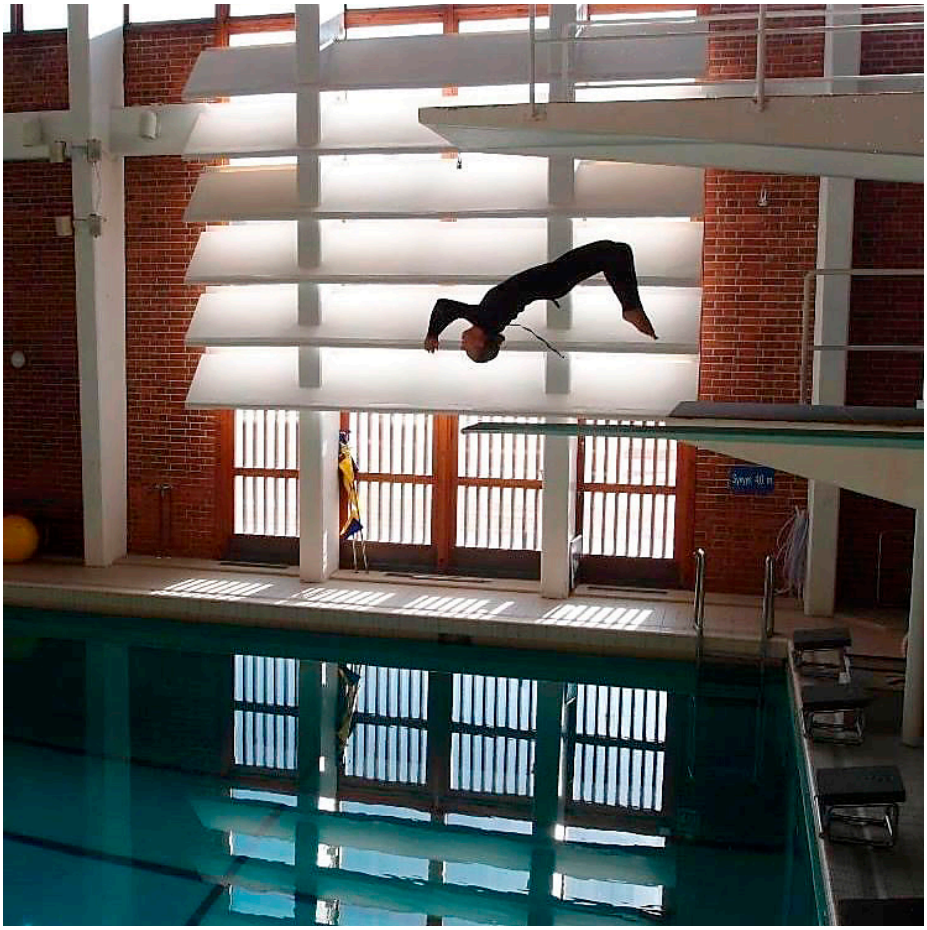
JYU DISSERTATIONS 522

Mari Kääpä

Understanding and Promoting Physical Activity among Finnish Adolescent Girls

The Role of Active Physical Education Homework



UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF SPORT AND
HEALTH SCIENCES

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"Walk on, walk on
With hope in your heart
And you'll never walk alone"

– Oscar Hammerstein II

ABSTRACT

Kääpä, Mari
Understanding and Promoting Physical Activity among Finnish Adolescent Girls and the Role of Active Physical Education Homework
Jyväskylä: University of Jyväskylä, 2022, 107 p.
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The majority of adolescents do not reach the recommended levels of physical activity, and especially females have low levels of activity as they approach adolescence. The purpose of this dissertation was to examine the physical activity of adolescent girls, with a focus on after-school activities and active physical education (PE) homework assignments given to promote the physical activity of adolescent girls. The aim was also to study, how active physical education homework could function in PE, how students react on these kind of homework assignments, accompanied with perceptions of students and parents.
The participants were girl students from a Finnish lower secondary school, and their physical activity was examined using objectively measurements (N = 88) and self-reported information (N = 81). The opinions about active physical education homework were gathered using questionnaires (N = 117), interviews with students and parents (N = 43), and a teacher-researcher diary. Objectively measured data with questionnaire and self-reported structured diary data were analysed by frequencies, cross-tabulation, comparison of mean values by t-test and analysis of variance, Cohen's d, and Kruskal-Wallis. For the interviews, qualitative content analysis was used, supplemented with open answers and teacher-researcher diary content.
On average, participants spent 1 hour 11 minutes on the MVPA level, 3 hours 8 minutes at the light activity level, and sedentary time was 7 hours 37 minutes. The high-active girls participated the most frequently in organized sports activities, and the low-active girls were the most active in participating in household chores. The physical education homework was a small aspect of the participants' whole-day physical activity, averaging 34 minutes per week. Students did the voluntary active physical education homework very often, with almost 90% doing the homework always. According to students and parents diverse, fun, interesting, and challenging opportunities should be provided with family support in physical education homework assignments. The average addition of 34 minutes of physical activity a week in form of physical education homework is a start, but there is still a need to find new useful ways to promote adolescent girls' physical activity.

Keywords: physical activity, physical education, homework assignments, after-school hours, physical activity patterns, adolescent girls, parents

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Kääpä, Mari
Yläkouluikäisten tyttöjen fyysisen aktiivisuuden ymmärtäminen ja edistäminen – Liikunnalliset kotitehtävät osana koululiikuntaa
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Liikuntasuositusten mukaisen liikkumisen määrän saavuttaa vain pieni osa nuorista, erityisesti tyttöjen liikkumisen määrä vähenee teini-iässä. Lapsena ja nuorena liikkuminen vaikuttaa positiivisesti aikuisiän liikkumismääriin, joten nuorten liikkumista tukevat toimenpiteet ovat erityisen tärkeitä. Tämän tutkimuksen tavoitteena oli tarkastella teini-ikäisten tyttöjen fyysistä aktiivisuuta, keskittyen erityisesti liikkumiseen koulupäivän jälkeen sekä liikunnallisiin kotitehtäviin koululiikunnan osana tukemassa fyysistä aktiivisuutta. Lisäksi tutkittiin oppilaisen ja heidän vanhempiensa käsityksiä liikunnallisista kotitehtävistä.

Tutkimuksen aineisto kerättiin suomalaisen yhtenäiskoulun yläkouluikäisiltä tytöiltä objektiivisilla kiihtyvyysanturimittauksilla (N = 88), puolistrukturoiduilla päiväkirjoilla (N = 81), kyselylomakkeilla (N =117) sekä oppilaiden että vanhempien haastatteluilla (N = 43). Aineistoa täydensi opettaja-tutkija päiväkirjan muistiinpanot. Objektiivisista mittauksista ja itseraportoiduista tiedoista analysoitiin frekvenssit, ristiintaulukointi, keskiarvovertailut t-testillä sekä varianssianalyysilla, Cohenin d ja Kruskal-Wallis. Haastattelut analysoitiin laadullisella sisällönanalyysillä, täydentäen avointen kysymysten vastauksilla ja opettaja-tutkija-päiväkirjan viittauksilla.

Osallistujat olivat keskimäärin tunnin ja 11 minuuttia päivässä reippaan ja rasittavan liikkumisen tasolla, 3 tuntia 8 minuuttia kevyen liikkumisen alueella, paikallaanoloa heille tuli 7 tuntia 37 minuuttia. Paljon liikkuvat tytöt osallistuivat eniten organisoituihin liikuntaharrastuksiin, kun taas vähän liikkuvat tytöt tekivät eniten kotitöitä. Tytöt tekivät vapaaehtoisia liikuntaläksyjä ahkerasti, lähes 90 % heistä kertoi tekevänsä läksyt aina, suosituinta oli tehdä liikuntaläksyt yksin (51,3 %). Liikuntaläksyt olivat pieni osa tyttöjen koko päivän fyysistä aktiivisuutta, keskimäärin liikuntaläksyihin käytettiin 34 minuuttia viikossa. Oppilaiden ja vanhempien mukaan liikuntaläksyjen tulisi olla monipuolisia, hauskoja, kiinnostavia ja sopivan haastavia, aikataulultaan joustavia ja vanhempien tukemia. Nuorten liikkumisen edistämiskeinoja tulisi hakea aktiivisesti, liikuntaläksyt voisivat olla yksi tapa lisätä nuorten liikkumista.

Avainsanat: liikkuminen, fyysinen aktiivisuus, nuoret, tytöt, liikuntaläksyt, vanhemmat, vapaa-aika

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Jyväskylä 28.5.2022
Mari Kääpä

ORIGINAL PUBLICATIONS AND AUTHOR CONTRIBUTION

This thesis is based on the following original publications, which will be referred to by their Roman numbers (I-IV). The thesis also includes unpublished data.

I. Kääpä, M., Hirvensalo, M., Palomäki, S., & Valleala, U.M. (2017). Liikuntatehtäviä kotiläksyinä: Koulun ulkopuolella tapahtuva oppiminen opetuksen tukena tyttöjen liikunnassa. *Liikunta & Tiede*, 54(2–3), 74–82.

II. Kääpä, M., Palomäki, S., Vähä-Ypyä, H., Vasankari, T., & Hirvensalo, M. (2019). The Role of Physical Education Homework to Adolescent Girls' Physical Activity in Finland. *Advances in Physical Education*, 9, 223–239.

III. Kääpä, M., Palomäki, S., Vähä-Ypyä, H., Vasankari, T., Hirvensalo, M., & Fedewa, A. (2021). Finnish Adolescent Girls' Activity Patterns and The Effects of an Activity-Based Homework Intervention on Their Physical Activity. *Physical Activity and Health*, 5(1), 1–14.

IV. Kääpä, M., Palomäki, S., Valleala, U.M., Fedewa, A., & Hirvensalo, M. The Role of Parental Support and the Students' Opinions in Active Physical Education Homework in Finland. Submitted.

As the first author of the original publications, considering the comments from the co-authors, the author of the thesis drafted the study questions and designs for the publications, had the main responsibility in the data collection, prepared the data for statistical analysis, performed statistical analysis with help from the statisticians and took main responsibility of writing the manuscripts (I–IV).

