecutive days per student. In the U.S., forty-two percent of elementary and 8% of secondary school-aged students met the guidelines based on at least one day accelerometer data (Troiano et al., 2008), whereas 27% of 11-year-old and 25% of 15-year-old girls and boys self-reported at least 60-minute of PA on a daily basis (Currie et al., 2012). Similarly, Shiely and MacDonncha (2009) found that, when PA was measured using a self-reported questionnaire, slightly more than 11% of Irish adolescents (n = 28) met the international moderate intensity PA guidelines for adolescents, whereas, none of the adolescents met the international guidelines on sustained vigorous PA using heart rate monitors. In addition to the variation between measurement techniques, Kulmala and colleagues (2012) noted that 7 to 15-year-old Finnish students' objectively measured PA scores were higher in spring than fall measurements.

A range of measurement techniques are available for assessing PA in children and youth. Measures of activity, such as direct observation (McKenzie, 2002) indirect calorimeter (Sirard & Pate, 2001), doubly labeled water (Arvidsson, Slinde, & Hulthen, 2005), pedometers (Tudor-Locke et al., 2002), accelerometers (Rowlands, 2007), heart rate monitors (Eston, Rowlands, & Ingledew, 1998) and multichannel activity monitors (Trost, McIver, & Pate, 2005) are considered as objectively or directly measured because the data being collected do not need to be cognitively and perceptually processed by the partici-

pants (Marshall & Welk, 2008). Objective measures can provide important insights into the true activity levels of children and youth (Bates, 2006) and the main techniques (e.g., accelerometers, multichannel activity monitors, heart rate monitors) have been shown to provide more accurate measures of PA than self-reported methods (Bates, 2006; de Vries et al., 2006; Trost, 2000). Limitations of direct measures also exist, such as higher costs compared to self-reported measures and the requirement for devices to be worn consistently and in the prescribed method to gather reliable data (Bates, 2006).

Self-reported measures have been used widely in many countries, including Finland, to assess overall PA for the purposes of economical and practical expediency. Additionally, self-reported measures, such as diaries (Rodriguez et al., 2002), logs (Welk et al., 2007), interviews (Welk et al., 2007), and questionnaires (Arvidsson, Slinde, & Hulthen, 2005) require a certain level of cognitive and perceptual processing by the participants to generate the data (Marshall & Welk, 2008). However, previous findings have shown that children and adolescents are less able than adults to recall their PA levels, indicating that questionnaires provide a restricted measure of PA in children and adolescents (Marshall & Welk, 2008). Generally, self-assessment methods are reliable and valid, relatively simple and inexpensive to administer, and appropriate for use in youth population studies (Bates, 2006).

Given the complexity of the construct and the variety of applications for measures of PA patterns, the current review of PA studies involving children and youth highlighted a consistent theme, whereby researchers were typically proposing that to advance knowledge on PA for children and youth, it is important to obtain valid and reliable measurements of typical behavior with greater scrutiny (e.g., Bates, 2006; Flohr, Todd, & Tudor-Locke, 2006; Marshall & Welk, 2008; Shiely & MacDonncha, 2009; Troiano, 2009). The combination of self-reports and objective measures should be used to optimize and enrich the quality of the data on PA behavior (Bates, 2006). Furthermore, Trost, McIver, and Pate (2005) suggested that at least a seven-day monitoring protocol provides reliable estimates of usual PA behavior in children and youth. However, a review of previous studies using both self-reports and objective measures revealed that lower limit for valid assessments greatly differed from the recommendation of seven-day monitoring, ranging from one to four days. The present study considers the potential for substantial methodological variation in relation to procedures reported within existing published research, particularly when only students with complete objective data collected over seven days were entered into the analyses.

2.2 Physical Education Enjoyment

One important determinant of children and youth's PA engagement is perceived enjoyment (Cairney et al., 2012). Specifically, *enjoyment* is described as a positive affect that reflects generalized feelings such as pleasure, liking, and fun

(Scanlan & Simmons, 1992), and most recently defined as a multidimensional structure related to enthusiasm, excitement, and cognitions such as perceptions of competence and attitude toward the particular activity (Hashim, Grove, & Whipp, 2008). Previous research has consistently showed that enjoyment is an essential element underlying exercise motivation for children and youth so as to maintain positive engagement in PA (Dishman et al., 2005; Prochaska et al., 2003; Sallis, Prochaska, & Taylor, 2000) and PA participation in PE (Barr-Anderson et al., 2008; Hashim, Grove, & Whipp, 2008; Ntoumanis, 2002; Standage, Duda, & Ntoumanis, 2005; Wallhead & Buchworth, 2004; Yli-Piipari et al., 2009).

In school PE classes, enjoyment represents a direct and substantial influence on students' participatory behavior, providing immediate reward for being physically active (Vallerand, Fortier, & Guay, 1997). PE teachers' choices of instructional strategies, class activities, and general class structure are usually influenced by their conscious attempt to create an enjoyable learning environment for all students (O'Reilly, Tompkins, & Gallant, 2001). For instance, Sallis, Prochaska, and Taylor (2000) found that students' enjoyment in PE classes was a strong predictor of PA at both younger (Grade 4 to 6) and older (Grade 7 to 12) ages. In a study targeting students in the U.S. at Grades 4 to 12, enjoyment in PE was one of the strongest and most consistent correlates of PA (Sallis et al., 1999). Similarly, enjoyment was positively correlated with perceptions of success in a study of 69 Canadian elementary school children. Considering gender differences, Carroll and Loumidis (2001) found that boys scored higher than girls on enjoyment in a sample of 922 British Grade 6 students. In a large Finnish study of 4 397 Grade 9 students, boys enjoyed PE classes more than girls (Soini, 2006). In a recent longitudinal analysis over a period of two years, PE enjoyment decreased among girls of 9 to 10-year-old at baseline but remained constant among boys (Cairney et al., 2012).

PE enjoyment is an important psychosocial factor to consider when exploring links to PA (Garcia Bengoechea et al., 2010), because participation in school PE has been associated with greater leisure-time PA in adolescents (Gordon-Larsen, McMurray, & Popkin, 2000; Pate et al., 2007; Salmon et al., 2007). In addition, Carroll and Loumidis (2001) found PE enjoyment to be linked to higher PA intensity outside of school. If PA programs are enjoyable for students, they may encourage youth to become more active also in different PA contexts (Hagger, 2014; Wallhead & Buckworth, 2004). In doing so, PE enjoyment has an essential role in PA engagement more broadly than in PE classes (Garcia Bengoechea et al., 2010). Unfortunately, age-related decline in PE enjoyment (Digelidis & Papaioannou, 1999; Hashim, 2007; Prochaska et al., 2003) suggests that there might be deficiencies in the current PE programs being implemented (Cairney et al., 2012).

In general, previous interventions suggest that if they are designed to enhance perceptions of enjoyment, they will also result in maintaining and increasing PA levels in children (Weiss, Corbin, & Pangrazi, 2000). To elicit change in PA behavior of school students it is important to know, what their

current behavior patterns are and also their enjoyment levels for the physical activities in which they are involved (Coulter & Woods, 2011). For instance, Dishman et al. (2005) reported that increased enjoyment in PE classes resulted in higher levels of daily PA in a sample of Grade 9 and 10 girls. In an intervention of 51 English boys with a mean age of 14.3 years (Wallhead & Ntoumanis, 2004), PE enjoyment increased in conjunction with perceived effort, perceived competence, and goal orientation when a) students chose personal skill practices from a range of offered practices, b) students were responsible for setting up equipment, c) recognition was based on individual progress, d) student worked together within same small cooperative group structure, e) student-coaches emphasized individual improvement in order to benefit team performance goals, and f) during classes students often dictated the rate of progression through specific practices. Specifically, during the intervention, students led warm-ups, took responsibility for refereeing and the choice of tactics and team strategies, and were responsible for selecting individuals to fulfil each role of coach, referee, captain, and scorer. The results of the previous practical interventions support task-involving teaching methods to promote adolescent's PE enjoyment through secondary school years among both girls and boys.

Recent research involving children and adolescents reveals that enjoyment in PE classes may play a crucial role in PA engagement and have a unique impact on different PA contexts (Garcia Bengoechea et al., 2010). However, a review of PE research within children and adolescents showed that there are no reports of studies attempting to test the theoretical assumptions regarding the relationships of PE enjoyment and total PA among secondary school students, who are at critical age with repsect to age-related decline in PE enjoyment (Digelidis & Papaioannou, 1999; Hashim, 2007; Prochaska et al., 2003). The present study expands the previous findings by investigating the longitudinal change in students' PE enjoyment together with the relationships between grade, duration of school-initiated treatments and PE enjoyment. This latter proposition has not previously been empirically tested.

2.3 School Physical Education

School PE can provide children and youth with a substantial proportion of the PA recommended for health purposes (U.S. Department of Health and Human Services, 2008). *Physical education* is described as systematic instruction in PE classes to learn and practice skills likely to enhance lifelong fitness and health (European Commission, 2013). PE is not limited to training physical skills, because involvement in many physical activities generates knowledge and insight centered on concepts such as rules, fair play, respect, tactics, bodily and social awareness, and personal interaction linked to team effort (European Commission, 2013). Schools can provide a unique venue for youth to meet the activity recommendations, as these institutions are capable of providing PA knowledge and skills to the target population at minimal additional cost to the community

through PE classes, recess activities, and health education (McKenzie, 2007; National Board of Education, 2004).

In Finland, all schools follow a national core curriculum, which includes the objectives and core contents of PE. The objectives for Grade 5 to 9 define the essential PE goals, which include a) developing basic motor skills and specific forms of physical activity, b) understanding the importance of regular PA for health and well-being, c) observing and developing of functional abilities, d) developing swimming and water-rescue skills, e) learning to act safely and appropriately in situations of physical activity, f) learning to work independently and in a group, g) learning to accept themselves and tolerate diversity, and g) learning to look for information on local possibilities for exercising (National Board of Education, 2004). The core contents of secondary school PE consist of a) running, jumping and throwing in different forms of physical activity, b) floor gymnastics, gymnastics with equipment, and apparatus gymnastics, c) dance and exercise, d) ball games, e) hiking and orienteering, f) winter exercise, g) swimming and water rescue, h) development and monitoring of functional abilities, and i) introduction to new forms of PA (National Board of Education, 2004). The local education authorities and the schools themselves draw up their own curricula within the framework of national curriculum considering local conditions (National Board of Education, 2013). Education is publicly funded at all levels, and the education providers are responsible for practical teaching arrangements, the effectiveness and quality of its education (Ministry of Education and Culture, 2012). The number of class hours required for PE during basic education is decided upon by the Government. The present distribution was confirmed in 2012 and will be implemented together with the new core curriculum in 2016 (National Board of Education, 2013). Currently, comprehensive schools have at least 90 minutes of PE per week including active and non-active periods (organization and setting up equipment) (National Board of Education, 2013). Additional classes and activities can be provided by the decision of local education providers and schools (National Board of Education, 2013). The schools are free to determine how to group pupils (Ministry of Education and Culture, 2012). The majority of schools have gender groups in PE classes. Furthermore, recess breaks, on average 30 breaks (at least 10 minutes) per week and daily lunch break (30 minutes) are mandatory to all students (Basic Education Act, 1992). Typically, Finnish secondary school students spend their recess breaks indoors, mainly accumulating sedentary time (Tammelin, Laine, & Turpeinen, 2013). Furthermore, Tammelin and colleagues (2013) found that approximately 90% of students reported to commute to school by active transportation, when the distance was less than one kilometer. In general, Grade 4 to 9 boys commuted to school by bike more often than girls, whereas girls walked more often than boys. The transport mode strongly depended on the distance to the school.

It is clear that school PE alone cannot provide young people with all the PA they need (McKenzie et al., 2004). In addition to regular classes, schools should offer guidance and additional activities for students to increase PA out-

side of school (Hagger et al., 2009; Lytle et al., 2009), recess, before or after school programs or extra-curricular programs (Flohr, Todd, & Tudor-Locke; 2006) in order to limit the decline in daily PA level (Corbin, Pangrazi, & Le-Masurier, 2004; Currie et al., 2008; 2012; Yli-Piipari, 2011). The present study is one of the few studies to examine the development of students' PA using school PE as a tool to promote in-school and out-of-school activities across a period of three academic years.

2.4 Physical Education Motivation

The objectives of school PE are challenging to achieve if students are not motivated to participate actively in their PE classes (Ntoumanis, 2001). *Physical education motivation* is a process whereby goal-directed activity in PE is instigated or sustained (Schunk, Pintrich, & Meece, 2008). It is generally accepted that motivation is one crucial factor behind PA (Chen, 2001; Ntoumanis et al., 2004; Yli-Piipari, 2011). Therefore, enhancing motivation constitutes one of the most central concerns of PA in school PE (Roberts, 2001). Motivation in PE is a complex and dynamic process which means that it is reasonable to take into consideration more than one point of view to examine the process of motivation (Roberts, 2001). Social-cognitive theories, such as the Achievement goal theory (Nicholls, 1989), the Self-Determination theory (Deci & Ryan, 1985; 1991; 2000), and the Expectancy-value theory (Eccles et al., 1983) view motivation as an increased or continual level of responding to stimuli brought about by reinforcement (Schunk, Pintrich, & Meece, 2008). Thus, the present study adopted specific features of these behavioral theories widely used in general education research (e.g., Ryan & Deci, 2006; Vallerand, Fortier, & Guay, 1997) and in PE studies (e.g., Ntoumanis, 2005; Soini, 2006; Standage, Duda, & Ntoumanis, 2005; Yli-Piipari, 2011).

2.4.1 Achievement Goal Theory

Achievement Goal Theory (AGT; Nicholls, 1989) is a theoretical approach, which not only recognizes the role of social environment, but also provides a plausible model to facilitate understanding the relationship between the psychological environment and student behavior in PE. Thus, the achievement is defined to be the attainment of a personally or socially valued goal in a PA context (Roberts, 2001). The achievement goals govern achievement beliefs and guide subsequent decision making and behavior (Nicholls, 1989). In PE, when standards for success are implicated, the goal of action is to demonstrate competence which is the distinguishing feature of achievement goals (Nicholls, 1984; Roberts, 2001). Previously, AGT has been successfully applied to the context of education (Vallerand, Fortier, & Guay, 1997) and PE (Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2005).

2.4.1.1 Goal Orientations

According to the AGT, the basic motive of students is to demonstrate their competence or achievement in the achievement settings such as PE or PA. The focal tenet of the theory is that there are two key concepts for defining competence and success in activity, namely *task* (learning) and *ego* (performance) *orientation* (Nicholls, 1984; 1989). Task-oriented students employ perceptions of ability which are self-referenced, for instance, learning new skills. The focus of activity is in mastering the current tasks and improvement, resulting in increased PE motivation (Deci & Ryan, 2000; Nicholls, 1989). This means that an individual has adopted personal improvement (task orientation) as criteria for competence and success (Ames, 1992). Task goal orientations play an important role by influencing the students' motivated behavior, cognitions or beliefs by controlling situational motivation toward activities in PE setting (Nicholls, 1989; Roberts, 2001). In turn, ego-oriented students experience subjective success when they have a better performance than others and the main objective of engagement in an activity is to demonstrate normative competence (Nicholls, 1989; Roberts, 2001; Standage, Duda, & Ntoumanis, 2003). Thus, motivated behavior does not depend directly on control by the individual (Duda 2007). Additionally, Elliot and Church (1997), and Cury et al. (2006) split ego orientation into approach and avoidance dimensions indicating pursuit of positive judgment of one's competence and attempts to avoid negative evaluation of one's competence respectively. An important assumption of the AGT is that achievement goals are orthogonal. In other words, a student can be high in one orientation and low in the other or high or low in both when engaged in achievement-related activities such as PE classes (Roberts, 2001). However, there appears to be consensus that to optimize motivation and subsequently PA in school PE, task orientation should be promoted, regardless of whether student has high or low ego orientation (Duda & Ntoumanis, 2003; Roberts, 2001).

Previous research has consistently shown the positive relationship between task orientations and achievement behavior consequences such as PA in PE (Ferrer-Caja & Weiss, 2000; Papaioaunou et al., 2006; Theodosiou & Papaioaunou, 2006; Weiss, 2000), and PE enjoyment (Baron & Downey, 2007; Digelidis & Papaioannou, 2002; Soini, 2006; Wallhead & Ntoumanis, 2004). When considering gender differences, girls tend to score higher on task orientation, whereas boys score higher than girls on ego orientation (Anderson & Dixon, 2009; Jaakkola, 2002; Yli-Piipari, 2011). Although, girls scored higher on task orientation and boys on ego orientation in the Finnish one-year intervention of 461 Grade 9 students, the intervention had similar effect on both girls' and boys' task orientation and no effect on ego orientation (Jaakkola, 2002). In addition to these conceptualizations of competence and success, the situational goal structure addressed by instructors in learning environments is also described, namely perceived motivational climate (Ames, 1992).

2.4.1.2 Motivational Climate

Motivational climate in PE refers to students' perceptions of achievement goals addressed by instructors in learning environments (Ames, 1992). Two types of motivational climate are proposed to exist, a task-involving climate and an ego-involving climate (Nicholls, 1989). Task-involving motivational climate refers to structures that support effort, cooperation, emphasis on learning and task orientation, and student evaluation on the basis of self-referenced criteria (Ames, 1992; Ames & Archer, 1988). In contrast, ego-involving motivational climate refers to situations that foster normative comparisons, competition, and evaluation on the basis of normative competence criteria (Ames & Archer, 1988; Duda, 1996). Previous studies have shown that perceptions of task-involving climate in PE influence positively on students' perceptions of task orientation (Ferrer-Caja & Weiss, 2000; Kokkonen et al., 2010; Weiss, 2000), whereas ego-involving climate advances ego orientation and social comparison, (Duda & Balaguer, 2007; Kokkonen et al., 2010; Papaioannou, 1998). Positive development of PE motivation is most likely to occur when task orientation is emphasized either through enhancing socialization experiences or through structuring the motivational climate so that it is more task-involving (Ames, 1992; Roberts, 2001).
For example, according to the Vallerand's (1997) hierarchical model, social factors (e.g., motivational climate) mediated by a psychological mediator (e.g., perceived competence), and exercise motivation are related to positive consequences (e.g., intentions to be active, enjoyment, physical activity) in the PE context. Gender differences in perceived motivational climate in PE have also been found. In a Finnish study of 4397 Grade 9 students, boys scored higher in ego-involving climate compared to girls (Soini, 2006), whereas in a Finnish intervention of 178 Grade 9 students, girls scored higher in perception of task-involving climate than boys (Kokkonen, 2003).

The interventions which adopted some features of the Epstein's TARGET model (1989) (detailed description in the following section), highlighted that teachers who structure (task) motivational climate that encourages a self-referenced definition of success are likely to positively influence students' task orientation (Digelidis et al., 2003; Jaakkola & Liukkonen, 2006; Morgan & Carpenter, 2002; Weigand & Burton, 2002), perceived physical competence (Wallhead & Buckworth, 2004; Wallhead & Ntoumanis, 2004; Weigand & Burton, 2002), intrinsic motivation (Digelidis & Papaioannou, 1999; Kalaja, 2012), PE enjoyment (Barkoukis, Tsorbatzoudis, & Grouios, 2008; Baron & Downey, 2007; Digelidis & Papaioannou, 2002; Wallhead & Ntoumanis, 2004), PA in PE (Bowler, 2009), and out-of-school PA (Wallhead & Buckworth, 2004). In contrast, students' perceptions of an ego-involving climate in PE in terms of outperforming others and winning is either unrelated or negatively related to such outcomes (Stuntz & Weiss, 2008). For instance, ego-involving climate was related to higher ego orientation in Greek secondary (Digelidis et al., 2003) and English elementary students (Wallhead & Ntoumanis, 2004). Similarly, the association of ego-involving climate and low levels of enjoyment was detected

in a large study of Finnish Grade 9 students (Soini, 2006). The possibility for a cultural differentiation in the presence of separated ego and task goal orientations has been proposed (Cervelló & Santos Rosa, 2001). The additional studies should therefore be done regarding the generalization of measures assessing goal orientation and perceptions of motivational climate (Flores, Salguero, & Márquez, 2008).

2.4.1.3 The TARGET Motivational Climate Structures

To enhance students' motivation in PE classes, several interventions based on Epstein's (1989) TARGET model have been implemented. The model consists of certain task- and ego-involving motivational climate structures. These structures construct the teaching model, in which task (design of learning activities), authority (locus of decision-making), recognition (criteria for rewards), grouping (homogenous or heterogeneous ability), evaluation (criteria for success or failure), and timing (pace of instructions) create the TARGET acronym.

Basically, teachers can manipulate these six features to influence the motivational climate in PE classes to reflect either task- or ego-involving motivational climate. For instance, in a Greek study of 374 students with mean age of 13.8 years old, students in the experimental group reported higher levels of task orientation, enjoyment and perceived competence, and lower levels of worry after the seven-month intervention based on Epstein's (1989) model (Barkoukis, Tsorbatzoudis, & Grouios, 2008). In this particular study, students were allowed to work at their own level (i.e. shooting in basketball from different distances) (Task), to select their own teammates and opportunities were created for students to lead an activity (Authority), praised for exerting effort and participating in both the class and out-of-school physical activities (Recognition). In addition, the formation of small teams during the classes was encouraged in order to promote students' social interaction (Grouping), and students were encouraged to evaluate themselves based on self-referenced criteria (Evaluation). Teachers used students' self-evaluations during grading. Students were also allowed to dictate the pace of learning based on their needs and interests, that is, opportunities were given to students to decide on when to move on to the next drill (Timing).

Similarly, in another Greek intervention, developed with 783 Grade 7 students over a one-year period (Digelidis et al., 2003), the experimental school students had higher task orientaton, lower ego orientation and more positive attitudes toward exercise than the control group, when task-involving climate was promoted in PE classes. More precisely, a) students exercised in stations and usually in groups of four to six persons in order to maximize academic learning time, b) task cards were developed for each station and students were taught specific protocols to avoid time wasting during transition from one station to another, c) competitive goals were avoided but co-operative and personal development goals were used extensively, d) students were organized in pairs or groups of three where one of them undertook some of the teacher's tasks (e.g., giving feedback to the other two by using a criterion form that the

teacher had prepared), e) teachers were instructed to emphasize with their students, through discussion, values connected to task orientation, such as personal improvement, co-operation, health-improvement and exercise behavior, and f) self-talk, mental imagery and relaxation techniques were applied to several activities.

The recent intervention of Bowler (2009) comprised thirty-two English girls aged 13-14 years, who participated in track and field athletics classes over a period of three classes. The experimental group followed an intervention consistent with the TARGET model. As a result, the experimental group received more (11 minutes) MVPA than the control group when assessed using accelerometers. More precisely, students were given "Tasks" for self-referenced targets and improvement, "Authority" to make some decisions such as in designing activities, effort and improvement was "Recognized" through individual praise and feedback where possible, co-operative "Groups" where teamwork was encouraged, self-referenced "Evaluation", and "Time" to have multiple attempts at different activities, so instead of waiting for their turn in a throwing activity, they participated in a related activity. The control group followed a program of athletic activities delivered in the normal way by the class teacher.

Previous studies revealed that most attempts to promote task-involving motivational climate in PE are related only to the in-class outcomes and are in that sense effective as evidenced by consequences such as increased PA levels as a result of extra PE classes (Bowler, 2009; Fairclough & Stratton, 2006). Because the amount of school PE classes cannot be substantially increased, it remains unclear whether students' total daily PA can be increased by promoting task-involving climate across regular PE classes without additional classes. The present study extends the previous research by examining the effects of a task-involving climate treatment on secondary school students' PA across regular (90 minutes per week) PE classes during one school year.

2.4.2 Self-determination Theory

As a social-cognitive theory, *Self-determination theory* (SDT; Deci & Ryan, 1985; 1991; 2000) has confluences with AGT, since SDT addresses the effects of social context (i.e. motivational climate in physical education) on intrinsic motivation or how psychological factors (e.g., physical competence) impact on perceived intrinsic motivation and interest (Deci & Ryan, 1985; 2000). In turn, the difference between these theories is that when AGT focuses on perceived competence in success, SDT emphasizes perceived autonomy and social relatedness in addition to competence. Previous research has applied SDT in many domains including PE (Lonsdale et al., 2009; Ntoumanis, 2005; Ommundsen & Eikanger-Kvalo, 2007; Standage, Duda, & Ntoumanis, 2005) and PA (Kalaja, 2012; Taylor et al., 2010; Yli-Piipari, 2011).

SDT proposes that intrinsically motivated students are more likely to perceive their PA experiences as positive, thus leading them toward being further physically active (Weiss, 2000). The development and functioning of intrinsic motivation are specified using the concept of basic psychological needs,

i.e. competence, autonomy and social relatedness. *Physical competence* is the desire to interact effectively with the environment and to attain valued outcomes (Deci & Ryan, 1985), and it refers to one's beliefs about the ability to be successful in an achievement domain (Ferrer-Caja & Weiss, 2000). When students are allowed to work at their own level (choices of different levels in the particular activity), they are more likely to feel competent (Alderman, Beighle & Pangrazi, 2006). Previous research has revealed that perceived physical competence is consistently linked with intrinsic motivation (Deci & Ryan, 2000; Ommundsen, 2005; Standage, Duda & Ntoumanis, 2003; 2005), enjoyment in PA (Biddle et al., 2003; Ferrer-Caja & Weiss, 2000), enjoyment in PE (Carroll & Loumidis, 2001; Fairclough, 2003), and self-reported PA (Cox, Smith, & Williams, 2008; Kalaja, 2012; Yli-Piipari, 2011). Gender differences in perceived competence have also been observed, with boys scoring more positive perceptions than girls (Carroll & Loumidis, 2001; Fairclough, 2003; Kalaja, 2012).

Autonomy refers to the need to self-organize one's behavior and to achieve consistency between the particular activity and one's sense of self (Deci & Ryan, 2000). To increase intrinsic motivation in PE, it is important to allow students make choices. Students who feel that they have more than one activity to choose from are more likely to perform the activity than if they are required to participate in a single activity (Alderman, Beighle, & Pangrazi, 2006). Physical educators should seek to promote class structures that support students' perceived autonomy, since this facilitates the development of self-determined motivation in PE classes (Standage, Duda, & Ntoumanis, 2005), and PA (Soini, 2006; Standage, Duda, & Ntoumanis, 2003; Wallhead & Buckworth, 2004). In a Finnish study of Grade 9 students, boys scored higher on perceived autonomy in PE classes than girls (Soini, 2006).

Relatedness is the need to feel connected and to perceive acceptance from others (Baumeister & Leary, 1995). According to Standage, Duda, and Ntoumanis (2003), although peers clearly have the potential to impact on other students' motivation, less is known about the role of social relatedness in the PE domain. Previous findings indicate that students may engage in physical activities, because they do not wish to be isolated from a group (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003). PE classes that support students' perceived social relatedness, predict students' PE enjoyment (Cox, Smith, & Williams, 2008), and PA participation (Cox, Smith, & Williams, 2008; Standage, Duda, & Ntoumanis, 2003; Taylor et al., 2010). Current PE studies have found competence to be the strongest predictor of intrinsic motivation compared with autonomy and relatedness (Ferrer-Caja &Weiss, 2000; Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003; Taylor et al., 2010).

According to SDT (Deci & Ryan, 1985; 1991; 2000) human behaviors can be categorized as intrinsically motivated, extrinsically motivated, or amotivated. The regulation of motivation reflects a continuum comprising different levels of self-determination ranging from intrinsic motivation through extrinsic motivation to amotivation (Deci & Ryan, 1985; 2000). The forms of motivation vary in their degree of relative autonomy, ranging from high to low (Deci &

Ryan, 2008). The most essential element of the SDT is intrinsic motivation, which refers to doing an activity for the satisfactions inherent in the activity without external contingencies (Hagger & Chatzisarantis, 2007). In other words, intrinsic motivation involves pursuing an activity out of interest and enjoyment. Four different types of extrinsic motivation exist within the continuum, specifically external regulation, introjected regulation, identified regulation, and integrated regulation (Deci & Ryan, 1985; 2000). External regulation is occurring if an activity is done because of external factors, such as rewards, constraints, or fear of punishment (Deci & Ryan, 2000). Introjected regulation can be performed, for example, in order to avoid internal pressures or feelings of guilt (Deci & Ryan, 2000). Identified regulation refers to the outcomes of the behavior that are highly valued, and the latter is performed with less pressure even if it is not particularly pleasant (Deci & Ryan, 2000). Integrated regulation represents behaviors in which the individual could assimilate the regulation of exercise into her or his personal goals (Deci & Ryan, 2000). Amotivation is defined as a state in which a person lacks the intention to behave and experience feelings of incompetence, expectancies of uncontrollability, and perform activities without purpose (Deci & Ryan, 1985). In a Finnish study of secondary school students (Yli-Piipari, 2011), boys scored higher on intrinsic motivation, identified regulation, extrinsic motivation, and amotivation than girls. Similarly, Jaakkola (2002) found gender differences in identified regulation, external regulation, and amotivation in a sample of Finnish Grade 9 students.

Previous evidence indicates that intrinsic motivation and more autonomous types of extrinsic motivation lead to positive behavioral consequences, such as greater PE enjoyment (Ntoumanis, 2001; Ryan & Deci, 2007; Yli-Piipari, 2011), PA levels in PE (Lonsdale et al., 2009), and daily self-reported PA (Kalaja, 2012). In contrast, non-autonomous types of motivation have been shown to be related to negative outcomes, such as boredom and unhappiness (Ntoumanis, 2002; Standage, Duda, & Ntoumanis, 2005). The present review of PE research within children and adolescents reveals that there is an impressive body of literature incorporating constructs from both self-determination and achievement goal theories (Soini, 2006; Standage, Duda, & Ntoumanis, 2003; 2005; Wallhead & Ntoumanis, 2004). However, assumptions of motivational climate, perceived physical competence, and exercise motivation on current PE enjoyment over secondary school years have not been tested empirically. This study extends previous research by investigating the motivational climate related ramifications in PE setting across three school years.

2.4.3 Expectancy-value Theory

In addition to the presented social-cognitive approaches, *Expectancy-value theory* (Eccles et al., 1983; Eccles & Wigfield, 2002) provides a useful framework for predicting achievement related behaviors, such as PA in PE (Cox & Waley, 2004; Gao et al., 2009; Xiang, McBride, & Bruene, 2006). In accordance to AGT's goal orientations and SDT's needs, expectancies and task-values are conceived as perceptions about the self or activities and are viewed as a more specific ori-

entation toward task or activity (Plante, O'Keefe, & Théorét, 2012). The Expectancy-value theory addresses whether or not children desire to participate in an activity and how much effort they are prepared to put into the activity (Eccles et al., 1983; Wigfield & Eccles, 2000). The level of persistence and performance in the activity are determined by their beliefs about how well they will perform the activity (expectancy beliefs) and values they attach to the activity (subjective task values). The expectancy-value approach is highly valuable to envisage the link between students' expectancy-related beliefs and subjective task values to one's actual PA participation in PE (Cox & Waley, 2004; Gao et al., 2009; Xiang, McBride, & Bruene, 2006).

Beliefs about ability are defined as an individual's beliefs about competence in performing or learning different achievement tasks, whereas expectancies for success refer to how individuals view their probability for success at a specific task. Cox and Whaley (2004) reported that 14 to 19 year-old students' expectancy beliefs were positively associated with effort and persistence in basketball. The association between beliefs and intentions to future participation in an elementary school running program was addressed within a sample of 7 to 10 year-old children in Texas (Xiang, McBride, & Bruene, 2006). Similarly, in a longitudinal Finnish study, students' expectancy-related beliefs toward PE decreased across Grade 6 to Grade 9 (Yli-Piipari, 2011).

Another essential element of the expectancy-value theory is *subjective task values*, which are defined as individuals' incentives for doing different tasks. Eccles et al. (1983) have demonstrated that subjective task values are a function of four distinct components that are attainment value (importance), intrinsic value (interest), utility value (usefulness), and cost. Attainment value is defined as the importance to do well on a given task, and it incorporates identity issues as tasks are important when individuals view them as central to their own sense of themselves, and allow them to express or confirm important aspects of themselves (Eccles et al., 1983). Intrinsic value is similar to SDT's intrinsic motivation (Deci & Ryan, 2000), since enjoyment is gained from doing the task. When individuals value an activity intrinsically, they often become deeply engaged in it and can persist at it for a long time (Deci & Ryan, 2000; Eccles et al., 1983). Utility value or usefulness refers to how a task fits into an individuals' future plans, for instance, taking a PE class to fulfil a need for social interaction. Thus, utility value is similar to SDT's identified regulation (Deci & Ryan, 2000), because doing an activity out of utility value, the activity is a mean to an end rather than an end in itself. Utility value is also connected to personal goals and sense of self, and so has also some ties to intrinsic motivation (Deci & Ryan, 2000). Cost refers to what the individual has to give up to do a task, as well as the anticipated effort one will need to put into task completion (Eccles et al., 1983). Cox and Whaley (2004) found that subjective task values just as beliefs were positively associated with high school students' effort and persistence in basketball. Particularly, the one-mile run was more strongly associated with attainment value rather than intrinsic or utility value in the elementary school running program study (Xiang, McBride, & Bruene, 2006). Yli-Piipari (2011)

reported that Finnish children aged 11-13 years, who valued PE highly became more physically active across Grade 6 to 9 based on self-reported PA scores.

Gender differences have been observed in expectancy beliefs (Xiang, McBride, & Bruene, 2006; Xiang et al., 2003; Yli-Piipari, 2011), and subjective task values in PE (Jacobs et al., 2002; Eccles et al., 1983; Yli-Piipari, 2011), with boys scoring higher. In contrast, gender differences in task values have not been observed in some other studies (Cox & Whaley, 2004; Xiang, McBride, & Bruene, 2006). Several researchers have suggested that differences may be result of participation in gender appropriate activities, when expectancy beliefs increase as a result (Shen et al., 2003; Solmon et al., 2003). Gender differences have, therefore, been found more regularly in gender preference activities, such as dance or ice hockey, as girls and boys will often tend to value activities that they perceive as appropriate for their gender (Gao & Xiang, 2008).

Currently, PE classes have been considered as potential functions to increase students' PA on a daily basis in expectancy-value theory based studies (Cox & Waley, 2004; Gao et al., 2009; Xiang, McBride, & Bruene, 2006). However, none of the studies used objective devices to assess PE related levels of PA. Furthermore, a systematic review of school-based interventions (Sluijs, McMinn, & Griffin, 2007) to promote PA in adolescents revealed that only one study used objective method (direct observation) in PE classes. More recently, Bowler (2009) and Tammelin, Laine and Turpeinen (2013) used accelerometers in PE classes. This reinforces the potential for substantial methodological variation to be introduced in the literature regarding PA levels in PE classes. The current study presents the associations of expectancy beliefs, subjective task values, and objective scores for out-of-school and total MVPA in the sample of secondary school students.

2.5 Summary of the Previous Findings

The tasks of the present dissertation evolved from the findings of previous investigations and the subsequent proposition of a need for further studies. Previous research has consistently highlighted that the level of PA declines during adolescence as children transfer from childhood into adulthood (e.g., Currie et al., 2004; 2008; 2012; Dumith et al., 2011; Telford et al., 2013; Troiano et al., 2008; Veitch et al., 2010; Yli-Piipari, 2011). Similarly, there is evidence suggesting an age-related decline in PE enjoyment (e.g., Digelidis & Papaioannou, 1999; Hashim, 2007; Prochaska et al., 2003). To prevent declining patterns of physical activity, multilevel interventions have been evidenced as being effective in changing PA behavior (e.g., Murillo et al., 2013; Sallis & Owen, 1999; Sluijs et al., 2007) and one-treatment interventions (Digelidis et al., 2003; Stuntz & Weiss, 2010) on PE enjoyment in elementary and secondary school students. In addition, expectancy beliefs and subjective task values have been found to be crucial factors in predicting students' PA participation in school PE (e.g., Cox & Waley, 2004; Gao et al., 2009; Xiang, McBride, & Bruene, 2006). However, the following

limitations have been apparent in studies of the temporal growth of PA and enjoyment in physical education:

1) *Previous school-based interventions have been targeted toward specific groups of elementary or secondary school students or can typically be considered as short-term interventions.* The present study adopted the whole school approach and promoting MVPA using a multilevel program across three school years. This study is one of the few studies to examine the development of students' MVPA using school PE as a tool to promote long-term total MVPA. Additionally, along with the self-reported scores, objective measures were used to get more detailed information about MVPA levels of children and youth.

2) *Previous interventions implemented on the basis of the Epstein's TARGET model, have not analyzed the longitudinal data by predicting students' MVPA scores using multilevel modelling.* Instead of analyzing mean scores, the level of MVPA and its change within individuals and groups is most appropriate for analysis using the multilevel models (Byrne, 2012). The present study used multilevel modelling method to examine the longitudinal change in Grade 5 to 8 experimental and control girls' and boys' self-reported MVPA across three years of program.

3) *To increase students' MVPA levels, it is also important to consider their enjoyment levels related to the PE context.* Coulter and Woods (2011) suggested that to elicit change in PA behavior of school students it is important to know, what their current behavior patterns are and also their enjoyment levels of the physical activities in which they partake. Similarly, Cairney et al. (2012) underlined that there are deficiencies in the current PE programs being implemented, because of age-related decline in PE enjoyment. Therefore, the present study examined both PE enjoyment and total MVPA including MVPA in PE classes, recess activity, and out-of-school activity across three school years among students, who represent the most critical age group considering age-related decline in MVPA and PE enjoyment. Furthermore, there are no reports about studies attempting to test the theoretical assumptions regarding the relationships of motivational climate, perceived physical competence, and exercise motivation on enjoyment in school PE classes. Therefore, the entire psychological mechanism (Vallerand, 1997; Weiss, 2000) underlying PE motivation was investigated to clarify the longitudinal relationships between motivational climate at Grade 7, perceived physical competence and exercise motivation at Grade 8, and PE enjoyment at Grade 9. This proposition was tested with the use of control group because PE enjoyment was investigated across regular PE classes in order to determine the relationships of the motivational variables without additional treatments.

4) *It is unclear whether students' total daily MVPA can be increased by promoting task-involving climate across regular PE classes without additional PE classes.* Since, the amount of school PE classes cannot be substantially increased, the present study examined the effects of task-involving climate treatment on secondary school students' MVPA across regular PE classes (90 minutes per week) during one school year.

5) *The Expectancy-value theory based interventions have been considered as potential functions to increase students' MVPA on a daily basis when using self-reported physical activity.* However, none of the studies used objective devices to assess PE related levels of MVPA. The current study presents the associations of expectancy beliefs, subjective task values, and objective MVPA scores.

2.6 Theoretical Framework of the Study

The current study was grounded in the achievement goal (Ames, 1992; Nicholls, 1989), self-determination (Deci & Ryan, 1985; 1991; 2000), and expectancy-value frameworks (Eccles et al., 1983; Eccles & Wigfield, 2002). The review of PE research involving children and adolescents reveals that previous studies have generally been consistent with a model of student motivation in the context of PE that incorporates constructs from both AGT and SDT (Soini, 2006; Standage, Duda, & Ntoumanis, 2003; 2005; Wallhead & Ntoumanis, 2004) or SDT and Expectancy-value theory (Yli-Piipari, 2011). A common issue to all theories incorporated in the current study is the identification of perceptions of competence as contributors to motivation, thus accounting for youths' desire to develop and demonstrate PA (Weiss, 2013). However, Pintrich (2003) and Wigfield (1994) argued that AGT has not considered how goals may operate differently at various levels of task values. Conversely, expectancy-value models have focused on the role of expectancy beliefs and subjective task values, and their relation to future performance and achievement related choices, but have not examined how these variables might be related to goals (Pintrich, 2003). SDT has also been criticized, as the theory assumes that all people have an active, growth-oriented nature toward health and well-being. Critics posit that these assumptions may not apply to all people (Miles, 2012). Thus, the integration of theories could allow researchers to understand motivational processes in a way that a single perspective may not completely capture (Hulleman et al., 2008). The strength of the present study is that students' PE motivation was examined using the essential features of the AGT, the SDT, and the Expectancy-value theory.

Adopting the certain constructs of all presented theories, is useful for determining how individuals varying in exercise motivation differ in their participation motives in PA and PE enjoyment. The central assumption of the current study was that an individual's behavior can be influenced by manipulating the psychological and physical environment. In current PA program, the interac-

tion of the AGT and the SDT provides appropriate framework for the social environment in physical education, whereas the Expectancy-value approach focuses on the more specific viewpoint toward PA, especially in-class PA. Specifically, the AGT provides a plausible model to understand the relationship between motivational climate and students' total PA and PE enjoyment. Respectively, the SDT addresses the effects of PE classes, on students' physical competence and intrinsic motivation. Beliefs and subjective task values toward objective PA are the specific components of the Expectancy-value theory. This dissertation was designed to examine the effects of the particular program presented with detailed description in the following chapter. The theoretical framework (Deci & Ryan, 2000; Eccles et al., 1983; Hagger & Chatzisarantis, 2007; Vallerand, 1997) of the current study is presented in Figure 1.

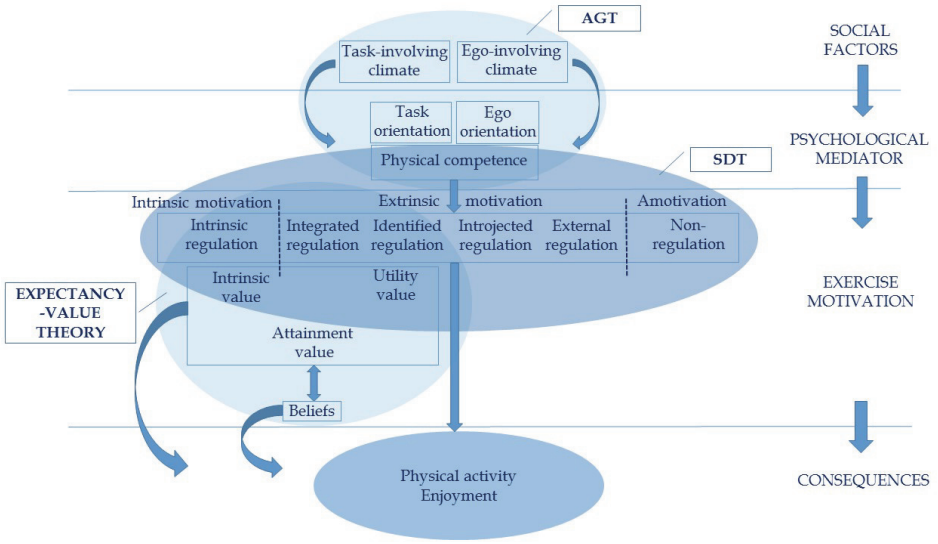


FIGURE 1 The theoretical framework of the study.

3 THE PURPOSE OF THE STUDY

The purpose of this study was to examine the effects of the Sotkamo Physical Activity as Civil Skill Program 2010-2014 on students' MVPA and PE enjoyment. The main tasks (2-4), and the additional task 5, were implemented using a longitudinal design, whereas, main task 1 and the additional tasks 6 to 8 used a cross-sectional design. Main tasks (2-4) included the investigation of whether the experimental and control group differed in self-reported MVPA and PE enjoyment across the program. Main tasks (2-3) and additional tasks (5-8) consisted of analyses of gender differences. Furthermore, students' MVPA engagement and the relationships between motivational climate and PE enjoyment were examined. The validity and reliability of the scales were also tested.

The main tasks:

1) To examine the validity and reliability of the PE Enjoyment Scale, the MCPES, the POSQ, the PSPP, the SMS, and the STPQ in the total sample of the study.

2) To examine the longitudinal change in self-reported MVPA and its relations to grade and duration across the school-initiated program.

3) To examine the longitudinal change in PE enjoyment and its relations to grade, duration across the school-initiated program.

4) To examine the effects of task-involving climate and physical school environment treatment on Grade 7 experimental and control groups' self-reported MVPA across one-year participation in the school-initiated program (Study IV).

The additional tasks:

5) To examine the relationships between perceived motivational climate, physical competence, exercise motivation, and PE enjoyment of Grade 7 control group students' across three school years (Study I).

6) To analyze the relationships between Grade 7 to 9 experimental group students' expectancy beliefs, subjective task values, objective out-of-school MVPA, and MVPA in PE classes (Study III).

7) To analyze the relationships between self-reported and objectively measured MVPA in the samples of elementary school and secondary school students (Study II).

8) To analyze the percentages of Grade 5 to 9 experimental group students who engaged in at least 60 minutes of MVPA on a daily basis across the school-initiated program (Study II).

4 METHOD

4.1 Participants

The total sample comprised 847 students (422 girls, 425 boys) at the age of 12 to 15 years from two school districts. The experimental group (n = 208) and four control groups (n = 639) were recruited from North-East and Central Finland through direct contact with school principals. Both school districts were typical Finnish mid-sized cities with 96% of students being Caucasian. Permission to conduct the study was obtained from the Ethical Committee of the University of Jyväskylä. Written, informed consent was obtained from each student and their parent or legal guardian after they were given, in writing, a full explanation of the tasks of the study, possible hazards, discomfort, and inconvenience (Appendix 4). Participation in this study was voluntary and no extra credit was awarded for participation.

The present study was implemented across the academic years 2010–2013. All experimental group students from Grade 5 to Grade 9 students filled the questionnaires in April 2010 (T0), 2011 (T1), 2012 (T2), and 2013 (T3). The control group students (Yli-Piipari, 2011) participated in equal measures in April 2007 (T0), 2008 (T1), 2009 (T2), and November 2009 (T3). Participants completed the questionnaires under the supervision of the researchers during 45-minute classes, typically held in the classroom or gym. The participants were advised to ask for help if confused concerning either the instructions or the clarity of a particular item. To minimize students' tendency to give socially desirable responses, students were encouraged to answer honestly and were assured that their responses were confidential. The students were told that their involvement was voluntary and they were allowed to terminate their participation at any time.

Table 1 presents the proportion of students at each measurement phase. All analyses were completed using the data collection of repeated cross-sectional design due to the economic resources. Thus, the objective measures were not possible to implement for all students. All students did not provide

proper data or were not willing to participate in the follow-up study. Only the students who provided complete data were included into the longitudinal analyses. Therefore, the experimental group's sample sizes ranged from 61 to 208 students and control group from 430 to 639 students. The detailed information of samples in studies I to IV are described below. The samples involved in previously unpublished analyses are presented in the results chapter.

TABLE 1 The proportion of students at each measurement phase.

Phase	Experimental			Control		
	Girls	Boys	Total	Girls	Boys	Total
T0	278	247	525	216	213	429
T1	275	237	512	296	343	639
T2	277	225	502	240	251	491
T3	236	158	394	230	248	478

Study I

The sample of study I comprised 639 Grade 7 students (girls = 296, boys = 343) aged between 13- to 15-years at the commencement of the study. The participants of this study were recruited from four secondary schools located in the region of Central Finland. The Grade 7 students represented 32 different PE classes. Both student consent and parental consent were returned by 73% of the students. This sample was considered as control group in study IV. In addition, students who provided complete longitudinal data were included as control group members in the previously unpublished analyses.

Study II and III

The samples comprised 96 secondary school students (58 girls, 38 boys) aged between 12- to 16-years (M = 15.03, SD = .94) from North-East Finland. Only those who returned their parental and student consents in order to obtain the accelerometer for personal use were included in studies II and III.

Study IV

In study IV the total sample of 847 students (422 girls, 425 boys) aged between 12 to 14 years from the experimental school (n = 208) and four control schools (n = 639) were examined. All Grade 7 students' in each class were invited to participate and 75% (experimental school) and 73% (control schools) of the students were able to return both student consent and parental consent.

4.2 Sotkamo Physical Activity as Civil Skill Program 2010-2014

4.2.1 Nature of the Program

The European Union funded Sotkamo Physical Activity as Civil Skill Program (ESF 2012-2014/6) took place in Sotkamo, Northwest-Finland in 2010-2014. The program was implemented to enhance children's and adolescents' MVPA and health behavior, and in turn, to prevent long-term effects of inactivity for children and youth's well-being and health. Specifically, the program was designed to create a new physically active school culture, which requires changes in two different elements, psychological (e.g., attitudes, motivation, motivational climate) and physical environment (e.g., facilities, structures, and methods). The program involved teacher training and parent consultation modules conducted by the program staff. Parents and school teachers are important promoters of the psychological environment, as their actions play a crucial role in regards to promoting MVPA in children and youth (Figure 2). For instance, parents were advised to encourage their children to be physically active in terms of transportation to school and out-of-school activities by suggesting other options to driving them by car. Teachers were given supplemental training to increase MVPA during the school days. The physical environment modifications consisted of improving school facilities, equipment supply, and supporting active transportation to school, as well as after-school activities.

FIGURE 2 The partners of the Sotkamo Physical Activity as Civil Skill Program.

The primary goal of Sotkamo Physical Activity as Civil Skill Program was to reduce the decline of elementary and especially secondary school students daily minutes of MVPA as assessed through self-reports and accelerometers. The

treatments were operationalized between program staff-teachers and between teachers-students. Two full-time employees were responsible for organizing the teacher and parent consultation including practices, teacher training, public communication, and supervision. The task of the researchers was to implement systematic follow-up study for the key variables regarding students' MVPA and motivation. Researchers did not attempt to control the treatments either at program staff-teacher level or teacher-student level. It was solely based on the teachers' systematic feedback and notes. The funding for the program was granted for two years at the time, consequently, research was accomplished in two phases, from 2010 to 2012 and 2012 to 2014.

4.2.2 Description of the Program

Public elementary schools and the secondary school nearby to the surrounding community where the majority of students lived were eligible to participate. Nine elementary schools (n = 229) and a secondary school (n = 341) were involved in the baseline measurements in April 2010. The school-based program began in fall 2010 and lasted through spring 2013 when the primary outcome data were collected. Samples of students from Grades 5 to 9 were recruited for measurement in spring 2010, spring 2011, spring 2012, and spring 2013. This repeated cross-sectional design was chosen to allow assessment of treatment effects in the entire population of students enrolled in the participating schools at the time of the surveys. Parental consent and student assent were obtained prior to each measurement period. A student was excluded if he or she did not return the consent. Thus, seven cohorts were involved in the program across April 2010 to April 2013. Grade 5 and 6 students in the first measurement phase (2010) received three years of treatments, Grade 7 (2010), Grade 8 (2010), and Grade 9 (2010) received one year of treatments. In addition, children who transferred to Grade 5 in 2011 received two years of treatments, and Grade 5 (2012) received one year of treatments. The control group data (n = 639) were collected in Central Finland in 2007-2009 (Yli-Piipari, 2011) using the same measurement procedures as in the case of experimental schools. Control group students from eight schools (Grade 7 in the beginning) were taught PE following the guidelines of the Finnish national curriculum (National Board of Education, 2004). No additional exercise motivation treatment or physical activities were provided to the control group students.

Forty-six teachers (31 females, 15 males) aged approximately from 30 to 60 years of age participated in the program. Seventy percent of them worked at elementary schools and most (61%) had work experience of more than ten years. Half of the teachers (47%) taught PE classes to their own or other students. Teachers participated in the program as a part of teacher's collective bargaining agreement of supplemental training. In the opening seminar of the program in fall 2010 the teachers and parents were provided with specific information in order to clarify their understanding in regards to participating in the program. They were given brief information about the demands, goals, and methods. Most teachers were interested in how to increase students' MVPA and motiva-

tion toward physical activities in school and out-of-school. They were concerned about the sufficiency of resources, as the program was designed to cover a relatively long period of time. In addition, some of them were concerned that fostering physical activities might decrease the resources of other school subjects, such as music and art. The core content of the program was designed in two workshops in fall 2010 by a team possessing relevant expertise including program staff, teachers, school healthcare personnel, policy-makers, school PE and sport experts from the university, and local sport clubs. The team had regular meetings approximately once in a month starting fall 2011 through spring 2013. The results of the program were presented at three public seminars, which were organized in spring 2011, fall 2012, and spring 2013.

4.2.3 School-based Treatments

The current school-based program included two treatments: 1) psychological environment (*Task-involving climate treatment*) and 2) physical environment (*Physical school environment treatment*). The first phase focused on supplemental teacher training and school physical environment improvement. In 2010-2011, the meetings with program staff and teachers were mainly theoretical, focusing on the design of the program. The program adopted the features of the SDT, the AGT, and the Expectancy-value theories. Specifically, the TARGET-model (Epstein, 1989) and Social Ecological Model (Sallis & Owen, 1999; Stokols, 1996) were used as practical tools to establish more opportunities for daily physical activities, to improve social support, as well as to increase PE motivation and perceived physical competence in order to foster greater levels of MVPA in elementary and secondary school students. In the beginning of 2010, teachers were asked to give suggestions to implement the program in practical terms. The purpose was to list all best practices together in order to help all schools to improve their school day activities. The teacher education was organized by the program staff. In addition, experts were involved in the practical sessions, for instance, the functional demonstration of apparatus gymnastics. In total, twenty-six 90 to 120-minute practical education sessions were completed during two academic years 2011-2013. The teachers participated in the supplemental training sessions voluntarily or in the minority of cases as a part of teachers' collective bargaining agreement for supplemental training. Consequently, most teachers (61%) participated in the supplement training at least once. In particular, PE teachers from the experimental schools participated in four 90-minute workshops to extend and develop their current PE teaching practices. The teachers were also given written material on PE motivation, physical competence, and activating teaching practices.

Task-involving climate treatment consisted of training of teachers to support greater levels of activity and choice during PE classes. Teachers' workshops were organized during the academic year 2010–2011 by the program staff. The workshops and treatment had the following main elements: *1) Task-involving and activating teaching practices (*students work together within small cooperative group structure, students are responsible for setting up equipment, during class

time students dictate the rate of progression through specific practices), *2) Physical competence and task orientation support (*evaluation emphasizes individual improvement, experiences of learning, and success), *3) Improving students personal skills (*students choose practices from a range of offered practices with different skill requirements, more activity and less waiting during PE classes), and *4) Positive feedback and encouragement (*recognition and feedback is based on the individual progress. The feedback concerning the first phase was collected from 46 teachers in fall 2012. Additionally, the program staff informed parents during the staff-directed treatments as a way to promote maintenance of the program. The school–parents link was a feature of the program that focused on bringing together school, community and families to develop and promote MVPA for students outside of the regular school day.

School physical environment treatment was developed to foster sustainability of school-wide activities during the school days, and started during the academic year 2010-2011. This component was based on the socio-ecological model, which proposes that multilevel promotion programs (Sallis & Owen, 1999) have a greater likelihood of being sustained if individuals in the school take ownership of the program after the research-directed intervention phase has ended (Osganian, Parcel, & Stone, 2003). The physical school environment treatment focused on providing additional activities and equipment. The activities were organized during extended and regular breaks. The students were allowed plenty of autonomy when selecting activities. The recess activities and treatment included the following actions: *1) Extended break (*daily extended break of 30 minutes in addition to the lunch break and regular breaks), *2) Access to fitness hall (*students were allowed to use fitness facilities during the extended and regular breaks in order to exercise or play games), *3) Controlled ballgames (*students were responsible for setting up ballgames and refereeing during extended breaks (i.e. 5 days x 30 minutes x 12 weeks) under the teachers' supervision, *4) Equipment supply (*exercise equipment were available to all students during the extended and regular breaks, students were responsible for setting up equipment).

The program staff monitored the school breaks twice a month. Additionally, the active transportation survey was conducted in fall 2011. This information collection procedure was designed to find out problems in regards to active commuting to the school or out-of-school activities. The teachers and parents were advised to encourage students to choose active transportation to the school and out-of-school activities instead of inactive modes in order to increase total MVPA. More detailed information about the schedule of program is presented in Appendix 1.

4.3 Measures

4.3.1 Self-reported Physical Activity

To assess students' self-reported PA, the Health Behavior in School-aged Children Research Protocol was used (Currie et al., 2002). The scale incorporated a modified version of the MVPA measure (Prochaska, Sallis, & Long, 2001). The introduction preceding the items was: "*In the next two questions physical activity means all activities which raises your heart rates or momentarily get you out of breath for example in doing exercise, playing with your friends, going to school, or in school physical education. Sport also includes for example jogging, intensive walking, roller skating, cycling, dancing, skating, skiing, soccer, basketball and baseball.*" The items required students to summarize their time spent in PA each day in the following way: 1) "*When you think about your typical week, on how many days are you physically active for a total of at least* 60 *minutes per day*?" and 2) "*Over the past* 7 *days, on how many days were you physically active for a total of at least* 60 *minutes per day*?" Both items rated on an eight-point response scale (0 to 7 days of the week). The mean score of the two items was calculated and used as the students' MVPA score. Prochaska, Sallis, and Long (2001) reported that for a sample of 138 US children and adolescents with a mean age of 12.1 years, the MVPA items were reliable (ICC = .77) and had moderate correlation (r = .40) with accelerometer data in a study based on a five-day data collection period.

4.3.2 Objective Physical Activity

Accelerometers were used for the objective assessments of students' MVPA. Specifically, Polar activity monitors (Polar Electro, 2011) and Actigraph GT3X+ (Actigraph, 2012) were chosen to investigate the patterns of MVPA on a minute-by-minute basis. The monitors were light, small, and easy to use. The Polar monitors were worn on the wrist and the Actigraph monitors on the waist. The electronic monitors detected the intensity of the movements at ten second intervals and displayed minutes spent in the moderate to vigorous activity zone. For the purpose of this study the manufacturer's protocols were followed to determine minutes as the representation of MVPA score including all activity during school days and out-of-school across a seven-day period. The manufacturer's cut points (moderate 3.5 to 5 MET, vigorous 5 to 8 MET) were used for Polar based MVPA levels. The Polar monitors have been validated in both children and adolescents (Virtanen, 2011). A validation study conducted in a sample of Finnish 6–15 year old children and adolescents (n = 20), revealed MET values for playing games, walking and running had a high correlation with MET values from indirect calorimetry (r = .91), whereas the correlation was low for sitting activities (r = .31) (Virtanen, 2011). In another study the correlation between monitors and indirect calorimetry (r = .86) was similar to the correlation between Actigraph accelerometers and indirect calorimetry (r = .84) for seven different activities (sitting quietly, seated playing a video game, a standing warm-

up, walking, jumping rope, video-led kickboxing, and running for a total of 30 min in a sample of 23 Finnish 11–17 year-old children and youth (Virtanen, 2011). The cut-off points presented by Freedson, Pober, and Janz (2005) were used for the Actigraph based MVPA scores. The Actigraph device has been widely calibrated for young people in laboratory and free-living conditions (Martinez-Gomez et al., 2012).

4.3.3 Physical Education Enjoyment

Enjoyment in PE classes was assessed using the PE Enjoyment Scale (Soini et al., 2007), which adopted the protocol of Sport Enjoyment Scale (Scanlan et al., 1993) into school PE. The item stem was "*In my PE class...*" The subscale consists of four items (*e.g.,* "*I like PE classes*") and the responses were indicated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Soini et al. (2007) reported that the Finnish version of the scale, which was modified to the context of PE, showed satisfactory internal consistency ($\alpha = 0.93$). Previously, the construct validity (TLI = 1.00, CFI = 1.00, RMSEA = .00) and internal consistency (Cronbach alpha >.93) of the scale were strongly supported in a sample of Finnish secondary school students (Yli-Piipari et al., 2012).

4.3.4 Motivational Climate in Physical Education

Perception of motivational climate in PE classes was measured using the Motivation Climate in PE Scale (MCPES; Soini et al., 2014), which consists of four subscales representing task-, ego-involving, autonomy and social relatedness climates. For the purpose of the current study only task- and ego-involving climate dimensions were used. The individual item stem used in the measure was "*In my PE class…*" The task-involving climate dimension consisted of five items (*e.g., "It is important for students to try their best in PE classes*"), and the ego-involving climate dimension included four items (*e.g., "It is important for students to succeed better than others in PE classes*"). Responses were indicated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Recently, the confirmatory factor analysis supported the construct validity (TLI = .97, CFI = .97, RMSEA = .037) and internal consistency (Cronbach alphas >.78) of the scale for Finnish secondary school students (Soini et al., 2014).

4.3.5 Achievement Goal Orientations

Goal orientations were analyzed using the children's version of the Perception of Success Questionnaire (POSQ; Roberts, Treasure, & Balagué, 1998). The questionnaire used in the current study had the individual item stem of "*I feel most successful in PE classes, when…"* The scale consists of twelve items, six measuring task orientation (*e.g., "I feel most successful in physical education classes, when I really improve"*) and six ego orientation (*e.g., "I feel most successful in physical education classes, when I do better than others*"). Items were rated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Mean

scores were calculated for both subscales. According to Yli-Piipari et al. (2013), a confirmatory factor analysis supported the construct validity (TLI = .97, CFI = .97, RMSEA = .030) and internal consistency (Cronbach alpha > .88) of the scale for Finnish secondary school students.

4.3.6 Perceived Physical Competence

Perceived physical competence was analysed using the Physical Self-Perception Profile (PSPP; Fox & Corbin, 1989). The item stem was "*What am I like*?" The subscale consisted of five items (*e.g., "I am confident in physical education*") and students responded to each item using a five-point Osgood-scale from I'm among the best when it comes to athletic ability (1) to I'm not among the best when it comes to athletic ability (5). Higher values reflected higher perceived physical competence. Kalaja et al. (2009) showed that the Cronbach's alpha coefficients were above .70 demonstrating satisfactory internal consistency of the Physical Self-Perception Profile. Confirmatory factor analysis undertaken in that study supported the construct validity of the scale (TLI = .91, CFI = .97, RMSEA = .012).

4.3.7 Motivational Regulation in Physical Education

Contextual intrinsic and extrinsic motivation were measured using the Sport Motivation Scale (SMS; Pelletier et al., 1995) which is a modified for the context of Finnish PE (Jaakkola, 2002). Recently, the original SMS scale was revised by Pelletier and colleagues (2013), because the version received some criticism. In the present study the original scale was used, since the revised SMS II scale was not yet available in 2009. The scale used in this study had the individual item stem "*I'm currently participating in physical education, because?*" The instrument consists of seven subscales, comprising three types of intrinsic motivation (intrinsic motivation to know: *e.g., "For the pleasure it gives me to know more about the sport skills that I practice"*, intrinsic motivation to stimulate: *e.g., "For the pleasure I feel in living exciting experiences",* and intrinsic motivation to accomplish: *e.g., "For the pleasure I feel while improving some of my weak points*) and three types of extrinsic motivation (identification: *e.g., "Because it is a good way to learn lots of things which could be useful to me in other areas of my life"*, introjected regulation: *e.g., "Because I must do sports to feel good about myself",* and external regulation: *e.g., "Because people around me think it is important to be in shape*) and amotivation (*e.g., "I often ask myself, I can't seem to achieve the goals that I set for myself").* Each dimension consisted of four items and each was rated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). For the purpose of this study only dimensions of intrinsic motivation and extrinsic motivation were used. Jaakkola et al. (2008) reported that the Finnish PE version of the scale demonstrated adequate psychometric properties (Cronbach's alphas between .71 and .93). Confirmatory factor analysis results detailed by Kalaja et al. (2009), however, did not fully support the construct validity of the scale (TLI = .86, CFI = .88, RMSEA = .081).

4.3.8 Expectancy Beliefs and Subjective Task Values

The expectancy beliefs and subjective task values were measures using the Self- and Task-Perception Questionnaire (STPQ), originally developed by Eccles et al. (1984). The scale was modified following procedures outlined by Xiang et al. (2003) and to address the domain-specific questions for Finnish PE classes. The introduction preceding the items was "*When you think about your school PE classes.*" Beliefs about ability (*e.g.*, "*How good in PE classes are you?*") and expectancies for success (*e.g.*, "*How good would you be in PE classes learning something new in this semester?*") were used as a combination, similar to the one used by Xiang et al. (2003). For the purpose of this study, the attainment (*e.g.*, "*Compared with other school subjects, how important is it to you to be good in PE classes?*"), intrinsic (*e.g.*, "*How much do you like PE classes?*"), and utility value (*e.g.*, "*Compared with other school subjects, how useful is what you learn in PE classes?*") dimensions of subjective task values were measured. Responses were given on five-point Likert-scales anchored by totally disagree (1) and totally agree (5). Yli-Piipari (2011) demonstrated outstanding model fit for expectancy beliefs (TLI = 1.00, CFI = 1.00, RMSEA = .025), task values (TLI = 1.00, CFI = 1.00, RMSEA = .000) and reliability scores (Cronbach's alphas between 0.88 and 0.92) using these self-reports with the Finnish secondary school students in school PE.

4.4 Statistical methods

Several statistical methods were used in the current study. Prior to statistical analyses, normal distribution, missing values, and outliers of the data were examined. The outlier detection was completed using standardized values and Mahalanobis distance procedures (Tabachnick & Fidell, 2007). No modification due to normality or outliers was required in Studies I, II or IV. In contrast, the Box M test revealed a violation of the assumption of homogeneity of covariance matrices for intrinsic value, and MVPA in PE classes in Study III. When the within-group covariance matrices were not equal, Pillai's trace criterion was used to detect significant gender differences (Anderson, 2003).

The between-group differences in mean scores were analyzed using independent samples t-tests and MANOVA. The within-group differences were analyzed using paired-sample t-tests. Wald's test was used to test the statistical significance of regression coefficients in Study III. The factor structure of the scales based on the measure scores were tested using confirmatory factor analysis (CFA). Composite reliability of the scales were estimated using standardized factor loadings and error variances. A commonly accepted threshold value for composite reliability is .70 or more (Hair et al., 1998). The multilevel modelling (MLM) was used to examine the changes in experimental and control groups' MVPA and PE enjoyment across the three-year program. Path analysis in Studies I and IV, linear regression analysis in Study II, and logistic regression analysis in Study III were implemented to investigate the relationships of the study

variables. Preliminary analyses, means, standard deviations, internal consistencies, and Pearson's correlation coefficients between study variables were examined using SPSS Statistics package (Version 21.0; IBM Corporation, 2012). All structural equation models were performed using the Mplus statistical package Version 6.1 (Studies III, IV) (Muthén & Muthén, 1998–2013) and Amos software Version 18.0 (Study I) (Arbuckle, 2007). Detailed description of the MLM and path analysis are presented below. The original papers should be consulted for further information regarding the other methods applied.

4.4.1 Multilevel Modelling

In order to examine the longitudinal change in self-reported MVPA between groups, gender, and the relationships of grade, duration, and self-reported MVPA across the program, the two-level regression models were implemented using MLM method (Byrne, 2012). An identical model was implemented for PE enjoyment as an outcome variable regarding the third task of the study. The primary objective of MLM is to summarize *within-group* variability at individual level and *between-group* variability at the cohort level (Byrne, 2012; Hox, 2002). MLM is useful for the hierarchically structured data (e.g., students nested within schools), which may involve multilevel structures, for instance, the lower level representing individuals and the upper level representing groups (Byrne, 2012). Two-level modelling also allows variability in the timing and number of assesments (Hox, 2002). The current data consisted of three measurements (T0, T1, and T3), in which the within-level examined the relationships between grade, duration of treatments, and repeated MVPA measures. The between-level represented the relationships between gender, school, and change in MVPA from T0 to T1, T1 to T3, and in total T0 to T3.

Missing values were detected in dependent MVPA variable at T0, T1, and T3 (experimental schools 5.3%, 50.4%, 88%; control school 66.4%, 12.5%, 26%) and PE enjoyment (experimental schools 7.6%, 56%, 88%; control school 53.7%, 18.8%, 29.1%). Due to the design of the study, each group represented a different pattern of missing values (i.e. younger experimental groups had missing data in the first measurement and older experimental groups in the final measurement (Muthén & Khoo, 1998; see Tables 3 and 5) and contributed a different section to the overall development of MVPA (Duncan et al., 1999). Therefore, to examine an overall picture of the changes in MVPA across the school-based program, a cohort sequential data covered Grades 5 to 8 combining information from the four different overlapping grades (Duncan et al., 1999). The statistical analyses investigating whether the missing values were random showed that the pattern of missing data was not associated with an independent variable of gender at $p < .05$ level (McCartney et al., 2006). To run the MLM model in the described way, the missingness was assumed to be missing at random (MAR) (Muthén & Khoo, 1998). Random two-level regression analyses were run with the help of dummy coded variables in order to examine if the program effected on repeated measures of MVPA and PE enjoyment (T0 to T3). The first dummy variable examined the individual change from T0 to T1. The second dummy analyzed the individual change from T1 to T3 in addition to the effect to the first dummy. All analyses were estimated using the MLR (maximum likelihood with robust standard errors) estimator (Byrne, 2012). The program produces estimates, standard errors, and p-values (Kaplan, 1998). In the case of the random regression model, fit indices were not provided (Muthén & Muthén, 1998-2013).

Two-level regression models of self-reported MVPA and PE enjoyment with random regression coefficients and intercepts shown in Figures 3 and 4 were estimated. The dependent variables (MVPA and PE enjoyment) in these regressions were continuous. The within part of the models describes the regression of "Grade" (5^{th} to 8^{th}), "Duration T0-T1" and "Duration T1-T3" on a dependent variables MVPA and PE enjoyment. In the within part of the models, the filled circle at the end of the arrows from "Grade", "Duration T0-T1, and "Duration T1-T3" to MVPA or PE enjoyment represent a random intercept that is referred to as MVPA or PE enjoyment in the between part of the models. Additionally, the filled circles in the middle of the arrows (S1 = grade, S2 = duration T0 to T1, and S3 = duration T1 to T3) describe random regression coefficients. On the between-level, the random intercept is shown in a circle because it is a continuous latent variable that varies across clusters. On the between-level, random intercept MVPA or PE enjoyment, S2 (duration T0 to T1), and S3 (duration T1 to T3) is regressed on cluster-level covariates "Gender" (girl or boy) and "School" (treatment or control). For these random variables intercepts are freely estimated and non-significant residual variances were fixed to zero. For S1 only mean value is estimated at between levels.

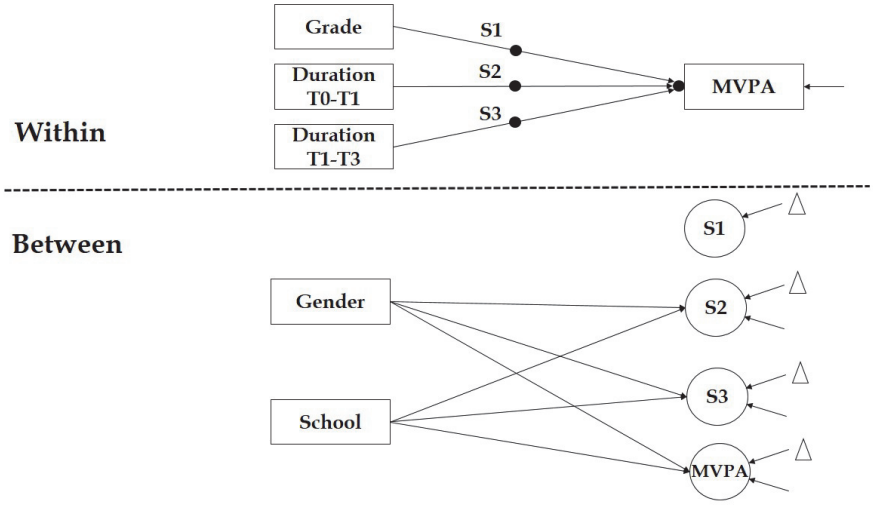


FIGURE 3 The two-level regression model of self-reported MVPA with intercept and random regression coefficients.

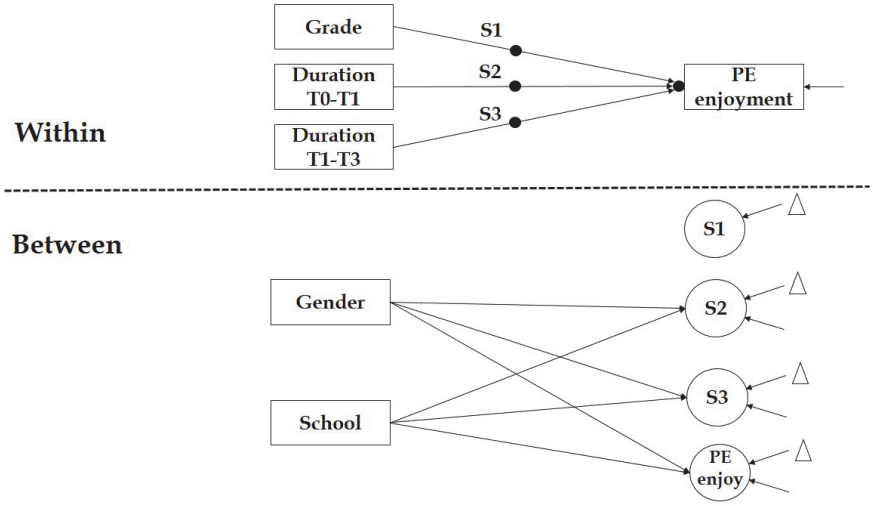


FIGURE 4 The two-level regression model of PE enjoyment with intercept and random regression coefficients.

4.4.2 Path Analysis

In order to analyze the specified effects of task-involving climate treatment and physical school environment treatment on Grade 7 experimental and control students' self-reported MVPA across a one-year participation in the school-initiated program, a path model presented in Figure 5 was conducted. Similarly, to examine the relationships of Grade 7 students' perceived motivational climate, physical competence, exercise motivation, and PE enjoyment across three school years by utilizing Vallerand's (1997) motivational sequence model, a path model was implemented (Figure 6). Practically, path analysis is a statistical technique to test the comparative strength of direct and indirect relationships among variables. The path analysis estimates the magnitude and strength of effects within a hypothesized causal system and fit the data to the hypothesized model (Lleras, 2005). A series of path models (Figures 5 and 6) were conducted to test the fit of the present correlation matrixes (Studies I, IV). Pearson's chi-square test ($\chi 2$) was used as a test of the model's overall goodness-of-fit to the data. A non-significant difference between observed frequency distribution and theoretical distribution had an acceptable fit to the data. To determine the appropriateness of the model the root mean square residual (RMR) and the root mean square error of approximation (RMSEA), the normed fit index (NFI), the comparative fit index (CFI), the Tucker-Lewis index (TLI), the goodness-of-fit index (GFI), and the adjusted goodness of fit index (AGFI) were also examined (Arbuckle, 2007). A value of .05 or less for RMR indicate the reasonable magnitude of a varying quantity, a value .05 or less indicate a close fit of the model and values between .06–.08 for the RMSEA indicate an acceptable fit of the model in the relations to the degrees of freedom (Browne & Cudeck, 1993). The NFI, CFI, TLI, GFI and AGFI indices range from 0 to greater than 1. Fit indices greater than .90 are indicative of acceptable and indices greater than .95 excellent model fit. Moreover, the proportion of variance predicted by independent variables for the dependent variables were investigated using squared multiple correlations (R^2). The modified path models are presented in results chapter.

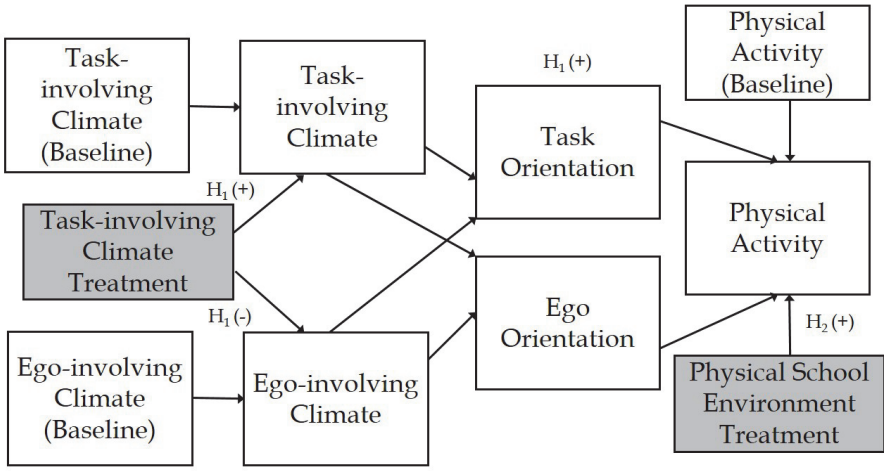


FIGURE 5 Path model presenting the theorized relationships between the variables and treatment effects (Study IV).

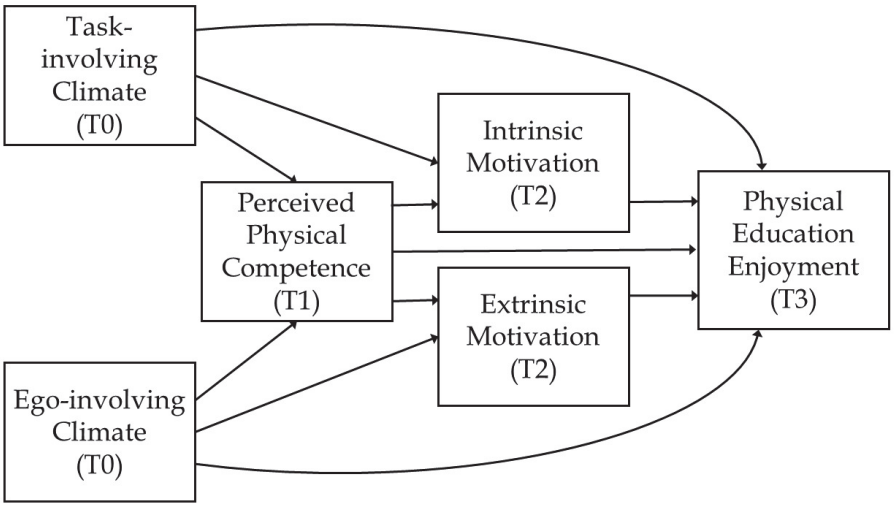


FIGURE 6 The hypothesized PE enjoyment model (Study I).

5 RESULTS

This chapter summarizes the primary findings and introduces some unpublished results. Original papers (I-IV) and appendices should be consulted for more information.

5.1 Validity and Reliability of the Scales

In order to examine the one-factor structure of the PE Enjoyment Scale, two-factor structure of the MCPES, two-factor structure of POSQ, one-factor structure of the PSPP, two-factor structure of the SMS, and four-factor structure of the STPQ, confirmatory factor analyses (CFA) were conducted. Although the χ2–tests indicated statistical significance (typical in case of small or large sample sizes), the rest of the fit indicators suggested a good fit for the PE Enjoyment, the MCPES, the POSQ, and the PSPP scales. However, neither the SMS scale *(χ^2 (251) = 1000.833, p < .001, CFI = .86, TLI = .84, RMSEA = .068, SRMR = .062)* or the STPQ scale *(χ^2 (38) = 85.367, p < .001, CFI = .93, TLI = .89, RMSEA = .114, SRMR = .045)* yielded an acceptable with the data based on the selected fit indices. The next step was to modify the factor models based on the model modification indices. The residuals of the SMS items *"For the pleasure of discovering new training techniques", "For the pleasure I feel in living exciting experiences", "Because it is one of the best ways to maintain good relationships with my school friends", "Because I like the feeling of being totally immersed in the activity", "Because I must do sports regularly", "Because it is absolutely necessary to do sports if one wants to be in shape", Because people around me think it is important to be in shape", "Because I must do sports to feel good about myself", and "Because it allows me to be well regarded by people that I know"* were allowed to correlate. Similarly, the correlations between measurement errors of the STPQ items *"How good are you in PE classes", "Compared to other students, how good are you in PE classes?", "How well do you expect to learn new skills in PE classes next year?", and "How well do you expect to do in PE classes next year?"* were accepted. The final CFAs revealed an acceptable fit for

the modified SMS and STPQ scales. In addition, composite reliability for the factor loadings for PE enjoyment (.93), task-involving climate (.86), ego-involving climate (.86), task orientation (.93), ego orientation (.94), perceived physical competence (.90), intrinsic motivation (.95), extrinsic motivation (.90), expectancy beliefs (.92), attainment value (.97), intrinsic value (.96), and utility value (.99) indicated satisfactory internal consistencies. Based on the results of the CFAs, the current measures demonstrated adequate validity and reliability. All fit indices for the scales are presented in Table 2.