FIGURES

TABLES

CONTENTS

1 INTRODUCTION

The insufficient physical activity of adolescents is an ongoing challenge, with the majority of adolescents failing to achieve recommended levels of physical activity (Currie et al., 2008; Husu et al., 2019; Pate & O'Neill, 2009;). Participation in physical activities decreases during teenage years, with especially adolescent girls having low levels of physical activity (American College of Sports Medicine Position Standard, 2018; Dias et al., 2015; Gill et al., 2018; Hallal et al., 2019; Júdice et al., 2017; Kirby et al., 2011; Morrisey et al., 2015; Ruiz et al., 2011; Sallis et al., 2000; Silva et al., 2015). Adolescents are especially susceptible to social and environmental influences, but they still have a limited amount of autonomy over their own behaviours (Abdelghaffar et al., 2019). However, previous physical activity is related to physical activity later in life, and the future patterns of adult health behaviours, such as physical activity and attitudes towards it, are established during adolescence and childhood and possibly maintained into adulthood (Atkin et al., 2015; Kirby et al., 2011; Lounassalo et al., 2021; Pardo et al., 2014; Sallis et al., 2000; Telama et al., 2005). For that reason, adolescents are an important target for health promotions, including physical activity, and effective physical activity programs are recommended at this age (Abdelghaffar et al., 2019; Atkin et al., 2015; Kirby et al., 2011; Martins et al., 2015).

Promoting physical activity in youth is a challenge because of the variety of social contexts of which they are a part. In addition, there are multiple reinforcing factors for what makes some youth more active than others, such as total and peer social support, self-efficacy, and difficulty getting to and from activities. (Silva et al., 2014). The review by Martins et al. (2015) suggests that three key characteristics of physically active adolescents are high intrinsic motivation, social support, and environmental opportunities (Martins et al., 2015). The perceived barriers to physical activity during leisure time are more prevalent among girls than among boys (Dias et al., 2015). The prior studies support the notion that girls are more influenced by different types of family support for physical activity than boys are (Henriksen et al., 2016; Morrisey et al., 2015). Furthermore, social motives are rated higher by girls than by boys and associated with physical activity by girls (Kopcakova et al., 2015). The review by Martins et al. (2015)

showed that key facilitators and barriers to physical activity of adolescent are related to individual (e.g., attitude, motivation, perception), social (e.g., family, friends, and physical activity professionals such as physical education teachers), and environmental (e.g., access to physical activity facilities, physical activity opportunities) levels (Martins et al., 2015).

Physical activity is an important determinant of health (PAG, 2018; WHO, 2018), and physically active teenagers' self-perceived health, body image and academic achievement are better than those of teenagers who are less active (Atkin et al, 2015; Fedewa & Ahn, 2011). Increased physical activity is an integral component in enhancing school aged children's physical health and well-being (Fedewa et al., 2013). School-based multicomponent preventions that include families have been shown to be the most effective way to influence the physical activity of girls in a positive direction (Abdelghaffar et al., 2019; Cook-Cottone at al., 2009; Kriemler et al., 2011; Mears & Jago, 2016; Okely et al., 2011; Owen et al., 2017). Both Mears and Jago's (2016) and Owen et al.'s (2017) meta-analysis of school-based interventions in adolescent physical activity indicated the effectiveness of multicomponent interventions underpinned by theory (Mears & Jago, 2016; Owen et al., 2017). The systematic review on physical activity promotions in school by Kriemler et al. (2011) showed strong evidence that school-based interventions can increase the physical activity of adolescents. The duration of effective interventions was long enough (over one year), the intervention was voluntary by nature, and it extended to the family or community (Kriemler et al., 2011). Abdelghaffar et al. (2019) demonstrated that the use of single-gender groups and the involvement of parents and teachers in addressing inactivity among girls to be a useful approach (Abdelghaffar et al., 2019). In addition, according to Cook-Cottone et al. (2009), the effective school-based interventions should involve parents as well as concentrate on the reduction of sedentary behaviour (Cook-Cottone et al., 2009). The combination of school-based approach, theory background and multicomponent intervention that involves parents seems to be an effective way to increase physical activity of adolescents.

The vast majority of children and adolescents participate in school and physical education, a situation that provides a great opportunity for physical activity promotion in terms of public-health reach, regardless of the participants' social differences (Abdelghaffar et al., 2019; Beets et al., 2009; Palomäki et al., 2017; Scruggs, 2007; Siekkinen et al., 2019). In the school-level approaches, physical education plays a considerable role in providing physical activity (Mayorga-Vega et al., 2018; Meyer et al., 2013), and interventions can increase the proportion of time students spend in moderate-to-vigorous physical activity (MVPA) during physical education lessons (Lonsdale et al., 2013). The prior studies indicate that children and adolescents who enrol in physical education lessons were reported to be more physically active than were those who did not participate in physical education (Cheung, 2019; Mayorga-Vega et al., 2018; Mooses et al., 2017; Pate et al., 2007). According to an Estonian study by Mooses et al. (2017), on days with physical education, students had 12.8 minutes more MVPA and 9.7 minutes less sedentary time than they did on days without physical education (Mooses et al.,

2017.) The physical activity intervention of Mitchell et al. (2015), found that a physical education environment that promotes feelings of autonomy and competence by offering choices, and relatedness due to consultation with teachers and students, resulted in increased participation and more positive perceptions of physical education for girls (Mitchell et al., 2015). To create a positive environment and increase the physical activity levels of girls, they should feel empowered and motivated to be physically active. In addition, physical education should increase perceived motor competence, and physical activity opportunities should be provided on their own terms, in the form of gender-specific physical activities, for example (Corr et al., 2019; Marttinen et al., 2020a).

Even well-organized school physical education lessons do not exert a sufficient influence over physical activity and the health of adolescents, while school sports contribute only marginally to MVPA (Fairclough & Stratton, 2005; Gråstén et al., 2015; Hollis et al., 2017; Pfitzner et al., 2013). To meet adequate levels of total physical activity, adolescent need to participate in physical activity during, before and/or after school (Siekkinen et al., 2019). The active physical education homework assignments could be one possible way of promoting physical activity after-school hours (Gabbei & Hamrick, 2001; Williams & Hannon, 2013; Kääpä et al., 2017). The Finnish National Core Curriculum allows and encourages the use of leisure time to practice skills learned during school hours (Finnish National Core Curriculum for Basic Education, 2014).

In this Finnish Physical Education Homework Study project, the physical activity of lower secondary school girls was studied by objective measurements and by self-reported diaries. The role of physical education homework was studied as a part of adolescent girls' physical activity. The opinions and thoughts about physical education homework were gathered from the questionnaire and interview responses of students, as well as from interviews with parents. (Kääpä et al., 2017; 2019; 2021)

2 PHYSICAL ACTIVITY OF ADOLESCENT GIRLS

2.1 Physical activity

Physical activity is a complex phenomenon including several elements. Physical activity as a health behaviour is defined by Caspersen (1985) as "any bodily movement produced by skeletal muscle that results in energy expenditure". Physical activity can be categorized in a variety of ways, for example, as portions of daily life during which physical activity occurs, such as work or leisure time. Leisure-time activities can include subcategories such as household chores, sports or exercise and other activities, including active commuting (Caspersen, 1985). According to WHO (2017a), physical activity refers to all movement. Popular ways to be active can be done by everybody and at any level of skill, such as walking, cycling, different sports and active recreation and play. (WHO, 2017a)

Steps are the basic unit of locomotion and an important component of physical activity. Steps provide an easy-to-understand metric of ambulation as well as one choice in categorizing physical activity. Measuring step counts has been shown to motivate people to increase their physical activity levels (PAG, 2018). Nowadays, device-based technologies and physical activity trackers, such as wearable devices and apps, smartphones, or pedometers, are already available to all. Physical activity trackers are increasingly being used by young adolescents as well. (Ng et al., 2020)

Frequently, physical activity is classified by intensity, MET (the metabolic equivalent) being an indicator of exertion. MET values were used as the metric for the present study. MET are values of physical activity levels, with 1MET the rate of energy expenditure while sitting at rest. The conventional energy expenditure is an oxygen uptake of 3.5 millilitres per kilogram of body weight per minute, and MET values express the energy cost of physical activities as a multiple of the resting metabolic rate. (Pate et al., 2008) Sedentary behaviours are activities that do not significantly increase resting energy expenditure. The accurate

information on MET-values broadens the results from the pedometer's step counts. (Vähä-Ypyä et al., 2015a, 2015b.) When using MET as an indicator of exertion, the physical activity is frequently categorized by different intensity levels (Pate et al., 2008; Vähä-Ypyä et al., 2018). The classification based on the Angle for Posture Estimation (APE) algorithm compares the accelerometer orientation in relation to an identified upright position at the end of each 6-second epoch. The low movement intensity, body postures like standing, sitting, or lying, are under the level of 1.5 METs. Light physical activity is defined as activity corresponding to between 1.5 and 2.9 MET, moderate activity as 3.0 to 6.0 MET, and vigorous activity as more than 6 MET. (Vähä-Ypyä et al., 2018)

Previous studies have confirmed that because the accelerometers are able to record all ambulatory activity, they are reliable in assessing gait parameters in children and adolescents (Ekelund et al., 2011). For example, compared to self-reported data, accelerometer methods are more reliable for making conclusions about predictors and health impacts of intensity-based physical activity (Aittasalo et al., 2015; Brandes et al., 2006). By using MET values or steps, it is also possible to divide physical activity into light, moderate, or vigorous intensity (Caspersen, 1985). In addition, using both MET -values and total and running steps adds variety and reliability to the results, enabling reviews and comparison between the studies. (Aittasalo et al., 2015; Vähä-Ypyä et al., 2015a, 2015b)

With reductions in costs and complexity, along with technological improvements, objective measurements, such as accelerometers, are also increasingly used in research on physical activity (Biddle et al., 2011). However, understanding physical activity thoroughly requires information on what kind of physical activity people do alongside how much they do. Frequently, the physical activity research requires the use of self-reported physical activity, at least alongside objective methods, because of the simultaneous assessment of some aspects of physical activity. The self-report instruments will continue to be needed as producing important information on both the context and type of physical activity. Even if, self-reported physical activity data, especially in young people, might be affected by biases such as over-reporting, problems with recall or social desirability, it still provides information that cannot be reached by accelerometers. For example, patterns and types of physical activity, attitudes towards sport and physical activity, motivation or facilitators and barriers in physical activity cannot be revealed by objective measurements. Combining contextual self-reported physical activity data and accelerometer-assessed physical activity data allows researchers to arrive at meaningful findings, which makes this combination a desirable surveillance mechanism for collecting data concerning the physical activity of adolescents. (Biddle et al., 2011; Corr et al., 2019; Martins et al., 2015.)

There are plenty of studies concerning the physical activity of adolescents. Only the focus varies, for example, from different age groups to different times of the week or to socio-demographic or socio-economic backgrounds (American College of Sports Medicine Position Standard, 2018; Chaput et al., 2020; Currie et al., 2008; Hallal et al., 2006; Husu et al., 2019; Sutherland et al., 2016). There is consistent evidence of benefits from adolescent physical activity, and an

appreciation of all the mechanisms by which adolescent physical activity influences adult health is warranted. Adolescent physical activity has been shown to be positively associated with adult physical activity levels and it provides several health benefits, such as a long-term protective effect on bone health and breast cancer, and short-term benefits like better mental health. However, an excessive amount of exercise might be harmful for growing adolescents. Even if, the multiple benefits of adolescent physical activity are unequivocal, the exact amount of exercise needed to achieve those health benefits remains unknown. (Hallal et al., 2006)

Chaput et al. (2020) examined evidence on the associations between physical activity, sedentary behaviour, and the health-related outcomes of WHO guidelines on physical activity of children and adolescents. Their review of updated literature demonstrated that higher intensities and greater amounts of physical activity along with different types of physical activity are associated with improved health outcomes (Chaput et al., 2020). Furthermore, an Australian study by Sutherland et al. (2016) among secondary school students, suggested that implementation of the intervention by disadvantaged schools has the potential to increase daily minutes of MVPA. The intervention showed effectiveness in increasing physical activity in the intervention group compared with a decrease in the control group for all students, regardless of socio-economic status, implying the potential to reverse the physical activity decline in adolescent population (Sutherland et al., 2016).

Physical activity at school is associated with PE, recesses, as well as with before school and lunchtime activities (Haapala et al., 2014; McKenzie et al., 2010), but leisure time physical activity is quite often associated with organized sport (Kjønniksen et al., 2008). Participation in organized sport has been shown to be a significant factor in assisting adolescents to achieve and sustain higher levels of physical activity and especially MVPA (Koorts et al., 2011; Lawler et al., 2017; Lytle et al., 2009). However, the significance of non-organised physical activity, such as walking, jogging, or running has been shown to make an important contribution to physical activity (Lawler et al., 2017). The informal nature of self-initiated physical activities makes them accessible to all adolescents. These activities are easy to perform because they can be undertaken across multiple settings, with little cost, with friends or alone, and without any commitment or organization (Lawler et al., 2017). The importance of self-initiated activities alongside organized sport is undeniable.

2.1.1 Physical activity in public health recommendations

Regular physical activity has been demonstrated to have positive impacts on health systems, for example, preventing noncommunicable diseases such as cardiovascular diseases, diabetes, and several cancers (Guthold et al., 2018; Hallal et al., 2012). Physical activity helps to maintain a healthy bodyweight and prevent hypertension, as well as improves the quality of life and overall well-being (WHO, 2017a). According to the Finnish National Recommendation on physical activity for children and adolescents aged 7 to 17 years, which follow, for

example, the American guidelines, adolescents are recommended to be physically active for at least 60 minutes per day (American College of Sports Medicine Position Standard, 2018; Publication of the Finnish Ministry of Education and Culture, 2021). These recommendations conclude that greater amounts and higher intensities of physical activity alongside with different types of physical activity are associated with improved health outcomes. The guidelines recommend that physical activity should be versatile, brisk, and strenuous as well as performed in the way that suits the individual. In addition, recommendations suggest that adolescent should regularly engage in specific physical activities, such as resistance training (muscular-strengthening), stretching and flexibility exercises, bone-strengthening exercises and especially in aerobic-based activity. (American College of Sports Medicine Position Standard, 2018; Chaput et al., 2020.)

Depending on the study and the methodology used, there is a great range of variation in step-count guidelines for adolescents, with figures varying from 9,000 to 16,000 steps per day (Silva et al., 2015). The well-known recommendations by Tudor-Locke et al. (2011) directed at adolescent girls, suggest that to maintain health, the minimal recommendation of 60 minutes of MVPA is associated with 10,000 to 11,700 steps per day for adolescents (Tudor-Locke et al., 2011).

On the other hand, increased sedentary behaviours have negative impacts on well-being and health systems (Guthold et al., 2018; Hallal et al., 2012). According to WHO, the prevalence of insufficient physical activity among adolescents aged 11 to 17 years is 81% (WHO, 2017b). There is also a significant difference between low-income countries and wealthier countries, with the prevalence of insufficient physical activity in high-income countries double the prevalence in low-income countries (Guthold et al., 2018). Guthold et al. (2018) suggested that explanation lies in the fact that in low-income countries more physical activity is undertaken for transport and at work. However, the transition towards more sedentary occupations and personal motorized transportation is happening rapidly in urbanizing countries (Guthold et al., 2018). In Ruiz et al. (2011) adolescents from central-northern Europe were more active than their peers from southern Europe. Even if, the number of adolescent boys meeting the physical activity recommendations was similar between the regions, 1 in every 3 girls from central-northern Europe and only 1 of every 5 girls from southern Europe met the recommendations. (Ruiz et al., 2011.) In Finland, a high-income country, over a third (38%) of children and adolescents (aged between 7 and 15) met the recommended amount of physical activity. A larger share of boys than girls reached the recommended 60 minutes per day. Physical activity decreases and sedentary time increases with age, with the most radical decline in physical activity occurring among girls aged between 11 and 15. Of 11-year-old girls, 38% reached the recommended level of physical activity, but for 13-year-olds figure was 15%, and at age 15 only 6% met the physical activity guidelines. (Kokko et al., 2015a; 2019; Husu et al., 2019)

2.1.2 Physical activity of adolescent girls

In the research on adolescent physical activity, there is a consensus of decreasing physical activity among adolescent, with especially girls falling short of the recommended amounts of physical activity (ACSM, 2018; Hallal, et al., 2012; Husu et al., 2019; Júdice et al., 2017; Pate et al., 2009; Pate & O'Neill, 2009; Ruiz et al., 2011). Annually, objectively measured adolescent girls' physical activity declines at a rate of approximately 4%, which means that with time, the level of physical activity of adolescent girls recedes further from recommendations (Pate & O'Neill, 2009). The changes in the transition period of adolescence coincides with a significant decrease in physical activity for youth, and especially girls are at particular risk of physical inactivity (Abdelghaffar et al., 2019; Martins et al., 2015; Júdice et al. 2017; Ruiz et al. 2011). In Finland, 10% to 17% of youth between ages 13 and 15 attain moderate-to-vigorous levels of physical activity, with the most radical decline in physical activity occurring among girls aged between 11 and 15 (Husu et al., 2019; Kokko et al., 2015a). Whereas boys are more likely to participate in MVPA intensity team-based activities, girls are more likely to participate in individual sports with low active patterns, such as dance or self-initiated activities like swimming or running (Lawler et al., 2017.)

Given that adolescence is a particularly vulnerable time and that health-enhancing habits of an active lifestyle are established during this developmental period (Atkin et al., 2015; Pardo et al., 2014), it is particularly important to intervene to prevent the decline in physical activity in adolescence. The lower participation in overall physical activity and out-of-school activities, especially for girls, might be due to increase in social screens such as texting, emailing, social media and another internet use (Kemp, et al., 2020.) Since female adolescents seem to be at greater risk of physical inactivity (Aelterman et al., 2012), there is an urgent need for effective strategies to promote physical activity among them .

During that time of significant biological changes, adolescents start to individuate from their family and peers become more central to the socialization process (Kirby et al., 2011). In time peers' influence may exceed parents' influence and this transition period contains behavioural risk factors for increasing sedentary time and decreasing physical activity (Atkin et al., 2015; Kirby et al., 2011; Silva et al., 2014). Competitive physical activity and a performance motivational climate were considered barriers to the physical activity of adolescent girls. According to adolescents, these barriers are the result of unfavourable factors such as negative experiences in PE, the pressure to win along with failing in front of peers, peers' negative reactions, the absence of fun, feeling uncomfortable and the absence of learning opportunities. On the other hand, active adolescent girls' favourable attitudes stemmed from associations with multiple health benefits, physical appearance, fun and positive experiences, social interactions and recognizing its importance. They valued physical activity that is safe, varied, social, reserved, mastery-oriented but with an emphasis on autonomy, non-competitive but challenging, associated with feelings of entertainment, health (general and mental), physical fitness and body image impact. (Martins et al., 2015.) For adolescent girls, feeling uncomfortable, sweating, or showing incompetence in front

of peers might become an obstacle to physical activity (Bradley et al., 2011; Martins et al., 2015). In front of others, discomfort related to physical appearance might be especially embarrassing for less skilled girls, or girls with low levels of physical activity. For those girls, performing sports of their own choosing might be an easier way to approach a physically active lifestyle. (Lawler et al., 2017) In a list of the reasons for not participating in organized sport, Finnish adolescents from 9 to 15 years reported the following as the most crucial: not finding an interesting or appropriate type of sport (46%), no motivation (28%), a lack of transportation to sports facilities (23%), sport hobbies are too expensive (22%), no time (22%) or there are no sport opportunities near home 22% (Blomqvist et al., 2019). Acknowledging the most crucial barriers to the physical activity is important in promoting physical activity of adolescent girls.

As adolescents become older, greater levels of autonomy and fewer restrictions add to their amount of freedom to be independently physically active (Kirby et al., 2011; Silva et al., 2014). The adequate conditions are favourable to adolescents' physical activity, for example access to physical activity facilities, existence of equipment and perceived neighbourhood safety, and doing physical activities without parents' supervision might contribute to increasing the physical activity of adolescent girls (Gill et al., 2018; Kirby et al., 2011; Martins et al., 2015). In promoting adolescents' physical activity, it is important to trust adolescents' capability to organize their own physical activity and let that activity become their own choice. In addition, when promoting physical activity among adolescent females, the provision of gender-specific non-competitive activities have shown promising results (Haapala et al. 2014; Biddle et al. 2005).

2.1.3 Physical activity during after-school hours

In Finland, the overall distribution of lesson hours for basic education and minimum number of lessons for core subjects are decided by the Government. Students' workload differs according to age, and the legislation ensures students' ability to cope by defining an appropriate workload. According to legislation, there should be enough time for rest, recreation and hobbies after the school day, including commuting and homework. Seventh and eighth graders have the right to 29 hours of education per week, for ninth graders the weekly amount is 30 hours, and the maximum daily workload is seven lessons. One lesson usually consists of a minimum of 45 minutes of teaching, but the length of lessons can be arranged otherwise as well. (Finlex, 628/1998 24 §)

In addition to school physical education and recess activities, adolescents need to participate in physical activities during after-school hours to meet physical activity guidelines, because even if physical activity levels during physical education lessons are adequate, school sports do not contribute sufficiently to MVPA (Pfitzner et al., 2013; SHAPE, 2016). Activities during school hours do not, therefore, exert a sufficient influence over the physical activity and health of youth (Arundell et al., 2016; Fairclough & Stratton, 2005; Grao-Cruces et al., 2019). The after-school period represents a segment of the day during which young people could accumulate daily recommendation of 60 minutes of physical activity

(Beets et al., 2009; Mears & Jago, 2016; Pate & O'Neill, 2009). Nearly half of adolescents' total daily physical activity is accumulated after school, although sedentary exposure increases gradually during preadolescence (Wickel et al., 2013).