TABLE 2 The results of confirmatory factor analyses for the scales of the study.

	PE Enjoyment	MCPES	POSQ	PSPP	SMS	STPQ
N	847	847	847	639	639	96
χ^2	3.590	51.709	295.405	22.668	769.012	53.938
df	2	19	53	5	245	36
p	.166	.000***	.000***	.000***	.000***	.016*
CFI	1.00	.98	.95	.98	.90	.97
TLI	1.00	.96	.94	.97	.89	.96
RMSEA	.031	.059	.073	.074	.058	.072
SRMR	.007	.038	.047	.020	.056	.035
90% CI	.00, .08	.04, .08	.07, .08	.05, .11	.05, .06	.00, .10

***p < .001, *p < .05

5.2 Longitudinal Change in Self-reported MVPA and Its Relations to Grade and Duration across the School-initiated Program

The second task was to examine the longitudinal change in self-reported MVPA, between experimental and control group, and related gender differences. Additionally, the relationships between grade, duration, and self-reported MVPA across the school-initiated program were studied. Grade 5 and 6 experimental students (n = 138) received three years of treatments, Grade 7 and 8 students (n = 255) received one year of treatments, and control group (n = 639) did not receive any treatments across three years of program. Means and standard deviations of students' self-reported MVPA scores in experimental and control groups are presented in Table 3. The mean scores indicated that the decrease in the experimental school students' self-reported MVPA was not as large as in control school students. Self-reported MVPA mean scores were higher in the experimental group at T1 than T0, while the control group's mean score at T1 was lower than in the beginning at T0.

TABLE 3 Means and standard deviations of self-reported MVPA for experimental and control group students.

	MVPA (T0)		MVPA (T1)		MVPA (T3)	
Group (T0)	M	SD	M	SD	M	SD
Grade 5 (50)	4.62	1.99	5.39	1.27	4.69	1.33
Grade 6 (88)	4.92	1.74	5.34	1.38	4.32	1.91
Grade 7 (124)	3.76	1.91	4.38	1.68	na	na
Grade 8 (131)	3.74	2.05	3.91	1.72	na	na
Grade 6* (639)	5.01	1.45	4.27	1.70	3.66	1.78

* control group. Sample sizes in parentheses.

On the within-level of the MLM model (two-level random regression) (see Figure 3), the relationships between grade, duration, and self-reported MVPA level across the program were investigated. The sum score of MVPA at T0, T1 and T3 were used as students' overall MVPA scores in the analysis. In addition to the within-level, the differences in self-reported MVPA change between experimental and control groups, and girls and boys were studied on the between-level of MLM. Specifically, the between-level analyzed the gender effects and differences in MVPA change between repeated measures T0 to T1, and T1 to T3.

The variable S1 represented grade effect and the dummy variable S2 treatment effect from T0 to T1, and the dummy S3 treatment effect from T1 to T3. In order to estimate the model properly, the residual variances of S1, S2, and S3 were fixed to zero, because the particular variances were statistically non-significant. The parameter estimates and standard errors of the final model are presented in Table 4.

TABLE 4 Non-standardized parameter estimates for the two-level hierarchical model of Grade 5 to 8 students' self-reported MVPA.

Parameter estimates	Self-reported MVPA		S1 Grade Effect	S2 Duration T0-T1	S3 Duration T1-T3
	Between	Within	Between	Between	Between
Mean			-.494 (.08)***		
Intercept	7.811 (.57)***			-.518 (.33)	.976 (.33)**
Variances	1.132 (.12)***	1.910 (.12)***	0[a]	0[a]	0[a]
β_1	.214 (.17)			.054 (.19)	-.397 (.17)*
β_2	-.591 (.20)**			1.337 (.21)***	-.209 (.26)

Standard errors in parentheses. [a] fixed to 0.
β_1 = Gender (1 = girl, 2 = boy), β_2 = School (Experimental = 1, control = 0).
***p < .001, p < .01, *p < .05.

The results revealed the statistically significant difference in self-reported MVPA level between the experimental and control schools (β_2 = -.591). Control group students scored higher than the experimental group at T0. The variance in self-reported MVPA variable on the between-level also showed that the MVPA levels varied between individuals. In addition, the variance on the within-level indicated the variation in MVPA across repeated measures.

Experimental group students' self-reported MVPA increased across the first year of the program from 2010 to 2011, while control group's MVPA decreased, respectively. Younger grades had higher self-reported MVPA scores than older grades across the program. Additionally, the change in MVPA was greater in girls' MVPA compared to boys' MVPA from 2011 to 2013. Taken together, the results showed that the overall decrease in the experimental group students' self-reported MVPA was less dramatic than in control group across the school-initiated three-year program.

5.3 Longitudinal Change in Physical Education Enjoyment and Its Relations to Grade and Duration across the School-initiated Program

The third task was to investigate the longitudinal change in PE enjoyment between the experimental group and control group, and related gender differences. Further, the relationships between grade, duration, and PE enjoyment across the school-initiated program. Grade 5 and 6 experimental group students (n = 138) received three years of treatments, Grade 7 and 8 students (n = 255) received one year of treatments, and control group (n = 639) did not receive any treatments across three years of program. Means and standard deviations of students' PE enjoyment scores in the experimental and control groups are presented in Table 5. The mean scores indicated that PE enjoyment was lower in both Grade 5 and 6 experimental and control students' in the end rather than in the beginning of program. Grade 7 and 8 experimental students' PE enjoyment mean scores were higher after the first year of program T1 than in the beginning T0.

TABLE 5 Means and standard deviations of PE enjoyment for experimental and control group students.

	PE Enjoyment (T0)		PE Enjoyment (T1)		PE Enjoyment (T3)	
Group (T0)	M	SD	M	SD	M	SD
Grade 5 (50)	4.24	.77	4.10	.85	3.55	.88
Grade 6 (88)	4.19	.74	4.09	.64	3.79	.91
Grade 7 (124)	3.65	1.08	3.80	1.70	na	na
Grade 8 (131)	3.88	1.05	4.01	.90	na	na
Grade 6* (639)	3.59	1.09	3.78	1.01	3.54	.91

* control group. Sample sizes in parentheses.

On the within-level of MLM model (two-level random regression) (see Figure 4), the relationships between grades, duration, and PE enjoyment across the program were examined. The sum score of PE enjoyment at T0, T1 and T3 were used as students' overall PE enjoyment scores in the analysis. The longitudinal change in PE enjoyment between the experimental and control groups together with girls and boys were studied on the between-level of MLM. Specifically, the between-level analyzed the gender effects and differences in PE enjoyment change between repeated measures T0 to T1, and T1 to T3. In consistent with

the presented self-reported MVPA model, the variable S1 represented grade effect and the dummy variable S2 treatment effect from T0 to T1, and the dummy S3 effect from T1 to T3 measurement points. The residual variances of S1, S2, and S3 were fixed to zero, because the particular variances were statistically non-significant. The parameter estimates and standard errors of the final model are presented in Table 6.

TABLE 6 Non-standardized parameter estimates for the two-level hierarchal model of Grade 5 to 8 students' PE enjoyment.

Parameter estimates	PE Enjoyment		S1 Grade Effect	S2 Duration T0-T1	S3 Duration T1-T3
	Between	Within	Between	Between	Between
Mean			-.117 (.04)**		
Intercept	3.826 (.28)***			.377 (.14)**	.089 (.17)
Variances	.449 (.04)***	.493 (.03)***	0[a]	0[a]	0[a]
β_1	.343 (.08)***			-.095 (.08)	-.061 (.09)
β_2	.393 (.08)***			-.144 (.08)	-.167 (.15)

Standard errors in parentheses. [a] fixed to 0.
β_1 = Gender (1 = girl, 2 = boy), β_2 = School (Experimental = 1, control = 0).
***p < .001, **p < .01, *p < .05.

The results revealed the statistically significant difference in PE enjoyment between girls and boys (β_2 = .343) and the experimental and control school at T0 (β_2 = .393), girls scored higher and the experimental group scored higher than control group at T0. The variance in PE enjoyment variable on the between-level also showed that the enjoyment levels varied between individuals. In addition, the variance on the within-level indicated the variation PE enjoyment across repeated measures.

The results showed that the levels of the experimental students' PE enjoyment were higher than control students' PE enjoyment across the program. Younger students had higher PE scores than older students. Students PE enjoyment increased across the first year of program, although gender and school were not related to the change. To conclude, students' PE enjoyment sustained at the same level across the school-initiated program.

5.4 Effectiveness of Task-involving Climate Treatment and Physical School Environment Treatment on Students' Self-reported MVPA (Study IV)

The fourth task was conducted to examine the total effects of the specified treatments (task-involving climate treatment and physical school environment treatment) on Grade 7 experimental and control students' self-reported MVPA across a one-year participation (T1 to T2) (Figure 5). Table 7 presents Pearson's correlation coefficients, means, standard deviations, and Cronbach's alphas. The correlation coefficients showed either negligible or weak positive relationships between task-involving climate and ego-involving climate, weak to moderate positive relationships between task and ego orientation, and moderate to strong positive relationships between self-reported MVPA at grades 7 and 8. In addition, the Bonferroni-corrected (significance level of .006) independent t-tests showed that the control group had higher levels of ego-involving climate at time points T1 ($t(754) = 4.06$, $p < .001$, $d = .30$) and T2 ($t(834) = 2.93$, $p = .004$, $d = .20$), ego orientation at T2 ($t(845) = 2.72$, $p < .001$, $d = .19$), and MVPA at time point T1($t(764) = 2.77$, $p = .006$, $d = .20$). In other words, the control students had a higher ego-involving motivational climate in PE classes and total MVPA at the baseline measures than the experimental group. Additionally, higher ego-involving climate and ego orientation were detected in follow-up measures for the control group. A repeated measures analysis of variance using the treatments (experimental group = 1, control group = 0) as an independent variable and repeated measures of perception of task- and ego-involving climate and MVPA as dependent variables revealed a statistically significant interaction between time and MVPA $F(1,764) = 22.116$, $p < .001$, $\eta^2 = .028$, but no statistically significant effect emerged between time and task-involving climate $F(1,756) = .679$, $p = .410$, $\eta^2 = .001$ or ego-involving climate $F(1,754) = .421$, $p = .519$, $\eta^2 = .001$. This indicates that students' daily MVPA participation changed across the treatment period, but no changes in task- or ego-involving climate emerged.

TABLE 7 Summary of intercorrelations, means, standard deviations, and Cronbach's alpha coefficients for self-reported MVPA, goal orientations, and motivational climate variables.

Variables	1	2	3	4	5	6	7	8	M	SD	α
1 Self-reported MVPA (T1)	-	.85**	.23**	.08	.08	.25**	.14	.08	3.90[a]	1.51	na
2 Self-reported MVPA (T1)	.47**	-	.25**	.05	.11	.26**	.19*	.06	4.07	1.44	na
3 Task Orientation (T2)	.11*	.27**	-	.39**	.26**	.66**	-.09	.09	3.77	.75	.93
4 Ego Orientation (T2)	.09*	.23**	.34**	-	-.12	.20*	.09	.35**	2.76[a]	.87	.94
5 Task-involving Climate (T1)	.13*	.14**	.33**	.02	-	.48**	-.13	-.20*	3.64	.63	.79
6 Task-involving Climate (T2)	.11*	.27**	.60**	.18**	.44**	-	-.10	.19*	3.65	.67	.80
7 Ego-involving Climate (T1)	.08*	.05	-.06	.18***	.10*	.00	-	.26**	2.76[a]	.62	.75
8 Ego-involving Climate (T2)	.01	.08*	.19**	.39**	.05	.28**	.25**	-	2.85[a]	.76	.81
M	4.24	3.86	3.81	3.04	3.59	3.53	2.99	3.04			
SD	1.58	1.75	.85	.95	.74	.81	.72	.83			
α	.91	.91	.94	.95	.99	.70	.98	.75			

Note 1. Intercorrelations for the experimental group (n = 208) are presented above the diagonal and intercorrelations for the control group (n = 639) are presented below the diagonal. Means, standard deviations, and Cronbach's alphas for the experimental group are presented in vertical columns and means, deviations, and Cronbach's alphas for the control group are presented in horizontal columns. **p < .001, *p < .05, [a] stands for the higher means of control group at the Bonferroni-corrected significance level (p =.006). Na = not available.
Note 2. Cronbach's alphas for the experimental group's measurements (time 1): Self-reported MVPA (.92), task orientation (.85), ego orientation (.40), task-involving climate (.65), and ego-involving climate (.40).
Note 3. Cronbach's alphas for the control group's measurements (time 1): Self-reported MVPA (.67), task orientation (.64), ego orientation (.62), task-involving climate (.65), and ego-involving climate (.42).

In order to analyze the specified effects of task-involving climate treatment and physical school environment treatment on Grade 7 experimental and control students' self-reported MVPA across a one-year participation in the school-initiated program, a path model was conducted. To test the theorized model without treatment effects (see Figure 5) a path analysis was conducted (Model

0). Although the χ^2 –test achieved statistical significance (typical in case of large sample sizes) the rest of the fit indicators suggested an appropriate data fit: $\chi^2(22) = 55.680$, $p < .001$, CFI = .97, TLI = .95, RMSEA = .056, 90%, CI [.05, .08]. The study showed that the previous (T1) perceptions of task- and ego-involving ($\beta_{task\text{-}involving} = .49$, $\beta_{ego\text{-}involving} = .27$) climate and MVPA ($\beta = .54$) were significant predictors of subsequent (T2) perceptions of task- and ego-involving climate and MVPA. The effect sizes ranged from weak to moderate explaining 16% to 37% of the variance of students' task and ego orientation and MVPA ($R^2_{task} = .37$, $R^2_{ego} = .16$, $R^2_{MVPA} = .34$). Based on these findings, the current data demonstrated the parallel cause and effect relationship between motivational climate and self-reported MVPA.

To examine the total effects of the treatments on Grade 7 students' self-reported MVPA across one year of program, Model 1 was estimated, in which both treatment effects (task-involving climate treatment and physical school environment treatment) were added into the Model 0 as covariates. The model fit was in acceptable limits: $\chi^2(16) = 32.676$, $p = .003$, CFI = .98, TLI = .98, RMSEA = .044, 90%, CI [.04, .07]. Model 1 had better fit indices and lower AIC and BIC compared to Model 0 indicating that the inclusion of the both task-involving climate treatment and physical school environment treatment effected on students' self-reported MVPA. Regression coefficients showed that treatments had a weak negative influence on ego-orientation ($\beta = -.07$), no influence on task-orientation ($\beta = .04$) and moderate effect on MVPA ($\beta = .19$). The effect sizes were moderate ($R^2_{task} = .37$, $R^2_{ego} = .16$, $R^2_{MVPA} = .39$).

To conclude, the model including both task-involving motivational climate treatment and physical school environment treatment indicated to be an effective strategy to prohibit declining levels of students' MVPA participation across one year period. However, the closer examination of the effect of task-involving climate treatment, i.e. the actions to increase MVPA through manipulation of motivational climate in PE emerged a negligible results, yielding only a small negative size effect on students' ego orientation. In turn, physical school environment treatment, i.e. providing students increased opportunities for school-day physical activities, had a stronger effect on the declining levels of students' MVPA participation across a one-year period. All fit indices and the model parameter estimates are presented in Table 8.

TABLE 8 Regression and correlation coefficients for the path models.

Parameter Estimates	**Model 0**	**Model 1**
	Standardized Values (β)	Standardized Values (β)
Regression Coefficients		
TC (T1) -> TC (T2)	.49(.03)***	.48(.03)***
TC (T1) -> EC (T2)	.01(.04)	-.02(.04)
EC (T1) -> EC (T2)	.27(.05)***	.27(.05)***
EC (T1) -> TC (T2)	-.05(.04)	-.05(.04)
TC (T2) -> Task (T2)	.60(.03)***	.61(.03)***
TC (T2) -> Ego (T2)	.09(.04)	.05(.04)
EC (T2) -> Ego (T2)	.37(.03)***	.36(.04)***
EC (T2) -> Task (T2)	.02(.03)	.01(.03)
Task (T2) -> PA (T2)	.17(.04)***	.15(.04)***
Ego (T2) -> PA (T2)	.07(.03)*	.07(.03)***
PA (T1) -> PA (T2)	.54(.03)***	.56(.03)***
Treatment Effects		
TE1 -> TC (T2)	ne	.04(.03)
TE1 -> EC (T2)	ne	-.07(.03)*
TE2 -> PA (T2)	ne	19(.02)***
Correlation Coefficients		
TC (T1) – EC (T1)	.03(.03)	.03(.03)
TC (T2) – EC (T2)	.17(.03)***	.16(.03)***
Task (T2) – Ego (T2)	.19(.03)***	.18(.02)***
Fit of the Model	$\chi^2(22) = 55.680$ $p < .001$*** CFI = .97 TLI = .95 RMSEA = .056 90%, CI [.05, .08] AIC = 14,742.710 BIC = 14,894.445	$\chi^2(14) = 32.676$ $p = .003$** CFI = .98 TLI = .98 RMSEA = .044 90%, CI [.04, .07] AIC = 13,602.010 BIC = 13,764.452

*p < .05, **p < .01, ***p < .001. ne = not estimated.

5.5 Motivational Climate, Perceived Physical Competence, Exercise Motivation, and Enjoyment in School Physical Education (Study I)

The fifth task of the study was to investigate the relationships between motivational climate, perceived physical competence, exercise motivation, and PE enjoyment in girls' and boys' regular PE classes utilizing Vallerand's (1997) model of motivational sequence (Figure 6). The path model was conducted only for the control group's girls and boys, because the repeated cross-sectional design in experimental schools did not allow to study the longitudinal relationships between variables in a large sample of Finnish students. Means, standard deviations, internal consistencies between items and Pearson's correlations between variables were examined (Table 9). The results showed that girls' and boys' perceived PE motivational climate was more task-involving than ego-involving. Task-involving climate demonstrated significant positive correlations with enjoyment, intrinsic motivation, extrinsic motivation, and perceived physical competence for both boys and girls. Ego-involving climate did not correlate significantly with any variables for girls but significant correlations were found for boys in both extrinsic motivation and task-involving climate.

TABLE 9 Descriptive statistics, internal consistencies and Pearson´s correlations (girls = 296, boys = 343).

Variable	Gender	M	SD	α	1	2	3	4	5	6
1 Enjoyment	girls	3.47	.92	.92		.49***	.26***	.40***	.41***	.03
	boys	3.54	.76	.87		.44***	.22***	.29***	.45***	-.01
2 Intrinsic motivation	girls	3.13	.79	.96			.64***	.41***	.44***	.02
	boys	3.20	.65	.95			.63***	.39***	.44***	.10
3 Extrinsic motivation	girls	2.75	.76	.90				.37***	.19***	.10
	boys	2.99	.65	.91				.29***	.14**	.16***
4 Perceived physical	girls	3.16	.78	.90					.26***	-.04
competence	boys	3.43	.81	.89					.25***	.09
5 Task-involving climate	girls	3.56	.74	.86						.02
	boys	3.61	.71	.87						.23***
6 Ego-involving climate	girls	2.93	.79	.87						
	boys	3.18	.63	.73						

** p < .01, *** p < .001.

The hypothesized motivational models revealed a non-acceptable fit for the data of girls and boys. The next step was to formulate the most reasonable model for both groups by removing all non-significant path coefficients from the model. The final model had a good fit for the girls' data ($\chi 2 = [4] = 1.514$, $p > 0.05$; RMR = 0.010; RMSEA = 0.000; NFI = 0.99; CFI = 1.0; GFI = 1.0; AGFI = 0.99) and an acceptable fit to the model for the boys' data ($\chi 2 = [3] = 7.188$, $p > 0.05$; RMR = 0.014; RMSEA = 0.064; NFI = 0.97; CFI = 0.98; GFI = 0.99; AGFI = 0.96).

The path model of the girls' data evidenced four statistically significant paths from task-involving motivational climate to PE enjoyment (Figure 7). Firstly, there was a path from task-involving climate via perceived physical competence and intrinsic motivation to PE enjoyment. Secondly, the model revealed a path from task-involving motivational climate via intrinsic motivation to PE enjoyment. Thirdly, a path from task-involving motivational climate via perceived physical competence to PE enjoyment. Finally, there was a direct path from task-involving motivational climate to PE enjoyment. Squared multiple correlations showed that task-involving climate, perceived physical competence, and intrinsic motivation strongly explained the variance in PE enjoyment (.57). Task-involving climate also explained strongly the variance in perceived physical competence (.56). Additionally, both task-involving climate and perceived physical competence strongly explained the variance in intrinsic motivation (.45). The findings supported Vallerand's (1997) model of motivational sequence revealing that task-involving motivational climate predicted PE enjoyment via perceived physical competence and intrinsic motivation in girls.

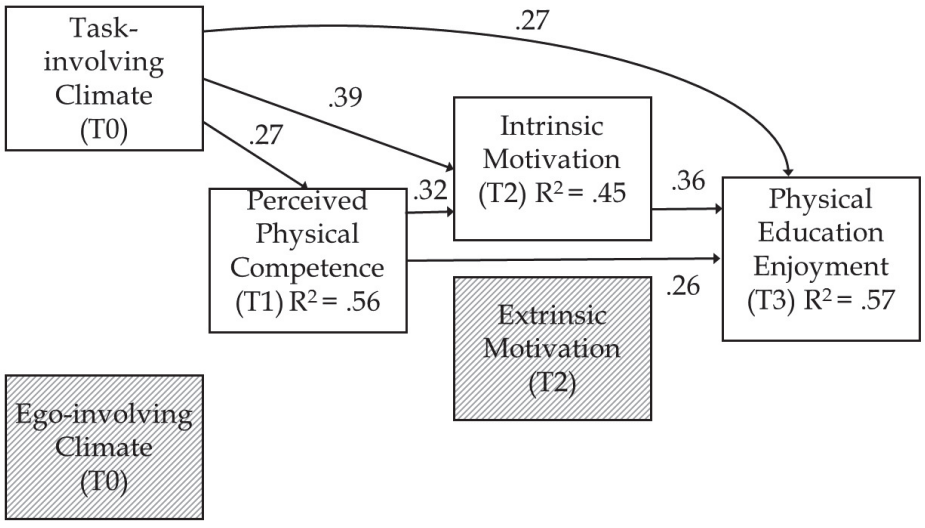


FIGURE 7 Path model of the study variables within girls (n = 296).

The path model of the boys' data revealed four statistically significant paths emanating from task-involving motivational climate (Figure 8). First, a path from task-involving climate via perceived physical competence and intrinsic motivation to PE enjoyment. Secondly, a path from task-involving climate via intrinsic motivation to PE enjoyment. Thirdly, a path from task-involving climate via perceived physical competence to PE enjoyment. Finally, there was also a path from task-involving motivational climate directly to PE enjoyment. Squared multiple correlations for the model showed that task-involving motivational climate, perceived physical competence, and intrinsic motivation strongly explained the variance in PE enjoyment (.41). Task-involving motivational climate also strongly explained the variance in perceived physical competence (.62). Both task-involving motivational climate and perceived physical competence moderately explained the variance in intrinsic motivation (.31). In consistency with the data of girls, the findings supported Vallerand's (1997) model of motivational sequence showing that task-involving motivational climate predicted PE enjoyment through perceived physical competence and intrinsic motivation.

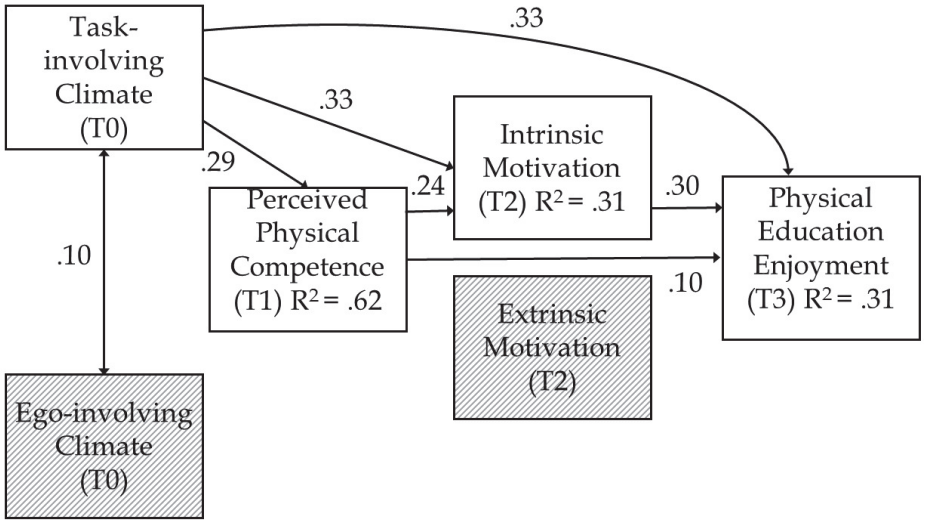


FIGURE 8 Path model of the study variables within boys (n = 343).

5.6 Expectancy Beliefs, Subjective Task Values, Out-of-school MVPA, and MVPA participation in Physical Education Classes (Study III)

The sixth task was to analyze the associations between expectancy beliefs, subjective task values, out-of-school MVPA and MVPA in PE classes in Grade 7 to 9 experimental group's girls and boys. The summary of correlations, means, standard deviations, and Cronbach's alphas for all variables are presented in Table 10. The results highlighted that the associations between expectancy beliefs and MVPA in PE, as well as subjective task values and MVPA in PE were comparatively weak, ranging from negligible to low in both girls and boys. In turn, correlations between expectancy beliefs and subjective task values ranged from moderate to high, indicating that students who scored higher on expectancy beliefs tended to feel PE classes more useful, important and interesting. The relationship between out-of-school MVPA and total MVPA was negative and moderate in boys' data, whereas the relationship was negative and low in girls' data, respectively. In addition, the results showed that girls engaged in up to 26.2% and boys 33.6% of their total weekly MVPA during only two 45-minute PE classes, when out-of-school MVPA was obtained by subtracting PE class activity out of total MVPA. The MANOVA revealed that there were statistically significant differences between girls and boys on expectancy beliefs *(F(1, 5) = 8.09, p < .01)*, attainment value *(F(1, 8) = 7.38, p < .01)*, intrinsic value *(F(1, 14) = 12.78, p < .001)*, utility value *(F(1, 6) = 7.71, < .01)*, MVPA in PE classes *(F(1, 653135) = 11.94, p < .001)*, and out-of-school MVPA *(F(1, 455773) = 4.04, p < .05)*. In brief, expectancy beliefs and subjective task values were higher for boys than girls, especially the interest value. In addition, boys engaged in more MVPA in PE classes than girls. In contrast girls were involved in more out-of-school MVPA than boys.

TABLE 10 Summary of correlations, means, standard deviations, and Cronbach's alpha coefficients for expectancy beliefs, subjective task values, out-of-school MVPA, and MVPA in PE classes.

Variable list	1	2	3	4	5	6	*M*	*SD*	α	Grand *M*
1 Expectancy beliefs	-	.493***	.706***	.612***	-.013	.144	3.61	.82	.91	3.85
2 Attainment value	.896***	-	.554***	.560***	.195	.050	3.22	1.05	.79	3.45
3 Interest value	.758***	.688***	-	.736***	.104	.250	3.66	1.18	.92	3.97
4 Utility value	.632***	.656***	.765***	-	.147	.152	3.65	.93	.79	3.85
5 MVPA[a]	.185	.310	.317	.322*	-	-.126	567.61	161.37	-	651.95
6 MVPA[b]	.041	.055	-.047	-.066	-.551***	-	1595.60	306.68	-	1525.16
M	4.14	3.80	4.45	4.16	736.28	1454.71				
SD	.80	1.02	.85	.80	314.37	376.26				
α	.92	.88	.93	.74	-	-				

Note1. Intercorrelations for girls (n = 58) are presented above the diagonal and intercorrelations for boys (n = 38) are presented below the diagonal. Means, standard deviations, and Cronbach's alphas for girls are presented in vertical columns and means, deviations, and Cronbach's alphas for boys are presented in horizontal columns. Grand mean of the target sample (n = 96) is presented in last vertical column on right. Note 2. [a] Total MVPA in physical education classes (MET minutes), [b] total out-of-school MVPA (MET minutes). ***p < .001, *p < .05.

A stepwise logistic regression analysis of variance was implemented to examine if expectancy beliefs, task values, and out-of-school MVPA predicted MVPA participation in PE classes. Expectancy beliefs, attainment value, interest value, utility value, and out-of-school MVPA were independent variables and MVPA in PE classes was a dependent variable in the analysis. The results of the stepwise logistic regression analysis are shown in Table 11. Results indicated that that MVPA participation in girls' PE classes was predicted by attainment value *(R^2 = .22, B = .76, Odds ratio 2.13, p < .05)*, and in boys' classes by attainment value *(R^2 = .24, B = 1.15, Odds ratio = 3.14, p < .05)* and out-of-school MVPA *(R^2 = .21, B = -.00, Odds ratio = 1.00, p < .05)*. Neither expectancy beliefs, utility value nor intrinsic value were statistically significant predictors of objective MVPA. The model-fit resulted in a *74.1%* correct overall prediction for active or inactive girls in PE classes, and *70.4%* for MVPA participation. Equal analysis of boys revealed 84.2% correct overall prediction, and *92.6%* for MVPA participation. Taken together, stepwise logistic regression analysis showed that MVPA in PE classes was affected by attainment value (importance) in girls' classes, and attainment value and out-of-school MVPA in boys' classes.

TABLE 11 Logistic regression analysis of expectancy beliefs, subjective task values and out-of-school MVPA on MVPA in PE classes.

	R^2	*B*	Exp (B)	SE	Wald	P
Girls (n = 58)						
Constant		.65	1.92	1.75	.14	.710
Attainment value	.22	.76	2.13	.30	6.24	.012*
Boys (n = 38)						
Constant		2.92	18.45	2.79	1.09	.296
Attainment value	.24	1.15	3.14	.50	5.35	.021*
MVPA[a]	.21	-.00	1.00	.00	5.84	.016*

[a] out-of-school, * $p < .05$

5.7 Self-reported and Objectively Measured MVPA in the Samples of Elementary and Secondary School Students (Study II)

The seventh task of the study was to analyze the relationship between objectively measured and self-reported MVPA in two samples, Grade 5 to 6 (n = 61, theoretical n = 229) and Grade 7 to 9 students (n = 96, theoretical n = 341). The elementary school children were measured in two measurement phases, in fall semester 2012 (T2) and spring semester 2013 (T3) in order to examine seasonal variation in children's MVPA. In total 75 children (33% of all Grade 5 to 6 children) were measured. Sixty-one of them worn the accelerometers for a seven-day period and filled in the questionnaire in order to provide equal self-reported scores. The secondary school students were measured in spring semester 2011. A total of 145 students (43% of all secondary school students) were measured, however, ninety-six students received complete data for a seven-day period and provided corresponding self-reported scores. The objective scores (0 to 7 days) were calculated manually out of the data in order to standardize them to be scaled equally with self-reported scores. Tables 12 and 13 present the descriptive statistics of self-reported and objectively measured MVPA for elementary and secondary school students.

TABLE 12 Means, standard deviations, Cronbach's alphas and Pearson's correlation coefficients of self-reported and objectively measured MVPA for elementary school students (n = 61).

Variables	1	2	3	4	M	SD	α	Grand M
1 Self-reported MVPA (T2)	-	.97***	-.21	.23	5.61_a	1.41	.97	5.78
2 Self-reported MVPA (T3)	.94***	-	-.14	.13	5.78_a	1.34	.94	5.80
3 Objective MVPA (T2)	-.11	.26	-	.41*	5.75	1.36	-	5.72
4 Objective MVPA (T3)	-.08	-.05	.49*	-	5.50	2.00	-	5.03
M	5.94	5.81_b	5.69_c	$4.55_{b,c}$				
SD	1.26	1.29	1.39	2.52				
α	.82	.93	-	-				

Note 1. Intercorrelations for girls (n = 32) are presented above the diagonal and intercorrelations for boys (n = 29) are presented below the diagonal. Means, standard deviations, and Cronbach's alphas for the girls' group is presented in vertical columns and means, deviations, and Cronbach's alphas for the boys' group is presented in horizontal columns. Grand mean of the target sample (n = 61) is presented in last vertical column on right.
Note 2. α = Cronbach's alphas for two physical activity items.
Note 3. ***p < .001, *p < .05. $_a$ = significant difference between self-reported scores within group, $_b$ = significant difference between self-reported and objective scores within group, c = significant difference between objective scores within group.

The self-reported and objective scores indicated that elementary school children achieved MVPA at least 60 minutes per day in most days across the seven-day period. For the elementary school girls and boys, the correlation coefficients between self-reported and objectively measured MVPA ranged from weak negative to weak positive. The relationships between two self-reported scores were strong and positive. The correlations between two objectively measured scores were moderate and positive in both girls and boys. Additionally, the Cronbach's alphas for two self-reported items were high at time points T2 and T3 for both girls and boys. The results of independent *t*-tests showed no differences between girls and boys in self-reported or objective scores. However, paired samples *t*-tests revealed that girls were more physically active at T3 than T2 when examining self-reported scores within group ($t(31) = -2.481$, $p < .05$). In contrast, boys received more MVPA at T2 than T3 when using objective scores ($t(28) = 2.948$, $p < .01$). A statistically significant difference was found between boys' self-reported and objective scores at T3 ($t(28) = 2.360$, $p < .05$).

The results highlighted that girls self-reported to be more active in spring than fall, whereas boys were more active in fall than spring when using objective scores. In addition, boys self-reported having higher levels of MVPA compared to objective scores in spring semester.

TABLE 13 Means, standard deviations, Cronbach's alphas and Pearson's correlation coefficients of self-reported and objectively measured MVPA for secondary school students (n = 96).

Variables	1	2	M	SD	α	Grand M
1 Self-reported MVPA (T1)	-	.46***	4.63	1.49	.89	4.73
2 Objective MVPA (T1)	.26	-	4.87	1.70	-	4.84
M	4.84	4.81				
SD	1.63	1.65				
α	.92	-				

Note 1. Intercorrelation for girls (n = 58) are presented above the diagonal and intercorrelation for boys (n = 38) are presented below the diagonal. Means, standard deviations, and Cronbach's alphas for the girls' group is presented in vertical columns and means, deviations, and Cronbach's alphas for the boys' group is presented in horizontal columns. Grand mean of the target sample (n = 96) is presented in last vertical column on right.
Note 2. α = Cronbach's alphas for two physical activity items.
Note 3. ***p < .001.

The self-reported and objective MVPA scores showed that secondary school students received MVPA at least 60 minutes on a daily basis approximately in five out of seven days. The correlation coefficients showed moderate positive relationship between self-reported and objective MVPA in girls and weak positive relationship in boys. Cronbach's alphas for the two self-reported items were considered to be high for both girls and boys. Independent *t*-tests showed no differences between girls and boys in self-reported nor objective scores. Neither paired samples *t*-tests revealed significant differences between self-reports and objective scores within groups.

The current results highlighted that although secondary school girls' mean scores of objective measures were higher than self-reports, no significant differences were detected. Girls' and boys' MVPA was similar in both self-reports and objective measurements within the current sample. Both self-reported and objectively measured MVPA mean scores were lower in secondary than elementary school students, indicating age-related decline in MVPA behavior. However, the current results did not fully support the expectation for the differences between self-reported and objectively measured MVPA, when equal standardized scores were used.

5.8 Percentages of Students Who Engaged in at Least 60 Minutes of MVPA on a Daily Basis (Study II)

The final task of the study was to examine the percentages of experimental group students who met the requirement for minimum 60 minutes of MVPA on a daily basis across the program. Furthermore, the self-reported and objective score based percentages were compared in elementary and secondary school girls and boys. First, the results for self-reported MVPA highlighted that only 11% of girls and 18.9% of boys met the guidelines in the beginning of the program 2010 (Figure 9 and 10). The proportion of physically active girls increased up to 24% and boys up to 32.9% in 2013, although the percentages reached the top of 27.5% for girls and 37.8% for boys in 2012. Based on the self-reported scores the proportion of physically active girls (at least 60 minutes per day) increased 13%-points and boys 14%-points from the beginning of the program 2010 to 2013.

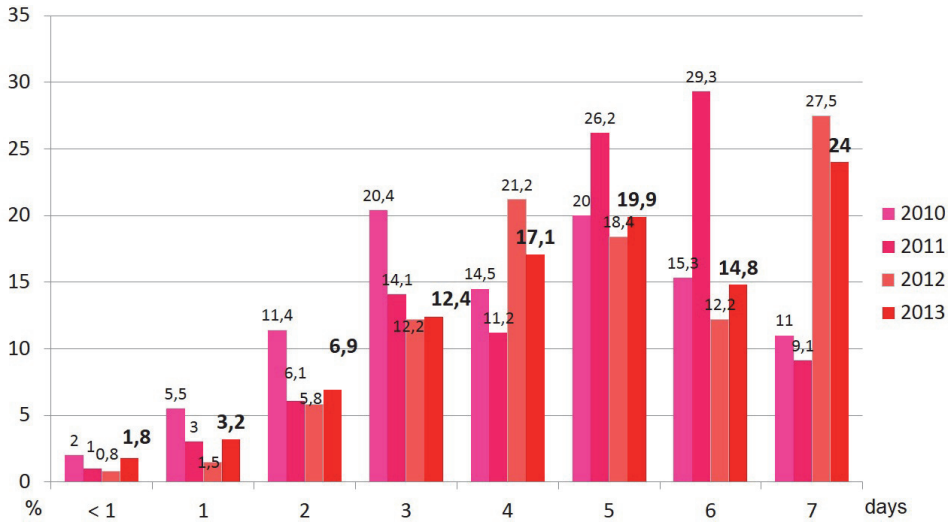


FIGURE 9 The percentages of girls' self-reported MVPA for minimum 60 minutes of MVPA on a daily basis (2010, n = 278; 2011, n = 275; 2012, n = 277; 2013, n = 236).

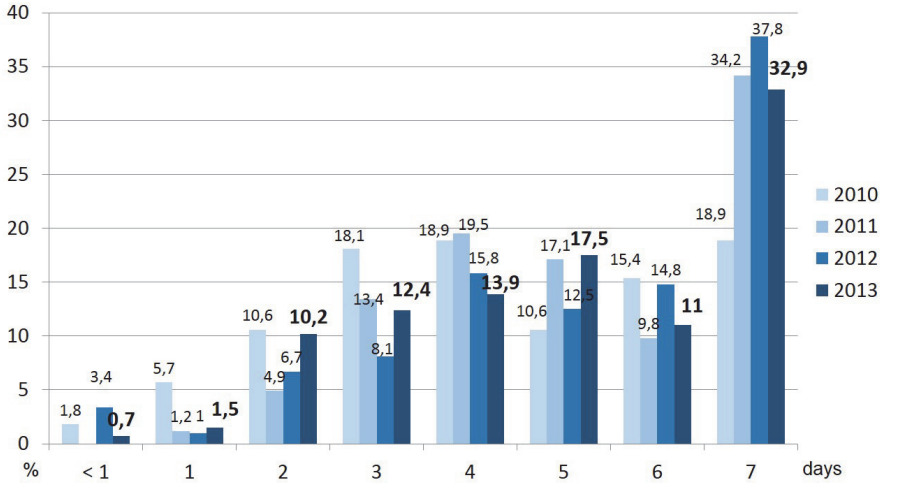


FIGURE 10 The percentages of boys' self-reported MVPA for minimum 60 minutes of MVPA on a daily basis (2010, n = 247; 2011, n = 237; 2012, n = 225; 2013, n = 158).