During the after-school hours, children and adolescents are freed from the constraints of the school environment and they often have the opportunity to choose from physically active domains and from sedentary domains. For example, homework competes directly against outdoor and sports activities during the most optimal time for leisure-time physical activity. Physical activity before academic tasks might just improve their performance, and the concept of active homework might reduce sitting time while completing homework tasks. (De Baere et al., 2015.)

The after-school physical activity patterns of adolescents are complex and include both physical and sedentary activities. However, these patterns, more than any single type of physical activity, need to be considered when encouraging adolescent girls to be more physically active (Kjønniksen et al., 2008). A cluster analysis by Trilk et al. (2012) yielded six clusters: educational sedentary, sports and play, organized sports, active transport and chores, electronic media, and sleep. In their study, in Grade 8, physical activity decreased, and sedentary time increased among girls in all clusters, specifically girls in the sports and play -cluster had the greatest decline in physical activity while the physical activity of girls in the organized sports -cluster declined less. (Trilk et al., 2012) For example, the Previous Day Physical Activity Recall (PDPAR) Questionnaire used by Koorts et al. (2011), included six categories of activity: housework (tidying up, gardening, meal preparation), outside activities (riding a bike, skateboarding), active job (a paper round), sedentary time (homework, listening to music, computer games), sports participation, and active travel (walking, cycling). Their results showed some clear differences in the type and context of physical activities among youth by objectively measured activity groups. A job, sport, and outside activities were more common among the more active youth. According to them, physical activity interventions could be effective if targeted outside of the school environment and at specific activities. (Koorts et al., 2011)

Increasing adolescent girls' participation in organized sports might help to sustain physical activity levels over time (Bélanger et al., 2009; Trilk et al., 2012; Pate et al., 2010; Zimmermann-Sloutskis et al., 2010). In the United States, approximately a quarter of school-aged adolescents participate in after-school activities (Afterschool Alliance, 2014), when in Finland, half of Finnish adolescents (aged 9 to 15 years) engage in sports club activities at least once a week (Blomqvist et al., 2019). However, intensive participation in general in physical activity and sport as well as continuous participation at school age predict the level of physical activity in adulthood more than the type of physical activity at a young age does (Telama et al., 2005). The trend of leisure-time physical activity seems to be, that participation in organized sports increases during early adolescence, with involvement in organized sports activities start younger today, in Finland on average at the age of six (Mathisen et al., 2019). Interest in healthy lifestyle, heightened body awareness, increase in the number of gyms, and knowledge about the

health benefits of training might be some of the reasons for adolescents' preference for certain types of organized activities (Coll et al., 2014; Koorts et al., 2011; Sand et al., 2015). Active commuting to hobbies might moderate young peoples' physical activity as well (Lytle et al., 2009). Physically active transport (walking or cycling) in youth has been observed to create lifelong healthy habits, physically active commuting from home is common in Finland, but needs to be encouraged (Mehtälä et al., 2020; Yang et al., 2014). Especially during the wintertime physically active transport might be laborious and encouragement is needed.

According to prior research, after-school physical activity types differ between low- and high-active girls (Koorts et al., 2011; Taverno Ross et al., 2013; Trilk et al., 2012; Zimmermann-Sloutskis et al., 2010). In Taverno Ross et al. (2013), the physically low-active girls engaged in leisure time and educational sedentary activities where as high-active girls reported more physical activity in team sports and individual sports than low-active girls did (Taverno Ross et al., 2013). According to Koorts et al. (2011), more active girls participate in activities like outdoor games and sports, which is likely how they achieve their higher activity levels (Koorts et al., 2011). In addition, sport club membership has a strong effect on moderate physical activity as well (Trilk et al., 2012; Zimmermann-Sloutskis et al., 2010). However, girls often accumulate their physical activity through leisure-time physical activity such as household and occupational tasks (Pardo et al., 2014).

2.2 Parental social support to physical activity

Family and social support have been consistently associated with the physical activity of youth, even if the actual parental physical activity does not correlate with adolescents' physical activity (Abdelghaffar et al., 2019; Atkin et al., 2015; Bauman et al., 2012; Gill et al., 2018; Martins et al., 2015; Sallis et al., 2000; Silva et al., 2014; Trost & Loprinzi 2011). Especially social support provided by the immediate community is a salient facilitator of youth physical activity, and while, an unsupportive social environment is perceived as a barrier to adolescents' physical activity (Abdelghaffar et al., 2019).

Even if during childhood the family is the primary factor in engaging in physical activity and learning PA-related beliefs, values, and habits (Atkin et al, 2015; Morrisey et al., 2015), family support is a consistent correlate in adolescents lives as well (Bauman et al., 2012; Biddle et al.; Gill et al., 2018; Reimers et al., 2012). A review by Trost and Loprinzi (2011) identified four types of parental influences: parental support, parental modelling, parenting style and family cohesion. Combining multiple forms of parental support was recommended (Trost & Loprinzi, 2011). Parental social support for physical activity, such as engagement, joining, watching, and talking about, are associated with adolescents' physical activity levels (Henriksen et al., 2016). Positive family relations reduce the time spent in sedentary behaviours performed alone, such as playing video games, reading, or doing homework (Atkin et al., 2015).

The inner circle adults have a great responsibility in encouraging adolescents' physical activity in several ways. Parental support can be verbal or direct assistance, for example transportation, financing hobbies, supporting, joining, and making healthy food and doing laundry (Sallis et al., 2000). In time, sports or physical activity might become a common context and a shared area of interest between adolescents and their parents (Henriksen et al., 2016).

Despite the importance of familial influence in physical activity, over time, the socialization process individuates adolescents from their families and the influence of their peers increases (Atkin et al., 2015; Kirby et al., 2011; Palomäki et al., 2017). Younger adolescents perceive more support from their parents. However, with increased independence and autonomy due to aging and maturation in adolescence, both the amount of support by the parents and its association with physical activity decreased. (Palomäki et al., 2017)

3 SCHOOL AS A PROMOTER OF PHYSICAL ACTIVITY

3.1 School-based approach

Schools have been called to expand their efforts to increase the physical activity of adolescents due to schools' great potential in terms of public health reach. All adolescents attend school and participate in physical education, which makes schools an important institution for physical activity promotion. (Abdelghaffar et al., 2019; Beets et al., 2009; Bowser, 2013; Scruggs, 2007.) Physical education teachers have great potential to influence youth attitudes toward physical activity. Creating functional knowledge and teaching children how to be active on their own might result in lifelong healthy behaviour such as regular physical activity. (Duncan et al., 2011) School-based multicomponent interventions have been shown to be an effective way to establish health behaviours (Mears & Jago, 2016; Cook-Cottone et al., 2009; Okely et al., 2011; Owen et al., 2017). Abdelghaffar et al. (2019) found that the use of single-gender groups and the involvement of parents and teachers proved to be a useful approach for addressing inactivity in adolescent girls (Abdelghaffar et al., 2019). Cook-Cottone et al. (2009) implicated that effective school-based physical activity intervention requires involving parents and concentrating on the reduction of sedentary behaviour (Cook-Cottone et al., 2009). In addition, school-based strategies that do not require new equipment or additional staffing but utilize existing school resources are most likely to be implemented and maintained (Bowser, 2013). Overall, a meta-analysis by Mears and Jago (2016) concluded that after-school programmes may have an opportunity to increase the physical activity of school-aged children and reduce their physical inactivity (Mears & Jago, 2016).

There are encouraging results of school-based intervention targeting physical activity during the school day (Abdelghaffar et al., 2019; Bailey et al., 2022; Haapala et al., 2014). In Finland, a large school-based intervention had a

significant impact on youth PA. The intervention consisted of spending recess outdoors, more organized recess activities, the greater provision of activity-based equipment, the development of sports facilities and offering gender-specific activities especially for girls (Haapala et al., 2014). HEPAS literature review report presents key aspects of activity-promoting schools in the form of the Active School concept (Bailey et al., 2022). For Active School settings, influential tools include active learning and active breaks during the lessons, active recess, active transport, active homework, consideration of the curriculum for physical education lessons, the education and attitudes of teachers and workforce along with school sports. Each of these aspects can be notified separately, but the real significance comes from a synergistic whole, where the whole school commits to shared values, priorities and providing sufficient time. (Bailey et al., 2022)

3.1.1 Curriculum

The highly respected Finnish National Curriculum for Basic Education (2014) emphasizes that equality, students' individual development and needs are to be considered and acknowledged in teaching and learning processes. School culture promotes participation, learning together and learning from each other, building a positive and realistic self-image, well-being, safety, and a sustainable way of living. A school's leaning community encourages all its members to try their best, work together and learn. Learning is promoted by regular evaluation of one's own work along with information received through development, research, and evaluation, as well as encouragement for exploring and experimentation. (Finnish National Curriculum for Basic Education, 2014, 43, 47–48, 57)

In Finland, schoolwork applies pedagogically varied approaches and learning environments systematically, encouraging students to work outside the classroom, project and problem-centred work, studying in modules and cooperation within the school and with the surrounding community. Information and communication technology in a varied media culture are part of diverse learning environments. The pupils take part in developing learning environments and develop their personal competence by gathering experiences in various environments and learning situations. Skills in finding, analysing, processing, applying, combining, presenting, evaluating, and creating information are valued in learning. The wide range of working and assessment methods give each pupil a possibility to demonstrate their competence in different ways, while varied methods also support motivation, self-regulation and the feeling of being part of the group. The pupils' different ways of learning and teachers' knowledge of their pupils' personal needs are considered in pedagogical choices and in the selection of working methods. The learning-to-learn skills, pupils' participation in planning and evaluating and joint discussions of goals and principles of assessment motivate and help pupils to assume responsibility for their learning and commitment to work. The Finnish National Curriculum, which is followed throughout the country, defines the boundary conditions for physical education and its learning objectives (Finnish National Curriculum for Basic Education, 2014). In Finland,

the distribution of lesson hours in basic education defines the number of different subjects during lower secondary school (grades 7–9). (Table 1).

TABLE 1 Distribution of lesson hours in lower secondary school basic education (Finlex 793/2018, 6§).