Finally, the MVPA scores from both self-reports and accelerometers were compared to examine whether the portion of physically active children and youth differed between the measurement methods. The present analysis was completed using the standardized scores presented in Table 12 and 13. In the sample of elementary school children (n = 61), the findings revealed that the portion of physically active girls was smaller when using self-reports (2012, 45.8%; 2013, 44.4%) than accelerometers (2012, 51.9%; 2013, 52.2%). Similarly, the portion of physically active elementary school boys was smaller when self-reported scores (2012, 30.4%; 2013, 38.5%) were compared to the accelerometer scores (2012, 42.3%; 2013, 36.8%). Secondary school students' MVPA scores (2011) indicated that 9.8% of girls and 12.2% of boys met the requirement for minimum 60 minutes of per day when assessed by self-reports. In contrast, objective scores indicated that 34.4% of girls and 17.1% of boys achieved the recommendation. Taken together, a larger portion of the current student sample of Grade 5 to 9 met the guidelines of daily 60 minutes MVPA (World Health Organization, 2010; 2013) on the basis of their objectively measured MVPA results than in relation to their self-reported MVPA.

6 DISCUSSION

6.1 Scales of the Study

The first task of the study was to test the validity and reliability of the PE Enjoyment Scale, the MCPES, the POSQ, the PSPP, the SMS, and the STPQ in the total sample of the study. The results based on the CFAs revealed that the current measures demonstrated adequate validity and reliability. The findings were consistent with the previous Finnish studies using PE Enjoyment Scale (Soini et al., 2007), the MCPES (Soini et al., 2014), the POSQ (Yli-Piipari et al., 2013), the PSPP (Kalaja et al., 2009), and the STPQ (Yli-Piipari, 2011) to measure elementary and secondary school-aged students' relationships of motivational and affective variables and MVPA. Additionally, the SMS scale achieved an acceptable model fit for the present data, when several measurement errors were allowed to correlate. Because the objective was to examine the long-term relationships of motivational climate, physical competence, exercise motivation and PE enjoyment, only the dimensions of intrinsic motivation and extrinsic motivation were used for this purpose. Amotivation was excluded, because the particular results were used to improve the design of the school-based program. From that point of view, amotivation was not an essential dimension. In a previous Finnish study of Kalaja et al. (2009), the findings did not fully support the construct validity of the whole scale. Jaakkola et al. (2008) reported the Finnish PE version of the scale demonstrated adequate internal consistency, when the CFA based indices were not available. It should be noted that the SMS scale used in this study was revised by Pelletier and colleagues (2013), because the original version received some criticism. In the present study the original scale was used, since the revised SMS II scale was not yet available in 2009. Similarly, the correlations between measurement errors of the STPQ items were allowed to correlate. Both the SMS and the STPQ were used in one measurement point. Generally, the results showed that the scales used in the current study were appropriate for the measures of relationships of motivational and affective variables and MVPA.

6.2 Longitudinal Change in Self-reported MVPA and Its Relations to Grade and Duration across the School-initiated Program

The second task was to examine the longitudinal change in self-reported MVPA between the experimental and control groups, and related gender differences. In addition, the relationships of grade, duration, and self-reported MVPA across the school-initiated Sotkamo Physical Activity as Civil Skill Program 2010-2014 were analyzed. According to the reviewed literature, previous interventions implemented on the basis of the Epstein's TARGET model (1989), have not analyzed longitudinal data by predicting students' MVPA scores using multilevel modelling. Instead of mean scores, the present study used the MLM method to examine the longitudinal change in Grade 5 to 8 students' self-reported MVPA across three years of program. In addition, this study investigated students' MVPA patterns adopting the whole school approach and promoting MVPA using a multilevel program over school days across a period of three years.

The results showed that the decrease in the experimental students' self-reported MVPA was smaller than in control group across the three-year program. More precisely, the experimental students' self-reported MVPA increased across the first year of the program, while control group's MVPA decreased. The control group's declining MVPA level was consistent with many previous findings (e.g., Currie et al., 2008; Dumith et al., 2011; Liukkonen et al., 2014. Telford et al., 2013; Troiano et al., 2008; Veitch et al., 2010; Yli-Piipari, 2011). In turn, the experimental students' MVPA remained more or less at the same level across the program. Similarly, previous studies have shown that school-based PA interventions have had positive effects on students' total daily PA (de Bourdeaudhuij et al., 2010; Harrison et al., 2006; Jurg et al., 2006; McManus et al., 2008; Metcalf et al., 2012; Schneider, Dunton, & Cooper, 2008; Pate et al., 2005). The present finding is important, because the program was targeted to all students using the whole school approach across a three-year period. Many previous PA promotions have been targeted to the specific group of elementary (Harrison et al., 2006; Kriemler et al., 2010) or secondary school students (Schneider, Dunton, & Cooper, 2008) or can mainly be considered as short-term interventions (Bowler, 2009; Digelidis et al., 2003), ranging from three weeks to 12 months.

The program provided several actions for students during the school days over three years. Task-involving climate treatment consisted of the actions to increase MVPA through manipulation of motivational climate and supporting perceived physical competence in regular PE classes, while physical school environment treatment provided increased opportunities for school-day physical activities, including extended breaks, access to sport facilities, and equipment supply. In many previous interventions, the additional PE classes have been provided. For instance, in an intervention implemented for Grade 1 and 5 chil-

dren in Switzerland, the program included structuring the three existing PE classes each week and adding two additional classes a week, daily short activity breaks, and PA homework (Kriemler et al., 2010). As part of a Finnish program, targeting all students from Grade 4 to 9, longer school breaks, games during breaks, equipment supply, and an extra 45-minute PE class after school days were provided (Tammelin, Laine, & Turpeinen, 2013). The present findings were promising regarding the positive consequences of the program, in which the additional PE classes were not given.

The results showed also that the change in self-reported MVPA was greater in girls compared to boys from 2011 to 2013. This finding was contrary to previous studies, as boys PA patterns were detected to be higher than girls based on self-reports (Currie et al., 2004; 2008; 2012; Duncan et al., 2007; Tammelin, Laine, & Turpeinen, 2013; Yli-Piipari, 2011). A plausible explanation for the gender difference in MVPA change may be that girls' and boys' school break activity have been found to be different. Previously, participation in physically active play during school breaks declined from elementary to secondary school, from 32% to 4% in Finnish girls and from 45% to 25% in boys (Tammelin, Laine, & Turpeinen, 2013). Because the current program strongly focused on the additional opportunities during the school days, the school-based treatments seemed to especially effect on girls' PA behavior across last two years of program. Additionally, the two-item self-reported scale used in the present study included in-school and out-of-school MVPA. Perhaps, a noticeable change in boys' total self-reported MVPA did not materialize, because in general, boys participate more frequently in sport club activities than girls (Aira et al., 2013). However, the present finding was important, since previous research in school PE emerged that the change in girls MVPA behavior is more challenging to carry out, as they are not as active as boys in terms of total MVPA (e.g., Currie et al., 2004; 2008; 2012; Duncan et al., 2007; Tammelin, Laine, & Turpeinen, 2013; Yli-Piipari, 2011), MVPA in PE classes active transportation to school, and sport club activities (Aira et al., 2013).

Together, the Sotkamo Physical Activity as Civil Skill Program 2010-2014 was effective in order to change the sharp declining pattern of Grade 5 to 9 students' self-reported MVPA to be more positive and less substantial compared to the control group's MVPA pattern across three years of the program. The effects were greater in the experimental groups' girls than boys, especially across the last two years of the program.

6.3 Longitudinal Change in Physical Education Enjoyment and Its Relations to Grade and Duration across the School-initiated Program

The third task was to investigate the longitudinal change in PE enjoyment between the experimental and control group, and related gender differences. Fur-

ther, the relationships of grade, duration, and PE enjoyment across the school-initiated Sotkamo Physical Activity as Civil Skill Program 2010-2014 were studied. The review of previous studies highlighted that to increase students' MVPA levels, it is also important to consider their enjoyment levels related to the PE context. Coulter and Woods (2011) suggested that to elicit change in MVPA behavior of school students it is important to know, what their current behavior patterns are and also their enjoyment levels of the physical activities they partake in. The present study expands the previous findings by investigating the longitudinal change in students' PE enjoyment together with the relationships between grade, duration of school-initiated treatments and PE enjoyment. This latter proposition has not been previously empirically tested.

The results showed that students' PE enjoyment increased across the first year of program in both the experimental and control students. Although, the levels of PE enjoyment were higher in the experimental students than control students, school was not related to the change. The findings did not fully support the conclusion of Wallhead and Buckworth (2004), as they suggested that the enjoyable school-based PA programs for students may encourage youth to become more active also in different PA contexts. In the current study, the difference was not found in PE enjoyment, although in contrast, control groups' total MVPA decreased more than the experimental groups' MVPA. Further, previous interventions found that if they are designed to enhance perceptions of enjoyment, they will also result in maintaining and increasing PA levels in children (Weiss, Corbin, & Pangrazi, 2000). For instance, Dishman et al. (2005) reported that increased enjoyment in PE classes resulted in higher levels of daily PA in a sample of Grade 9 and 10 girls. Considerably, the main goal of the Sotkamo program was to promote total MVPA rather than PE enjoyment. The PE enjoyment scores in both the experimental and control groups were relatively high at the baseline measurement. Perhaps, to increase PE enjoyment may require more additional PE classes to become noticeable. On the other hand, previous PE enjoyment may be more difficult to recall than MVPA, and therefore, more challenging to investigate in terms of longitudinal change than PA behavior. No clear reasons for the differences in the level of the experimental and control school students' PE enjoyment were determined. It still remains unclear, if students' PE enjoyment levels were affected by the variation in local sport facilities and further, opportunities to organize PE classes.

The results also revealed that gender was not related to change in PE enjoyment, although gender differences in change in PE enjoyment were found in a recent longitudinal study of Cairney et al. (2012). The reason behind the similar PE enjoyment patterns in girls and boys may be that Finnish schools are free to determine how to group pupils and PE teachers' are totally independent in order to choose instructional strategies, class activities, and general class structure (Ministry of Education and Culture, 2012). Practically, the Finnish PE teachers can target their teaching practices and strategies for each PE class considering the needs of each PE group.

Despite, another finding regarding differences in PE enjoyment level of grades, with younger students scoring higher than older students, was not surprising. Many previous studies have revealed age-related decline in PE enjoyment (Digelidis & Papaioannou, 1999; Hashim, 2007; Prochaska et al., 2003). Although, the current program consisted of Epstein's TARGET model (1989) elements, PE enjoyment levels of older grades maintained on lower level than enjoyment levels of younger students across the program. For instance, Wallhead and Ntoumanis (2004) found in their intervention that PE enjoyment increased, when students led warm-ups, took responsibility for refereeing and the choice of tactics and team strategies, and were responsible for selecting individuals to fulfil each role of coach, referee, captain, and scorer. The difference between these two studies was that the study of Wallhead and Ntoumanis (2004) provided eight additional PE classes, whereas in this study extra classes were not a part of the program. According to the reviewed literature and current findings, age-related decline in PE enjoyment may require additional PE classes to promote a positive pattern of change to enjoyment.

In brief, although, students' PE enjoyment was sustained at the same level across the Sotkamo Physical Activity as Civil Skill Program, all attempts to increase students' PE enjoyment are valuable, since previous research (Dishman et al., 2005; Prochaska et al., 2003; Sallis, Prochaska, & Taylor, 2000) has consistently showed that PE enjoyment is an essential element underlying the exercise motivation for children and youth to maintain positive engagement in PA in PE (Barr-Anderson et al., 2008; Hashim, Grove, & Whipp, 2008; Ntoumanis, 2002; Standage, Duda, & Ntoumanis, 2005; Wallhead & Buchworth, 2004; Yli-Piipari et al., 2009).

6.4 Effectiveness of Task-involving Climate and Physical School Environment Treatments on Students' Self-reported MVPA

The fourth task examined the total effects of the task-involving climate treatment and physical school environment treatment on Grade 7 experimental and control group students' self-reported MVPA across a one-year participation. According to the findings presented in the previous literature, it was unclear whether students' total daily MVPA can be increased by developing the physical school environment and task-involving climate without additional PE classes. The present study examined the treatment effects across regular PE classes during one school year.

The Sotkamo Physical Activity as Civil Skill Program appeared to be effective as an approach to change the sharp decline in the pattern of Grade 7 students' MVPA across the school year. Specifically, change in the experimental condition students' total MVPA was 13.4 percent higher compared to MVPA of the students in the control condition across one year of program. For comparison, Simon et al. (2004) reported that the additional opportunities for MVPA led

to increases of 18 percent in the active participation of U.S. middle school students over a four-year intervention including in-school and out-of-school activities. In turn, a recent Finnish report of Tammelin, Laine, and Turpeinen (2013) indicated that secondary school students' daily MVPA was sustained at the same level, when longer school breaks, games during breaks, improved equipment access, and an extra 45-minute after school PE class were provided. Several previous multilevel interventions have been evidenced as being effective in changing students' MVPA behavior in school context (Murillo et al., 2013; Sallis & Owen, 1999; Sluijs et al., 2007). Considering that the Sotkamo program provided activities only during the school days, the current increase in total MVPA could be seen as relatively high. In line with the previous school-based interventions (Murillo et al., 2013; Ridgers et al., 2006; Verstraete et al., 2006), inexpensive playground equipment as provided in the current study, encouraged students to be more active. Specifically, exercise equipment (i.e. balls, dance pads, table tennis tools, and floor hockey sticks), structured school days, and usage of exercise facilities were reconfigured to allow an extended daily break for students to participate in the additional physical activities.

The physical school environment treatment had a stronger effect than the task-involving climate treatment. The reason may be that structural changes in school context (extended break, access to sport facilities, and equipment) are easier to facilitate than motivational climate change in PE classes, and in that sense more effective. Although the study showed that the task-involving climate treatment decreased ego-orientation, the treatment did not have a significant effect on students' self-reported MVPA participation. This was unexpected, because previous intervention studies have shown that the manipulations of motivational climate were positively related to students' task orientation in school PE (Digelidis et al., 2003; Jaakkola & Liukkonen, 2006; Wallhead and Ntoumanis, 2004; Weigand & Burton, 2002), MVPA engagement (Braithwaite, Spray, & Warburton, 2011), and MVPA participation in school PE (Papaioaunou et al., 2006). The baseline scores for perceived task-involving climate in both groups could be considered to be relatively high, which may be reason why the change did not materialize.

Alternatively, it may be that a stronger effect of task-involving climate treatment via task orientation should be measured using more specific MVPA measures in the PE context to manifest actual MVPA changes. The present task-involving climate treatment focused on improving PE instruction for all students across a relatively short period. Although, the period of investigation covered the whole academic year, students had only one allotted 90-minute PE class per each week. Hence, the present finding may be a consequence of a relatively small number of PE classes undertaken during the school year. Perhaps, outcomes such as self-reported MVPA of at least 60 minutes per day including school breaks, out-of-school, and PE classes would require more specific measurement method for an appropriate effect via task orientation. In earlier studies task-involving motivational climate was manipulated across relatively intensive periods (e.g., Bowler, 2009; Digelidis et al., 2003; Wallhead & Ntoumanis, 2004).

For instance, in the study of Digelidis et al. (2003), the experimental group had three 45-minute classes per week for each student across the academic year. The intervention of Wallhead and Ntoumanis (2004) was directed toward a certain sport education group of 25 students, who received eight 60-minute basketball classes.

To conclude, the present and previous findings (e.g., Carrell et al., 2005; Schneider Jamner et al., 2004; Simon et al., 2004; Ward, 2011; Webber et al., 2008) provide further impetus to advocate recess and breaks during the school days as a process to improve students' MVPA participation using the multilevel settings (Spence & Lee, 2003). Schools should take advantage of the recess and breaks as means to promote greater MVPA during the school days providing personalized and group activities to all students.

6.5 Motivational Climate, Perceived Physical Competence, Exercise Motivation, and Enjoyment in School Physical Education

The fifth task was to analyze the relationships between motivational climate, perceived physical competence, exercise motivation, and PE enjoyment in girls' and boys' regular PE classes utilizing Vallerand's (1997) motivational sequence model. A review of PE research within children and adolescents reveals there are no reports about studies attempting to test the theoretical assumptions regarding the relationships of motivational climate, perceived physical competence, and exercise motivation on enjoyment in school PE classes. Therefore, the entire psychological mechanism (Vallerand, 1997; Weiss, 2000) underlying PE motivation was investigated to clarify the relationships of motivational climate at Grade 7, perceived physical competence and exercise motivation at Grade 8 on PE enjoyment at Grade 9. The path model was conducted only for the control group, because the repeated cross-sectional design in the experimental schools did not allow the examination of the longitudinal relationships between variables in a large sample of Finnish students. As discussed in the chapter 6.5, longitudinal change in PE enjoyment was not related to the program treatments, consequently, the presented results regarding the relationships between of motivational climate, perceived physical competence, exercise motivation, and PE enjoyment were appropriate to a general representation of Finnish secondary school students.

The results derived from path analyses indicated that task-involving motivational climate predicted PE enjoyment via perceived physical competence and intrinsic motivation in both girls and boys. In particular, the examination supported previous findings associated with the self-determination theory (Deci & Ryan, 1985; 1991; 2000) and the achievement goal theory (Nicholls, 1989) as demonstrated by the linking of task-involving climate in PE to perceived physical competence (Wallhead & Ntoumanis, 2004), intrinsic motivation (Digelidis & Papaioannou, 1999), and PE enjoyment (Digelidis & Papaio-

annou, 2002; Soini, 2006; Wallhead & Ntoumanis, 2004). Additionally, as consistent with previous studies, perceived physical competence was strongly connected with both intrinsic motivation (Ntoumanis, 2001; Ryan & Deci, 2007; Yli-Piipari, 2011) and PE enjoyment (Carroll & Loumidis, 2001; Fairclough, 2003). In accordance with Ferrer-Caja and Weiss (2000), adolescents who report stronger beliefs about their physical competence are more likely to enjoy the activity than adolescents who report lower levels of physical competence. An important notion related to the current results was that PE enjoyment among girls was better explained by task-involving climate via perceived physical competence, and intrinsic motivation than for boys. This finding is dissimilar to the findings of Carroll and Loumidis (2001), as they found that boys scored higher than girls on PE enjoyment in a sample of British Grade 6 students. The possible explanation for the presented gender difference may be that, perhaps, girls and boys perceived motivational climate in PE classes in different ways, since gender differences in perceived motivational climate in PE have been found (Kokkonen, 2003; Soini, 2006).

In contrast, ego-involving motivational climate did not relate to extrinsic motivation either in girls or boys. This finding did not support the model of Vallerand (1997), as ego-involving motivational climate did not significantly influence on the lower level of PE enjoyment. This finding was not completely in line with the study of Ntoumanis (2005), in which he found that task-involving motivational climate was more conducive to the satisfaction of perceived physical competence compared to an ego-involving climate among British adolescents. Standage, Duda, and Ntoumanis (2005) also reported that to a lesser extent, perceptions of ego-involving climate positively impacted mediating variables to foster more autonomous types of exercise motivation. In addition, similar to ego-involving climate, extrinsic motivation did not relate PE enjoyment. This was dissimilar with previous findings of Ntoumanis (2002) and Standage, Duda, and Ntoumanis (2005), in which non-autonomous types of motivation showed to relate to negative outcomes in PE. The possible reason for non-significant relationships between ego-involving climate, extrinsic motivation and PE enjoyment may be due to the study design with several measurement points. In the present study, it was expected that perceived ego-involving climate at Grade 7 would have related to PE enjoyment at Grade 9 via physical competence and intrinsic motivation at Grade 8. Although previous studies (Kalaja et al., 2009; Ntoumanis, 2005; Ommundsen & Eikanger-Kvalo, 2007; Standage, Duda, & Ntoumanis, 2005) gave some support for the Vallerand's model (1997), they were not conducted using several measurement points through entire secondary school years. Perhaps, the significant relationships between ego-involving climate, extrinsic motivation, and PE enjoyment would need a clear cross-sectional study design to be noticeable.

However, the current results provide continuing support for the investigation of Vallerand's model (1997) in the PE setting, and highlight that motivational climate is an area that requires further evaluation as a contributing factor in the improvement of PE classes. Based on Epstein's TARGET model (1989),

task-involving motivational climate structures in PE could be used as a relevant method to promote perceived competence, intrinsic motivation, and PE enjoyment. A better understanding of the role of motivational climate may assist efforts to promote children's and adolescents' PE enjoyment in the school contexts.

6.6 Expectancy Beliefs, Subjective Task Values, Out-of-school MVPA, and MVPA participation in Physical Education Classes

The sixth task was to analyze the associations between expectancy beliefs, subjective task values, out-of-school MVPA and MVPA in PE classes in Grade 7 to 9 girls and boys. The previous Expectancy-value theory based interventions have been considered as potential functions to increase students' MVPA on a daily basis when using self-reported MVPA measures. However, none of the studies used objective devices to assess PE related levels of MVPA. The current study was the first attempt to examine the associations with the accelerometer scores in a sample of Finnish secondary school students. Neither previous reports using objective measure scores from other countries were found.

The results highlighted that the associations between expectancy beliefs and MVPA in PE classes, as well as subjective task values and MVPA in PE classes participation were comparatively weak, ranging from negligible to low. The current findings were unexpected as expectancy-related beliefs and subjective task values have been found to be crucial factors in predicting individuals' performance in school PE (Cox &Whaley, 2004; Gao et al., 2009; Xiang, McBride, & Bruene, 2006). A plausible reason for the inconsistent associations may be that two objectively measured 45-minute periods for each student was too limited. In earlier studies, performance was analyzed using more extensive questionnaires (Yli-Piipari, 2011) or via a timed one-mile run (Xiang, McBride, & Bruene, 2006). Yli-Piipari (2011) investigated total MVPA using the protocol of World Health Organization (Currie et. al., 2002; 2004; 2008; 2012), which measured self-reported MVPA across a seven-day period, including both PE and leisure activity. In the running-program study, PE performance was measured using the structured test run, in which the children were encouraged to run as fast as they were able (Xiang, McBride, & Bruene, 2006). The MVPA scores of the current study were derived only from actual PE class activity and students performed without any additional stimulation. Perhaps, the association of beliefs and subjective task values with objective outcomes such as MVPA in PE classes may require a longer period of assessment or several measurement techniques to be fully elucidated.

The associations between expectancy beliefs and subjective task values ranged from moderate to high. The present finding was similar to previous studies concerning PE in secondary school and middle school students (Gao et

al., 2009; Yli-Piipari, 2011). The results indicated that students who scored higher on expectancy-related beliefs in PE classes tended to feel it as more useful, important and interesting than students who scored lower on expectancy beliefs. In other words, if students do well and believe they are competent on the tasks, they view PE classes more useful, important, and interesting (Gao et al., 2009). Both physically active girls and boys valued PE classes as more important than less active students, who valued classes as less important. The current finding was similar to other studies. For example, Xiang, McBride, and Bruene (2006) found that attainment value was more strongly associated with one-mile run performance than intrinsic or utility value in an elementary-school running program. Unexpectedly, in the present study neither expectancy beliefs, intrinsic value, nor utility value achieved significance for secondary school students. The latter finding may be a consequence of a decrease in expectancy beliefs or relatively stable subjective task values across the secondary school years (Yli-Piipari, 2011). The outcomes of these studies were not equivalent, consequently, the corresponding conclusions were restricted on the basis of the findings without additional information. The differences indicate a possibility that expectancy beliefs and subjective task values for MVPA in certain PE classes are different to those that activate students in structured PE programs or overall MVPA across the secondary school years. In addition, out-of-school activities related with boys' MVPA participation in PE classes. This finding was not unexpected, as an earlier study of Flohr, Todd, and Tudor-Locke (2006) highlighted that MVPA participation could be increased by providing enhanced opportunities for out-of-school activities. The other way round, schools should also use PE as a means to promote greater MVPA outside of school (Hagger et al., 2009).

Expectancy beliefs, subjective task values, especially interest value were higher for boys. This pattern was in line with previous findings, in which more physically active students scored higher than less active on expectancy beliefs (Xiang, McBride, & Bruene, 2006; Xiang et al., 2003; Yli-Piipari, 2011), and subjective task values in PE (Eccles et al., 1983; Jacobs et al., 2002; Yli-Piipari, 2011). The reason for gender differences in expectancy beliefs and subjective task values may be the result of participation in gender-appropriate activities whereby expectancy beliefs and subjective task values increase as a result (Shen et al., 2003; Solmon et al., 2003). In the present study, the activities undertaken in PE classes such as volleyball, badminton, and floor hockey may be more appropriate for boys. According to a recent Finnish study (Finnish Sports Federation, 2010), 13 to 18-year-old girls were most likely to participate in gymnastics and dance classes, whereas boys tended to prefer ball games (i.e. soccer, ice or floor hockey), which require relatively high ball handling skills. Stodden et al. (2008) suggested that competence increased the likelihood of participating in different physical activities. Therefore, it was not surprising that boys scored higher on the belief and value variables, as girls and boys tend to value activities that they perceive as gender-oriented or specific (Gao & Xiang, 2008). Additionally, boys engaged in more MVPA in PE classes than girls. This particular result was con-

sistent with earlier findings based on pedometers used to detect overall MVPA in school PE (Flohr, Todd & Tudor-Locke, 2006). In contrast, girls were involved in more out-of-school MVPA than boys. Tammelin, Laine, and Turpeinen (2013) found that Finnish secondary school-aged boys achieved more out-of-school MVPA than girls when using self-reports. Furthermore, Trost et al. (2002) highlighted that for overall MVPA, the magnitudes of the gender differences were small when measured objectively by accelerometers.

However, the major cause of concern arising from the current findings was that girls engaged in 26.2% and boys 33.6% of their weekly MVPA during only two 45-minute PE classes. When out-of-school activity was transformed for total minutes using manufacturer's procedure (5 MET) as the lower limit for MVPA, on average, each student engaged in daily out-of- school MVPA for only 44 minutes. This finding should be considered a concern, especially among the most inactive students.

6.7 Self-reported and Objectively Measured MVPA in the Samples of Elementary and Secondary School Students

The seventh task of the study was to analyze the relationship between objectively measured and self-reported MVPA in two samples, elementary and secondary school students. A review of previous studies using both self-reports and objective measures revealed that lower limits for valid assessments greatly differed from the recommendation of seven-day monitoring, ranging from one to four days. The present study introduces the potential for substantial methodological variation in the published literature, when only students with complete objective data for seven days were entered into the analyses.

The results highlighted that elementary girls self-reported to be more active in spring than fall measurement. This finding was in line with the previous results of Kulmala et al. (2012), who noticed that Finnish 7 to 15-year-old students' objectively measured PA scores were higher in spring than fall measurements. In turn, elementary boys were more active in fall than spring when using objective scores. There was no clear reason for the contrasting differences in boys' fall and girls' spring measurements. One possibility may be that many sport clubs started to operate a new season in fall semester and many of these boys may have been involved in leisure sport activities. On the other hand, many sports, such as ice hockey club finished their season in April, when the measurements were carried out. Overall, the present data was collected in a relatively small town, where walking, biking, and snow based activities are common, and local community and school facilities, including sport and exercise settings, parks, trails, and pathways may promote both girls and boys to be physically active across the different seasons of the year (Sallis et al., 2006). Many earlier studies were conducted in bigger cities where opportunities for MVPA are a lesser focus of the community and natural environments. The

school-based and natural possibilities for MVPA could be considered to be very good for the current sample constituting a possible reason for the seasonal differences between findings. Thus, the local opportunities for recreational sport and non-organized activities may provide a natural explanation for the seasonal variation in boys' MVPA.

The current findings revealed no gender differences in elementary or secondary school students based on MVPA measured using accelerometers and questionnaires, indicating that girls and boys were similarly physically active. This unexpected finding was not in line with previous research that showed boys were physically more active than girls based on both self-reports (Duncan et al., 2004; National Board of Education, 2011; Yli-Piipari, 2011; Currie et al., 2004; 2008) and objectively measured scores (Sherar et al., 2007; Trost et al., 2002). More precisely, both self-reported and objective scores indicated that elementary school children achieved MVPA at least 60 minutes on a daily basis on six days across the seven-day period, whereas secondary school students received MVPA approximately on five out of seven days. These scores were slightly higher than the recent findings of Yli-Piipari (2011), when Finnish Grade 6 students received 60 minutes of MVPA daily on five days per week and Grade 9 on four days per week based on self-reported MVPA scores. The most recent PA study by the National Board of Education (2011) found that the difference between Grade 9 girls' and boys' participation in organized and non-structured sports during leisure time narrowed or disappeared across the time period of 2003-2010. Overall, the current and several previous MVPA assessments (e.g., Sherar et al., 2007; Thompson et al., 2003) indicated a trend in which the gender differences in total MVPA disappeared or were consistently smaller during this age period. Additionally, Sherar and colleagues (2007) reported that gender differences in MVPA reduced across adolescence.

Many investigators have advocated (e.g., Bates, 2006; de Vries et al., 2006; Trost, 2000; Sherar et al., 2007) that objective measures provide more accurate measures of MVPA than self-reported methods in children and adolescents. Overall, the current results did not fully support the expectation for these differences. A limitation highlighted in relation to the PA measurement techniques used with children and youth is that most methods are unable to evaluate multiple dimensions of MVPA at the same time (e.g., frequency, type, intensity, and duration) (Dale, Welk, & Mattews, 2002). Therefore, the use of MVPA measures requires careful scrutiny by researchers when used to observe age-related decline in MVPA. Bates (2006) suggested that the combination of self-reports and objective measures should be used to optimize and enrich the quality of the data on PA behavior. This typically necessitates that research dependent on the highly accurate assessment of MVPA would require the use of multiple approaches.

To fully understand gender disparities in PA behavior, consideration must be given to the confounding effects of physical development, because boys attain biological maturity later than girls. In that sense, PA of girls and boys observed in early adolescence are not directly comparable (Sherar et al., 2007). De-

spite this, it remains unclear as to why gender differences in elementary school children did not materialize, as variation has been detected in many previous studies (Yli-Piipari, 2011; Currie et al., 2004; 2008; 2012). One reason may be the small number of participants, since it is impossible to confirm if the participants represented the primary or average active proportion of children. Since, the review of previous studies revealed that lower limits for MVPA assessments greatly differed from the recommendation of seven-day monitoring (Trost, McIver, & Pate, 2005), ranging from one to four days, the current results provide important preliminary insights into the elementary and secondary school students total MVPA on the daily basis.

6.8 Percentages of Students Who Engaged in at Least 60 minutes of MVPA on a Daily basis across the School-initiated Program

The eighth task of the study was to examine the percentages of the experimental students who met the requirement for minimum 60 minutes of MVPA on a daily basis across the program. According to the presented literature, international guidelines propose that all children and youth should engage themselves in 60 minutes of daily MVPA to accrue necessary health benefits (World Health Organization, 2010; 2013). However, less than one third of 13-year-olds in most Western countries meet the recommendation PA (Currie et al., 2008; 2012; Yli-Piipari, 2011). Thus, the present study examined if the percentages of physically active girls and boys increased across the school-initiated program.

The findings based on the self-reported scores for MVPA highlighted that the proportion of physically active (at least 60 minutes per day) Grade 5 to 9 experimental students increased from the beginning of the program 2010 to 2013. Only 11% of girls and 19% of boys met the guidelines in the beginning of the program 2010. The percentages of physically active adolescents were considerably lower compared to the large study of World Health Organization (Currie et al., 2012), in which 18% of Finnish 11 to 15 year-old girls and 30% of boys met the recommendation. However, the proportion of physically active girls increased 13 percentage-points and boys 14 percentage-points from the beginning of the program 2010 to 2013. It is difficult to point at one clear reason that increased the percentages, in general, the actions to increase students' MVPA by promoting motivational climate and physical competence in PE and providing increased opportunities for school-day physical activities were effective strategies to prohibit declining levels in the number of physically active students' across the program. The Sotkamo program was successful in order to increase the proportion of physically active students, when the latest measurement revealed that 24% of girls and 33% of boys met the current guidelines. However, the present PA recommendation (Ministry of Education and Culture & Nuori Suomi, 2008; World Health Organization, 2010; 2013) suggests that all

(100%) of elementary and secondary school-aged students should achieve the PA guidelines to accrue necessary health benefits. From this point of view, the percentages of physically active students can still be increased to promote public health.

The results also showed that a larger portion of the current student sample of Grade 5 to 9 met the guidelines of daily 60 minutes MVPA (Currie et al., 2012; World Health Organization, 2010) on the basis of their objectively measured MVPA results than in relation to their self-reported MVPA. No previous studies incorporating standardized scores are available in the samples of Finnish children or adolescents. Similarly, in a large European study involving children and adolescents in Denmark, Portugal, Estonia, and Norway, the majority of boys (82%) and girls (62%) at age 15 achieved the current recommendation of PA, when MVPA was measured using accelerometers worn on the hip over a seven-day period (Riddoch et al., 2004). Furthermore, the findings were in contrast to previous international studies (Shiely & MacDonncha, 2009; Slootmaker et al., 2012), that reported that objectively measured MVPA determined smaller percentages of adolescents that meet the recommendation of daily PA. When compared to the sample of US adolescents (Troiano et al., 2008), in which only 8% of adolescents met the recommendation of MVPA daily by direct measures, the percentage of physically active students based on objective MVPA scores could be considered to be relatively high. Possible reasons for differences between US and European studies may be due to cultural influences or the duration of the monitoring period. The US study included all ethnic groups, and differences in MVPA behavior have been observed based on ethnicity (Biddle, Gorely, & Stensel, 2004; Brodersen et al., 2007). The participants for present analysis were drawn from the native population of Finland. Furthermore, the US data was collected from participants who provided one to four days of accelerometer data, whereas a seven-day monitoring was used in the present study.

This study was completed using standardized scores for both self-reported and objective measured MVPA. Because the current and previous findings indicated substantial differences in the assessment results for similarly aged samples, continuing studies using objectively assessed techniques are required to gain detailed information concerning the MVPA behavior of Finnish children and adolescents. This will extend the limited resource of objectively measured MVPA data gathered from research involving school-aged students. No clear reasons for the differences observed between the present accelerometer and questionnaire scores have as yet been fully determined.

6.9 Practical Implications

Recent evidence from the World Health Organization (2010; 2013) reinforces the strong link between physical activities and continuing positive benefits to health, well-being and weight control among elementary school children and secondary school students of all grades. It remains an almost overwhelming

and difficult challenge for school PE classes to provide young people with sufficient opportunities to achieve the recommended levels of daily MVPA (McKenzie et al., 2004). However, the treatments of the Sotkamo Physical Activity as Civil Skill Program 2010-2014 showed to be effective in order to change the sharp declining pattern of Grade 5 to 9 students' MVPA across three school years. The results of this study yielded following practical implications for school communities and physical educators.

1) Schools could provide increased opportunities for physical activities during school days, for instance a daily extended break of 30 minutes in addition to the lunch break and regular breaks. These structural changes are inexpensive to implement.

2) Schools could allow students to have access to sport facilities during extended and regular breaks. These facilities may be unoccupied for most of the breaks or recess time, when more effective use is recommended.

3) Schools could provide several personalized and group activities in addition to the regular PE classes, such as ballgames and equipment supply. Students should be involved in organization, distribution, and storage.

4) Although, the effect of task-involving climate treatment was low in the current study, several previous interventions based on Epstein's (1989) TARGET model have revealed that school PE could be most effective if based on task-involving motivational climate structures. To enhance students' MVPA engagement in PE classes, the main objective should be increasing students´ perceived physical competence and intrinsic motivation.

5) It is clear that school PE classes alone cannot provide young people with all the physical activity they require (McKenzie et al., 2004). Outcomes of this study support the proposition, the more value and importance students gave to the PE classes, the more MVPA they received across the 90-minute classes and out-of-school activities.

6.10 Limitations and Future Directions

A key strength of this study was the adoption of three main theories and objective scores to measure MVPA. The accelerometers provided unique information about the associations of expectancy beliefs and subjective task values to secondary school students' actual MVPA across PE classes. The scores provided a description of activity levels in conventional PE classes without any confounding factors which might have had a significant effect on scores, for example spe-

cific motivation to exercise. In addition, the present study used multilevel modelling method to examine the longitudinal change in Grade 5 to 8 experimental group and control group girls and boys self-reported MVPA across three years of the program. No other studies were found that have used a similar procedure to measure MVPA as used in the current study. Therefore, the current results provide important preliminary insights into the secondary school students' total MVPA participation including PE classes and out-of-school activities.

This research took place in Finland and the program may not be replicable in other international school contexts just as in Finland, for instance, considering mandatory regular breaks. Although the research plan included experimental and control groups, the sampling process was not randomized and, therefore, the conclusions regarding cause and effect require careful scrutiny. The treatment fidelity was not controlled for in this study. An additional limitation of this study is related to the use of subjective scales to evaluate the main variables. The truthfulness and accuracy of self-reported measures may be compromised because some health and well-being behaviors such as MVPA are difficult to recall and may also be so sensitive that respondents are reluctant to provide exact details. In addition, children and adolescents may purposely under-report or over-report some health and well-being behaviors because they believe engaging in these behaviors is socially undesirable or desirable (Brener, Billy, & Grady, 2003). Moreover, the present study was partly cross-sectional and correlational and, therefore, the associations identified should not be interpreted as cause-effect relationships.

Considering the techniques used for MVPA assessment, Dale, Welk, and Mattews (2002) asserted that any one technique may not detect the full range of dimensions of MVPA such as frequency, type, intensity or duration. The accelerometer based intensity levels for secondary school students may be a reason why a larger portion of students met the recommendation of 60 minutes MVPA per day in the current study. The manufacturer's lower level for moderate PA was 3.5 MET (e.g., walking at 5.6 kph) whereas, for instance, in a study conducted with 8 - 18 year old American children and youth (Harrell et al., 2005) using indirect calorimetry, a level of 3.8 MET was considered to represent moderate PA. Tammelin, Laine, and Turpeinen (2013) reported that the difference between Polar and Actigraph devices in daily MVPA for Finnish elementary school children was 32 minutes and for secondary school students 59 minutes, with Polar monitors scoring higher. Despite this previous contrasting pattern, differences between standardized self-reported and objective MVPA scores were not found in the current sample of elementary school or secondary school students. Apparently, the difference may not occur when standardized MVPA scores are used instead of actual MVPA minutes. Therefore, the present self-reported MVPA scores can be considered reliable based on the comparison of both self-reported and objectively assessed MVPA.

Furthermore, the sample sizes ranged across the study analyses due to the limited economic and practical resources. The current cross-sectional samples of 61 elementary school children and 96 secondary school students for objective

measures were relatively small and all seasonal variations were not possible to measure. In addition, it could be speculated that the children with lowest MVPA levels were not willing to be involved in the objective measurements. Therefore, conclusions regarding national trends in objective measures are restricted based on these findings without additional information.

It is recommended that for future investigations, the teachers' teaching practices could be observed and the students' perceptions of teaching practices surveyed using several methods in order to standardize the practices as accurately as possible. The more efficient use of PE time for MVPA could make a modest contribution to meeting activity guidelines and helping control the epidemic of overweight and obesity in youth (McKenzie et al., 2004). It seems that substantiating a long-term influence on the task-involving motivational climate in regular secondary school PE classes is challenging. This indicates that further multicomponent interventions that include the treatment of task-involving motivational climate are required to clarify the efficacy of this pedagogical strategy in relation to increased MVPA. Specifically, longer than one academic year and considering the psychological and environmental factors associated with change in students' MVPA related behavior.

7 FINDINGS AND CONCLUSIONS

The primary findings of the study were as follows:

1) The Sotkamo Physical Activity as Civil Skill Program 2010-2014 showed to be effective in order to change the declining pattern of Grade 5 to 9 students' self-reported MVPA.

2) Although, Grade 5 to 9 students' PE enjoyment was sustained at the same level across program, all attempts to increase students' PE enjoyment are valuable, since previous research (Dishman et al., 2005; Prochaska et al., 2003; Sallis, Prochaska, & Taylor, 2000) has consistently showed that PE enjoyment is an essential element underlying the exercise motivation for children and youth.

3) Of the various school-initiated promotion methods examined, the greatest effect was seen with the physical school environment treatment, which provided additional opportunities for MVPA across the school days, and access to equipment and facilities during recess and breaks.

4) Both physically active secondary school girls and boys valued PE classes more important than less active students, who valued classes as less important. If students do well and believe they are competent on the tasks, they view PE classes more useful, important, and interesting (Gao et al., 2009).

5) Secondary school boys engaged in more MVPA in PE classes than girls. In contrast, girls were involved in more out-of-school MVPA than boys. However, the major cause of concern arising from the current findings was that girls engaged in up to 26.2% and boys 33.6% of their weekly MVPA during only two 45-minute PE classes.

6) The Sotkamo program was successful in order to increase the proportion of physically active students, when the latest measurement revealed that 24% of girls and 33% of boys met the current guidelines. However, the present recommendation (Ministry of Education and Culture & Nuori Suomi, 2008; World Health Organization, 2010) advises that all school-aged students should achieve the MVPA guidelines. From this point of view, the percentages of physically active students can still be increased to promote public health.

TIIVISTELMÄ

Koululaisten fyysinen aktiivisuus, viihtyminen ja liikuntamotivaatio Liikkumisesta kansalaistaito -ohjelman aikana

Tutkimuksen tarkoituksena oli analysoida 5−9-luokkalaisten koululaisten fyysisen aktiivisuuden kehitystä sekä viihtymisen ja liikuntamotivaation yhteyttä liikuntatunneilla Liikkumisesta kansalaistaito -ohjelman aikana 2010–2013. Liikkumisesta kansalaistaito -ohjelman tavoitteena on lisätä lasten ja nuorten hyvinvointia liikkumisen laadun, määrän sekä puitteiden kehittämisellä. Kontrolliryhmä osallistui tavanomaiseen opetussuunnitelman mukaiseen liikunnanopetukseen. Tutkimuksen päätehtävänä oli tutkia muutoksia koululaisten fyysisessä aktiivisuudessa ja viihtymisessä koe- ja kontrolliryhmän välillä. Lisäksi analysoitiin itseraportoidun ja objektiivisesti mitatun fyysisen aktiivisuuden yhteyttä, koululaisten odotusarvojen ja fyysisen aktiivisuuden yhteyttä liikuntatunneilla sekä päivittäisen liikuntasuosituksen (hengästymistä ja hikoilua aiheuttavaa liikuntaa vähintään 60 minuuttia päivässä) saavuttaneiden koululaisten määrää.

Tutkimukseen osallistui 847 koululaista (422 tyttöä, 425 poikaa) Kainuusta ja Keski-Suomesta. Aineisto kerättiin strukturoiduilla kyselyillä ja objektiivisilla liikunta-aktiivisuusmittareilla neljässä mittauksessa 2010–2013. Tulokset osoittivat, että koululaisten fyysinen aktiivisuus säilyi suhteellisen samalla tasolla tutkimusjakson ajan, kun taas kontrolliryhmän aktiivisuus väheni. Fyysisen kouluympäristön muokkaaminen, pidennetyt välitunnit, liikuntasalin välituntikäyttö, välituntisarjat ja liikuntavälineet lisäsivät koululaisten fyysistä aktiivisuutta kontrolliryhmään verrattuna. Liikuntatunneilla viihtyminen säilyi samalla tasolla niin koe- kuin kontrolliryhmässä. Lisäksi, erityisesti alakoulun pojilla itseraportoidussa ja objektiivisesti mitatussa fyysisessä aktiivisuudessa havaittiin eroja. Kun pojat arvioivat itse omaa liikkumistaan, he saivat korkeamman tuloksen kuin mitattaessa liikkumista objektiivisella liikunta-aktiivisuusmittarilla. Tutkimuksen tuloksista nousi myös huolestuttavia havaintoja, sillä noin kolmasosa yläkoululaisten viikoittaisesta aktiivisuudesta kertyi vain kahden liikuntatunnin aikana, mikä viittaa vähäiseen vapaa-ajan liikuntaan. Terveytensä kannalta riittävästi liikkuvien osuus lisääntyi kuitenkin tutkimuksen aikana. Keväällä 2010 vähintään tunnin päivässä rasittavaan liikuntaan osallistui 11 % tytöistä ja 19 % pojista. Vastaavasti 24 % tytöistä ja 33 % pojista ilmoitti liikkuvansa vähintään 60 minuuttia päivässä keväällä 2013. Fyysisesti aktiivisten määrän lisääntyminen on tuntuva, sillä esimerkiksi WHO:n koululaiskyselyssä 2010 vain 17 % suomalaistytöistä ja 29 % pojista saavutti päivittäisen liikuntasuosituksen.

Tutkimuksen perusteella voidaan sanoa, että monipuolisen välituntitoiminnan lisääminen ja kouluympäristön muokkaaminen fyysistä aktiivisuutta tukevaksi innostaa oppilaita liikkumaan. Koululiikunnan sisältöjä tulisi kehittää yhä enemmän viihtymistä edistäviksi ja kaikille oppilaille tulisi kyetä tarjoamaan kyvykkyyden kokemuksia. Lisäksi toiminnan tulisi olla sellaista, johon

voi itse vaikuttaa. Erityisesti fyysisesti aktiivisten tyttöjen määrä lisääntyi hankkeen aikana. Jatkossa suurin haaste on koululaisten liikunta-aktiivisuuden lisääminen, erityisesti vapaa-ajalla ja liikuntamotivaation säilyttäminen hyväksi havaittuja toimenpiteitä käyttäen.

REFERENCES

Actigraph (2012). *Actilife 6 user's manual*. Pensacola: Actigraph Software Department. Available at http://www.actigraph.com

Aira, T., Kannas, L., Tynjälä, J., Villberg, J., & Kokko, S. (2013). Hiipuva liikunta nuoruusiässä. Drop off-ilmiön aikatrendejä ja kansainvälistä vertailua WHO-koululaistutkimuksen (HBSC Study) aineistoilla 1986–2010. [Diminishing physical activity in adolescence. The time trends and international comparisons of the drop-off phenomena in the 1986-2010 data of Health Behavior in School-aged Children Study]. Jyväskylä: *Publications of Research Center for Health Promotion at University of Jyväskylä 5*.

Alderman, B., Beighle, A., & Pangrazi, R. (2006). Enhancing motivation in physical education. *Journal of Physical Education, Recreation, and Dance* 77(2), 41-45.

Ames, C. (1992). Achievement goal, motivational climate, and motivational processes. In G. Roberts (Ed.) *Motivation in Sport and Exercise* (pp. 161-176). Champaign, IL: Human Kinetics.

Ames, C. & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology* 80(3), 260-267.

Anderson, T. (2003). *An Introduction to multivariate statistical analysis*. New York: Wiley.

Anderson, D. & Dixon, A. (2009). Winning isn't everything. Goal orientation and gender differences in university leisure-skill classes. *Recreational Sports Journal* 33(1), 54-64.

Arbuckle, J. (2007). *Amos 18.0 User's Guide*. Chicago, IL: Amos Development Corporation 1995-2009.

Arvidsson, D., Slinde, F., & Hulthen, L. (2005). Physical activity questionnaire for adolescents validated against doubly labelled water. *European Journal of Clinical Nutrition* 59(3), 376-383.

Barkoukis, V., Tsorbatzoudis, H., & Grouios, G. (2008). Manipulation of motivational climate in physical education: Effects of a 7-month intervention. *European Physical Education Review* 14(3), 376-387.

Baron, L. & Downey, P. (2007). Perceived success and enjoyment in elementary physical education. *Journal of Applied Research on Learning* 1(2), 1-24.

Barr-Anderson, D., Neumark-Sztainer, D., Schmitz, K., Ward, D., Conway, T., Pratt, C., Baggett, C., Lytle, L., & Pate, R. (2008). But I like PE: Factors associated with enjoyment of physical education class in middle school girls. *Research Quarterly for Exercise and Sport* 79(1), 18-27.

Basic Education Act (1992). Helsinki: *Ministry of Education and Culture*, 27.11.1992/1174/§23.

Bates, H. (2006). *Daily physical activity for children and youth: a review and synthesis of the literature*. Edmonton: Canadian Fitness and Lifestyle Research Institute.

Baumeister, R. & Leary, M. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin* 117(3), 497-529.

Biddle, S., Gorely, T., & Stensel, D. (2004). Health-enhancing physical activity and sedentary behavior in children and adolescents. *Journal of Sport Sciences* 22(8), 679-701.

Biddle, S., Wang, C., Chatzisarantis, N., & Spray, C. (2003). Motivation for physical activity in young people: Entity and incremental beliefs about athletic ability. *Journal of Sport Sciences* 21(12), 973-989.

Bowler, M. (2009). The influence of the TARGET motivational climate structures on pupil physical activity levels during year 9 athletics classes. Proceedings from the *British Educational Research Association Annual Conference*, Manchester, 2-5 September 2009.

Braithwaite, R., Spray, C., & Warburton, V. (2011). Motivational climate interventions in physical education: a meta-analysis. *Psychology of Sport and Exercise* 12(6), 628-638.

Brener, N., Billy, J., & Grady, W. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. *Journal of Adolescent Health* 33(6), 436-457.

Brodersen, N., Steptoe, A., Boniface, D., & Wardle, J. (2007). Trends in physical activity and sedentary behaviour in adolescence: Ethnic and socioeconomic differences. *British Journal of Sports and Medicine* 41(3), 140-144.

Browne, M. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen & J. Long (Eds.) *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.

Byrne, B. (2012). Testing change over time. The latent growth curve model. In B. Byrne (Ed.) *Structural equation modelling with Mplus. Basic concepts, applications, and programming* (pp. 313-344). New York: Routledge.

Cairney. J, Kwan, M., Velduizen, S., Hay, J., Bray, S., & Faught, B. (2012). Gender, perceived competence and the enjoyment of physical education in children: a longitudinal examination. *International Journal of Behavioral Nutrition & Physical Activity* 9(3). Published online March 6, 2012.

Carrell, A., Clark, R., Peterson, S., Nemeth, B., Sullivan, J., & Allen, D. (2005). Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program - A randomized controlled study. *Archives Pediatrics & Adolescent Medicine* 159(10), 963-968.

Carroll, B. & Loumidis, J. (2001). Children's perceived competence and enjoyment in physical education and physical activity outside school. *European Physical Education Review* 7(1), 24-43.

Caspersen, C., Powell, K., & Christensen, G. (1985). Physical activity, exercise and physical fitness: definitions and distinctions for health-related research. *Public Health Reports* 100(2), 126-131.

Cervelló, E. & Santos-Rosa, F. (2001). Motivation in sport: An achievement goal perspective in young Spanish recreational athletes. *Perceptual and Motor Skills* 92(2), 527-534.

Chen, A. (2001). A theoretical conceptualization for motivation research in physical education: An integrated perspective. *Quest* 53(1), 35-58.

Christodoulos, A., Douda, H., Polykratis, M., & Tokmakidis, S. (2006). Attitudes toward exercise and physical activity behaviours in Greek school children after a yearlong health education intervention. *British Journal of Sports Medicine* 40(4), 367-371.

Corbin, C., Pangrazi, R., & Le-Masurier, G. (2004). Physical activity for children: Current patterns and guidelines. *The President's Council of Physical Fitness and Sports Research Digest* 5(2), 1-8.

Coulter, M. & Woods, C. (2011). An exploration of children's perceptions and enjoyment of school-based physical activity and physical education. *Journal of Physical Activity & Health* 8(5), 645-654.

Cox, A., Smith, A., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *The Journal of Adolescent Health* 43(5), 506-513.

Cox, A. & Whaley, D. (2004). The influence of task value, expectancies for success, and identity on athletes' achievement behaviors. *Journal of Applied Sport Psychology* 16(2), 103-117.

Currie, C., Samdal, O., Boyce, W., & Smith, B. (2002). *Health behavior in school-aged children: A WHO cross-national study. Research Protocol for the 2001-2002 Survey.* Edinburgh: University of Edinburgh.

Currie, C., Roberts, C., Morgan, A., Smith, R., Settertobulte, W., Samdal, O., & Barnekow, V. (2004). *Health behaviour in school-aged children study (HBSC): International report from the 2001/2002 survey.* Copenhagen: World Health Organization.

Currie, C., Gabhainn, S., Godeau, E., Roberts, C., Smith, R., Currie, D., Picket, W., Richter, M., Morgan, A., & Barkekow, V. (2008). *Inequalities in young people's health. HBSC International report from the 2005/2006 survey.* Copenhagen: World Health Organization.

Currie, C., Zanotti, C., Morgan, A., Currie, D., de Looze, M., Roberts, C., Samdal, O., Smith, O., & Barnekow, V. (2012). Social determinants of health and well-being among young people. *Health behaviour in school-aged children (HBSC) Study: International report from the 2009/2010 survey.* Copenhagen: World Health Organization.

Cury, F., Elliot, A., Da Fonseca, D., & Moller, A. (2006). The social-cognitive model of achievement motivation and the 2 × 2 achievement goal framework. *Journal of Personality and Social Psychology* 90(4), 666–679.

Dale, D., Welk, G., & Mattews, C. (2002). Methods for assessing physical activity and challenges for research. In G. Welk (Ed.) *Physical activity assessments for health-related research* (pp. 19-34). Champaign: Human Kinetics.

de Bourdeaudhuij, I., Maes, L., de Henauw, S., de Vriendt, T., Moreno, L., Kersting, M., Sarri, K., Manios, Y., Widhalm, K., Sjöstrom, M., Ruiz, J., & Haerens, L. (2010). Evaluation of a computer-tailored physical activity intervention in adolescents in six European countries: The Activ-O-Meter in the HELENA intervention study. *Journal of Adolescent Health* 46(5), 458-466.

Deci, E. & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum Press.

Deci, E. & Ryan, R. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.) *Perspectives on motivation: Nebraska Symposium on Motivation* (pp. 237-288). Lincoln, NE: University of Nebraska.

Deci, E. & Ryan, R. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry* 11(4), 227-268.

Deci, E. & Ryan, R. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology* 49(1), 14-23.

Dencker, M. & Andersen, L. (2008). Health-related aspects of objectively measured daily physical activity in children. *Clinical Physiology and Functional Imaging* 28(3), 133-144.

de Vries, S., Bakker, I., Hopman-Rock, M., Hirasing, R., & van Mechelen, W. (2006). Clinimetric review of motion sensors in children and adolescents. *Journal of Clinical Epidemiology* 59(7), 670-680.

Digelidis, N. & Papaioannou, A. (1999). Age -group differences in intrinsic motivation, goal orientations and perceptions of athletic competence, physical appearance and motivational climate in Greek physical education. *Scandinavian Journal of Medicine and Science in Sports* 9, 375 - 380.

Digelidis, N. & Papaioannou, A. (2002). Interactions between effort, enjoyment, perceived motivational climate, and task and ego orientations in physical education classes during a school year. *Ahtlitiki Psychologia* 13, 35-55.

Digelidis, N., Papaioannou, A., Laparidis, K., & Christodoulidis, T. (2003). A one-year intervention in 7th grade physical education classes aiming to change motivational climate and attitudes toward exercise. *Psychology of Sport and Exercise* 4(3), 195-210.

Dishman, R., Motl, R., Saunders, R., Felton, G., Ward, D., & Pate, R. (2005). Enjoyment mediates the effects of a school-based physical activity intervention among adolescent girls. *Medicine and Science in Sports and Exercise* 37(3), 478-487.

Dobbins, M., Husson, H., DeCorby, K., & LaRocca, R. (2013). *School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18.* Hamilton: The Cochrane Collaboration.

Duda, J. (1996). Maximizing motivation in sport and physical education among children and adolescents: The case for greater task involvement. *Quest* 48(3), 290-302.

Duda, J. (2007). Motivation in sport settings. A goal perspective approach. In D. Smith & M. Bar-Eli (Eds.) *Essential Readings in Sport and Exercise Psychology* (pp. 78-93). Champaign, IL: Human Kinetics.

Duda, J. & Balaguer, I. (2007). Coach-created motivational climate. In S. Jowett & D. Lavallee (Eds.) *Social psychology in sport* (pp. 117-130). Champaign, IL: Human Kinetics.

Duda, J. & Ntoumanis, N. (2003). Correlates of achievement goal orientations in physical education. *International Journal of Educational Research* 39(4), 415–436.

Dumith, S., Gigante, D., Domingues, M., & Kohl, H. (2011). Physical activity change during adolescence: a systematic review and a pooled analysis. *International Journal of Epidemiology* 40(3), 1–14.

Duncan, S., Duncan, T., Strycker, L., & Chaumeton, N. (2007). A cohort sequential latent growth model of physical activity from ages 12 to 17 years. *Annals of Behavioral Medicine 33*(1), 80-89.

Duncan, T., Duncan, S., Strycker, L., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications*. Mahwah, NJ: Lawrence Erlbaum Associates.

Eccles, J., Adler, T., Futterman, R., Goff, S., Kaczala, C., Meece, J., & Midglay, C. (1983). Expectancies, values and academic behaviours. In J. Spence (Ed.) *Achievement and achievement motivation* (pp. 75-146). San Francisco, CA: W. H. Freeman.

Eccles, J., Adler, T., & Meece, J. (1984). Sex differences in achievement: a test of alternative theories. *Journal of Personality and Social Psychology* 46(1), 26-43.

Eccles, J. & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology* 53(1), 109-132.

Elliot, A. & Church, M. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology* 72(1), 218-232.

Epstein, J. (1989). Family structures and student motivation: A developmental perspective. In C. Ames & R. Ames (Eds.) *Research on motivation in education* (pp. 259-295). San Diego, CA: Academic Press.

Eston, R., Rowlands, A., & Ingledew, D. (1998). Validity of heart rate, pedometry, and accelerometry for predicting the energy cost of children's activities. *Journal of Applied Physiology* 84(1), 362-371.

European Commission (2013). *Physical education and sport at school in Europe Eurydice report*. Luxembourg: Publications Office of the European Union.

Fairclough, S. (2003). Physical activity, perceived competence and enjoyment during secondary school physical education. *The European Journal of Physical Education* 8(1), 5-18.

Fairclough, S. & Stratton, G. (2006). A review of physical activity levels during elementary school physical education. *Journal of Teaching in Physical Education* 25(2), 239-257.

Ferrer-Caja, E. & Weiss, M. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport* 71(3), 267-279.

Finnish Sports Federation (2010). *National survey of sport and exercise 2009-2010.* Available at http://slu-fi- bin.directo.fi

Flohr, J., Todd, K., & Tudor-Locke, C. (2006). Pedometer assessed physical activity in young adolescents. *Research Quarterly for Exercise & Sport* 77(3), 309-315.

Flores, J., Salguero, A., & Márquez, S. (2008). Goal orientations and perceptions of the motivational climate in physical education classes among Colombian students. *Teaching & Teacher Education* 24(6), 1441–1449.

Fox K. & Corbin C. (1989). The physical self-perception profile: development and preliminary validation. *Journal of Sport and Exercise Psychology* 11(4), 408 - 430.

Freedson, P., Pober, D., & Janz, K. (2005). Calibration of accelerometer output for children. *Medicine & Science in Sports & Exercise* 37(11), 523–530.

Gao, Z., Lee, A., Solmon, M., & Zhang, T. (2009). Changes in middle school students' motivation toward physical education over one school year. *Journal of Teaching in Physical Education* 28(4), 378-399.

Gao, Z. & Xiang, P. (2008). College students' motivation toward weight training: an application of expectancy-value model. *Journal of Teaching in Physical Education* 27(3), 399-415.

Garcia Bengoechea, E., Sabiston, C., Ahmed, R., & Farnoush, M. (2010). Exploring links to unorganized and organized physical activity during adolescence: The role of gender, socioeconomic status, weight status, and enjoyment of physical education. *Research Quarterly for Exercise and Sport* 81(1), 7-16.

Gordon-Larsen, P., McMurray, R., & Popkin, B. (2000). Determinants of adolescent physical activity and inactivity patterns. *Pediatrics* 105(6), 83-93.

Hagger, M. (2014). *An integrated multi-theory model to explain the processes of motivational transfer across contexts*. Doctoral thesis, University of Jyväskylä.

Hagger, M. & Chatzisarantis, N. (2007). The trans-contextual model of motivation. In M. Hagger & N. Chatzisarantis (Eds.) *Intrinsic motivation and self-determination in exercise and sport* (pp. 53-70). Champaign: Human Kinetics.

Hagger, M., Chatzisarantis, N., Hein, V., Pihu, M., Soós, I., Karsai, I., & Lee-mans, S. (2009). Teacher, peer, and parent autonomy support in physical education and leisure-time physical activity: A trans-contextual model of motivation in four cultures. *Psychology & Health* 24(6), 689-711.

Hagger, M., Chatzisarantis, N., Culverhouse, T., & Biddle, S. (2003). The process by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology 95*(4), 784-795.

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate Data Analysis*. Upper Saddle River, NJ: Prentice-Hall.

Harrell, J., McMurray, R., Baggett, C., Pennell, M., Pearce, P., & Bang-diva S. (2005). Energy costs of physical activities in children and adolescents. *Medicine and Science in Sports and Exercise* 37(2), 329-336.

Harrison, M., Burns, C., McGuiness, M., Heslin, J., & Murphy, N. (2006). Influence of a health education intervention on physical activity and screen time in primary school children: "Switch Off–Get Active". *Journal of Science and Medicine in Sport* 9(5), 388-394.

Hashim, H. (2007). *Components of enjoyment in physical education*. Doctoral thesis, The University of Western Australia.

Hashim, H., Grove, J., & Whipp, P. (2008). Validating the youth sport enjoyment construct in high school physical education. *Research Quarterly for Exercise and Sport* 79(2), 183-195.

Hox, J. (2002). *Multilevel analysis: Techniques and applications.* Mahwah, NJ: Lawrence Erlbaum Associates Inc.

Hulleman, C., Durik, A., Schweigert, S., & Harackiewicz, J. (2008). Task values, achievement goals, and interest: An integrative analysis. *Journal of Educational Psychology* 100(2), 398-416.

IBM Corporation (2012). *Statistics for Windows Version 21.0*. Armonk, NY: IBM Corp.

Jaakkola, T. (2002). *Changes in students' exercise motivation, goal orientation, and perceived competence as a result of modifications in school physical education teaching practices*. Doctoral thesis, LIKES-Research Center for Sport and Health Sciences 131.

Jaakkola, T. & Liukkonen, J. (2006). Changes in students' self-determined motivation and goal orientation as a result of motivational climate intervention within high school physical education classes. *International journal of Sport and Exercise Psychology* 4(3), 302-324.

Jaakkola, T., Liukkonen, J., Laakso, T., & Ommundsen, Y. (2008). The relationship between situational and contextual self-determined motivation and physical activity intensity as measured by heart rates during ninth grade students' physical education classes. *European Physical Education Review* 14(1), 13-31.

Jacobs, J., Lanza, S., Osgood, D., Eccles, J., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grade one through twelve. *Child Development* 73(2), 509-527.

Jurg, M., Kremers, S., Candel, M., Van Der Val, M., & De Meij, J. (2006). A controlled trial of a school-based environmental intervention to improve physical activity in Dutch children: JUMP-in, kids in motion. *Health Promotion International* 21(4), 320-330.

Kalaja, S. (2012). *Fundamental movement skills, physical activity, and motivation toward Finnish school physical education – A fundamental movement skills intervention.* Doctoral thesis, The University of Jyväskylä.

Kalaja, S., Jaakkola, T., Watt, A., Liukkonen, J., & Ommundsen, Y. (2009). The associations between seventh grade Finnish students' motivational climate, perceived competence, self-determined motivation and fundamental movement skills. *European Physical Education Review* 15(3), 315-335.

Kaplan, D. (1998). Methods for multilevel data analysis. In G. Marcoulides (Ed.) *Modern methods for business research* (pp. 337-358). Mahvah, NJ: Erlbaum.

Kokkonen, J. (2003). *Changes in students' perceptions of task-involving motivational climate, teacher's leadership style, and helping behaviour as a result of modifications in school physical education teaching practices.* Doctoral thesis, LIKES-Research Center for Sport and Health Sciences 138.

Kokkonen, J., Kokkonen, M., Liukkonen, J., & Watt, A. (2010). An examination of goal orientation, sense of coherence, and motivational climate as

predictors of perceived physical competence. *Scandinavian Sport Studies Forum* 1, 133-152.

Kriemler, S., Zahner, L., Schindler, C., Meyer, U., Hartmann, T., Hebestreit, H., Brunner-La Rocca, H., van Mechelen, W., & Puder, J. (2010). Effect of school based physical activity programme (KISS) on fitness and adiposity in primary schoolchildren: cluster randomised controlled trial. *British Medical journal* 340(1). Published online February 24, 2010.

Kulmala, J., Hakonen, H., Siekkinen, K., & Tammelin, T. (2012). Seasonal variation in objectively measured physical activity among Finnish boys and girls aged 7 to 15 years. Proceedings from the *7th European Youth Heart Study Scientific Symbosium,* Madeira, 22-26 October 2012.

Liukkonen, J., Jaakkola, T., Kokko, S., Gråstén, A., Yli-Piipari, S., Koski, P., Tynjälä, J., Soini, A., Ståhl, T., & Tammelin, T. (2014). Results from the Finnish 2014 Report Card on Physical Activity for Children and Youth. *Journal of Physical Activity and Health* (in press).

Lonsdale, C., Sabiston, C., Raedeke, T., Ha, A., & Sum, R. (2009). Self-determined motivation and students' physical activity during structured physical education classes and free choice periods. *Preventive Medicine* 48(1), 69-73.

Loucaides, C., Jago, R., & Charalambous, I. (2009). Promoting physical activity during school break times: piloting a simple, low cost intervention. *Preventive Medicine* 48(4), 332-334.

Lleras, C. (2005). Path analysis. In K. Kempf-Leonard (Ed.) *Encyclopedia of Social Measurement* (pp.25-30). San Diego: Academic Press.

Lytle, L., Murray, D., Evenson, K., Moody, J., Pratt, C., Metcalfe, & L., Parra-Medina, D. (2009). Mediators affecting girls' levels of physical activity outside of school: findings from the trial of activity in adolescent girls. *Annals of Behavioral Medicine* 38(2), 124-136.

Marshall, S. & Welk, G. (2008). Definitions and measurement. In A. Smith, & S. Biddle (Eds.) *Youth physical activity and sedentary behavior* (pp. 3-29). Champaign: Human Kinetics.

Martinez-Gomez, D., Gomez-Martinez, S., Ruiz, J., Diaz, L., Ortega, F., Widhalm, K., Cuenca-Garcia, M., Manios, Y., de Vriendt, T., Molnar, D., Huybrechts, I., Breidenassel, C, Gottrand, F., Plada, M., Moreno, S., Ferrari, M., Moreno, L., Sjöström, M., & Marcos, A. (2012). Objectively-measured and self-reported physical activity and fitness in relation to inflammatory markers in European adolescents: The HELENA Study. *Atherosclerosis* 221(1), 260-267.

McCartney, K., Burchinal, M., & Bub, K. (2006). Best practices in quantitative methods for developmentalists. *Monographs of the Society for Research in Child Development* 71(3).

McKenzie, T. (2002). The use of direct observation to assess physical activity. In G. Welk (Ed.) *Physical activity assessments for health-related research* (pp.179-195). Champaign: Human Kinetics.

McKenzie, T. (2007). The preparation of physical educators: A public health perspective. *Quest* 59(4), 345-357.

McKenzie, T., Sallis, J., Prochaska, J., Conway, T., Marshall, S., & Rosengard, P. (2004). Evaluation of a two-year middle-school physical education intervention: M-SPAN. *Medicine & Science in Sports & Exercise* 36(8), 1382-1388.

McManus, A., Masters, R., Laukkanen, R., Yu, C., Sit, C., & Ling, F. (2008). Using heart-rate feedback to increase physical activity in children. *Preventive Medicine* 47(4), 402-408.

Metcalf, B., Henley, W., & Wilkin, T. (2012). Effectiveness of intervention on physical activity of children: systematic review and meta-analysis of controlled trials with objectively measured outcomes. *British Medical journal* 345(1). Published online September 27, 2012.

Miles, J. (2012). Self-determination theory - Criticisms and critiques of the theory. In J. Miles (Ed.) *Management and Organization Theory* (pp. 233-240). Hoboken, NJ: Wiley.

Ministry of Education and Culture (2012). *Finnish education in a nutshell − Education in Finland.* Espoo: Kopijyvä.

Ministry of Education and Culture & Nuori Suomi (2008). *Fyysisen aktiivisuuden suositukset 7-18-vuotiaille kouikäisille [Recommendations for the physical activity of school-aged children]*. Helsinki: Ministry of Education and Culture and Nuori Suomi ry.

Ministry of Social Affairs and Health (2013). *Adolescent Health and Lifestyle Survey*. Tampere: University of Tampere, School of Health Sciences.

Moore, J., Maloney, H., & Yin, Z. (2007). Differential relationship between subjectively and objectively measured physical activity and psychosocial correlates of physical activity in rural youth. Proceedings of the *135th APHA Annual Meeting and Exposition,* Washington DC, 3-7 November 2007.

Morgan, K. & Carpenter, P. (2002). Effects of manipulating the motivational climate in physical education classes. *European Physical Education Review* 8(3), 207-229.

Murillo, P., García, B., Generelo, L., Bush, P., Zaragoza, C., Julián, C., & García, G. (2013). Promising school-based strategies and intervention guidelines to increase physical activity of adolescents. *Health Education Research* 28(3), 523-538.

Muthén, B. & Khoo, S. (1998). Longitudinal studies of achievement growth using latent variable modeling. *Learning and Individual Differences* 10(2), 73-101.

Muthén, L. & Muthén, B. (1998–2013). *Mplus user's guide sixth edition.* Los Angeles, CA: Muthén & Muthén.

National Board of Education (2004). National core curriculum for basic education 2004. Vammala: Vammalan Kirjapaino Oy.

National Board of Education (2011). A follow-up evaluation of physical education learning outcomes. S. Palomäki & P. Heikinaro-Johansson (Eds.) Koulutuksen serantaraportit 2011/4.

National Board of Education (2013). *Curricula and qualifications*. Available at http://www.oph.fi/english/curricula_and_qualifications/basic_education

National Institute for Health and Welfare (2010). *School Health Promotion Study 2010*. Available at http://info.stakes.fi/kouluterveyskysely/FI/tulokset/index.htm

Nemet, D., Barkan, S., Epstein, Y., Friedland, O., Kowen, G., & Eliakim, A. (2005). Short- and long-term beneficial effects of a combined dietary–behavioral–physical activity intervention for the treatment of childhood obesity. *Pediatrics* 115(4), 443-449.

Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review* 91(3), 328-346.

Nicholls, J. (1989). *The competitive ethos and democratic education*. Cambridge, MA: Harvard University Press.

Nilsson, A., Andersen, L., Ommundsen, Y., Froberg, K., Sardinha, L., Piehl-Aulin, K., & Ekelund, U. (2009). Correlates of objectively assessed physical activity and sedentary time in children: a cross-sectional study (The European Youth Heart Study). *BMC Public Health* 9(9). Published online September 7, 2009.

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Education Psychology* 71(2), 225-242.

Ntoumanis, N. (2002). Motivational clusters in a sample of British physical education classes. *Psychology of Sport and Exercise* 3(3), 177-194.

Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology* 97(3), 444-453.

Ntoumanis, N., Pensgaard, A., Martin, C., & Pipe, K. (2004). An ideographic analysis of amotivation in compulsory school physical education. *Journal of Sport and Exercise Psychology* 26(2), 197-214.

Ommundsen, Y. (2005). Motivation and affect in physical education classes- a self-determination perspective. Active lifestyles: The impact of education and sport. Proceedings from the *AIESEP 2005 World Congress,* Lisbon, November 16-20, 2005.

Ommundsen, Y. & Eikanger-Kvalo, S. (2007). Autonomy-mastery, supportive or performance focused? Different teacher behaviours and pupils' outcomes in physical education. *Scandinavian Journal of Educational Research* 51(4), 385-413.

O'Reilly, E., Tompkins, J., & Gallant, M. (2001). They ought to enjoy physical activity, you know? Struggling with fun in physical education. *Sport, Ecucation and Society* 6(2), 211-221.

Osganian, S., Parcel, G., & Stone, E. (2003). Institutionalization of a school health promotion program: background and rationale of the CATCH-ON study. *Health Education and Behavior* 30(4), 410–417.

Papaioannou, A. (1998). Goal Perspectives, reasons for being disciplined, and self-reported discipline in physical education classes. *Journal of Teaching in Physical Education* 17(4), 421-441.

Papaioannou, A., Bebetsos, E., Theodorakis, Y., Christodoulidis, T., & Kouli, O. (2006). Causal relationships of sport and exercise involvement with goal orientations, perceived competence and intrinsic motivation in physical education: A longitudinal study. *Journal of Sports Sciences* 24(4), 367-382.

Pate, R., Saunders, R., Dishman, R., Addy, C., Dowda, M., & Ward, D. (2007). Long-term effects of a physical activity intervention in high school girls. American *Journal of Preventive Medicine* 33(4), 276-280.

Pate, R., Ward, D., Saunders, R., Felton, G., Dishman, R., & Dowda, M. (2005). Promotion of physical activity among high-school girls: A randomized controlled trial. *American Journal of Public Health* 95(9), 1582-87.

Pelletier, L., Fortier, M., Vallerand, R., Tuson, K., Brière, N., & Blais, M. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sport Motivation Scale (SMS). *Journal of Sport and Exercise Psychology* 17(1), 35 - 53.

Pelletier, L., Rocchi, M., Vallerand, R., Deci, R., & Ryan, R. (2013). Validation of the revised sport motivation scale (SMS-II). *Psychology of Sport and Exercise* 14(3), 329-341.

Pintrich, P. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology* 95(4), 667-686.

Plante, I., O'Keefe, P., & Théorét, M. (2012). The relation between achievement goal and expectancy-value theories in predicting achievement-related outcomes: A test of four theoretical conceptions. *Motivation and Emotion* 37(1), 65-78.

Polar Electro (2011). *Polar Active activity monitor.* Available at http://www.polar.fi/fi/b2b_tuotteet/liikuntakasvatus/aktiivisuudenmittaus/polar_active

Prochaska, J., Sallis, J., & Long, B. (2001). A physical activity screening measure for the use with adolescents in primary care. *Archives of Pediatrics and Adolescent Medicine* 155(5), 554-559.

Prochaska, J., Sallis, J., Slymen, D., & McKenzie, T. (2003). A longitudinal study of children's enjoyment of physical education. *Pediatric Exercise Science* 15(2), 170-178.

Riddoch, C., Andersen, L., Wedderkopp, N., Harro, M., Klasson-Heggebø, L., Sardinha, L., Cooper, A., & Ekelund, U. (2004). Physical activity levels and patterns of 9- and 15-yr-old European children. *Medicine and Science in Sport and Exercise* 36(1), 86-92.

Ridgers, N., Stratton, G., & Fairclough, S. (2006). Physical activity levels of children during school playtime. *Sports Medicine* 36(4), 359-371.

Roberts, G. (2001). Understanding the dynamics of motivation in physical activity: The influence of achievement goals, personal agency beliefs, and

the motivational climate. In G. Roberts (Ed.) *Advances in motivation in sport and exercise.* Champaign, IL: Human Kinetics, 1-50.

Roberts, G., Treasure, D., & Balagué, G. (1998). Achievement goals in sport: The development and validation of the Perception of Success Questionnaire. *Journal of Sports Sciences* 16(4), 337-347.

Rodriguez, G., Beghin, L., Michaud, L., Moreno, L., Turck, D., & Gottrand, F. (2002). Comparison of the TriTrac-R3D accelerometer and a self-reported activity diary with heart rate monitoring for the assessment of energy expenditure in children. *British Journal of Nutrition* 87(6), 623-631.

Rowlands, A. (2007). Accelerometer assessment of physical activity in children: An update. *Pediatric Exercise Science* 19(3), 252-266.

Ryan, R. & Deci, E. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination and will? *Journal of Personality* 74(6), 1557-1586.

Ryan, R. & Deci, E. (2007). Active human nature: Self-determination theory and the promotion and maintenance of sport, exercise, and health. In M. Hagger & N. Chatzisarantis (Eds). *Intrinsic motivation and self-determination in exercise and sport* (pp. 1-19). Champaign, IL: Human Kinetics.

Sallis, J., Cervero, R., Ascher, W., Henderson, K., Kraft, M., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health* 27(1), 297-322.

Sallis, J. & Owen, N. (1999). *Physical Activity and Behavioral Medicine.* Thousand Oaks, CA: Sage.

Sallis, J., Prochaska, J., & Taylor, W. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise* 32(5), 963-975.

Sallis, J., Prochaska, J., Taylor, W., Hill, J., & Geraci, J. (1999). Correlates of physical activity in a national sample of girls and boys in grades 4 through 12. *Health Psychology* 18(4), 410-415.

Salmon, J., Booth, M., Phongsavan, P., Murphy, N., & Timperio, A. (2007). Promoting physical activity participation among children and adolescents. *Epidemiologic Reviews* 29(1), 144-159.

Scanlan. T., Carpenter, P., Schmidt, G., Simons, J., & Keeler, B. (1993). An introduction to the sport commitment model. *Journal of Sport and Exercise Psychology* 15(1), 1-15.

Scanlan, T. & Simmons, J. (1992). The construct of sport enjoyment. In G. Roberts (Ed.) *Motivation in sport and exercise*. Champaign, IL: Human Kinetics, 199-216.

Schneider, M., Dunton, G., & Cooper, D. (2008). Physical activity and physical self-concept among sedentary adolescent females: An intervention study. *Psychology of Sport and Exercise* 9(1), 1-14.

Schneider Jamner, M., Spruijt-Metz, D., Bassin, S., & Cooper, D. (2004). A Controlled evaluation of a school-based intervention to promote physical activity among sedentary adolescent females: Project FAB. *Journal of Adolescent Health* 34(4), 279-289.

Schunk, D., Pintrich, P., & Meece, J. (2008). *Motivation in education: Theory, research, and applications* (3rd ed.). Columbus, OH: Pearson Merrill Prentice Hall.

Shen, B., Chen, A., Tolley, H., & Scrabis, K. (2003). Gender and interest-based motivation in learning dance. *Journal of Teaching in Physical Education* 22(4), 396-409.

Sherar, L., Esliger, D., Baxter-Jones, A., & Trembley, M. (2007). Age and gender differences in youth physical activity: Does physical maturity matter? *Medicine and Science in Sport and Exercise* 39(5), 830-835.

Shiely, F. & MacDonncha, C. (2009). Meeting the international adolescent physical activity guidelines: A comparison of objectively measured and self-reported physical activity levels. *Irish Medical Journal* 102(1), 15-19.

Simon, C., Wagner, A., DiVita, C., Rauscher, E., Klein-Platat, C., Arveiler, D., Scweitzer, B., & Triby, E. (2004). Intervention centred on adolescents' physical activity and sedentary behaviour (ICAPS): concept and 6-month results. *International Journal of Obesity* 28, 96-103.

Sirard, J. & Pate, R. (2001). Physical activity assessment in children and adolescents. *Sports Medicine* 31(6), 439 -454.

Slootmaker, S., Schuit, A., Chinapaw, M., Seidell, J., & Mechelen, W. (2012). Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status. Available at http://www.ijbnpa.org

Sluijs, E., McMinn, A., & Griffin, S. (2007). Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. *British Medical journal* 335(7622).

Soini, M. (2006). *Motivaatioilmaston yhteys yhdeksäsluokkalaisten fyysiseen aktiivisuuteen ja viihtymiseen liikuntatunneilla* [*The relationship of motivational climate to physical activity intensity and enjoyment within ninth grade pupils in school physical education classes*]. Doctoral thesis, University of Jyväskylä.

Soini, M., Liukkonen, J., Jaakkola, T., Leskinen, E., & Rantanen, P. (2007). Motivaatioilmasto ja viihtyminen koululiikunnassa [Motivational climate and enjoyment of physical education in school]. *Liikunta & Tiede* 44(1), 45-51.