Subjects	**Grades 7–9**	**Total** (during basic education 1–9)
Mother tongue and literature	10	42
A1 language	7	18
B1 language	4	6
Mathematics	11	32
Biology and geography	7	
Physics and chemistry	7	
Health education	3	
Environment and nature studies in total	*17*	*31*
Religion/Ethics	3	10
History and social studies	7	12
Music	2	8
Visual arts	2	9
Crafts	2	11
Physical Education	**7**	**20**
Home economics	3	3
Artistic and practical elective subjects	5	11
Artistic and practical subjects in total		*62*
Guidance counselling	2	2
Optional subjects		9
Minimum number of lessons		**224**

The importance of physical activity and reducing sedentary way of living, and diversity of learning are recognized by the whole leaning community of a school. Flexible school practices enable a range of activities, physical exercises and shared activities that promote mental well-being. The school's learning community gives space for active learning, physical activity, play, creative work, and experiences characteristic of different learners and children of various ages. (Finnish National Curriculum for Basic Education, 2014). In addition to school PE, a great deal of effort has been made to make school days more active (Haapala et al., 2017). In Finland, the school day often consists of 45-minute lessons and 15-minute breaks, which provides adolescents with consistent opportunities to be active during the school day. In addition, in many schools it is mandatory to go out during recess. The organized recess activities and activators, the development of school sports facilities and equipment provision, and gender-specific physical activities have had positive effects on youth physical activity (Haapala et al., 2014).

The Finnish National Core Curriculum for Basic Education (2014) allows and even encourages using children's and young peoples' leisure time as a resource and extending skills practice into after-school hours as well (Finnish National Core Curriculum for Basic Education, 2014). Highly educated teachers are able to provide homework assignments planned to support the learning of the selected age range of children. Even if school-aged children and adolescents are used to homework assignments in many school subjects, active physical education homework assignments are not a widely used method.

3.1.2 Physical education

In Finland, the amount of physical education is seven hours weekly per year for three school years during grades 7, 8 and 9 (Table 1), meaning on average two to three hours per week during those grades. An average of half of adolescents in grades 5, 7 and 9 had a maximum of 90 minutes of physical education weekly (2x45 minutes), a quarter had 135 to 150 minutes and another quarter at least 180 minutes of physical education per week (Palomäki et al., 2019). The total average amount was 135 minutes of physical education weekly. The differences between the grades might be due to optional physical education, which students choose, especially ninth graders have the opportunity to choose extra physical education lessons. A little over 10% of the students have been selected to study in a class that has specialised in sports, meaning they have more physical education lessons than those not in the specialized classes. (Palomäki et al., 2019)

One instance of physical activity during a physical education lesson once a week does not reach the recommended physical activity level (ACSM, 2018; Recommendation in Publication of the Finnish Ministry of Education and Culture, 2021). In the section on physical education in the Finnish National Curriculum, equality, diversity and approaching individual development and needs are highlighted. According to the curriculum, the content of physical education lessons should vary and take seasonal variation into account.

The curriculum objectives of physical education are divided into physical, social, and psychological functional capacities. The physical objectives of instruction in grades 7 to 9 include encouraging the pupil to be physically active, guiding them to practise perceptual motor skills and develop balance and locomotor skills through practice in different environments and during different seasons, and guiding pupil to develop manipulative skills using different equipment. In addition, the goals are to encourage and guide the pupil to evaluate, maintain, and develop physical fitness, to strengthen the pupil's swimming and water rescue skills, and to guide the pupil towards safe and appropriate action. In social functioning capacity, the goals are to guide the pupil to work together with everyone, to regulate actions and emotional expression in exercise situations, and to guide them to follow the principle of fair play. The objectives of psychological functional capacity are to encourage the pupil to take responsibility for one's actions, support the pupil's skills in working independently, and ensure that the pupils have enough positive experiences of their own body, self-efficacy, and togetherness. Altogether, physical education includes learning motor skills, but

also working, collaboration and emotional skills, which are evaluated as well. (Physical Education, Finnish National Core Curriculum, 2014)

The school environment is the most common place for PE, but it is highly recommended to use nearby sports facilities and the natural environment as well. The familiarity of an environment for physical activity might be important, especially among adolescents (Corder et al., 2013), because the most common activities, such as low intensity self-initiated and household activities, take place at home or in a neighbourhood setting or a nearby sports environments or facilities (Corder et al., 2013; He et al., 2013).

3.1.3 Teacher influence in the physical activity of students

One strength of the Finnish educational system is that teachers have great deal of autonomy in deciding the way they teach, following the curriculum of course (Haapaniemi et al., 2021). Teacher can create opportunities for decision-making and regulate the amount of student involvement in it. Teacher can improve students' autonomy and self-determination by involving them in planning, choosing scale, complexity, or amount of physical active assignments (Deci & Ryan, 2000). By fostering perceptions of ownership over participation in physical education and physical activity, students are enabled to be active in a way they choose (Corder et al., 2013; Deci & Ryan, 2000; Lawler et al., 2017). If students feel their teacher is supporting their physical knowledge, learning, and health improvement, they report satisfaction of basic psychological needs and autonomous motivation and are more likely to participate in physical activity (Ferriz et al. 2016). According to Nogg et al. (2021) it might be beneficial to shift focus from addressing barriers to physical activity to the efforts on fostering more self-determined levels of motivation, such as identified, integrated, and intrinsic motivation. Specifically, to improve overall physical activity in adolescents the focus should be on cultivating intrinsic motives. For example, focusing on skills improvement increase perceptions of competence which lead toward intrinsic motivation. In addition, multicomponent interventions directed at several forms of motivation are supported as well. (Deci & Ryan, 2000; Nogg et al., 2021)

In generating an increase in PA, reinforcement by influential adults, such as physical education teacher, is important (Behrens et al., 2015; Trilk et al., 2012). The teacher's supportive interaction with students in promoting physical activity affected students' MVPA in a positive way, but when teachers did not promote physical activity with participants, they were positively associated with lower levels of physical activity as well as sedentary time (Behrens et al., 2015). Furthermore, a Finnish study among adolescents (11 to 15 years) revealed that students appreciate a teacher's pedagogical competence and consider the fairness and encouragement of teachers to being important (Lyyra et al., 2019). Extending the teacher's interactions and promotional work to the daily lives of students could increase the physical activity levels of adolescents (Duncan et al., 2019; Trilk et al., 2012). Physical education teachers have the opportunity to explain the benefits of physical activity to contribute to girls' health knowledge and improve their motor and collaborative skills (Duncan et al., 2011; Duncan et al., 2019). Teachers

also have a significant role in encouraging attachment to society and creating connections with the surrounding school community, for example in encouraging students in active commuting (Martins et al., 2015; Martins et al., 2016).

3.2 Physical active physical education homework assignments

Physical activity physical education homework assignments are designed to provide an opportunity for students to apply and practice activities and skills learned earlier at school. In previous research it has been found that one possible way of promoting physical activity among adolescents is to assign active physical education homework, when practicing takes place during after-school hours (Bowser, 2013; Duncan et al., 2011; Gabbei & Hamrick, 2001; Hart, 2001; Jorgenson et al., 2001; Mitchell et al., 2000; Novak & Lynott, 2015; Williams & Hannon, 2013). The curriculum-based active physical education homework assignments enable teachers to effectively deliver health-related educational material. Utilizing the existing curriculum and expertise of trained teachers in introducing active physical education homework, enables adding physical activity without sacrificing learning objectives or teaching obligations, all done in a cost-effective way as well. (Duncan et al., 2011.)

Research concerning physical education homework is limited, but those few studies show that physical education homework could be effective in increasing levels of physical activity (Claxton & Wells, 2009; Duncan et al., 2011; Duncan et al., 2019; Fairclough et al., 2013; Kriemler et al., 2011). Active physical education homework should follow the core curriculum and physical education tasks. Some physical education teachers have suggested that active physical education homework could be used as a tool to meet physical activity recommendations and physical education curriculum learning objectives (Hill, 2018).

Physical education homework assignments increase the time spent in practicing various skill, which might lower the threshold to participate in organized sport activities. Participation in organized sports might help to better sustain adolescents' physical activity levels over time (Bélanger et al., 2009; Pate et al., 2010). In addition, extending skill practice to after-school hours, physical education homework assignments offer an opportunity to increase physical literacy (Shortt et al., 2019), for students as well as parents. Parents' perceptions of physical education can be somewhat outdated, thus physical education homework assignments provide family members an opportunity to familiarize themselves with the current physical education learning objectives and practices aa well as the content of the physical education curriculum, including health literacy more broadly (Williams & Hannon, 2013).

4 THE SOCIO-ECOLOGICAL FRAMEWORK

4.1 The socio-ecological framework in addressing physical activity

The framework used is Bronfenbrenner's (1979) socio-ecological model. In this approach health behaviours, such as physical activity, are influenced by factors at various levels from the individual to the societal realm. This framework is suitable for interventions utilizing multiple levels and therefore it can be effective in promoting healthy practices (Bowser, 2013), which is why it is often used in health promotion (Abdelghaffar et al., 2019; Bowser, 2013; Brendon et al., 2016; Sallis et al., 2000). The multiple levels of the socio-ecological model work independently and interdependently to influence health behaviours (McLeroy et al., 1988). Moving beyond intrapersonal factors and adopting multilevel ecological model broadens the vision of physical activity (Bauman, 2012), and taking into account these different levels enables approaching all the interaction between influences on physical activity and enables capturing synergistic effects of each level (Bronfenbrenner & Morris, 2006; Bowser, 2013; Bauman et al., 2012).

The socio-ecological model used in this study was modified from Bronfenbrenner's (1979), Bronfenbrenner & Morris's (2006) and Elder et al.'s (2007) models (Figure 1). The levels of the socio-ecological model begin with the individual (intrapersonal) level and expand to the socioecological influences that directly and indirectly influence individuals and their actions. Intrapersonal influences are those individual characteristics such as attitudes, knowledge, skills, beliefs, and prejudices. The next level is the interpersonal level. Interpersonal influences are immediate community factors connected to the individual by social interaction, or more precisely, through a close circle of people such as family and friends. (Bronfenbrenner 1979; Bronfenbrenner & Morris, 2006; Elder et al., 2007.) The source of influence on adolescents' behaviours is an interesting component, because young peoples' decisions are increasingly influenced as much as by

social (peer) and environmental (school and community) influences as they are by their familial and individual influence (Bowser, 2013).

The individual (intrapersonal) and interpersonal levels are framed by the environmental level. School is a semi-controlled environment where opportunities for physical activity are built into the school day. Addressing the school environment provides an opportunity to influence behaviours such as physical activity. Indirectly, this can influence outcomes such as a having more active lifestyle, where the effects extend outside of direct interaction with school or other students. People interact with their physical environment and community, and environmental considerations can impact physical activity levels. For physical activity, important elements include built and natural environments, security, transportation and commuting, nearby sports facilities and access to them. (Bowser, 2013).