Soini, M., Liukkonen, J., Watt, A., Yli-Piipari, S., & Jaakkola, T. (2014). Factorial validity and internal consistency of the motivational climate in physical education scale. *Journal of Sports Science and Medicine* 13(1), 137-144.

Sollerhed, A. & Ejlertsson, G. (2008). Physical benefits of expanded physical education in primary school: findings from a 3-year intervention study in Sweden. *Scandinavian Journal of Medicine and Science in Sports* 18(1), 102-107.

Solmon, M., Lee, A., Belcher, D., Harrison, L., & Wells, L. (2003). Beliefs about gender appropriateness, ability, and competence in physical activity. *Journal of Teaching in Physical Education 22*(3), 261–279.

Sotkamo Physical Activity as Civil Skill Program (2010-2014). European Commission: European Social Fund; 2010. Available at http://www.liikaha.fi/yhteystiedot/liikaha-hanke

Spence, J. & Lee, R. (2003). Toward a comprehensive model of physical activity. *Psychology of Sport and Exercise* 4(1), 7-24.

Standage, M., Duda, J., & Ntoumanis, N. (2003). Predicting motivational regulations in physical education: The interplay between dispositional goal orientations, motivational climate and perceived competence. *Journal of Sports Sciences* 21(8), 631-647.

Standage, M., Duda, J., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology* 75(3), 411-433.

Stodden, D., Goodway, J., Langendorfer, S., Roberton, M., Rudisill, M., Garcia, C., & Garcia, L. (2008). A developmental perspective on the role of motor skill competence in physical activity: an emergent relationship. *Quest* 60(2), 290-306.

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion* 10(4), 282-298.

Strong, W., Malina, R., Blimkie, C., Daniels, S., Rodney, H., Dishman, K., Gutin, B., Hergenroeder, A., Must, A., Nixon, P., Pivarnik, J., Rowland, T., Trost, S., & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *Journal of Pediatrics* 146(6), 732-737.

Stuntz, C. & Weiss, M. (2008). Achievement goal orientations and motivational outcomes in youth sport: The role of social orientations. *Psychology of Sport and Exercise* 10(2), 255-262.

Stuntz, C. & Weiss, M. (2010). Motivating children and adolescents to sustain a physically active lifestyle. *American Journal of Lifestyle Medicine* 4(5), 433-444.

Tabachnick, B. & Fidell, L. (2007). *Using Multivariate Statistics*. Boston: Allyn and Bacon.

Tammelin, T., Laine, K., & Turpeinen, S. (2013). Physical activity of school-aged children. *Research Reports on Sport and Health 272*. Jyväskylä: LIKES.

Taylor, I., Ntoumanis, N., Standage, M., & Spray, C. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. *Journal of Sport and Exercise Psychology* 32(1), 99-120.

Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood and adulthood: a 21-year tracking study. *American Journal of Preventive Medicine* 28(3), 267-73.

Telford, R.M., Telford, R.D., Cunningham, R., Cochrane, T., Davey, R., & Waddington, G. (2013). Longitudinal patterns of physical activity in children aged 8 to 12 years: the LOOK study. *International Journal of Behavioral Nutrition and Physical Activity* 10(1), 81-92.

Theodosiou, A. & Papaioaunou, A. (2006). Motivational climate, achievement goals and metacognitive activity in physical education and exercise involvement in out-of-school settings. *Psychology of Sport and Exercise* 7(4), 361-379.

Thompson, A., Baxter-Jones, A., Mirwald, R., & Bailey, D. (2003). Comparison of physical activity in male and female children: Does maturation matter? *Medicine and Science in Sport and Exercise* 35(10), 1648-1690.

Troiano, R. (2009). Can there be a single best measure of reported physical activity? *The American Journal of Clinical Nutrition* 89(3), 736-737.

Troiano, R., Berrigan, D., Dodd, K., Mâsse, L., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise* 40(1), 181-188.

Trost, S. (2000). Objective measurement of physical activity in youth: Current issues, future directions. *Exercise and Sport Science Reviews* 29(1), 32-36.

Trost, S., McIver, K., & Pate, R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise* 37(11), 531-543.

Trost, S., Pate, R., Sallis, J., Freedson, P., Taylor, W., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise* 34(2), 350-355.

Tudor-Locke, C., Williams, J., Reis, J., & Pluto, D. (2002). Utility of pedometers for assessing physical activity. *Sports Medicine* 32(12), 795-808.

U.S. Department of Health and Human Services (2008). Physical activity guidelines for Americans. Available at http://www.health.gov/paguidelines/pdf/paguide.pdf

Vallerand, R. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. Zanna (Ed.) *Advances in Experimental Social Psychology* (pp. 271-359). New York: Academic Press.

Vallerand, R., Fortier, M., & Guay, F. (1997). Self-determination and persistence in a real-life setting: toward a motivational model of high school dropout. *Journal of Personality and Social Psychology* 72(5), 1161-1176.

Veitch, J., Salmon, J., & Ball, K. (2010). Individual, social and physical environmental correlates of children's active free-play: a cross-sectional study. *International Journal of Behavioral Nutrition & Physical Activity* 7 (11). Published online February 2, 2010.

Verstraete, S., Cardon, G., De Clercq, D., & de Bourdeaudhuij, I. (2006). Increasing children's physical activity levels during recess periods in elementary schools: the effects of providing game equipment. *European Journal of Public Health* 16(4), 415-419.

Virtanen, P. (2011). Measurement of children's physical activity. Development of Polar Active activity monitor. Proceedings from the *International Congress on Enhancement of Physical Activity of Children and Youth,* Vuokatti, 7-9 April 2011.

Wallhead, T. & Buckworth, J. (2004). The role of physical education in the promotion of youth physical activity. *Quest* 56(3), 285-301.

Wallhead, T. & Ntoumanis, N. (2004). Effects of a sport education intervention on students' motivational responses in physical education. *Journal of Teaching in Physical Education* 23(1), 4-18.

Ward, D. (2011). *School Policies on Physical Education and Physical Activity. Research Synthesis.* Princeton, NJ: Robert Wood Johnson Foundation.

Webber, L., Catellier, D., lytle, L., Murray, D., Pratt, C., young, D., Elder, J., Lohman, T., Stevens, J., Jobe, J., & Pate, R. (2008). Promoting physical activity in middle school girls: Trial of activity for adolescent girls. *American Journal of Preventive Medicine* 34(3), 173-184.

Weigand, D. & Burton, S. (2002). Manipulating achievement motivation in physical education by manipulating the motivational climate. *European Journal of Sport Science* 2(1), 1-14.

Weiss, M. (2000). Motivating kids in physical activity. *President's Council on Physical Fitness & Sports Research Digest* 3(11), 1-8.

Weiss, M. (2013). Back to the future: Research trends in youth motivation and physical activity. *Pediatric Exercise Science* 25(4), 561-572.

Weiss, M., Corbin, C., & Pangrazi, B. (2000). Motivating kids in physical activity. *Research Digest President's Council on Physical Fitness and Sports* 3(11).

Welk, G., Wickel, E., Peterson, M., Heitzler, C., Fulton, J., & Potter, L. (2007). Reliability and validity of questions on the youth media campaign longitudinal survey. *Medicine and Science in Sports and Exercise* 39(4), 612-621.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychologist* 6(1), 49–78.

Wigfield, A. & Eccles, J. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology* 25(1), 116-119.

World Health Organization (2010). *Global recommendations on physical activity for health.* Available at: http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf

World Health Organization (2013). *Physical activity*. Available at http://www.who.int/topics/physical_activity/en/

Xiang, P., McBride, R., Guan, J., & Solmon, M. (2003). Children's motivation in elementary physical education: An expectancy-value model of achievement choice. *Research Quarterly for Sport & Exercise* 74(1), 25-35.

Xiang, P., McBride, R., & Bruene, A. (2006). Fourth graders' motivational changes in an elementary physical education running program. *Research Quarterly for Exercise & Sport* 77(2), 195-207.

Yli-Piipari, S. (2011). The development of students' physical education motivation and physical activity: A 3.5-year longitudinal study across Grades 6 to 9. Doctoral thesis, University of Jyväskylä.

Yli-Piipari, S., Leskinen, E., Jaakkola, T., & Liukkonen, J. (2012). Predictive role of physical education motivation: The developmental trajectories of physical activity during grades 7-9. *Research Quarterly for Exercise and Sport* 83*(4), 560-578.*

Yli-Piipari, S., Liukkonen, J., Jaakkola, T., Watt, A., & Nurmi, J-E. (2009). Relationships between physical education students' motivational profiles, enjoyment, state anxiety, and self-reported physical activity. *Journal of Sport Science and Medicine* 8(3), 327-336.

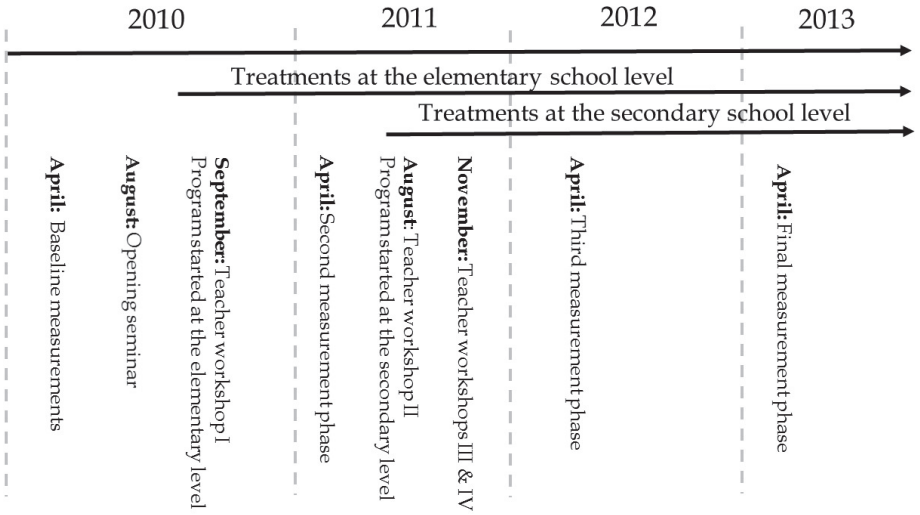
Yli-Piipari, S., Barkoukis, V., Liukkonen, J., & Jaakkola, T. (2013). The effect of physical education cognition and affect in adolescent physical activity: A parallel process latent growth analysis. *Sport, Exercise, and Performance Psychology 2*(1), 15-31.

APPENDICES

Appendix 1. The characteristics of the school-initiated program treatments

The European Union funded Sotkamo Physical Activity as Civil Skill Program took place in Sotkamo, Northwest-Finland in 2010-2014. The cities of Kajaani and Kuhmo were included into the program in 2012-2014. This report comprises the results of the municipality of Sotkamo 2010-2013. The purpose of the following section is to give examples on the program at the teacher-student level. The detailed schedule and characteristics of the program are presented below. Teachers' workshops were organized during the academic year 2010–2011 by the program staff, who controlled the program. Task-involving climate treatment and school physical environment treatment was developed to foster sustainability of school-wide activities during the school days, and started during the academic year 2010-2011. All partners of the program were invited to participate in the general information session organized by the program staff. The schedule of the program is presented in Table 14 and the details of treatments in Table 15.

TABLE 14 The schedule of the Sotkamo Physical Activity as Civil Skill Program from 2010 to 2013.



Teacher workshops

Teacher supplement training was organized as workshops based on the TARGET model of Epstein (1989). The workshops consisted of four training sessions of 90-minute. The program school students were given "Tasks" for self-referenced improvement, the "Authority" to make some decisions such as in

designing activities, effort and improvement was "Recognized" through positive individual feedback where possible, co-operative "Grouping" where teamwork was encouraged, self-referenced "Evaluation", and "Timing" to have multiple attempts at different activities, so instead of waiting for their turn, the activities were organized using multiple scenes for activities. The control group followed a program of activities delivered in the normal way by the PE teacher.

Task-involving climate treatment
1) AUTHORITY and GROUPING: Task-involving and activating teaching practices; students work together within small cooperative group structure, students are responsible for setting up equipment, during class time students dictate the rate of progression through specific practices.
2) TASK: Physical competence and task orientation support; evaluation emphasizes individual improvement, experiences of learning and success.
3) TASK and TIMING: Improving students personal skills; students choose practices from a range of offered practices with the different skill requirements, more activity and less waiting during physical education classes.
4) RECOGNITION and EVALUATION: Positive feedback and encouragement; recognition and feedback is based on the individual progress.

Physical school environment treatment
1) Extended break; daily extended break of 30 minutes in addition to the lunch break and regular breaks,
2) Access to fitness hall; Students were allowed to use fitness facilities during the extended and regular breaks in order to exercise or play games,
3) Controlled ballgames; students were responsible for setting up ballgames and refereeing during extended breaks (i.e., 5 days x 30 minutes x 12 weeks) under the teachers' supervision,
4) Equipment supply; exercise equipment were available to all students during the extended and regular breaks, students were responsible for setting up equipment. The program staff monitored the school breaks twice a month. Furthermore, the active transportation survey was conducted in fall 2011. This act was designed to find out problems in regard to active commuting to the school or out-of-school activities. The teachers and parents were advised to encourage students to choose active transportation to the school and out-of-school activities instead of inactive modes in order to increase total physical activity.

TABLE 15 The contents of the school-initiated treatments.

Object	Method	Duration/amount	Time	Evaluation
Task-involving Climate Treatment				
Teacher Workshops	1) Lecture: Task-involving teaching practices 2) Demo: Task orientation support 3) Demo: Improving students' personal skills 4) Demo: Positive feedback and encouragement	1x 90 min 1x 90 min 1x 90 min 1x 90 min	Sep 2010 Aug 2011 Nov 2011 Nov 2011	Structured self-report form to teachers, Nov 2011 and April 2012
Physical School Environment Treatment				
Recess Activities	1) Extended break 2) Access to fitness hall 3) Controlled ballgames	5x 30 min x 38 wk 5x 30 min x 38 wk 5x 30 min x 12 wk	Sep 2011 to May 2013	Teachers informed project leader twice a month; Project leader monitored the school breaks twice a month
Equipment Supply	1) Dance pad 2) Floor hockey stick 3) Volleyball 4) Basketball 5) Ball bouncer stick 6) Table tennis table 7) Table tennis racket 8) Table tennis ball 8) Disc golf disc	2 pieces 30 pieces 2 pieces 2 pieces 20 pieces 6 pieces 12 pieces 100 pieces 6 pieces	Sep 2011 to May 2013	Students responsible for setting up equipment under teachers' supervision

Appendix 2. The Finnish versions of the scales

Health Behavior in School-aged Children Research Protocol (HBSC)

Seuraavassa kysymyksessä liikunnalla tarkoitetaan kaikkea sellaista toimintaa, joka nostaa sydämen lyöntitiheyttä ja saa sinut hetkeksi hengästymään esimerkiksi urheillessa, ystävien kanssa pelatessa, koulumatkalla tai koulun liikuntatunneilla. Liikuntaa on esimerkiksi juokseminen, ripeä kävely, rullaluistelu, pyöräily, tanssiminen, rullalautailu, uinti, laskettelu, hiihto, jalkapallo, koripallo ja pesäpallo.

Mieti tyypillistä viikkoasi. Merkitse kuinka monena päivänä olet liikkunut vähintään 60 minuuttia päivässä?

□	□	□	□	□	□	□	□
0	1	2	3	4	5	6	7 päivänä

Mieti edellistä 7 päivää. Merkitse kuinka monena päivänä olet liikkunut vähintään 60 minuuttia päivässä?

□	□	□	□	□	□	□	□
0	1	2	3	4	5	6	7 päivänä

Physical Education Enjoyment Scale

Valitse numero, joka parhaiten vastaa käsitystäsi koulun liikuntatunneista.

1 = Täysin eri mieltä…5 = Täysin samaa mieltä

1. Pidän liikuntatunneista	1	2	3	4	5
2. Liikuntatunneilla on hauskaa	1	2	3	4	5
3. Liikuntatunnit tuovat minulle iloa	1	2	3	4	5
4. Nautin liikuntatunneista	1	2	3	4	5

Motivation Climate in Physical Education Scale (MCPES)

Valitse numero, joka parhaiten vastaa käsitystäsi koulun liikuntatunneista.

1 = Täysin eri mieltä…5 = Täysin samaa mieltä

1. Oppilaille on tärkeä yrittää parhaansa liikuntatunneilla	1	2	3	4	5
2. Pääasia on, että kehitymme vuosi vuodelta omissa taidoissamme	1	2	3	4	5
3. Uuden oppiminen kannustaa minua oppimaan yhä enemmän	1	2	3	4	5
4. Oppilaille on tärkeää näyttää muille olevansa parempia liikuntatunneilla kuin toiset	1	2	3	4	5
5. Liikuntatunneilla oppilaat vertaavat suorituksiaan pääsääntöisesti toisten suorituksiin	1	2	3	4	5
6. Oppilaille on tärkeää yrittää parantaa omia taitojaan	1	2	3	4	5
7. On tärkeää jatkaa yrittämistä, vaikka olisi tehnyt virheitä	1	2	3	4	5
8. Oppilaille on tärkeää onnistua muita oppilaita paremmin	1	2	3	4	5
9. Liikuntatunneilla oppilaat kilpailevat suorituksissa toistensa kanssa	1	2	3	4	5

Perception of Success Questionnaire (POSQ)

Liikuntatunneilla tunnen itseni onnistuneimmaksi silloin kun…

1 = Täysin eri mieltä… 5 = Täysin samaa mieltä

1. Voitan toiset	1	2	3	4	5
2. Olen paras	1	2	3	4	5
3. Yritän kovasti	1	2	3	4	5
4. Huomaan todella kehittyväni	1	2	3	4	5
5. Pärjään paremmin kuin toiset	1	2	3	4	5
6. Näytän toisille olevani paras	1	2	3	4	5
7. Voitan vaikeudet	1	2	3	4	5
8. Onnistun sellaisessa, mitä en ole aikaisemmin osannut	1	2	3	4	5
9. Pärjään sellaisessa, jota toiset eivät osaa	1	2	3	4	5
10. Teen kaikkeni parhaan kykyni mukaan	1	2	3	4	5
11. Saavutan itselleni asettamani tavoitteen	1	2	3	4	5
12. Olen selvästi toisia parempi	1	2	3	4	5

Physical Self-Perception Profile (PSPP)

Vastaa seuraaviin itseäsi koskeviin väittämiin mahdollisimman tarkasti. Ympyröi yksi vaihtoehto, joka parhaiten vastaa sinun käsitystäsi.

Olen huono liikunnassa	1 2 3 4 5	Olen hyvä liikunnassa
Kuulun taidoiltani heikoimpiin liikunnassa	1 2 3 4 5	Olen mielestäni yksi parhaista liikunnassa
En luota itseeni urheilutilanteissa	1 2 3 4 5	Olen itsevarma urheilutilanteissa
En kuulu niihin, joita valitaan urheilu-tehtäviin (kilpailut, pelit ym.)	1 2 3 4 5	Kuulun niihin, jotka valitaan urheilu-tehtäviin (kilpailut, pelit ym.)
Vetäydyn taka-alalle, kun tarjoutuu mahdollisuus päästä suorittamaan urheilutehtäviä	1 2 3 4 5	Olen ensimmäisten joukossa, kun tarjoutuu mahdollisuus päästä suorittamaan urheilutehtäviä

Motivational Regulation in Physical Education Scale (SMS)

Syy miksi harrastan liikuntaa tai urheilua koulussa ja/tai vapaa-aikana. Valitse yksi vaihtoehto, joka parhaiten vastaa sinun käsitystäsi.

1 = Täysin eri mieltä…5 = Täysin samaa mieltä

1. Mielihyvän takia, jota saan jännittävistä kokemuksista.....	1	2	3	4	5
2. Mielihyvän takia, jota tunnen kun opin uusia asioita	1	2	3	4	5
3. Mielihyvästä, jota tunnen kun löydän uusia harjoittelutapoja.....	1	2	3	4	5
4. Koska se saa minulle tutut ihmiset arvostamaan minua	1	2	3	4	5
5. Koska mielestäni se on yksi parhaista tavoista tavata ihmisiä.....	1	2	3	4	5
6. Koska olen tyytyväinen, kun opin jonkin vaikean harjoittelutekniikan.....	1	2	3	4	5
7. Koska on todella tarpeellista harrastaa liikuntaa, jos haluaa pysyä kunnossa	1	2	3	4	5

8. Koska olen urheilullisesti lahjakas	1	2	3	4	5
9. Koska se on yksi parhaista valitsemistani tavoista kehittää elämäni muita osa-alueita	1	2	3	4	5
10. Mielihyvästä, jota saan kun parannan heikkoja kohtiani	1	2	3	4	5
11. Jännityksestä, jota tunnen kun osallistun toimintaan	1	2	3	4	5
12. Koska minun täytyy harrastaa liikuntaa, jotta voin olla tyytyväinen itseeni	1	2	3	4	5
13. Koska ihmiset ympärilläni ajattelevat, että on tärkeää pysyä kunnossa	1	2	3	4	5
14. Koska se on hyvä tapa oppia paljon asioita, jotka voivat olla hyödyllisiä elämän muillakin alueilla	1	2	3	4	5
15. Voimakkaiden tunteiden takia, joita tunnen, kun harrastan jotain mistä pidän	1	2	3	4	5
16. Mielihyvästä, jota tunnen vaikean tehtävän suorittamisen jälkeen	1	2	3	4	5
17. Koska tuntuisi pahalta jos minulla ei olisi aikaa tehdä sitä	1	2	3	4	5
18. Näyttääkseni muille kuinka hyvä olen liikunnassa	1	2	3	4	5
19. Mielihyvästä, jota tunnen kun opin tekniikan, jota en ole aikaisemmin yrittänyt	1	2	3	4	5
20. Koska se on yksi parhaista tavoista pitää suhteita yllä ystävieni kanssa	1	2	3	4	5
21. Koska minun täytyy harrastaa liikuntaa säännöllisesti	1	2	3	4	5
22. Mielihyvän tunteesta, jota uusien suoritusmenetelmien löytäminen aikaansaa	1	2	3	4	5
23. Koska pidän tunteesta olla täysin syventynyt toimintaan.	1	2	3	4	5
24. Tyytyväisyydestä, jota koen kun parannan kykyjäni	1	2	3	4	5

Self- and Task-Perception Questionnaire (STPQ)

Vastaa seuraaviin koulun liikuntatunteja koskeviin väittämiin mahdollisimman tarkasti. Valitse yksi vaihtoehto, joka parhaiten vastaa sinun käsitystäsi.

1 = olen huono…5 = olen hyvä

1. Kuinka hyvä olet liikuntatunneilla	1	2	3	4	5
2. Kuinka hyvä olet liikuntatunneilla, kun vertaat itseäsi muihin oppilaisiin	1	2	3	4	5
3. Kuinka hyvä olet liikuntatunneilla, kun vertaat liikuntaa muihin oppiaineisiin	1	2	3	4	5

	1 = huonosti…5 = hyvin				
4. Kuinka hyvin uskot oppivasi uusia taitoja liikuntatunneilla ensi lukuvuonna	1	2	3	4	5
5. Kuinka hyvin uskot pärjääväsi liikuntatunneilla ensi lukuvuonna	1	2	3	4	5

	1 = ei tärkeää…5 = tärkeää				
6. Minulle on tärkeää olla hyvä liikuntatunneilla	1	2	3	4	5
7. Kun vertaat liikuntaa muihin oppiaineisiin, miten tärkeää on olla hyvä juuri liikuntatunneilla	1	2	3	4	5

	1 = vähän… 5 = paljon				
8. Miten mielenkiintoinen oppiaine liikunta on	1	2	3	4	5
9. Miten paljon pidät liikunnasta oppiaineena	1	2	3	4	5
10. Miten hyödyllisinä pidät liikuntatunneilla opittuja taitoja	1	2	3	4	5
11. Kun vertaat liikuntaa muihin oppiaineisiin, miten hyödyllisinä pidät juuri liikuntatunneilla opittuja taitoja	1	2	3	4	5

Appendix 3. The English versions of the scales

Health Behavior in School-aged Children Research Protocol (HBSC)

In the next two questions physical activity means all activities which raise your heart rate or momentarily get you out of breath, for example, in doing exercise, playing with your friends, going to school, or in school physical education classes. Sport also includes, for example, jogging, intensive walking, roller skating, cycling, dancing, skate boarding, swimming, downhill and cross country skiing, soccer, basketball, and baseball.

When you think about your typical week, on how many days are you physically active for a total of at least 60 minutes per day?

□	□	□	□	□	□	□	□
0	1	2	3	4	5	6	7 days

Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?

□	□	□	□	□	□	□	□
0	1	2	3	4	5	6	7 days

Physical Education Enjoyment Scale

Using the scale below, please circle the number that best describes school physical education. In my physical education class…

1 = Strongly disagree…5 = Strongly agree

1. I like physical education classes	1	2	3	4	5
2. Physical education classes are fun	1	2	3	4	5
3. Physical education classes bring me joy	1	2	3	4	5
4. I enjoy physical education classes	1	2	3	4	5

Motivation Climate in Physical Education Scale (MCPES)

Using the scale below, please circle the number that best describes school physical education classes. In my physical education class…

1 = Strongly disagree…5 = Strongly agree

1. It is important for students to try their best during physical education classes	1	2	3	4	5
2. What's most important that we progress every year in our own skills	1	2	3	4	5
3. Learning new skills makes me want to learn more	1	2	3	4	5
4. It is important for students to show that they are better in physical education than others	1	2	3	4	5
5. During physical education classes students compare their performance mainly to that of others	1	2	3	4	5
6. It is important for students to try improve their own skills	1	2	3	4	5
7. It is important to keep trying even though you make mistakes	1	2	3	4	5
8. It is important for students to succeed better than others	1	2	3	4	5
9. During physical education classes students compete with each other in their performance	1	2	3	4	5

Perception of Success Questionnaire (POSQ)

I feel most successful in physical education classes, when…

1 = Strongly disagree…5 = Strongly agree

1. I beat other students	1	2	3	4	5
2. I am the best	1	2	3	4	5
3. I try hard	1	2	3	4	5
4. I really improve	1	2	3	4	5
5. I do better than others	1	2	3	4	5
6. I show other students, I am the best	1	2	3	4	5
7. I overcome difficulties	1	2	3	4	5
8. I succeed at something I could not do before	1	2	3	4	5
9. I accomplish something others cannot do	1	2	3	4	5
10. I perform to the best of my ability	1	2	3	4	5
11. I reach the target I set for myself	1	2	3	4	5
12. I am clearly better than other students	1	2	3	4	5

Physical Self-Perception Profile (PSPP)

Using the scale below, please circle the number that best describes you in physical education. What am I like…

I am good at sport	1 2 3 4 5	I am not good at sport
I am among the best when it comes to athletic ability	1 2 3 4 5	I am not among the best when it comes to athletic ability
I feel confident when participating in sport activities	1 2 3 4 5	I do not feel confident when participating in sport activities
I am among the best when it comes to joining sport activities (games etc.)	1 2 3 4 5	I am not among the best when it comes to joining sport activities (games etc.)
I am among the first to join in sport activities	1 2 3 4 5	I draw back when it comes to join in sport activities

Motivational Regulation in Physical Education Scale (SMS)

Using the scale below, please circle the number that best describes why you currently participate in exercises in physical education or leisure time.

1 = Strongly disagree…5 = Strongly agree

1. For the pleasure I feel in living exciting experiences.....	1	2	3	4	5
2. For the pleasure it gives me to know more about the sport skills that I practice	1	2	3	4	5
3. For the pleasure of discovering new training techniques....	1	2	3	4	5
4. Because it allows me to be well regarded by people that I know.	1	2	3	4	5
5. Because, in my opinion, it is one of the best ways to get acquainted with others.....	1	2	3	4	5
6. Because I feel a lot of personal satisfaction while mastering certain difficult training technique.	1	2	3	4	5
7. Because it is absolutely necessary to do sports if one wants to be in shape.....	1	2	3	4	5

8. For the prestige of being an athlete.	1	2	3	4	5
9. Because it is one of the best ways I have chosen to develop other aspects of myself	1	2	3	4	5
10. For the pleasure I feel when I improve some of my weak points	1	2	3	4	5
11. For the excitement I feel when I'm really involved in the activity	1	2	3	4	5
12. Because I must do sports to feel good about myself.	1	2	3	4	5
13. Because people around me think it is important to be in shape	1	2	3	4	5
14. Because it is a good way to learn lots of things which could be useful to me in other areas of my life	1	2	3	4	5
15. For the intense emotions that I feel when I am doing sports that I like	1	2	3	4	5
16. For the pleasure that I feel when executing certain difficult movements	1	2	3	4	5
17. Because I would feel bad if I was not taking time to do it	1	2	3	4	5
18. To show others how good I am at sport	1	2	3	4	5
19. For the pleasure that I feel when learning skills that I have never tried before	1	2	3	4	5
20. Because it is one of the best ways to maintain good relationships with my school friends	1	2	3	4	5
21. Because I must do sports regularly	1	2	3	4	5
22. For the pleasure of discovering new performance strategies.	1	2	3	4	5
23. I like the feeling of being totally immersed in the activity	1	2	3	4	5
24. For the satisfaction I experience when I am perfecting my abilities	1	2	3	4	5

Self- and Task-Perception Questionnaire (STPQ)

Using the scale below, please circle the number that best describes your perception of physical education classes.

1 = very bad…5 = very good

1. How good are you at physical education classes	1	2	3	4	5
2. Compared to other students, how good are you at physical education classes	1	2	3	4	5
3. Compared to other school subjects, how good are you at physical education classes	1	2	3	4	5

1 = very badly…5 = very well

4. How well do you expect to learn new skills in physical education classes next year	1	2	3	4	5
5. How well do you expect to do in physical education classes next year	1	2	3	4	5

1 = not important at all…5 = very important

6. How important is it to be good at physical education classes	1	2	3	4	5
7. Compared to other school subjects, how important is it to be good at physical education classes	1	2	3	4	5

1 = not at all…5 = very much

8. Do you find physical education as an interesting school subject	1	2	3	4	5
9. How much you like physical education as school subject	1	2	3	4	5
10. How useful is what you learn in physical education classes	1	2	3	4	5
11. Compared to other school subjects, how useful is what you learn in physical education classes	1	2	3	4	5

Appendix 4. Parental consent in Finnish

Euroopan unioni
Euroopan sosiaalirahasto

TIEDOTE TUTKITTAVALLE – KOULULAISET JA HUOLTAJAT

Liikkumisesta kansalaistaito

Arvoisa vastaanottaja,

Pyydämme Teitä tutustumaan tähän tiedotteeseen, jossa kerrotaan Liikkumisesta kansalaistaito –hankkeeseen liittyvästä tutkimuksesta. Tutkimushankkeesta vastaavat tutkija Arto Gråstén ja professori Jarmo Liukkonen Jyväskylän yliopistosta sekä tutkijat Leila Karhunen ja Tanja Tilles-Tirkkonen Itä-Suomen yliopistosta. Tutkimus tehdään yhteistyössä Sotkamon kunnan kanssa.

Tutkimuksen kohderyhmänä ovat Sotkamon kunnan 5–9-luokkien oppilaat.

Tutustuttuanne tähän tiedotteeseen pyydämme Teiltä, koululaiselta ja huoltajalta suostumusta koululaisen osallistumisesta tutkimukseen. Mikäli teillä on kysyttävää tutkimuksesta, ottakaa yhteyttä meihin joko itse tai opettajan välityksellä (yhteystiedot tiedotteen lopussa).

Tutkimuksen tarkoitus

Tutkimuksen tarkoituksena on selvittää lasten ja nuorten liikunta- ja ruokailutottumuksia sekä niiden yhteyttä muihin hyvinvointiin liittyviin elämäntapoihin. Tutkimuksesta saadaan tärkeää tietoa, jota voidaan käyttää kehitettäessä uudenlaisia menetelmiä lasten ja nuorten hyvinvoinnin edistämiseksi.

Tutkimuksen kulku

Liikunta- ja ruokailutottumuksia ja muita elämäntapoja sekä niihin vaikuttavia asioita selvitetään kysymyslomakkeen avulla 2010–2014. Kysymyslomake täytetään koulussa kevään kunkin lukuvuoden syksyn tai kevään aikana. Koulun liikuntatunneilla mitataan fyysistä toimintakykyä ja aktiivisuutta. Osalta oppilaista mita-

taan fyysistä aktiivisuutta objektiivisen aktiivisuusmittarin avulla viikon ajan pari kertaa lukuvuodessa.

Tutkimukseen liittyvät hyödyt ja riskit

Tutkimukseen osallistumiseen ei liity erityisiä riskejä. Tutkimuksen myötä on mahdollista miettiä omia ja perheen ruokailutottumuksia ja saada niihin mahdollisesti uutta näkökulmaa. Lisäksi oppilaalla on mahdollisuus saada tietoa omasta fyysisestä toimintakyvystään ja fyysisestä aktiivisuudestaan liikuntatunneilla ja vapaa-aikana.

Vapaaehtoisuus

Tutkimukseen osallistuminen on täysin vapaaehtoista ja voitte keskeyttää tutkimuksen koska tahansa.

Luottamuksellisuus, tietojen käsittely ja säilyttäminen

Keräämme tietoa kyselylomakkeilla. Kaikkia kerättyjä tietoja ja tuloksia käsitellään luottamuksellisesti ja siten, ettei tutkimuksen tuloksista voi tunnistaa ketään yksittäistä oppilasta.

Tutkimustuloksista tiedottaminen

Tutkimuksessa saaduista tuloksista kerrotaan tieteellisissä kokouksissa, lehdissä ja mediassa. Tuloksista kerrotaan myös koulussa ja kouluterveydenhuollossa.

Lisätietoja ja tutkijoiden yhteystiedot

Jos ilmenee kysyttävää tutkimuksesta, ota yhteyttä tai opettajaasi ottamaan yhteyttä:

Arto Gråsten, agrasten@jyu.fi
Jarmo Liukkonen, jarmo.liukkonen@jyu.fi
Tanja Tilles-Tirkkonen, tanja.tilles-tirkkonen@uef.fi
Leila Karhunen, leila.karhunen@uef.fi

Euroopan unioni
Euroopan sosiaalirahasto

TUTKITTAVAN SUOSTUMUS – KOULULAISET JA VANHEMMAT

Liikkumisesta kansalaistaito – hanke

Kouluikäisten lasten liikunta- ja ravitsemustutkimus

Minua/lastani on pyydetty osallistumaan yllämainittuun tieteelliseen tutkimukseen, jonka tarkoituksena on selvittää kouluikäisten lasten liikunta- ja ravitsemustottumuksia sekä niiden yhteyttä muihin hyvinvointitekijöihin. Tutkimus on osa Sotkamossa toteutettavaa Liikkumisesta kansalaistaito – hanketta. Tutkimus toteutetaan yhteistyössä Itä-Suomen yliopiston, Jyväskylän yliopiston ja Sotkamon kunnan kanssa.

Olen lukenut ja ymmärtänyt saamani kirjallisen tutkimustiedotteen. Tiedotteesta olen saanut riittävän selvityksen tutkimuksesta. Tiedän, että tutkimuksessa antamiani tietojani käsitellään luottamuksellisesti eikä niitä luovuteta sivullisille. Tiedän, että osallistumiseni on vapaaehtoista ja olen selvillä siitä, että voin peruuttaa tämän suostumukseni koska tahansa syytä ilmoittamatta eikä peruutukseni vaikuta kohteluuni millään tavalla.

Nimi: _____

Allekirjoituksellani vahvistan suostumukseni osallistumisestani tähän tutkimukseen

_____ _____
Päivämäärä Allekirjoitus

Huoltaja: Allekirjoituksellani vahvistan suostumukseni lapseni osallistumisesta tähän tutkimukseen

_____ _____
Päivämäärä Allekirjoitus

ORIGINAL PAPERS

I

PREDICTION OF ENJOYMENT IN SCHOOL PHYSICAL EDUCATION

by

Gråstén, A., Jaakkola, T., Liukkonen, J., Watt, A. & Yli-Piipari, S., 2012

Journal of Sports Science and Medicine 11 (2), 260-269.

©Journal of Sports Science and Medicine (2012) **11,** 260-269
http://www.jssm.org

Research article

Prediction of enjoyment in school physical education

Arto Gråstén [1]✉, Timo Jaakkola [1], Jarmo Liukkonen [1], Anthony Watt [2] and Sami Yli-Piipari [3]
[1] Department of Sport Sciences, University of Jyvaskyla, Finland, [2] School of Education, Victoria University, Melbourne, Australia, [3] Department of Kinesiology, University of North Carolina at Greensboro, USA

Abstract
The specific aim of this study was to examine whether motivational climate, perceived physical competence, and exercise motivation predict enjoyment in school physical education within the same sample of adolescents across three years of secondary school. A sample of 639 students (girls = 296, boys = 343) aged between 13- to 15-years at the commencement of the study completed the Intrinsic Motivation Climate in Physical Education Questionnaire, Physical Self-Perception Profile, Physical Education Motivation Scale, and Physical Education Enjoyment Scale. Results derived from path analyses indicated that task-involving motivational climate predicted enjoyment in physical education via perceived physical competence and intrinsic motivation in both girls and boys. In particular, these results supported previous findings of Vallerand et. al (1997) with the self-determination theory and the achievement goal theory. Ego-involving climate was not a significant predictor either in girls or boys. The current results provide continuing support for the investigation of Vallerand's model in the physical education setting, and highlight that motivational climate is an area that requires further evaluation as a contributing factor in the improvement of physical education teaching. A better understanding of the role of motivational climate may assist efforts to promote children's and adolescents' perceived physical competence, intrinsic motivation, and enjoyment in the school physical education setting.

Key words: enjoyment, motivation, school, physical education, path analysis.

Introduction

According to the recommendations of health experts, all primary school-aged children and secondary school adolescents should accumulate at least 60 minutes of moderate to vigorous intensity physical activity (PA) daily (World Health Organization, 2012). The review of recent studies (Adolescents Health and Lifestyle Survey, 2005; Finnish Board of Education's Physical Education Evaluation, 2010; School Health Promotion Study, 2010), shows that a large part of Finnish adolescents fail to achieve the recommended levels of daily PA. A number of studies have revealed that the level of PA declines during adolescence as they transfer from childhood into adulthood (e.g. Corbin, Pangrazi and Le-Masurier, 2004; Currie et al., 2008). It is generally believed that exercise motivation is one crucial factor behind PA (Chen, 2001; Ntoumanis et al., 2004; Yli-Piipari, 2011). Furthermore, a plethora of studies have demonstrated that enjoyment represents a key factor underlying the exercise motivation for children and adolescents to maintain positive engagement in both PA and physical education (PE) (Prochaska et al., 2003; Sallis, Prochaska and Taylor, 2000; Wallhead and Buckworth, 2004; Yli-Piipari et al., 2009). The current research was grounded in the self-determination (Deci and Ryan, 1985; 1991; 2000), and achievement goal frameworks (Ames, 1992; Nicholls, 1989), which has been successfully applied to the context of education (Ryan and Deci, 2006; Vallerand, Fortier and Guay, 1997) and recently also in PE (Ntoumanis, 2005; Soini, 2006; Standage, Duda and Ntoumanis, 2005; Yli-Piipari, 2011).

According to the achievement goal theory (Nicholls, 1989), motivational climate in PE refers to student perceptions of achievement goals addressed by instructors in learning environments (Ames, 1992). Two types of motivational climate are proposed to exist, a task-involving climate and an ego-involving climate (Nicholls, 1989). Task-involving motivational climate refers to structures that support effort, cooperation, emphasis on learning and task orientation, and student evaluation on the basis of self-referenced criteria (Ames, 1992; Ames and Archer, 1988). In contrast, ego-involving motivational climate refers to situations that foster normative comparisons, competition, and evaluation on the basis of normative competence criteria (Ames and Archer, 1988; Duda, 1996). Previous studies have shown that task-involving climate in PE is related to perceived physical competence (Wallhead and Ntoumanis, 2004), intrinsic motivation (Digelidis and Papaioannou, 1999), and enjoyment (Digelidis and Papaioannou, 2002; Soini, 2006; Wallhead and Ntoumanis, 2004). Student perceptions of an ego-involving climate in PE are more likely to lead to more controlling forms of motivation (Papaioannou, 1998), and low levels of enjoyment (Soini, 2006). In an intervention study involving a sample of 51 English boys with a mean age of 14.3 years, who were participating in the Sport Education Curriculum, a program based on a structure that focuses on a task-involving motivational climate, Wallhead and Ntoumanis (2004) reported these boys having higher post-intervention enjoyment scores than those students taught with the ego-involving approach. Limited number of intervention studies that have been conducted typically show that a task-involving motivational climate has a positive effect on enjoyment in PE (e.g. Solmon, 1996; Treasure and Roberts, 2001). However, the review of PE research within children and adolescents reveal that there are no studies reported investigating long-term influences of perceived motivational climate on enjoyment in PE.

Perceived physical competence is the desire to

Received: 29 November 2011 / Accepted: 18 February 2012 / Published (online): 01 June 2012

interact effectively with the environment and to attain valued outcomes (Deci and Ryan, 1985), and it refers to one's beliefs about the ability to be successful in an achievement domain (Ferrer-Caja and Weiss, 2000). Previous research has revealed that perceived physical competence is linked with intrinsic motivation (Deci and Ryan, 2000; Ommundsen, 2005), enjoyment in PA (Biddle et al., 2003) and PE (Carroll and Loumidis, 2001; Fairclough, 2003). Considerable evidence has also shown that youth who report stronger beliefs about their physical competence are more likely to enjoy the activity than those reporting lower levels of physical competence (Ferrer-Caja and Weiss, 2000). Gender differences in perceived competence have also been consistently observed, with boys possessing more positive perceptions than girls (Carroll and Loumidis, 2001; Fairclough, 2003). In a study by Ferrer-Caja and Weiss (2000), perceived physical competence was one of the strongest predictors of intrinsic motivation in PE.

According to the self-determination theory (Deci and Ryan, 1985; 1991; 2000), human behaviors can be categorized as intrinsically motivated, extrinsically motivated or amotivated. The regulation of motivation reflects a continuum comprising different levels of self-determination ranging from intrinsic motivation through extrinsic motivation to amotivation. Intrinsic motivation involves pursuing an activity out of interest and enjoyment without external contingencies (Deci and Ryan, 2000). Previous evidence suggest that intrinsic motivation and more autonomous types of extrinsic motivation lead to positive behavioral consequences, such as greater enjoyment (Ntoumanis, 2001; Ryan and Deci, 2007; Yli-Piipari, 2011) whereas non-autonomous types of motivation have been shown to be related to negative outcomes (Ntoumanis, 2002; Standage, Duda and Ntoumanis, 2005). Four different types of extrinsic motivation exist within the continuum: specifically, external regulation, introjected regulation, identified regulation, and integrated regulation. External regulation is occurring if an activity is done because of external factors, such as rewards, constraints, or fear of punishment. Introjected regulation can be performed, for example, in order to avoid internal pressures or feelings of guilt. Identified regulation refers to the outcomes of the behavior that are highly valued and the latter is performed with less pressure even if it is not particularly pleasant. Integrated regulation represents behaviors which are performed out of choice in order to bring different parts of the self. Amotivation is defined as a state in which a person lacks the intention to behave and experience feelings of incompetence, expectancies of uncontrollability, and perform activities without purpose. Despite a number of research studies based on self-determination theory being conducted in school PE (Lonsdale et al., 2011; Ntoumanis, 2005; Ommundsen and Eikanger-Kvalo, 2007; Standage, Duda and Ntoumanis, 2005), the role of motivational climate, perceived physical competence, and intrinsically regulated motivation has yet to be investigated to clarify long-term influences on students' enjoyment in PE.

Enjoyment is a positive affect that reflects generalized feelings such as pleasure, liking, and fun (Scanlan and Simmons, 1992), and most recently defined as a multidimensional structure related to enthusiasm, excitement, and cognitions such as perceptions of competence and attitude towards the activity (Hashim, Grove and Whipp, 2008). Enjoyment is an intrinsic element associated with exercise motivation to engage in PA (Dishman et al., 2005) and PE (Hashim, Grove and Whipp, 2008; Wallhead and Buchworth, 2004). Dishman et al. (2005) reported that increased enjoyment in PE resulted in higher levels of daily PA in a sample of Grade 9 and 10 adolescent girls. In a study targeting students in the U.S. at grades four to twelve, PE enjoyment was one of the strongest and most consistent correlates of PA (Sallis et al., 1999). Although, the importance of enjoyment in PE is widely accepted (Barr-Anderson et al., 2008; Ntoumanis, 2002; Standage, Duda and Ntoumanis, 2005), there is evidence suggesting an age-related decline in PE enjoyment (Digelidis and Papaioannou, 1999; Hashim, 2007; Prochaska et al., 2003). Moreover, Carroll and Loumidis (2001) found that boys scored higher than girls on enjoyment in a in a sample of 922 British Grade 6 students. A review of PE research within children and adolescents reveals there are no reports about studies attempting to test the theoretical assumptions regarding the effects of motivational climate, perceived physical competence, and exercise motivation on PE enjoyment.

The purpose of the current study was to examine the predictive relationships between motivational climate, perceived physical competence, exercise motivation and PE enjoyment using path analysis within the same sample of students over three secondary school years (Figure 1). In previous studies, statistically significant differences between girls and boys have been found in enjoyment (Carroll and Loumidis, 2001), perceived physical competence (Carroll and Loumidis, 2001; Fairclough, 2003), and extrinsic motivation (Yli-Piipari, 2011), boys scoring higher on each variable. Therefore, we used gender as grouping variable in subsequent path analyses. In line with previous findings (Digelidis and Papaioannou, 1999; 2002; Soini et al., 2007; Wallhead and Ntoumanis, 2004), it was hypothesized that the perception of task-involving climate at Grade 7 would be a positive predictor of PE enjoyment at Grade 9 via perceived physical competence and intrinsic motivation. Secondly, it was hypothesized that ego-involving climate at Grade 7 would be a negative predictor of PE enjoyment at Grade 9 via perceived physical competence and extrinsic motivation.

Methods

Participants

The participants of this study were recruited from eight secondary schools located in the region of Central Finland and sourced through direct contact with the school principals. The grade seven students were members of 32 different PE groups. All children in each PE class were invited to participate. The sample comprised 639 students (girls = 296, boys = 343) aged between 13- to 15-years at the commencement of the study. Data collection was

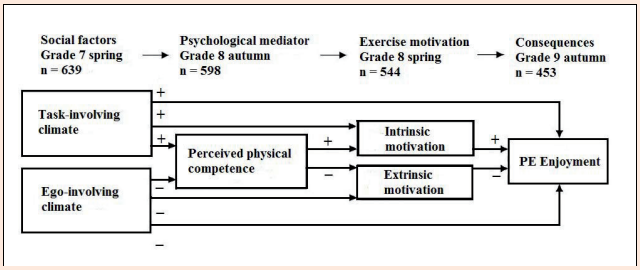


Figure 1. **The hypothesized PE enjoyment model.**

completed during the time period of 2008–2009. A cohort of 453 participants completed all measures at Grade 7, Grade 8, and Grade 9. Participation in this study was voluntary and no extra credit was awarded for participation. Permission to conduct the study was obtained from the Ethical Committee of the University of Jyvaskyla and consent to participate in the study was obtained from all participants and their parents before the start of the study.

Measures

Intrinsic Motivation Climate in Physical Education Questionnaire: Motivational climate in PE was measured using the Finnish version of Intrinsic Motivation Climate in Physical Education Questionnaire (IMCPEQ; Soini et al., 2007), which consists of four subscales representing autonomy support, social relatedness, and task- and ego-involving climate. For the purpose of this study only the dimensions of task- and ego-involving climate were analysed. The individual item stem used in the measure is "*In my physical education class*..." The task-involving dimension consisted of five items (e.g. "*It is important for students to try their best in PE lessons*"), and the ego-involving dimension consisted of four items (e.g. "*It is important for students to succeed better than others in PE lessons*"). Responses were indicated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Soini et al. (2007) reported that the psychometric properties of the questionnaire were satisfactory to measure motivational climate in school PE based on data collected from a Finnish secondary school sample (Cronbach's alpha for task-involving climate .80 and ego-involving climate .78). Confirmatory factor analysis of the entire measure reported by Kalaja et al. (2009) supported the construct validity of the scale (TLI = .96, CFI = .98, RMSEA = .055).

Perceived Physical Competence Scale: Perceived physical competence was analysed using the Finnish version (Jaakkola, 2002) of the Physical Self-Perception Profile (PSPP; Fox and Corbin, 1989). The subscale consisted of five items (e.g. "*I am confident in PE*"), and the stem was "*What I am*?" The students responded to each item using a five- point Osgood-scale from I'm among the best when it comes to athletic ability (1) to I'm not among the best when it comes to athletic ability (5). Higher values reflected higher perceived physical competence. Kalaja et al. (2009) showed that the Cronbach's alpha coefficients were above .70 demonstrating high internal consistency of the Physical Self-Perception Profile. Confirmatory factor analysis undertaken in that study supported the construct validity of the scale (TLI = .91, CFI = .97, RMSEA = .012).

Physical Education Motivation Scale: Contextual intrinsic motivation and extrinsic motivation were measured using the Finnish version (Jaakkola, 2002) of the Physical Education Motivation Scale, which is a modified version of the Sport Motivation Scale (SMS; Pelletier et al., 1995) for the context of PE. The scale used in this study had the individual item stem "*I'm currently participating in PE, because…?*" The instrument consists of seven subscales, comprising three types of intrinsic motivation and three types of extrinsic motivation, and amotivation. For the purpose of this study only dimensions of intrinsic motivation and extrinsic motivation were used. Each dimension consisted of four items and each was rated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Jaakkola et al. (2008) reported that the Finnish version of the PE Motivation Scale demonstrated adequate psychometric properties (Cronbach alphas between 0.71 and 0.93). Confirmatory factor analysis results detailed by Kalaja et al. (2009), however, did not fully support the construct validity of the PE Motivation Scale (TLI = 0.86, CFI = 0.88, RMSEA = 0.081).

PE Enjoyment Scale: Enjoyment in PE lessons was assessed using the Finnish version (Soini et al., 2007) of the Sport Enjoyment Scale (Scanlan et al., 1993). The subscale consists of four items (e.g. "*I like PE lessons*"), and the item stem was "*In my physical education class...*" Responses were indicated on a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Soini et al. (2007) reported that the Finnish version of the scale, which was modified to the context of PE, showed satisfactory internal consistency ($\alpha = 0.93$).

Procedures

The data were collected by the researchers on four occasions during the school's allotted 90-minute PE lessons, typically held in the school gym under the supervision of the PE teacher. The participants were told

that their involvement was voluntary, with scores kept confidential. In addition, the participants were told ask for help if confused concerning either the instructions or the clarity of a particular item. To minimize students' tendency to give socially desirable responses, students were encouraged to answer honestly and were assured that their responses were confidential. The four measurement phases were carried out in March 2008 (Grade 7 spring), November 2008 (Grade 8 autumn), March 2009 (Grade 8 spring), and November 2009 (Grade 9 autumn) under consistent data collection arrangements.

Data analyses

Prior to statistical analyses, the normality, missing values and outliers of the data were examined. No modification due to normality or outliers was required. Missing values in several measurement points were not systematic and did not represent any particular school or group. Based on this observation, it can be assumed that missing values did not have biased effects on the final results of the path analysis.

Enjoyment contained 29.1%, intrinsic motivation 1.3%, perceived physical competence 6.4%, ego-involving motivational climate 17.0% and task-involving motivational climate 16.0% of missing values out of total 639 completed questionnaires. The high percentage of missing values for the enjoyment variable occurred because it was the final measure completed in the longitudinal sequence at Grade 9. Thirty-three students changed to other school during the time period of 2008−2009. Several scholars have advocated (e.g. Allison, 2002; Widaman, 2006) that imputation is the most practical option to deal with the data of several measurement points, because removing study units with missing values purely may remove a remarkable part of the original data. Study units containing missing values were not removed, but were imputed with the Expected Maximum (EM) imputation method (Tabachnick and Fidell, 2007). Expected maximum values were calculated for each missing value using means and standard deviations of the particular variables. Using the EM-imputation method, the units with missing values were approved for the subsequent analysis.

The hypothesized motivational model of the study was tested using the path analysis method (Amos 18.0 version), in which the maximum likelihood method was selected for the path model analyses. Pearson's chi-square test ($\chi 2$) was used as a test of the model's overall goodness-of-fit to the data. A non-significant difference between observed frequency distribution and theoretical distribution had an acceptable fit to the data. To determine the appropriateness of the model the root mean square residual (RMR) and the root mean square error of approximation (RMSEA), the normed fit index (NFI), the comparative fit index (CFI), the goodness-of-fit index (GFI) and the adjusted goodness of fit index (AGFI) were also examined (Arbuckle, 2006). A value of .05 or less for RMR indicate the reasonable magnitude of a varying quantity, a value .05 or less indicate a close fit of the model and values between .06–.07 for the RMSEA indicate an acceptable fit of the model in the relations to the degrees of freedom (Browne and Cudeck, 1993). The NFI, CFI, GFI and AGFI indices range from 0 to greater than 1. Fit indices greater than 0.9 are indicative of acceptable model fit. More-over, the proportion of variance predicted by independent variables for the dependent variables were investigated using squared multiple correlations (R^2).

Results

Descriptive statistics, internal consistencies and Pearson's correlations between variables were examined (Table 1). Descriptive statistics show that adolescents' perceived PE motivational climate was more task-involving than ego-involving. Task-involving climate demonstrated significant positive correlations with enjoyment, intrinsic motivation, extrinsic motivation, and perceived physical competence for both boys and girls. Ego-involving climate did not correlate significantly with any variables for girls but significant correlations were found for boys in both extrinsic motivation and task-involving climate.

Path analysis

The hypothesized motivational model revealed a non-acceptable fit for the data of girls and boys together. The next step was to formulate the most reasonable model for both groups by removing all non-significant path coefficients from the model. The final model had a good fit for the girls' data ($\chi 2 = [4] = 1.514$, $p > 0.05$; RMR = 0.010; RMSEA = 0.000; NFI = 0.99; CFI = 1.0; GFI = 1.0; AGFI = 0.99) and an acceptable fit to the model for the boys' data ($\chi 2 = [3] = 7.188$, $p > 0.05$; RMR = 0.014;

Table1. Descriptive statistics, internal consistencies and Person´s correlations (girls = 296, boys = 343).

	Gender	Mean	SD	α	1	2	3	4	5	6
1 Enjoyment	♀	3.47	.92	.92		.49***	.26***	.40***	.41***	.03
	♂	3.54	.76	.87		.44***	.22***	.29***	.45***	-.01
2 Intrinsic motivation	♀	3.13	.79	.96			.64***	.41***	.44***	.02
	♂	3.20	.65	.95			.63***	.39***	.44***	.10
3 Extrinsic motivation	♀	2.75	.76	.90				.37***	.19***	.10
	♂	2.95	.65	.91				.29***	.14**	.16
4 Physical competence	♀	3.16	.78	.90					.26***	-.04
	♂	3.43	.81	.89					.25***	.09
5 Task involving climate	♀	3.56	.74	.86						.02
	♂	3.61	.71	.87						.23***
6 Ego- involving climate	♀	2.93	.79	.87						
	♂	3.18	.63	.73						

** p < 0.01, *** p < 0.001

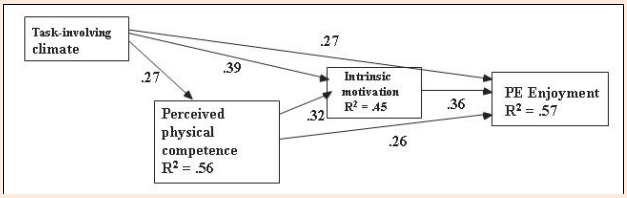


Figure 2. Path model of the study variables within girls (n = 296).

RMSEA = 0.064; NFI = 0.97; CFI = 0.98; GFI = 0.99; AGFI = 0.96).

The path model of the girls' data evidenced four paths from task-involving motivational climate to PE enjoyment (Figure 2). Firstly, there was a path from task-involving climate via perceived physical competence and intrinsic motivation to PE enjoyment. Secondly, the model revealed a path from task-involving motivational climate via intrinsic motivation to PE enjoyment. Thirdly, a path from task-involving motivational climate via perceived physical competence to PE enjoyment. Finally, there was a direct path from task-involving motivational climate to PE enjoyment. Squared multiple correlations showed that task-involving climate, perceived physical competence and intrinsic motivation strongly explained the variance in PE enjoyment. Task-involving climate also explained strongly the variance in perceived physical competence. Additionally, both task-involving climate, and perceived physical competence strongly explained the variance in intrinsic motivation.

The model based on the boys' data revealed four paths emanating from task-involving motivational climate (Figure 3). Firstly, a path from task-involving climate via perceived physical competence and intrinsic motivation to PE enjoyment. Secondly, a path from task-involving climate via intrinsic motivation to PE enjoyment. Thirdly, a path from task-involving climate via perceived physical competence to PE enjoyment. Finally, there was also a path from task-involving motivational climate directly to PE enjoyment. Squared multiple correlations for the model showed that task-involving motivational climate, perceived physical competence, and intrinsic motivation strongly explained the variance in PE enjoyment. Task-involving motivational climate also strongly explained the variance in perceived physical competence. Both task-involving motivational climate and perceived physical competence moderately explained the variance in intrinsic motivation.

Discussion

Enjoyment has been identified as a significant factor underlying exercise motivation for children and adolescents to maintain their positive engagement in both PA and PE (Prochaska et al., 2003; Sallis, Prochaska and Taylor, 2000; Wallhead and Buckworth, 2004; Yli-Piipari et al., 2009). However, previous studies have revealed that adolescents' PA decreases across the secondary school years (Corbin, Pangrazi and Le-Masurier, 2004; Currie et al., 2008; Yli-Piipari, 2011). Therefore, it is important to understand how motivational climate, perceived physical competence and exercise motivation influence enjoyment in school PE. The aim of this study was to examine whether motivational climate, perceived physical competence, and exercise motivation variables predict enjoyment in school PE. It was hypothesized that the perception of task-involving climate at Grade 7 would be a positive predictor of PE enjoyment at Grade 9 via perceived physical competence and intrinsic motivation. Additionally, it was hypothesized that ego-involving climate at Grade 7 would be a negative predictor of PE enjoyment at Grade 9 via perceived physical competence and extrinsic motivation.

This study was the first, in which the effects of social-cognitive motivational factors (i.e. motivational climate, perceived physical competence, and intrinsic motivation) on PE enjoyment were analysed across the secondary school years among the same sample of adolescents. A large sample of 639 students were monitored across their entire involvement at secondary school and assessed at several key measurement points. Previous studies have been designed as available cohort investigations with samples changing across various time

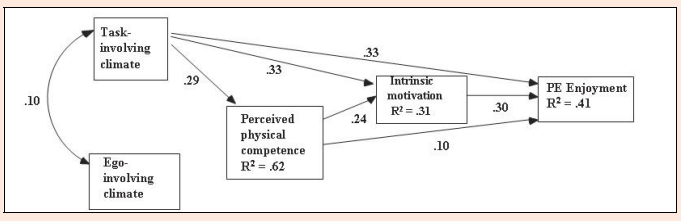


Figure 3. Path model of the study variables within boys (n = 343).

periods (e.g. Neumark-Sztainer, 2003) or relatively short-term interventions (e.g. Digelidis et al., 2003; Wallhead and Ntoumanis, 2004).

The findings of the current study support existing suggestions of Vallerand's (1997) model in which social factors mediated by a psychological mediator, and exercise motivation are related to positive consequences in the PE context such as fundamental movement skills (Kalaja et al., 2009), intentions to participate in optional PE courses (Ntoumanis, 2005), self-regulated motivation (Ommundsen and Eikanger-Kvalo, 2007), and concentration levels in PE (Standage, Duda and Ntoumanis, 2005). The hypothesized motivational model revealed a non-acceptable fit for the data with girls and boys together. In previous studies, PE enjoyment (Carroll and Loumidis, 2001), perceived physical competence (Carroll and Loumidis, 2001; Fairclough, 2003), extrinsic motivation (Yli-Piipari, 2011), and ego-involving motivational climate (Moreno-Murcia et al., 2011) have been shown to have statistically significant gender differences. Therefore, we used gender as a grouping variable in subsequent path analyses. As hypothesized, task-involving motivational climate predicted PE enjoyment via perceived physical competence and intrinsic motivation in both girls and boys. In particular, these results supported previous findings associated with the self-determination theory (Deci and Ryan, 1985; 1991; 2000) and the achievement goal theory (Nicholls, 1989) as demonstrated by the linking of task-involving climate in PE to perceived physical competence (Wallhead and Ntoumanis, 2004), intrinsic motivation (Digelidis and Papaioannou, 1999), and PE enjoyment (Digelidis and Papaioannou, 2002; Soini, 2006; Wallhead and Ntoumanis, 2004). The current results provide continuing support for the investigation of the Vallerand's model in the PE setting, and highlights that motivational climate is an area that requires continuing evaluation as a contributing factor in improving PE teaching.

In contrast, for the hypothesized model, ego-involving motivational climate had poor fit with the psychological outcomes in PE. Ego-involving climate did not fit either the data for the girls or boys. This finding did not support the model of Vallerand (1997), as PE lessons based on ego-involving motivational climate did not significantly influence on the level of PE enjoyment. This finding is similar to the results of the British study (Ntoumanis et al., 2005), in which they found that task-involving motivational climate was more conducive to the satisfaction of the three psychological needs compared to an ego-involving climate. Standage, Duda and Ntoumanis (2005) evidenced also that a lesser extent of perceptions of mastery climate positively impacted hypothesized mediating variables to foster self-determined motivation. Either extrinsic motivation did not fit into the hypothesized model, dissimilarly with previous findings of Ntoumanis (2002) and Standage, Duda and Ntoumanis (2005), in which non-autonomous types of motivation have been shown to be related to negative outcomes in PE. The possible reason for ego-involving climate and extrinsic motivation being removed from the hypothesized model might be the setting with several measurement points. Although previous studies (Kalaja et al., 2009; Ntoumanis, 2005; Ommundsen and Eikanger-Kvalo, 2007; Standage, Duda and Ntoumanis, 2005) have lent some support for the Vallerand's model (1997), most of them have not been conducted using several measurement points through entire secondary school years.

The results also showed that task-involving motivational climate in PE lessons at Grade 7 had a strong association with PE enjoyment via perceived physical competence and intrinsic motivation at Grade 9 for both girls and boys. The few intervention studies previously reported have shown that task-involving motivational climate has positive effects on perceived physical competence (Weigand and Burton, 2002), exercise motivation (Jaakkola, 2002), and PE enjoyment (Wallhead and Ntoumanis, 2004). Similarly, previous research has revealed that perceived physical competence is strongly connected with both task-involving climate in PE (Wallhead and Ntoumanis, 2004) and enjoyment in PE (Carroll and Loumidis, 2001; Fairclough, 2003). The finding of this study in conjunction with previous findings are in line with the suggestion of Ferrer-Caja and Weiss (2000) that events that provide opportunities to satisfy an individual's need to perceive competence in dealing with the contextual motivational climate will maximize intrinsic motivation, and further enjoyment. Furthermore, Ferrer-Caja and Weiss (2000) proposed that adolescents who report stronger beliefs about their physical competencies are more likely to enjoy the activity than adolescents who report lower levels of physical competence. In accordance with previous research, intrinsic motivation is associated with positive behavioral consequences such as greater enjoyment in PE (Ntoumanis, 2001; Ryan and Deci, 2007; Yli-Piipari, 2011).

Additionally, PE enjoyment was explained rather strongly by task-involving climate, perceived physical competence, and intrinsic motivation among both girls and boys. These findings were congruent with the self-determination theory (Deci and Ryan, 1985; 1991; 2000) and the achievement goal theory (Nicholls, 1989), as enjoyment has been previously shown to be positively related to cognitions, such as intrinsic motivation (Vallerand, 1997; Yli-Piipari et al., 2009), perceptions of competence (Hashim, Grove and Whipp, 2008; Wankel, 1997), and task-involving motivational climate (Digelidis and Papaioannou, 2002). An interesting fact related to the current results was that PE enjoyment among girls was better explained by task-involving climate via perceived physical competence, and intrinsic motivation than for the boys. This finding is dissimilar with the findings of Carroll and Loumidis (2001), as they found that boys scored higher than girls on enjoyment in a sample of British Grade 6 students. Therefore, task-involving motivational climate could be used as a relevant method to promote perceived competence, intrinsic motivation, and further enjoyment in school PE, especially among girls.

From the point of view of PE enjoyment, school physical education could be most effective if based on

task-involving motivational climate, in which the main objective is increasing students' perceived physical competence, intrinsic motivation, and further enjoyment. In previous interventions, based on the TARGET model of Epstein (1989), task-involving methods have been shown to be valid to improve positive consequences in school PE. In the TARGET model, task- and ego-involving climate consist of certain motivational structures. These structures construct the teaching model, in which task (design of learning activities), authority (locus of decision-making), recognition (criteria for rewards), grouping (homogenous or heterogeneous ability), evaluation (criteria for success or failure), and timing (pace of instructions) create the TARGET acronym. Basically, teachers can manipulate these six features to influence the motivational climate in their PE classes to reflect either task- or ego-involving motivational climate. For instance, Wallhead and Ntoumanis (2004) found in their intervention that PE enjoyment increased in conjunction with perceived effort, perceived competence, and goal orientation when a) students chose personal skill practices from a range of offered practices, b) students were responsible for setting up equipment, c) recognition was based on individual progress, d) student worked together within same small cooperative group structure, e) student-coaches emphasized individual improvement in order to benefit team performance goals, and f) during lessons students often dictated the rate of progression through specific practices. Specifically, during the intervention, students led warm-ups, took responsibility for refereeing and the choice of tactics and team strategies, and were responsible for selecting individuals to fulfill each role of coach, referee, captain, and scorer. The results of the current study and previous practical findings support task-involving teaching methods to promote adolescent's PE enjoyment through secondary school years among both girls and boys.

A key limitation of this study is related to the use of subjective scales to evaluate the main variables. The truthfulness and accuracy of self-report measures may be compromised because some health and well-being behaviors such as PA are difficult to recall and may also be so sensitive that respondents are reluctant to provide exact details. In addition, adolescents may purposely under-report or over-report some health and well-being behaviors because they believe engaging in these behaviors is socially undesirable or desirable (Brener, Billy and Grady, 2003). A further limitation of the study is the number of imputed missing values for the PE enjoyment variable. However, imputation was used as a method to save a remarkable part of the original data following the procedure proposed by Allison (2002), and Widaman (2006).

Future research should be directed towards the undertaking of additional longitudinal studies about the development of PE enjoyment from childhood to late adolescence, and the social-cognitive motivational processes behind PA engagement in PE. Specifically, these types of investigations could generate valuable evidence about the critical transition periods from elementary school to secondary school and from secondary to upper secondary or vocational school. This information could be utilized in various practical applications, such as PE teacher training and the professional development of existing PE teachers by providing a clearer understanding of the development of adolescents' PA patterns and their motivational determinants.

Conclusion

The present study examined whether motivational climate at Grade 7, perceived physical competence, and intrinsic motivation at Grade 8 predict enjoyment in school PE at Grade 9. The results showed that task-involving motivational climate at Grade 7 predicted enjoyment in PE at grade 9 via perceived physical competence, and intrinsic motivation. A better understanding of the role of motivational climate may assist efforts to promote children's and adolescents' perceived physical competence, intrinsic motivation, and further PE enjoyment by task-involving climate in PE.

References

Adolescents Health and Lifestyle Survey (2005) Physical activity – a possibility for welfare policy. The state and development of health-enhancing physical activity in Finland In: *Helsinki: Reports of the Ministry of Social Affairs and Health 2007:1.* . Eds: Fogelholm, M., Paronen, O. and Miettinen, M. (In Finnish: English abstract).

Allison, P. (2002) *Missing data*. Sage, Thousand Oaks, CA.

Ames, C. (1992) Achievement goal, motivational climate, and motivational processes. In: *Motivation in Sport and Exercise.* Eds: Roberts, G. C. Champaign, IL: Human Kinetics. 161- 76.

Ames, C. and Archer, J. (1988) Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology* **80**, 260-267.

Arbuckle, J. L. (2006) *Amos 7.0 User's Guide*. SPSS, Chicago, IL.

Barr-Anderson, D., Neumark-Sztainer, D., Schmitz, K., Ward, D., Conway, T., Pratt, C., Baggett, C., Lytle, L. and Pate, R. (2008) But I like PE: Factors associated with enjoyment of physical education class in middle school girls. *Research Quarterly for Exercise and Sport* **79**, 18-27.

Biddle, S., Wang, C., Chatzisarantis, N. and Spray, C. (2003) Motivation for physical activity in young people: Entity and incremental beliefs about athletic ability. *Journal of Sport Sciences* **21**, 973-989.

Brener, N.D., Billy, J.O. and Grady, W.R. (2003) Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. *Journal of Adolescent Health* **33**, 436-457.

Browne, M.V. and Cudeck, R. (1993) Alternative ways of assessing model fit. In: *Testing structural equation models*. Eds: Bollen, K.A. and Long, J.S. Sage, Newbury Park, CA. 136-162.

Carroll, B. and Loumidis, J. (2001) Children's perceived competence and enjoyment in physical education and physical activity outside school. *European Physical Education Review* **7**, 24-43.

Chen, A. (2001) A theoretical conceptualization for motivation research in physical education: An integrated perspective. *Quest* **2**, 35-58.

Corbin, C.B., Pangrazi, R.P. and Le-Masurier, G.C. (2004) Physical activity for children: Current patterns and guidelines. *The President's Council of Physical Fitness and Sports Research Digest* **52**, 1-8.

Currie, C., Gabhainn, S.N., Godeau, E., Roberts, C., Smith, R., Picket, W. and Barnekow, V. (2008) *Inequalities in young people's health. Health behaviour in school-aged children. International report from the 2005/2006 survey.* Available from URL: http://www.euro.who.int/data/assets/pdf_file/0005/53852/E91416.pdf

Deci, E.L. and Ryan, R.M. (1985) *Intrinsic motivation and self-determination in human behaviour*. Plenum Press, New York.

Deci, E.L. and Ryan, R.M. (1991) A motivational approach to self: Integration in personality. In: *Perspectives on motivation: Nebraska Symposium on Motivation*. Ed: Dienstbier, R. University of Nebraska, Lincoln, NE. 237-288.

Deci, E.L. and Ryan, R.M. (2000) The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry* **11**, 227-268.

Digelidis, N. and Papaioannou, A. (1999) Age-group differences in intrinsic motivation, goal orientations and perceptions of athletic competence, physical appearance and motivational climate in Greek physical education. *Scandinavian Journal of Medicine and Science in Sports* **9**, 375 - 380.

Digelidis, N. and Papaioannou, A. (2002) Interactions between effort, enjoyment, per-ceived motivational climate, and task and ego orientations in physical education classes during a school year. *Ahtlitiki Psychologia* **13**, 35-55.

Digelidis, N., Papaioannou, A., Laparidis, K and Christodoulidis, T. (2003) A one-year intervention in 7th grade physical education classes aiming to change motivational climate and attitudes towards exercise. *Psychology of Sport and Exercise* **4**, 195-210.

Dishman, R., Motl, R., Saunders, R., Felton, G., Ward, D. and Pate, R. (2005) Enjoyment mediates the effects of a school-based physical activity intervention among adolescent girls. *Medicine and Science in Sports and Exercise* **37**, 478-487.

Duda, J.L. (1996) Maximizing motivation in sport and physical education among children and adolescents: The case for greater task involvement. *Quest* **48**, 290-302.

Epstein, J.L. (1989) Family structures and student motivation: A developmental perspective. In: *Research on motivation in education*. Ed: Ames, C. and Ames, R. San Diego, CA. 259-295.

Fairclough, S. (2003) Physical activity, perceived competence and enjoyment during secondary school physical education. *The European Journal of Physical Education* **8**, 5-18.

Ferrer-Caja, E. and Weiss, M.R. (2000) Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport* **71**, 267-279.

Finnish Board of Education's Physical Education Evaluation (2010) A follow-up evaluation of physical education learning outcomes. In: *Helsinki: Follow-up Reports of Education 2011:4.* Eds: Palomäki, S. and Heikinaro-Johansson, P. (In Finnish: English abstract).

Fox K.R. and Corbin C.B. (1989) The physical self-perception profile: development and preliminary validation. *Journal of Sport and Exercise Psychology* **11**, 408 - 430.

Hashim, H. (2007) *Components of enjoyment in physical education*. Doctoral thesis, The University of Western Australia.

Hashim, H., Grove, J.R. and Whipp, P. (2008) Validating the youth sport enjoyment construct in high school physical education. *Research Quarterly for Exercise and Sport* **79**, 183-195.

Jaakkola, T. (2002) *Changes in students' exercise motivation, goal orientation, and sport competence as a result of modifications in school physical education teaching practices*. Doctoral thesis, University of Jyvaskyla.

Jaakkola, T., Liukkonen, J., Ommundsen, Y. and Laakso, T. (2008) The relationships between situational and contextual self-determined motivation and physical activity intensity as measured by heart rates during ninth grade students' physical education classes. *European Physical Education Review* **14**, 13-31.

Kalaja, S., Jaakkola, T., Watt, A., Liukkonen, J. and Ommundsen,Y. (2009) The associations between seventh grade Finnish students' motivational climate, perceived competence, self-determined motivation and fundamental movement skills. *European Physical Education Review* **15**, 315-335.

Lonsdale, C., Sabiston, C., Taylor, I and Ntoumanis, N. (2011) Measuring student motivation for physical education: examining the psychometric properties of the perceived locus of causality questionnaire and the situational motivation scale. *Psychology of Sport and Exercise* **12**, 284-292.

Moreno-Murcia, J., Sicilia, A., Cervelló, E., Huéscar, E. and Dumitru, E. (2011) The relationship between goal orientations, motivational climate and self-reported discipline in physical education. *Journal of Sports Science and Medicine* **10**, 119-129.

Neumark-Sztainer, D., Story, M., Hannan, P., Tharp, T. and Rex, J. (2003) Factors associated with changes in physical activity. *Archives of Pediatrics and Adolescent Medicine* **157**, 803-810.

Nicholls, J.G. (1989) *The competitive ethos and democratic education*. Harvard University Press, Cambridge, MA.

Ntoumanis, N. (2001) A self-determination approach to the understanding of motivation in physical education. *British Journal of Education Psychology* **71**, 225-242.

Ntoumanis, N. (2002) Motivational clusters in a sample of British physical education classes. *Psychology of Sport and Exercise* **3**, 177-194.

Ntoumanis, N. (2005) A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology* **97**, 444-453.

Ntoumanis, N., Pensgaard, A.M., Martin, C., and Pipe, K. (2004) An ideographic analysis of amotivation in compulsory school physical education. *Journal of Sport and Exercise Psychology* **26**, 197-214.

Ommundsen, Y. (2005) Motivation and affect in physical education classes- a self-determination perspective. Active lifestyles: The impact of education and sport. In: *AIESEP World Congress, Lisbon.* Book of Abstract. Available from URL: http://ask.bibsys.no/ask/action/show?pid=r05013464&kid=forskpub

Ommundsen, Y. and Eikanger-Kvalo, S. (2007) Autonomy-mastery, supportive or performance focused? Different teacher behaviours and pupils' outcomes in physical education. *Scandinavian Journal of Educational Research* **51**, 385-413.

Papaioannou, A. (1998) Goal Perspectives, reasons for being disciplined, and self-reported discipline in physical education lessons. *Journal of Teaching in Physical Education* **17**, 421-441.

Pelletier, L.G., Fortier, M.S., Vallerand, R.J., Tuson, K.M., Brière, N.M. and Blais, M.R. (1995) Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sport Motivation Scale (SMS). *Journal of Sport and Exercise Psychology* **17**, 35 - 53.

Prochaska, J.J., Sallis, J.F., Slymen, D.J. and McKenzie, T.L. (2003) A longitudinal study of children's enjoyment of physical education. *Pediatric Exercise Science* **15**, 170-178.

Ryan, R.M. and Deci, E.L. (2006) Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination and will? *Journal of Personality* **74**, 1557-1586.

Ryan, R. M. and Deci, E. L. (2007) Active human nature: Self-determination theory and the promotion and maintenance of sport, exercise, and health. In: *Intrinsic motivation and self-determination in exercise and sport*. Ed: Hagger, M. and Chatzisarantis, N. Champaign, IL: Human Kinetics.1 - 19.

Sallis, J. F., Prochaska, J. J. and Taylor, W. C. (2000) A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise* **32**, 963 - 975.

Sallis, J.F., Prochaska, J.J., Taylor, W.C., Hill, J.O. and Geraci, J.C. (1999) Correlates of physical activity in a national sample of girls and boys in grades 4 through 12. *Health Psychology* **18**, 410 - 415.

Scanlan. K., Carpenter, P.J., Schmidt, G.W., Simons, J.P. and Keeler, B. (1993) An introduction to the sport commitment model. *Journal of Sport and Exercise Psychology* **15**, 1-15.

Scanlan, T.K. and Simmons, J.P. (1992) The construct of sport enjoyment. In: *Motivation in sport and exercise*. Ed: Roberts, G.C. Champaign, IL: Human Kinetics, 199-216.

School Health Promotion Study (2010) *Statistics and registers.* National Institute for Health and Welfare. Available from URL: http://info.stakes.fi/kouluterveyskysely/FI/tulokset/index.htm

Soini, M. (2006) *The relationship of motivational climate to physical activity intensity and enjoyment within ninth grade pupils in school physical education lessons*. Doctoral thesis, University of Jyvaskyla. 120.

Soini, M., Liukkonen, J., Jaakkola, T., Leskinen, E. and Rantanen, P. (2007) Motivational climate and enjoyment of physical education in school. *Liikunta ja Tiede* **44**, 45-51. (In Finnish: English abstract).

Solmon, M.A. (1996) Impact of motivational climate on students' behaviors and per-ceptions in a physical education setting. *Journal of Educational Psychology* **88**, 731-738.

Standage, M., Duda, J.L. and Ntoumanis, N. (2005) A test of self-

determination theory in school physical education. *British Journal of Educational Psychology* **75**, 411-433.
Tabachnick, B. G. and Fidell, L. S. (2007) *Using Multivariate Statistics*. Allyn and Bacon, Boston.
Treasure, D.C. and Roberts, G.C. (2001) Students' perceptions of the motivational climate, achievement beliefs, and satisfaction in physical education. *Research Quarterly for Exercise and Sport* **72**, 165-175.
Vallerand, R.J. (1997) Towards a hierarchical model of intrinsic and extrinsic motivation. In: *Advances in Experimental Social Psychology*. Ed: Zanna, M.P. New York: Academic Press. 271-359.
Vallerand, R.J., Fortier, M.S. and Guay, F. (1997) Self-determination and persistence in a real-life setting: toward a motivational model of high school dropout. *Journal of Personality and Social Psychology* **72**, 1161-1176.
Wallhead, T.L. and Buckworth, J. (2004) The role of physical education in the promotion of youth physical activity. *Quest* **56**, 285-301.
Wallhead, T.L. and Ntoumanis, N. (2004) Effects of a sport education intervention on students' motivational responses in physical education. *Journal of Teaching in Physical Education* **23**, 4-18.
Wankel, L.M. (1997) "Strawpersons", selective reporting and inconsistent logic: A response to Kimiecik and Harris's analysis of enjoyment. *Journal of Sport and Exercise Psychology* **19**, 98-109.
Weigand, D.A. and Burton, S. (2002) When anxiety is not always a handicap in physical education and sport: Some implications of the defensive pessimism strategy. *European Journal of Sport Science* **12**, 1-14.
World Health Organization (2012) *Recommended levels of physical activity for children aged 5-17 years*. Available from URL: http://www.who.int/dietphysicalactivity/factsheet_young_people/en/index/html
Widaman, K. F. (2006) Missing data: What to do with or without them? *Monographs of the Society for Research in Child Development* **71,** 42-64.
Yli-Piipari, S., Watt, A., Jaakkola, T., Liukkonen, J. and Nurmi, J-E. (2009) Relationships between physical education students' motivational profiles, enjoyment, state anxiety, and self-reported physical activity. *Journal of Sports Science and Medicine* **8**, 327-336.
Yli-Piipari, S. (2011) *The development of students' physical education motivation and physical activity - A 3.5-year longitudinal study across Grades 6 to 9.* Doctoral thesis, University of Jyvaskyla.170.