The largest frame for peoples' action in society comes from in organizational level factors, public policy factors and the societal environment. This frame includes rules, structures, legislation, and policies. For physical activity especially important are urban planning and cultural practices, and for example physical education (homework), school polices and curriculum. The broader social influences may play an additional role in physical activity and its' health outcomes. The built environment may have direct impact on the physical activity of adolescents as well. Youth who have access to sports facilities and safe natural and built environments are more active than those adolescents who live in unsafe, unclean environments that do not provide facilities for activity (Corder et al., 2013; Gill et al., 2018; Lytle et al., 2009; Martins et al., 2015). For more effective promotion of physical activity, addressing multiple levels and capturing both the independent and synergistic effects is essential. Addressing physical activity in a semi-controlled school environment but reaching outside this environment to the home environment has the advantage of reaching multiple levels of the socio-ecological model and interaction between these levels. (Bowser, 2013)

4.2 The socio-ecological model in this study

In this study, all the levels are considered and interaction within and between levels is taken into account. The focus was on the individual and intrapersonal levels, with the societal and environmental levels acting as a framework for them. Adolescent decisions are influenced by their familial and individual influence, but more and more by social and environmental influences as well (Bowser, 2013). For more on the role of these frame levels, see the discussion section of this dissertation.

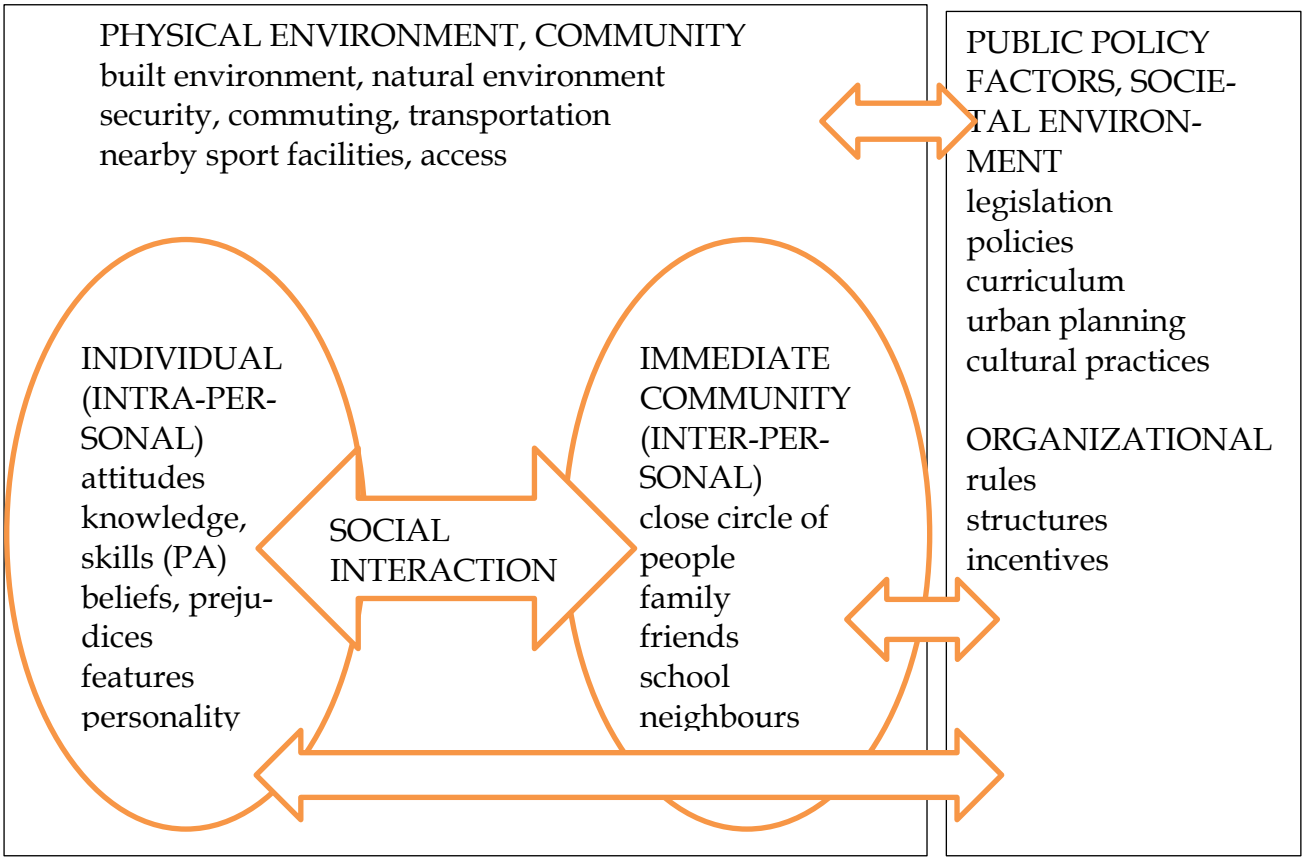

FIGURE 1 Interaction between the different levels of the socio-ecological model, framework modified according to Bronfenbrenner (1979), Bronfenbrenner & Morris (2006) and Elder et al. (2007).

Individually students' physical activity level, attitudes, beliefs, and prejudices towards physical education homework assignments are examined. Physical education homework assignments could include the participation of someone else, such as a family member, that broadens the social interaction between the individual and immediate community.

Physical education homework assignments were designed to be performed at home, in the nearby neighbourhood, the natural environment or in some common sports facility close to home. That aspect encourages interaction that also affects the immediate physical environment and community. Urban planning and the accessibility of the natural environment extends into public policy factors and the societal environment.

General laws and legislations concerning school are binding on the teacher, and the curriculum regulates the content of teaching, which creates a natural bridge between public policy and organizational factors and both immediate community and reaching toward individual level as well. Physical education homework assignments were given according to the curriculum, and for example, student active participation in decision-making in school community is important tone in curriculum. Teachers follow the requirements of the curriculum,

and for example, basic motor skills are practiced in physical education lessons as well as included in physical education homework, because of the planning based on curriculum objectives. (Finnish National Curriculum for Basic Education, 2014)

This study examined the types and patterns of students' after-school activities. That aspect extend interaction to all levels of the socio-ecological model. For example, if a student participates in organized sport, it requires a positive attitude toward physical activity, agreement from parents (at least to pay for fees, for example in case of swimming homework), access and commuting to a sports facility, and the guidance from a coach. All of these entities (transport company, sports facilities, coaches) are obligated to operate according to the laws as well as the local legislation and rules.

5 AIMS OF THE STUDY

Childhood and adolescence are the time when health behaviours such as physical activity habits are established (Atkin et al., 2015; Kirby et al., 2011; Sallis et al., 2000). However, it is also a time of significant decline in activity, especially among adolescent girls (ACSM, 2018; Hallal et al., 2012; Husu et al., 2019; Martins et al., 2015). Although the physical activity of adolescents has been examined extensively, there is still a need to pay more attention to the content of after-school hours and the levels and timeframe of physical activity during leisure time activities. There is an urgent need for active strategies to promote physical activity among female adolescents. This research tested one new tool to address the decreasing physical activity of adolescent girls by reducing sedentary time and increasing physical activity in after-school hours through physically active physical education homework. To contribute research knowledge of physical activity behaviours among teenage girls and promote their physical activity with an intervention targeted at them, the Finnish Physical Education Homework Study was conducted in lower secondary school. The target group was all adolescent girls of a midsize school in Central Finland.

Research questions and hypothesis of this study:

1. The aim of this study was to examine the physical activity of adolescent girls (Articles II, III).
    1.1. What were the objectively measured levels of physical activity and sedentary time of adolescent girls? (II, III)
    1.2. What were the self-reported patterns and types of physical activity of adolescent girls during after-school hours? (III)
    1.3. What was the content and proportion of the physically active physical education homework from the total physical activity in after-school hours? (II, III)
2. The second aim was to explore students' and their parents' perceptions of physically active physical education homework and how physically active physical education homework assignments could function in physical education.

2.1. How did the students react to physically active physical education homework assignments and what were their perceptions of them? (I, IV)

2.2. How did the parents react to physically active physical education homework assignments and what were their perceptions of them? (IV)

6 RESEARCH DESIGN AND METHODS

6.1 Research design

The Finnish Physical Education Homework Study was executed at the same lower secondary school where the researcher was a physical education teacher at the school. The study uses quantitative and qualitative methods to enrich the results and to broaden the acquired knowledge. Students as well as their parents were informed about the research, and their consent was obtained. The layer of the Ethics Committee of the University of Jyväskylä approved these measures.

In Finland it is common to study physical education in gender groups, which is why the study population consisted of female students at a lower secondary school in Finland (Table 2). Five parents of the students participated the study as well, with their interviews supplementing the data from the students. The data were acquired by objective measurements, structured questionnaires, self-reported diaries, and interviews accompanied with a teacher-researcher diary. Because of the diverse measurements, the approach, analyses, and methods varied as well, both during the research period and from article to article (Table 2).

6.1.1 Assigning physically active physical education homework

The girls (N = 117) participating in this study had some experience of physical education homework beforehand. The physical education teacher had occasionally given them active physical education homework assignments in past years, so the concept of physical education homework assignments was familiar to participants, but with the systematic Physical Education Homework Study, regular weekly physical education homework assignments began. Homework assignments followed physical education curriculum requirements, and being an aspect of physical education, they were given to all the girl students and strongly

recommended to do them. The skills and activities of physical education homework assignments were first practised in physical education lessons to ensure safe and proper technique and that the instructions were understood.

The physical education teacher gave homework assignments to all of students in every physical education lesson once a week during the study year. During that time, the physical education homework was given between 30 and 40 times. Even if active homework assignments were given to all the female students in this one lower secondary school, participating in the Physical Education Homework Study and doing physical education homework was voluntary. Highlighting students' autonomy might increase their commitment to tasks (Deci & Ryan, 2000; Novak & Lynott, 2015). However, the girls participated in physical education homework assignments actively, with almost 90% of the girls always completing their homework tasks. After the discussion, the girls decided that doing physical education homework assignments should be checked by a physical education teacher. In mutual agreement, the girls marked whether they did or did not do the physical education homework assignment given last time. The marking methods developed when students wanted different scales of doing to be recognized in the markings. For example, doing half of the task or doing an extra amount had its own markings. Doing physical education homework assignments did not have an effect to assessment.

Following the physical education learning objectives, homework assignments were varied. Involving students in planning their physical education homework was often part of the physical education lesson. In addition to having an influence on the activity, students could usually choose the scale, amount, and complexity of the homework themselves. The background reason for involving students in decision-making was to improve girls' self-determination and autonomy (Deci & Ryan, 2000). Some of the girls wanted to write down suggestions for physical education homework assignments, and in every lesson one of their proposals was drawn from the pile and chosen to be the homework of the week. One group of girls worked in pairs. After a short discussion with their partner, and considering individual needs, they together decided the homework of the week. One group of girls voted on the topic, such as strength training, endurance exercises, or stretching, and gave the teacher decision-making power about the details of the assignments. Some of the girls did not want to participate in planning at all, so they decided that teacher can give the actual homework assignments. Nonetheless, they wanted to participate in choosing the scale and deciding on the amount of physical education homework. For example, they decided the number of squats they aimed to do during the week. The numbers varied from 50 squats to over 500, and they could report their result on their own.

Physical education homework varied from body-conditioning exercises, stretching or muscular training to jogging and some skill or activity from the physical education lesson. The examples from body-conditioning exercises or muscular training could be push-ups, squats, or ab crunches. For the jogging assignment, students decided the length of the run suitable for them. One example of a physically active homework assignment, which included health literacy, was

balance practice. The task was to stand on one's right foot in the morning while brushing their teeth and on the left foot at night while doing the same. Some physical education homework assignments focused on tasks practised during the physical education lesson, extending skill practice into after-school hours, and increasing the time spent practicing various skills. Throwing and catching a ball could be an example of skill practice. Usually, physical education homework assignments were designed to be implemented without any equipment, but in case of tool-focused exercise, it was possible to borrow equipment from the school. Quite often, the physical education homework assignments included involving family members, meaning the physical education requirements were used to engage families and increase knowledge about the content of physical education. Taking a family member jogging or teaching a family the correct way to do squats were examples of parental involvement. The physical education homework assignment requiring going to swim was given for summer vacation. Because Finland features a large number of easily accessible lakes, this physical education homework was easy to implement and even a desired activity during summer holiday.

6.1.2 Data sources and study population

The study was executed in a midsized (300–350 students) lower secondary school in Central Finland from 2016 to 2020. The regular weekly physical education homework assignments began at during the 2015–2016 school year. All the female students had physical education homework, but at first, from 124 girl students, 105 (84,7%) agreed to participate in the research. The girls were from grades 7 to 9, aged between 12 and 15 years. The girls from Grade 6 were included in the first phase of the study, but they were excluded from later phases because of their small number. This study population was grouped differently for analysis, no experimental and control group was formed. In Table 2, there is a compilation of student population (*N*), data sources and used analysis of different articles in this study.

TABLE 2 Study population, data sources and analysing methods.

	Article I	Article II	Article III	Article IV
Time of data collection	Spring 2017	Autumn 2018 Retest 2020		Winter 2017 (students) Spring 2018 (parents)
study population	*N* = 117 girls from grades 6 to 9 (20 Grade 6 girls, 32 Grade 7 girls, 29 Grade 8 girls, 36 Grade 9 girls)	*N* = 88 accelerometer data (altogether 513 measurement days; 190 days from Grade 7 girls, 152 days from Grade 8 girls, 171 days from Grade 9 girls) *n* = 81 diaries (28 Grade 7 girls, 26 Grade 8 girls, 27 Grade 9 girls) retest in two different classes in different school *n* = 48		*N*= 43 (38 students, 5 parents)
data source	questionnaires teacher-researcher diary	accelerometers semi-structured diary questionnaire		interviews
analysis	frequencies, cross-tabulation (chi square) comparison of mean values (*t* -test, analysis of variance) categorisation, reduction and, conceptualization of open replies	means + *SD* MET values and steps by analysis of variance (ANOVA) and Tamhane post-hoc test independent-sample *t* -test and Cohen's *d* to compare two PE homework groups	proportioned MET values between light-, middle- and high-activity groups by analysis of variance (ANOVA) with Tukey and Tamhane post-hoc tests small sample sizes of organized sport and self-initiated types compared using independent-samples Kruskal-Wallis with Bonferroni post-hoc test	qualitative content analysis strategy (QCA) (coding frame, categorisation; frequencies, descriptive group comparison and interferential statistics)

6.2 Measurements

6.2.1 Objective measurements -Accelerometers (II, III)

The lower secondary school students were asked to participate in this phase of the study during autumn 2018, where different levels of physical activity, sedentary time, and number of steps were measured using accelerometers among girls in the grades 7, 8 and 9. The accelerometers were delivered with instructions during the physical education lesson, and students wore them for a period of one week.

Both accelerometer- and self-reported diary- measurements were implemented in November 2018. During that time of the semester, students completed several physical education homework assignments. The devices, accompanied with self-reported diaries, were handed out by the physical education teacher during physical education lessons. The physical education teacher gave oral instructions, and written instructions were attached to ensure the delivery of the instructions. The students were instructed to wear the flexible belt with a monitor around their waist for seven consecutive days during their waking hours, apart from during water-based activities such as swimming or showering. The monitoring stared straight away, if any malfunction was detected during the test, the device was replaced. The tri-axial accelerometer, UKK RM42 (UKK-Institute, Tampere, Finland), used in this study, is a small, and lightweight monitor which can be worn for 24 hours and for a week without needing to be charged. These accelerometers collect and store accurate information on the duration, intensity and pattern of physical activity and inactive periods, which increases verifiability of objective data. In addition, they measure posture and postural changes and the number of total and running steps (Aittasalo et al., 2015; Vähä-Ypyä et al., 2015a, 2015b). The accelerometers are reliable in recording all ambulatory activity and in assessing gait parameters in adolescents and children (Ekelund, Tomkinson, & Armstrong, 2011). The accelerometers with self-reported diaries were returned a week later during the next physical education lesson.

Altogether, 88 students agreed to this part of the study and delivered acceptable data from accelerometers and self-reported diaries in time. Some of the participants had not been allowed to wear accelerometer during their organised sport activities, for example in gymnastics. The actual study data consists of information from participants who had at least 4 days of accelerometer data (N = 88) and questionnaires concerning their self-report diaries (n = 81). In the objectively measured data analysis, to get the most comprehensive overview about the adolescents' physical activity, acceptable data (at least 4 days, 10 h minimum/day) accelerometer data (Mattocks et al., 2008; Troiano et al., 2008) were used from all the participants (N = 513). For this reason, the measurement days consisted of 190 days of data from the seventh-grade girls, 152 days of data from the eighth-grade girls and 171 days of data from the ninth-grade girls. Girls who had both objectively measured and self-reported data were included in analyses of compound measurement results (No physical education homework, n = 238, Physical education homework twice a week or more, n = 248).

6.2.2 Self-reported semi-structured diaries (II, III)

The self-reported semi-structured diary data was collected at the same time with objectively measured data. The information on participants' after-school activities was obtained through a semi-structured, self-reported diary questionnaire developed by the teacher-researcher. Koorts et al.'s (2011) questionnaire, the Previous Day Physical Activity Recall (PDPAR), provided a basis for the content and structure for the planning process of the questionnaire that was used. The students reported the type (e.g., walking, cleaning, dance lesson, playing outside)

and the frequency of activities in organized sports, household activities, self-reported activities, and physical education homework. In the self-reported data, the division was 28 girls from the Grade 7, 26 girls from the Grade 8 and 27 girls from Grade 9.

Participants reported the activity types they engaged in during after-school hours per week. The self-reported diary questionnaire consisted of categorized structures where students marked their activity frequency, level of self-initiated PA, organized sport activities, occupational activities, and the physical education homework in which they participated within the study week. **Organized sports activities** were activities led by instructors or coaches. The time spent in organized sports activities during the week was reported in minutes. **Household activities** were duties related to the home environment, such as babysitting younger siblings or performing household chores. The household activities included optional household chore categories to choose from: cleaning, walking the dog, taking care of siblings, and other chore-related activities around the house. In this "other" category, participants reported activities they performed such as shovelling snow, raking leaves, or delivering newspapers. Non-organized leisure time activities performed in without supervision were **self-initiated sports activities**.

The students estimated the time spent in active physical education homework assignments and in organized sports activities. The focus of time-consuming part on these two behaviours was pre-determined based on previous research on the activity preferences of Finnish adolescents, which implies that many adolescent girls participate in organized sports activities (Paakkari et al., 2017; Tammelin et al., 2016), which are usually held at the same time every week for the same duration. In self-reported activities and organized sports activities, participants answered open-ended questions as well, in contrast to the household activities and physical education homework questions, which were structured. Each specific activity type was recorded as one occasion of activity. The questionnaire was tested (N = 48) in two classes in different lower secondary schools in Central Finland. The survey answers of students across two schools were compared with a t-test to ensure that frequency and time used in physical education homework did not differ, which was the case (p = 0.656 and p = 0.655), indicating that the physical education homework questions could be used in a transferable matter. The questionnaire produced adequate test–retest coefficients ranging from 0.690 to 0.996.

6.2.3 Structured questionnaires and teacher-researcher diary (I)

The 117 voluntary girl students filled in the first questionnaire during spring 2017, with girls were in grades 6 to 9. The questionnaires were filled out during the physical education lesson, and it took around fifteen minutes to complete it. The questionnaire sought to reveal the opinions of students about physical education homework assignments, and it laid the foundation for this research. The physical education homework assignments developed from there and students got used to them.

The questionnaire consisted of 16 statements in semi-structured form, and the scale was six-point Likert (1= completely agree, 2= agree, 3= almost agree, 4= quite disagree, 5= disagree, 6= completely disagree). The statements addressed information whom homework assignments were done with (alone or together with someone), whether students liked the physical education homework assignments, what were students' opinions about the assignments (such as their usefulness, voluntary nature, and suitability for physical education), if the assignments increased girls' physical activity during after school hours, and students' thoughts about participating in decision-making. In addition, open-ended questions sought answers to which physical education homework assignments were memorable and why, and what kind of physical education homework assignments students wanted.

The notes from physical education homework situations and student comments from the teacher-researcher diary were gathered to enrich the results from the structured questionnaires. The teacher-researcher kept a research diary during the school year, which gathered the teacher-researcher's thoughts, choices, notes, and student comments during assigning or checking physical education homework tasks. Critical thinking in the process of planning the physical education homework and thoughts about developing the experiment were written in diary as well.

6.2.4 Interviews (IV)

This part of the study included a total of 43 interviews: 38 student interviews and 5 interviews from parents. Student interviews were carried out during the spring of 2016 at school during physical education lessons. Interviews took place in the dressing room while another physical education teacher was responsible for teaching the lesson. Students participated alone or with a partner, and interviews were short, mainly under 5 minutes (mean time 3 minutes 20 seconds). Some interviews had the poor sound quality during recording due to background noise or student speaking too quietly, which interrupted the recording from time to time and shortened interviews further. The short duration of the interview was compensated for by the number of interviews conducted. The students had interview themes on display and some of them spoke without many interview questions, whereas some students needed several questions and still their answers were short and unequivocal. The interview frame included issues about physical education homework and participating in them, interaction with parents, with whom and where assignments were performed, and facilitators and barriers in doing physical education homework.

The parent interviews took place during the spring of 2018, and the mean interview time was 14 minutes. Parents selected their own interview locations. From five parent interviews, three of the participants had two children participating in this study. Four of the parent interviewees were female and one was male, and interviewees were selected by asking volunteers via the students' parent mailing list. Three of the parent interviews were done at interviewees' homes, one was done in the cafeteria during the lunch break, and one took place at an

office after working hours. The parent interview frame followed the issues concerning attitude towards physical education homework, the family's sports background, family support for physical education homework, interaction with their children about physical education homework, and future wishes for physical education homework assignments.