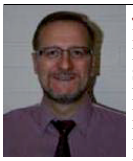
Key points

- The findings of the current study support existing suggestions of Vallerand´s (1997) model in which social factors mediated by a psychological mediator, and exercise motivation are related to positive consequences in the PE context.
- Task-involving motivational climate predicted PE enjoyment via perceived physical competence and intrinsic motivation with both girls and boys. Task-involving motivational climate in PE lessons at Grade 7 had a strong association with PE enjoyment via perceived physical competence and intrinsic motivation at Grade 9 for both girls and boys.
- Ego-involving climate did not fit either the data for the girls or boys, as PE lessons based on ego-involving motivational climate did not significantly influence on the level of PE enjoyment.
- The results of the current study and previous practical findings support task-involving teaching methods to promote adolescent´s PE enjoyment through secondary school years. School PE could be most effective if based on task-involving motivational climate, in which the main objective is increasing students´ perceived physical competence, intrinsic motivation, and enjoyment.

AUTHORS BIOGRAPHY

Arto GRÅSTÉN
Employment
Researcher, Department of Sport Sciences, University of Jyvaskyla, Finland
Degree
MEd
Research interests
Motivation, physical activity, physical education
E-mail: agrasten@jyu.fi

Timo JAAKKOLA
Employment
Lecturer, Department of Sport Sciences, University of Jyvaskyla, Finland
Degree
PhD
Research interests
Sport and exercise motivation, physical activity, motor skills
E-mail: timo.jaakkola@jyu.fi



Jarmo LIUKKONEN
Employment
Professor of Sport Pedagogy, Department of Sport Sciences, University of Jyvaskyla, Finland
Degree
PhD
Research interests
Motivational climate in school PE, psychosocial determinants of physical activity
E-mail: jarmo.liukkonen@jyu.fi

Anthony WATT
Employment
Senior Lecturer, School of Education, Victoria University, Melbourne, Australia
Degree
PhD
Research interests
Mental imagery, motor learning, assessment in sport psychology, physical activity participation, physical education pedagogy
E-mail: Anthony.Watt@vu.edu.au

Sami YLI-PIIPARI
Employment
Researcher, Department of Kinesiology, University of North Carolina at Greensboro, US
Degree
PhD
Research interests
Motivation, values, peer relationships in physical education
E-mail: srylipii@uncg.edu

✉ **Arto Gråstén**
University of Jyvaskyla, Department of Sport Sciences, Box 35, 40014 University of Jyvaskyla, Finland

II

DIRECTLY MEASURED AND SELF-REPORTED PHYSICAL ACTIVITY IN A SAMPLE OF FINNISH SECONDARY SCHOOL STUDENTS

by

Gråstén, A., Watt, A., Jaakkola, T. & Liukkonen, J., 2012

Advances in Physical Education 3 (2), 132-138.

Advances in Physical Education
2012. Vol.2, No.3, 132-138
Published Online August 2012 in SciRes (http://www.SciRP.org/journal/ape)

Scientific Research
http://dx.doi.org/10.4236/ape.2012.23023

Directly Measured and Self-Reported Physical Activity in a Sample of Finnish Secondary School Students

Arto Gråstén[1*], Anthony Watt[2], Timo Jaakkola[1], Jarmo Liukkonen[1]
[1]Department of Sport Sciences, University of Jyvaskyla, Jyvaskyla, Finland
[2]School of Education, Victoria University, Melbourne, Australia
Email: *agrasten@jyu.fi, Anthony.Watt@vu.edu.au, timo.jaakkola@jyu.fi, jarmo.liukkonen@jyu.fi

Received May 28th, 2012; revised June 27th, 2012; accepted July 11th, 2012

Background: Previous studies based on self-reports show that a majority of children and adolescents in Western countries fail to achieve the recommendation of 60 minutes moderate to vigorous physical activity (PA) on a daily basis. The specific aim of the study was to analyze the relationship between directly measured and self-reported PA in a cross-sectional sample of Finnish secondary school students. Moreover, how large proportion of adolescents accumulate at least 60 minutes of moderate to vigorous PA on a daily basis using self-reports and direct measure scores. **Methods:** Participants were recruited from a secondary school located in Northeast Finland. The sample comprised 96 students (58 girls, 38 boys) aged between 12- to 16-years (M = 15.03, SD = .94). Students' directly measured PA was collected using accelerometers over a seven-day period. The self-reported PA data was gathered during the school's allotted 90-minute lessons. **Results:** Results indicated that girls and boys were similarly physically active, based PA measured using both accelerometers and questionnaires. Grade 7 students were physically more active than Grade 9 students when PA was assessed using self-reports but no significant difference was found when direct measure scores were used. Self-reported PA emerged as the significant positive predictor for students' directly measured PA within Grade 8 ($p < .001$), and Grade 9 students ($p < .01$). The results highlighted that only 10% of adolescents met the recommendation of 60 minutes moderate to vigorous PA daily, when PA was measured using self-reports. On the contrary, a portion of 85% of students met the recommendation, when direct measure scores were used. **Conclusion:** Because the current and previous findings indicated substantial differences in the assessments results for similarly aged samples, continuing studies using directly assessed techniques are required to gain detailed information concerning the PA behavior of Finnish children and adolescents.

Keywords: Physical Activity; Accelerometers; Self-Reports; Secondary School

Introduction

Recent evidence from the World Health Organization (2012) reinforces the strong link between physical activity (PA) and continuing positive benefits to health, well-being and weight control. According to the recommendations of health experts, all secondary school-aged students should be physically active for at least 60 minutes on a daily basis (World Health Organization, 2012). A review of recent nationally representative studies based on self-reported PA (Finnish Board of Education, 2011; Ministry of Social Affairs and Health, 2007; National Institute for Health and Welfare, 2010), however, showed that only 10% - 40% of Finnish adolescents achieve these recommended levels. Similarly, self-report data drawn from large sample studies in the US indicated that the minority of adolescents (37% - 41%) had five or more sessions of moderate to vigorous PA (MVPA) per week (Gordon-Larsen, Nelson, & Popkin, 2004). In addition, when the activity was assessed directly using accelerometers, Troiano et al. (2008) reported that within a large sample of the US population, only 8% of adolescents obtained the recommended 60 minutes of PA on a daily basis. The numbers of physically active adolescents could be considered to be relatively high when PA was measured using self-reports. The gap between self-reports and directly measured scores makes it difficult to estimate the quantity of physically active adolescents, and furthermore to support policy and decision-making in the domain of children's and young people's health and well-being. The current study compared direct technique (accelerometer) to a more traditional subjective method (questionnaire) for the assessment of PA in a cross-sectional sample of Finnish secondary school students.

During adolescence, the opportunities for PA consist mainly of commuting to school, school physical education (PE), PA during recess and leisure time, participation in sports, and unorganized PA. A limitation highlighted in relation to the PA measurement techniques used with children and youth is that most methods are unable to evaluate multiple dimensions of PA at the same time (e.g., frequency, type, intensity, and duration) (Dale, Welk, & Mattews, 2002). This typically necessitates that research dependent on highly accurate assessment of PA would requires the use of multiple approaches.

A range of measurement techniques are available for assessing PA in children and adolescents. Measures of PA, such as direct observation (McKenzie, 2002) indirect calorimeter (Sirard & Pate, 2001), doubly labeled water (Arvidsson, Slinde, & Hulthen, 2005), pedometers (Tudor-Locke et al., 2002), accelerometers (Rowlands, 2007), heart rate monitors (Eston, Rowlands, & Ingledew, 1998) and multichannel activity monitor (Trost, McIver,

*Corresponding author.

& Pate, 2005) are considered as objectively or directly measured because the data being collected do not need to be cognitively and perceptually processed by the participants (Marshall & Welk, 2008). Limitations of direct measures also exist such as higher costs compared to self-report and the requirement for devices to be worn consistently and in the prescribed method to gather reliable data (Bates, 2006). PA may also be viewed as a latent, not directly observable, and time categorizable according to activity type and intensity, which can vary substantially over short periods of time (Corder et al., 2008). Direct measures can provide important insights into the true activity levels of adolescents (Bates, 2006) and the main techniques (e.g., accelerometers, multichannel activity monitors, heart rate monitors) have been shown to provide more accurate measures of PA than self-reported methods in children and adolescents (Bates, 2006; de Vries et al., 2006; Trost, 2000).

Self-reported PA measures have been used widely in many countries to assess overall PA, including Finland for the purposes of economical and practical expediency. However, previous findings have shown that children and adolescents are less able than adults to recall their PA levels, indicating that questionnaires provide a restricted measure of PA in children and adolescents (Marshall & Welk, 2008). Additionally, self-report measures, such as diaries (Rodriguez et al., 2002), logs (Welk et al., 2007), interviews (Welk et al., 2007), and questionnaires (Arvidsson, Slinde, & Hulthen, 2005) require a certain level of cognitive and perceptual processing by the participants to generate the data (Marshall & Welk, 2008). During adolescence, individuals become more capable of abstract, multidimensional, planned and hypothetical thinking on tasks in which they need to utilize basic cognitive mechanisms, such as short- or long-term memory (e.g., when recalling their PA levels) (Keating, 2004). Generally, self-assessment methods are reliable and valid, relatively simple and inexpensive to administer, and appropriate for use in population studies (Bates, 2006). Despite the variety of measurement methods, it is important to recognize that measurements of PA provide only estimates of actual behavior irrespective of the method being used (Marshall & Welk, 2008).

In previous studies, the correlation between self-reported and directly measured PA has varied as a function of the method used. In a study involving a sample of 115 American rural girls and boys with a mean age of 13.8 years, the correlation between self-reported PA and accelerometer-based PA was low ($r = .39$, $p < .01$) (Moore, Maloney, & Yin, 2007). Prochaska, Sallis, and Long (2001) also reported that for a US sample of 250 boys and girls with a mean age of 15 years, the self-reported measure had low correlation with the accelerometer data ($r = .40$, $p < .001$). According to the findings of Trost et al. (2002), for overall PA, the magnitudes of the gender differences in PA were small when measured directly by accelerometers. Shiely and MacDonncha (2009) found that, when PA was measured using a self-report questionnaire, more than 11% of 28 Irish adolescents met the international moderate intensity PA guidelines for adolescents, whereas, no adolescent met the international guidelines on sustained vigorous physical activity using heart rate monitors. The possible reason for differences is that the various techniques are based on different procedures, they provide raw data that are not directly comparable (Dale, Welk, & Mattews, 2002). Trost, McIver and Pate (2005) suggested that at least a seven-day monitoring protocol provides reliable estimates of usual PA behavior in children and adolescents. The current review of PA studies involving children and adolescents highlighted a consistent theme, whereby, researchers were typically proposing that to advance knowledge on PA in children and youth, it is important to obtain valid and reliable measurements of typical behavior (e.g., Bates, 2006; Marshall & Welk, 2008; Shiely & MacDonncha, 2009).

Although a large number of Finnish (Finnish Board of Education, 2011; Ministry of Social Affairs and Health, 2007; National Institute for Health and Welfare, 2010; Yli-Piipari, 2011), and international studies (Moore, Maloney, & Yin, 2007; Shiely & MacDonncha, 2009; Slootmaker et al., 2012; World Health Organization, 2004, 2008) highlight the increasing numbers of physically inactive children and adolescents, many of these findings are derived from self-report data. Furthermore, there is a lack of studies analyzing predictive relationships between self-reported and directly measured PA in children and adolescents. These types of comparisons would assist in determining if generally used self-reported PA instruments are sufficiently accurate to support policy and decision-making in the domain of children's and young people's health and well-being. Given the complexity of the construct and the variety of applications for measures of PA, continued methodological research is needed (Troiano, 2009).

The specific aim of the study was to examine if directly measured and self-reported PA differ by gender or grade. On basis of the theoretical framework (Marshall & Welk, 2008), it was expected that boys and Grade 7 students would score higher. A second aim was to analyze the predictive strength of self-reports on direct PA in a cross-sectional sample of Finnish secondary school students. In line with earlier studies (Moore, Maloney, & Yin, 2007), it was expected that self-reports would moderately predict directly measure scores. The final aim was to investigate the proportion of adolescents accumulating at least 60 minutes of moderate to vigorous physical activity (MVPA) on a daily basis as assessed by self-report and directly measured scores. In line with previous findings (Shiely & MacDonncha, 2009; Slootmaker et al., 2012), it was proposed that directly measured PA would reveal lower numbers of adolescents meeting the recommendation of daily PA levels than self-reported PA.

Methods

Participants

Participants were recruited from a secondary school located in Northeast Finland through direct contact with the school principal. All students in each PE class were invited to participate. Participation in this study was voluntary and no extra credit was awarded for participation. The sample comprised 96 adolescents (58 girls, 38 boys) aged between 12- to 16-years ($M = 15.03$, $SD = .94$). Permission to conduct the study was obtained from the Ethical Committee of the University of Jyvaskyla. Written, informed consent was obtained from each student and their parent or legal guardian after they were given, in writing, a full explanation of the aims of the study, possible hazards, discomfort, and inconvenience.

Instruments

Directly Measured PA

Accelerometers (Polar Active) were used for the direct assess-

ment of students' PA. The monitors were light, small, and worn on the wrist. Daily activity was detected automatically, including intensity (MVPA) and duration (minutes). The total minutes represented adolescents' MVPA. In the first validation study (Virtanen, 2011), conducted for a sample of Finnish 6 - 15 year old children and adolescents (n = 20), Polar Active's assessment in METs for playing games, walking and running had a high correlation to METs assessed using indirect calorimetry (r = .91), whereas the correlation was low for sitting activities (r = .31). In another validation study (Virtanen, 2011), the correlation between Polar Active and indirect calorimetry (r = .86) was similar to the correlation between Actigraph accelerometers and indirect calorimetry (r = .84) in seven different activities (sitting quietly, seated playing a video game, a standing warm-up, walking, jumping rope, video-led kickboxing, running for a total of 30 min) in a sample of 23 Finnish 11 - 17 year-old children and youth.

Self-Reported PA

Self-reported PA was assessed using the Health Behavior in School-aged Children Research Protocol (Currie et al., 2002) which incorporated a modified version of the Moderate to Vigorous Physical Activity (MVPA) measure (Prochaska, Sallis, & Long, 2001). The introduction preceding the items was: "*In the next two questions physical activity means all activities which raises your heart rates or momentarily get you out of breath for example in doing exercise*, *playing with your friends*, *going to school*, *or in school physical education. Sport also includes for example jogging*, *intensive walking*, *roller skating*, *cycling*, *dancing*, *skating*, *skiing*, *soccer*, *basketball and baseball*." The items required students to summarize their time spent in physical activity each day in the following way: 1) "*When you think about your typical week*, *on how many days you are physically active for a total of at least* 60 *minutes per day*?" and 2) "*Over the past* 7 *days*, *on how many days were you physically active for a total of at least* 60 *minutes per day*?" Both items used an eight-point response scale (0 to 7 days in a week). The mean of the two items was calculated and used as the adolescents' PA score. Prochaska, Sallis, and Long (2001) reported that for a sample of 138 US children and adolescents with a mean age of 12.1 years, the moderate to vigorous PA items were reliable (ICC = .77) and correlated moderately (r = .40) with accelerometer data in a study based on a five-day data collection period.

Design of the Study

The current cross-sectional data was compiled as part of a research project for promoting PA and health among children and youth. Self-report PA data was collected by the researchers during the school's allotted 90-minute lessons in April 2011. The participants had the procedures explained to them verbally, including a brief overview of possible physical discomfort that could be caused from wearing an accelerometer. The students were told that their involvement was voluntary and to ask for help if confused concerning the instructions, or if they required clarification of a particular item. To address the possibility of students' giving socially desirable responses, students were encouraged to answer honestly and were assured that their responses were confidential. Directly measured PA data was obtained during a seven-day period. The instructions for the use of the accelerometers were given by the researchers during the school PE lessons. Students provided demographic information associated with age, gender, height, and weight. The participants were asked to wear the accelerometers for 24 hours a day over a seven-day period. The monitors were collected by the PE teachers, and the data was downloaded to a computer by the researchers.

Statistical analyses

Prior to statistical analyses, normality, missing values, and outliers of the data were examined. The graphics and values of skewness (–.168 to .571) indicated that the data was within accepted limits to be considered normally distributed. The outliers were analyzed using standardized values (± 3.29), and Mahalanobis distance ($p < .001$) (Tabachnick & Fidell, 2007). One unit containing missing value and three outliers in directly measured PA were removed. No further modifications were required. The scores for both directly measured and self-reported PA were summarized using descriptive statistics. Pearson's correlation coefficients were examined to allow comparison with previous studies. Gender and grade differences were analyzed using MANOVA and Tukey's HSD-test. Prior to the MANOVA, the homogeneity of variance-covariance matrices was examined using Box's M test which revealed no violation either in self-reported ($F = .790$, $p > .05$) or directly measured data ($F = .135$, $p > .05$). Because of the nature of this study, general linear model of regression analysis was used to investigate the predictive strength of self-reported PA on directly measured PA (Yang & Miller, 2008). The distributions of regression residuals were analyzed using the Kolmogorov-Smirnov test which showed that the studentized residuals distributed normally within all grades ($p > .05$). Statistical analyses were conducted using SPSS 19.0 software.

Results

Descriptive Statistics, Differences, and Correlation Coefficients

Descriptive statistics are presented in **Table 1**. The MANOVA yielded a significant main effect for grade in directly measured PA (Wilks's $\Lambda = .89$, $F(1, 96) = 4.32$, $p < .05$; $\eta p2 = .04$) and self-reported PA (Wilks's $\Lambda = .89$, $F(1, 96) = 10.86$, $p < .001$; $\eta p2 = .11$). Tukey's HSD-test revealed that Grade 7 students were significantly more physically active than Grade 9 students when PA was measured using self-reports ($p < .01$). No further differences were found. Additionally, the Pearson's correlation coefficient between self-reported and directly measured PA scores was moderate in Grade 8 students ($r = .66$, $p < .001$), whereas the correlations were low in both Grade 9 ($r = .44$, $p < .01$), and Grade 7 students ($r = .32$, $p > .05$).

Linear Regression Analysis

The results of the linear regression analyses conducted for each grade level indicated (**Table 2**) that self-reported PA emerged as the significant positive predictor for students' directly measured PA within Grade 8 students ($p < .001$), and Grade 9 students ($p < .01$), accounting for 41.6% and 17.3% of variance. Self-reported PA was not a significant contributor for Grade 7 students' direct PA.

Achievement of the Recommendation of Daily PA

Results for self-reported PA indicated that only 11% of adolescents met the requirement for minimum 60 minutes of MVPA

Table 1.
Descriptive statistics of directly measured and self-reported PA.

			N	Min	Max	M	SD
Direct PA (minutes)	Grade 7	Girls	19	63.57	223.57	119.90	34.08
		Boys	6	74.43	150.14	113.50	27.58
		Total	25	63.57	223.57	118.36	32.21
	Grade 8	Girls	16	38.00	169.14	101.48	44.17
		Boys	13	28.20	206.57	108.88	56.25
		Total	29	28.20	206.57	104.80	49.14
	Grade 9	Girls	23	36.57	216.43	95.68	51.67
		Boys	19	55.14	162.12	94.90	35.66
		Total	42	36.57	216.43	95.33	44.62
Self-reported PA (days/week)	Grade 7	Girls	19	3	7	5.39	1.14
		Boys	6	4	7	5.50	1.27
		Total	25	3	7	5.42	1.14
	Grade 8	Girls	16	1	7	4.38	1.79
		Boys	13	2	7	4.69	1.81
		Total	29	1	7	4.52	1.78
	Grade 9	Girls	23	2	7	4.00	1.39
		Boys	19	1	7	4.29	1.83
		Total	42	1	7	4.13	1.59

Table 2.
Results of regression analysis on students' directly measured PA (N = 96).

		β	R^2	t-value
Self-reported PA	Grade 7	.320	.064	1.62
	Grade 8	.661	.416	4.57^{***}
	Grade 9	.440	.173	3.10^{**}

$^{**}p < .01, ^{***}p < .001$

per day. In contrast, 85% met the recommendation based on direct measure scores. Self-report data indicated that a minimally larger portion of Grade 8 students (13.1%) achieved the recommendation than either Grade 7 (12.0%) or 9 students (9.3%). Conversely, a higher percentage of Grade 7 students (92.0%) met the requirement of 60 minutes daily PA when assessed by direct measures than either Grade 8 (76.3%) or 9 (85.2%) students.

Discussion

Currently, no studies that incorporate both direct and self-reported measures of PA with samples of Finnish adolescents have been undertaken. The current study revealed that girls and boys were similarly physically active, based on PA measured using both accelerometers and questionnaires. Results also indicated that Grade 7 students were physically more active than Grade 9 students when PA was assessed using self-reports but no significant difference was found when direct measure scores were used. In addition, the associations between self-report and accelerometer scores were stronger for Grade 8 and 9 students than those in Grade 7. Unexpectedly, a majority of the students achieved 60 minutes of MVPA per day when PA was measured directly. In turn, self-reports revealed a smaller portion of students who met the recommendation.

The results of current study revealed that no significant gender differences were found for either self-reported or directly measured PA. This unexpected finding was not in line with previous research that showed boys were physically more active than girls based on both self-reports (Duncan et al., 2004; Finnish Board of Education, 2011; Yli-Piipari, 2011; World Health Organization, 2004; 2008) and direct measure scores (Sherar et al., 2007; Trost et al., 2002). The key strength of the current study was that both direct measures and self-reports were used, compared to the preceding national and international results. The present data was collected in a relatively small town, where walking, biking, and snow based activities are common, and local community and school facilities, including sport and exercise settings, parks, trails, and pathways may promote both girls and boys to be more physically active (Sallis et al., 2006). Many earlier studies were conducted in bigger cities where opportunities for PA are a lesser focus of the community structure. The school-based and environmental possibilities for PA could be considered to be very good for the current sample constituting a possible reason for the difference between present and previous findings. Additionally, the most recent PA study by the Finnish Board of Education (2011) found that the difference between Grade 9 girls' and boys' participation in organized and non-structured sport during leisure time narrowed over the time period of 2003-2010. Similarly, Sherar et al. (2007) reported that gender differences in PA decline across adolescence, because as children mature they tend to lower their engagement in PA. Girls reach biological maturity earlier than boys, and therefore the gender differences in PA observed early in adolescence are reduced as boys attain biological maturity. Overall, the patterns of the current and several previous PA assessments (e.g., Sherar et al., 2007; Thompson et al., 2003) indicated a trend in which the gender differences in overall PA disappeared or were consistently smaller during this age period. However, Sherar et al. (2007) concluded that to fully understand gender disparities in PA, consideration must be given to the confounding effects of physical development.

The present results showed that Grade 7 students were physically more active than Grade 9 students when PA was assessed using self-reports. This pattern was in line with earlier studies which indicated that PA declines over the secondary school years (Corbin et al., 2004; World Health Organization, 2004;

2008; Yli-Piipari, 2011). In contrast, a significant grade difference was not found when direct measure scores were examined. Sherar et al. (2007) reported that the age-related decline in objective PA has been shown to be associated with early puberty rather than late biological maturity. The present sample comprised students aged between 12- to 16-years, therefore, some of the participants were likely prepubertal. When students reach puberty within the secondary school years, they may develop new interests and pursuits. Many of these changes, getting a motorbike licence or starting to date, for example, reduce the time available for PA. This pattern has also been observed in other adolescent samples (Allison et al., 2007). Many investigators have advocated (e.g., Bates, 2006; de Vries et al., 2006; Trost, 2000; Sherar et al., 2007) that direct measures provide more accurate measures of PA than self-reported methods in children and adolescents. Overall, the results did not fully support the expectation for grade differences. Therefore, the use of self-report measures requires careful scrutiny by researchers when used to observe age-related decline in PA, particularly secondary school students.

The results of the current study highlighted a trend in which the prediction of adolescents' directly measured PA by self-reported PA scores strengthened non-linearly across the secondary school years, whereby, the shared variance was greater at Grade 8 than either Grade 7 or Grade 9. This was the first attempt to examine the predictive relationship between self-reported and directly measured PA within Finnish secondary school students. An additional strength of the current study was that the direct data was collected for 24 hours per day over a seven-day period. Trost et al. (2000) recommended that at least a seven-day monitoring protocol is needed in order to provide reliable estimates of the usual PA behavior of children and adolescents. Adolescents may purposely under-report or over-report health and well-being behaviors including PA, because they believe engaging in these behaviors is socially undesirable or desirable (Brener, Billy, & Grady, 2003). Taken together, the results of this study indicated that Grade 8 and 9 students managed to self-report their daily PA with a higher level of association to their directly measured PA than the Grade 7 students. Based on the current and previous findings (Prochaska, Sallis, & Long, 2001; Shephard, 2003), researchers need to be cautious when determining actual PA by self-report with adolescent samples because the scores may only provide basic estimates of the actual behavior irrespective of the method used (Marshall & Welk, 2008).

A larger portion of the current student sample met the recommendation of 60 minutes MVPA per day (World Health Organization, 2012) on the basis of their directly measured PA results than in relation to their self-reported PA. Only 11% of these adolescents met the daily recommendation of 60 minutes MVPA as assessed by the self-report measure. This result was consistent with the findings of the Finnish Board of Education's Physical Education Evaluation (2011) but not with other nationally representative studies (Ministry of Social Affairs and Health, 2007; National Institute for Health and Welfare, 2010). These studies reported that approximately 40% of Finnish adolescents achieve the recommendation by self-reported methods. The present study also revealed that 85% of students met the recommendation when direct measure scores were used. This finding is in contrast to previous research (Shiely, & MacDonncha, 2009; Slootmaker et al., 2012), that reported that objectively measured PA determined smaller percentages of adolescents that meet the recommendation of daily PA. No previous studies incorporating directly measured methods are available in the samples of Finnish children or adolescents. When compared to the sample of US adolescents (Troiano et al., 2008), in which only 8% of adolescents met the recommendation of MVPA daily by direct measures, the percentage of physically active Finnish adolescents could be considered to be relatively high. Similarly, in a large European study (involving 2185 children and adolescents in Denmark, Portugal, Estonia, and Norway), the majority of boys (82%) and girls (62%) at age 15 achieved the current recommendation of PA, when PA was measured using accelerometers worn on the hip over a seven-day period (Riddoch et al., 2004). Possible reasons for differences between US and European studies may be due to cultural influences or the duration of the monitoring period. The US study included all ethnic groups, while ethnic differences have been observed in PA behavior (Biddle, Gorely, & Stensel, 2004; Brodersen et al., 2007). The participants for present analysis were drawn from a native population of Finland. Furthermore, the US data was collected from participants who provided either one or four days of accelerometer data, whereas a seven-day monitoring was used in the present study. Because the current and previous findings indicated substantial differences in the assessments results for similarly aged samples, continuing studies using directly assessed techniques are required to gain detailed information concerning the PA behavior of Finnish children and adolescents. This will extend the limited resource of directly measured PA data gathered from research involving school-aged students. Furthermore, no clear reasons for the large differences observed between the present accelerometer and questionnaire scores have as yet been fully determined.

A key limitation of this study is related to the techniques used for PA assessment. Dale, Welk and Mattews (2002) asserted that any one technique may not detect the full range of dimensions of PA such as frequency, type, intensity or duration. The accelerometer intensity levels selected may be a reason why a larger portion of students met the recommendation of 60 minutes PA per day in the current study. The manufacturer's level for moderate PA was 3.5 MET (e.g., walking at 5.6 kph) whereas in a study conducted with 8 - 18 year old American children and youth (Harrell et al., 2005) using indirect calorimetry, a level of 3.8 MET was considered to represent moderate PA. Furthermore, the current cross-sectional sample of 96 students was relatively small due the available economic resources. Therefore, conclusions regarding national trends are restricted based on these findings without additional information.

In future studies, the main focus should be towards the continuing assessment of representative samples of children and adolescents of different ages using direct techniques. Additionally, longitudinal data collection incorporating both self-report and objective measures could benefit the continuing investigation of children's and adolescents' PA in PE and leisure time. Following the suggestion of Bates (2006), self-report and objective measures should be used in combination to optimize and enrich the quality of the data collected from respondents in daily PA. This information could be utilized in various practical applications, such as promoting children's and adolescents' PA in school PE and leisure time, PE teacher training, and the professional progress of existing PE teachers by providing a clearer understanding development of students' PA across the secondary school years.

REFERENCES

Allison, K., Adlaf, E., Dwyer, J., Lysy, D., & Irving, H. (2007). The decline in physical activity among adolescent students. A cross-national comparison. *Canadian Journal of Public Health, 98,* 97-100.

Arvidsson, D., Slinde, F., & Hulthen, L. (2005). Physical activity questionnaire for adolescents validated against doubly labelled water. *European Journal of Clinical Nutrition, 59,* 376-383. doi:10.1038/sj.ejcn.1602084

Bates, H. (2006). *Daily physical activity for children and youth: A review and synthesis of the literature.* Alberta: Canadian Fitness and Lifestyle Research Institute.

Bergh, H., Grydeland, M., Bjelland, M., Lien, N., Andersen, L., Klepp, K., Anderssen, S., & Ommundsen, Y. (2011). Personal and social-environmental correlates of objectively measured physical activity in Norwegian pre-adolescent children. *Scandinavian Journal of Medicine and Science in Sports, 21,* 315-324. doi:10.1111/j.1600-0838.2011.01295.x

Biddle, S., Gorely, T., & Stensel, D. (2004). Health-enhancing physical activity and sedentary behavior in children and adolescents. *Journal of Sport Sciences, 22,* 679-701. doi:10.1080/02640410410001712412

Brener, N., Billy, J., & Grady, W. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. *Journal of Adolescent Health, 33,* 436-457. doi:10.1016/S1054-139X(03)00052-1

Brodersen, N., Steptoe, A., Boniface, D., & Wardle, J. (2007). Trends in physical activity and sedentary behaviour in adolescence: Ethnic and socioeconomic differences. B*ritish Journal of Sports and Medicine, 41,* 140-144. doi:10.1136/bjsm.2006.031138

Corbin, C., Pangrazi, R., & Le-Masurier, G. (2004). Physical activity for children: Current patterns and guidelines. *The President's Council of Physical Fitness and Sports Research Digest, 52,* 1-8.

Corder, K., Ekelund, U., Steele, R, Wareham, N., & Brage, S. (2008). Assessment of physical activity in youth. *Journal of Applied Physiology, 105,* 977-987. doi:10.1152/japplphysiol.00094.2008

Currie, C., Samdal, O., Boyce, W., & Smith, B. (2002). *Health behavior in school-aged children: A WHO cross-national study. Research Protocol for the 2001-2002 Survey.* Edinburgh: University of Edinburgh.

Dale, D., Welk, G., & Mattews, C. (2002). Methods for assessing physical activity and challenges for research. In G. Welk (Ed.), *Physical activity assessments for health-related research* (pp. 19-34). Champaign: Human Kinetics.

de Vries, S., Bakker, I., Hopman-Rock, M., Hirasing, R., & van Mechelen, W. (2006). Clinimetric review of motion sensors in children and adolescents. *Journal of Clinical Epidemiology, 59,* 670-680. doi:10.1016/j.jclinepi.2005.11.020

Duncan, M., Al-Nakeeb, Y., Nevill, A. & Jones, M. (2004). Body image and physical activity in British secondary school children. *European Physical Education Review, 10,* 243-260. doi:10.1177/1356336X04047125

Eston, R., Rowlands, A., & Ingledew, D. (1998). Validity of heart rate, pedometry, and accelerometry for predicting the energy cost of children's activities. *Journal of Applied Physiology, 84,* 362-371.

Finnish Board of Education (2011). *Follow-up evaluation of physical education learning outcomes.* Helsinki: Follow-Up Reports of Education.

Gordon-Larsen, P., Nelson, M., & Popkin, P. (2004). Longitudinal physical activity and sedentary behavior trends adolescence to adulthood. *American Journal of Preventive Medicine, 27,* 277-283. doi:10.1016/S0749-3797(04)00183-7

Harrell, J., McMurray, R., Baggett, C., Pennell, M., Pearce, P., & Bangdiva S. (2005). Energy costs of physical activities in children and adolescents. *Medicine and Science in Sports and Exercise, 37,* 329-336. doi:10.1249/01.MSS.0000153115.33762.3F

Keating, D. (2004). Cognitive and brain development. In R. Lerner, & L. Steinberg (Eds.), *Handbook of adolescent psychology* (pp. 45-84). Hoboken, NJ: Wiley.

Marshall, S., & Welk, G. (2008). Definitions and measurement. In A. Smith, & S. Biddle (Eds.), *Youth physical activity and sedentary behavior* (pp. 3-29). Champaign: Human Kinetics.

McKenzie, T. (2002). The use of direct observation to assess physical activity. In G. Welk (Ed.), *Physical activity assessments for health-related research* (pp.179-195). Champaign: Human Kinetics.

Ministry of Social Affairs and Health (2007). Adolescents health and lifestyle survey. In M. Fogelholm, O. Paronen, & M. Miettinen (Eds.), Physical activity—A possibility for welfare policy: The state and development of health-enhancing physical activity in Finland. Helsinki: Reports of the Ministry of Social Affairs and Health.

Moore, J., Maloney, H., & Yin, Z. (2007). Differential relationship between subjectively and objectively measured physical activity and psychosocial correlates of physical activity in rural youth. *Proceedings of the 135th APHA Annual Meeting and Exposition,* Washington DC, 3-7 November 2007.

National Institute for Health and Welfare (2010). School Health Promotion Study 2010. URL. http://info.stakes.fi/kouluterveyskysely/FI/tulokset/index.htm

Prochaska, J., Sallis, J., & Long, B. (2001). A physical activity screening measure for the use with adolescents in primary care. *Archieves of Pediatrics and Adolescent Medicine, 155,* 554-559.

Riddoch, C., Andersen, L., Wedderkopp, N., Harro, M., Klasson-Heggebø, L., Sardinha, L., Cooper, A., & Ekelund, U. (2004). Physical activity levels and patterns of 9- and 15-yr-old European children. *Medicine and Science in Sport and Exercise, 36,* 86-92. doi:10.1249/01.MSS.0000106174.43932.92

Rodriguez, G., Beghin, L., Michaud, L., Moreno, L., Turck, D., & Gottrand, F. (2002). Comparison of the TriTrac-R3D accelerometer and a self-report activity diary with heart rate monitoring for the assessment of energy expenditure in children. *British Journal of Nutrition, 87,* 623-631. doi:10.1079/BJN2002571

Rowlands, A. (2007). Accelerometer assessment of physical activity in children: An update. *Pediatric Exercise Science, 19,* 252-266.

Sallis, J., Cervero, R., Ascher, W., Henderson, K., Kraft, M., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health, 27,* 297-322. doi:10.1146/annurev.publhealth.27.021405.102100

Sherar, L., Esliger, D., Baxter-Jones, A., & Trembley, M. (2007). Age and gender differences in youth physical activity: Does physical maturity matter? *Medicine and Science in Sport and Exercise, 39,* 830-835. doi:10.1249/mss.0b013e3180335c3c

Shephard, R. (2003). Limits to the measurement of habitual physical activity by questionnaires. *British Journal of Sport Medicine, 37,* 197-206. doi:10.1136/bjsm.37.3.197

Shiely, F., & MacDonncha, C. (2009). Meeting the international adolescent physical activity guidelines: A comparison of objectively measured and self-reported physical activity levels. *Irish Medical Journal, 102,* 15-19.

Sirard, J., & Pate, R. (2001) Physical activity assessment in children and adolescents. *Sports Medicine, 31,* 439-454. doi:10.2165/00007256-200131060-00004

Slootmaker, S., Schuit, A., Chinapaw, M., Seidell, J., & Mechelen, W. (2012). Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status. URL. http://www.ijbnpa.org

Tabachnick, B., & Fidell, L. (2007). Using multivariate statistics. Boston, MA: Allyn and Bacon.

Thompson, A., Baxter-Jones, A., Mirwald, R., & Bailey, D. (2003). Comparison of physical activity in male and female children: Does maturation matter? *Medicine and Science in Sport and Exercise, 35,* 1648-1690. doi:10.1249/01.MSS.0000089244.44914.1F

Troiano, R. (2009). Can there be a single best measure of reported physical activity? *The American Journal of Clinical Nutrition, 89,* 736-737. doi:10.3945/ajcn.2008.27461

Troiano, R., Berrigan, D., Dodd, K., Mâsse, L., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and Science in Sports and Exercise, 40,* 181-188.

Trost, S. (2000). Objective measurement of physical activity in youth: Current issues, future directions. *Exercise and Sport Science Reviews, 29,* 32-36. doi:10.1097/00003677-200101000-00007

Trost, S., McIver, K., & Pate, R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise, 37,* 531-543. doi:10.1249/01.mss.0000185657.86065.98

Trost, S., Pate, R., Freedson, P., Sallis, J., & Taylor, W. (2000). Using objective physical activity measures with youth: How many days of monitoring are needed? *Medicine and Science in Sports and Exercise, 32,* 426-431. doi:10.1097/00005768-200002000-00025

Trost, S., Pate, R., Sallis, J., Freedson, P., Taylor, W., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise, 34,* 350-355. doi:10.1097/00005768-200202000-00025

Tudor-Locke, C., Williams, J., Reis, J., & Pluto, D. (2002). Utility of pedometers for assessing physical activity. *Convergent validity. Sports Medicine, 32,* 795-808. doi:10.2165/00007256-200232120-00004

Virtanen, P. (2011). Measurement of children's physical activity. Development of Polar Active activity monitor. Proceedings from the *International Congress on Enhancement of Physical Activity of Children and Youth*, Vuokatti, 7-9 April 2011.

Welk, G., Wickel, E., Peterson, M., Heitzler, C., Fulton, J., & Potter, L. (2007). Reliability and validity of questions on the youth media campaign longitudinal survey. *Medicine and Science in Sports and Exercise, 39,* 612-621. doi:10.1249/mss.0b013e3180305c59

World Health Organization (2004). *Health behaviour in school-aged children: HBSC International report from the 2001/2002 survey*. Geneva: World Health Organization.

World Health Organization (2008). *Inequalities in young people's health. HBSC International report from the 2005/2006 survey*. Geneva: World Health Organization.

World Health Organization (2012). Recommended levels of physical activity for children aged 5-17 years. URL. http://www.who.int/dietphysicalactivity/ factsheet_young_people/en

Yang, K., & Miller, G. (2008). *Handbook of research methods in public administration.* Boca Raton: Taylor & Francis Group.

Yli-Piipari, S. (2011). *The development of students' physical education motivation and physical activity—A 3.5-year longitudinal study across Grades 6 to 9.* Ph.D. Thesis, Jyvaskyla: University of Jyvaskyla.

III

SECONDARY SCHOOL STUDENTS' PHYSICAL ACTIVITY PARTICIPATION ACROSS PHYSICAL EDUCATION CLASSES – THE EXPECTANCY-VALUE THEORY APPROACH

by

Gråstén, A., Watt, A., Hagger, M., Jaakkola, T. & Liukkonen, J., 2014

The Physical Educator 71 (4) (in press)

IV

EFFECTIVENESS OF SCHOOL-INITIATED PHYSICAL ACTIVITY PROGRAM ON SECONDARY SCHOOL STUDENTS' PHYSICAL ACTIVITY PARTICIPATION

by

Gråstén, A., Yli-Piipari, S., Watt, A., Jaakkola, T. & Liukkonen, J., 2014

Journal of School Health (in press)