The names of the interviewees were changed for the analyses and reporting to maintain anonymity. Both the student and parent interviews were conducted in Finnish and the quotations for reporting were translated into English. The quotations are verbatim, the goal in translation was to convey the message of the speaker as precisely as possible.

6.3 Data analysis

6.3.1 Data analysis of objectively measured physical activity (II, III)

The tri-axial accelerometer data were uploaded and stored. For the analysis, the statistician from UKK -institute transferred the data into Excel -spreadsheet form. The data were analysed in 6-second epochs and the mean amplitude deviation (MAD) of the resultant acceleration signal was calculated for each epoch (Vähä-Ypyä et al., 2015b). The measured MAD values were converted to MET values in a validated way (Vähä-Ypyä et al., 2015a). MET values were used to categorize physical activity into different intensity levels: Light physical activity was defined as activity corresponding to 1.5 – 2.9 MET, moderate activity as 3.0 – 6.0 MET and vigorous activity was more than 6 MET. Body posture was classified as standing, sitting, or lying for epochs of low movement intensity (APE) algorithm, which compares the accelerometer orientation in relation to an identified upright position at the end of each 6-second epoch (Vähä-Ypyä et al., 2018).

The objective measurement data were from all participants who had used the accelerometer at least 4 days during the week, at for a minimum of 10 hours per day (Mattocks et al., 2008; Troiano et al., 2008). SPSS software was used for the analyses to compare the values of girls in different grades as well as in physical activity groups.

6.3.1.1 Analysis of objectively measured physical activity in different grades (II)

The recorded physical activity levels and sedentary time of each girl from the measurement days were compared. Means and standard deviations in light, moderate, vigorous and MVPA MET values, along with standing and sedentary behaviour (i.e., sitting and lying) were analysed using analysis of variance (ANOVA) and Tamhane's post-hoc test. The MET values were smoothed by calculating a 1-minute exponential moving average for each epoch; the peak hourly MET value was analysed from the smoothed MET values. In addition, the mean values, and standard deviations from the number of average total and running

steps per day of the girls from grades 7, 8 and 9 were compared by means of ANOVA and Tamhane's post-hoc test.

An ANOVA and Tamhane's post-hoc tests were used to compare the seventh-, eighth- and ninth graders in terms of their self-reported data on the frequency and time spent doing their physical education homework. The girls were further divided into two physical education homework groups: Those who did not do physical education homework at all or did it only once a week and those who did it at least twice a week. Independent-sample *t*-tests were used to compare two groups' daily running and total steps with the objectively measured physical activity levels. For the independent-samples *t*-tests, Cohen's *d* was determined by calculating the mean difference between the two groups and then dividing the result by the pooled standard deviation. Cohen's *d* is the appropriate effect -size measure when two groups have similar standard deviations and are of similar size, as in these data.

6.3.1.2 Analysis of physical activity in different activity groups during after-school hours (III)

The total daily measurement time varied between activity groups: low-active girls had 13 hours 53 minutes, middle-active girls 15 hours 5 minutes, and high-active girls 14 hours 37 minutes. During this part of the study, the timing and variety of physical activity patterns of adolescent females was evaluated with low, moderate, and high activity levels. To compare METs between activity groups, the total MET values are presented in proportion to the participants' daily measurement time. Proportioned MET values in light, moderate, vigorous physical activity and MVPA, along with standing, and sedentary behaviour (sitting and lying), were compared between the low, middle, and high activity groups using analysis of variance (ANOVA) with Tukey and Tamhane post-hoc tests.

The mean frequencies per week of organized sports activities and self-initiated activities were compared using ANOVA with Tamhane post-hoc test between the low, middle, and high activity groups. An independent-samples Kruskal-Wallis test with a Bonferroni post-hoc test was used to compare the small sample sizes in the frequencies by type: organized sport and self-initiated type.

6.3.2 Data analysis of self-reported diaries (II, III)

The information on participants' after-school activities was obtained by the semi-structured self-reported diaries, and the data were uploaded and stored to the same file with objectively measured data and were handled with the same statistical analysis. The reported data from the self-reported diaries complemented the accelerometer data.

Activities during after-school hours were categorized in different activity patterns: organized sport activities, household activities, self-initiated activities, and physical education homework. Occasions in these activities were used in

analysis, as well as time data from organized sport activities and physical education homework.

6.3.3 Data analysis of questionnaires and teacher-researcher diary (I)

The student answers to statements of questionnaire were analysed using statistical software (SPSS). To explore associations, the frequency, *t*-test, analysis of variance and cross-tabulation were used. The questionnaire included open replies, which were categorized by grade, by the scale of doing physical education homework assignments, and by the degree of student involvement in the content of the physical education homework.

The teacher-researcher's diary notes were gathered and read several times to connect the situations with students' comments. The most meaningful citations and descriptive parts were marked. After that, the content was used to supplement and interpret the results.

6.3.4 Data-analysis of interviews (IV)

Analysing the interview data followed Schreier's qualitative content analysis strategy (2012). This strategy was selected because of the nature of the research questions, interview material, the need for interpretation, and its systematic feature, flexibility, and context involvement.

The focus of analysis was on family support of physical education homework, which was the dimension that was used to create the main categories of the coding frame. Because there was data from two different sources, the decision to break the data down according to source was natural. To rule out the bias of the teacher-researcher, there were two other persons doing the student interviews coding. This added to the reliability by bringing in unprejudiced perspectives and helping in correcting the bias. Comparison across persons was done independently (blind coding) to assure that analysis is intersubjective, and the categories apply across persons. The controversial parts of trial coding were solved by discussing afterwards, which clarified the criterion and coding frame.

The main categories of student interview data were named according to research questions and interview themes as (a) *the content of physical education homework*, (b) *family and physical education homework*, and (c) *doing physical education homework*. Family included participants such as parents, mother, father, siblings (sister, brother), and even pets. For example, *Family and physical education homework* connection (b) could occur through family discussions, active participation, or some other reaction from family members. Subcategories were *told at home*, *done with whom, performed where,* and *parent's reaction*. The subcategory *told at home* applies when physical education homework has been talked about with parents.

The parent interviews were coded and analysed by one person. For the reliability, the material was compared across points in time. For the second time, the coding frame, categories, and indicators had an extra revision to ensure that the adjustments were correct and made the coding frame easier to understand

and use. There were only slight adjustments to the coding frame, for example, one subcategory was divided into two separate categories due to overlapping.

The parents' interviews supplemented the students' interviews, and the main category of parents' interviews was predetermined as *family and physical education homework.* The parent interviews were divided into five subcategories for the coding frame: *family members' sport background* (B), *parents' attitudes towards school physical education* (A), *physical education homework as a familiar issue at home* (F), *parental support* (S), and *ideas or hopes for physical education homework* (H). For example, *Family members' sport background* indicates parents' sport activities and gave an expression of the family's attitude towards sport. The physical education experiences and attitudes were placed in their own subcategory. In the category *concerning content of the physical education homework or future ideas,* parents could mention several things, and all of them were marked separately, overlapping was intentional, and repletion was noted.

The results are presented in quantitative terms by category, not by case. Due to the data material, additional data exploration and analysis was made to explore results for patterns and co-occurrences. In addition to the individual unit of coding or category, the focus was on finding out how the categories are related. In linking the data and looking for connections or co-occurrences, frequency information is important and integrated into analysis. Comparing coding frequencies between the groups of sources is possible, at least to some extent. The three strategies used for presenting results in quantitative style are providing absolute frequencies, doing descriptive group comparisons, and using interferential statistics.

6.4 Ethical considerations

The participants and their parents were informed about the study beforehand, and informed consent was obtained from the guardians. All the girls attending grades 7 to 9 in school had physical education homework assignments during physical education lessons and they all were invited to participate, but participation in the study was voluntary. The participants, both parents and their parents, were informed about the research, and their consent was ensured. The layer of the Ethics Committee of the University of Jyväskylä considered this protocol to cover required ethical permissions established by the Helsinki Declaration concerning this type of research.

When students' own teacher conducts the research, it is the situation that might imply both disadvantages and advantages. Participating in this kind of study, might lead to heightened awareness of targeted behaviours (Beets et al., 2009). Students might exaggerate their amounts of physical activity in diaries, with the desire to impress their own physical education teacher. On the other hand, a confidential relationship and familiarity might increase willingness to participate and encourage students to take the study seriously. Since the teacher is the researcher positionality has to be understood in a way that it does not

undermine the truth of the research. The teacher-researcher has been aware of the role and responsibility that surrounds being the physical education teacher for study population during the study and defined the boundaries within which the research was produced.

7 RESULTS

7.1 Physical activity of girls (I, II, III)

7.1.1 Objectively measured physical activity levels and sedentary time (II, III)

The participants objectively measured average measurement time per day was 14 hours 30 minutes. On average, participants were sedentary for 52.5% of the total measurement time (7 hours 37 minutes). The combined light, moderate and vigorous average physical activity time of participants was 4 hours 18 minutes (*SD* ±1 hour 6 minutes).

7.1.1.1 MET -values

Individual daily total MET values varied from 43.8 to 158.6 MET. Girls spent most of their physically active time at the light activity level. The light physical activity coverage per day was 3 hours 8 minutes (±40 minutes), which accounted for 13.9% of their total waking hours. The MVPA accounted for 11.2% of participants' total waking hours, the time spent at the MVPA level was 1 hour 2 minutes (±20 minutes). Vigorous physical activity time was 8 minutes (±6 minutes) (1.3% of total daily amount) and moderate accounted for 9.9% of total waking hours.

The participants spent an average of 2 hours 41 minutes (±55 minutes) standing still, 6 hours 29 minutes (±1 hour 5 minutes) sitting, and 1 hour 8 minutes (±1 hour 5 minutes) lying down on each measurement day, with total sedentary time (sitting and lying) being 7 hours 37 minutes.

7.1.1.2 Steps per day

The participants recorded on average 8,535 steps per day, the number of total steps per day varied from 4,645 steps to 14,089 steps (Table 3). A third (32%) of the participants met the average 10,000-step daily recommendation (Adams, Johnson, & Tudor-Locke, 2013; Tudor-Locke et al., 2011). The eighth-grade girls

had the highest number of total steps (9,036), while the difference between the seventh- and eighth-grade girls was 982 steps (*p = 0.001*). Over 44% of the eighth-grade girls reached the average recommendation of 10,000 steps.

TABLE 3 Average total steps and running steps per day by grade (mean, *SD*, ANOVA *p* -value with Tamhane's post-hoc test).

	Grade 7 (*n* = 190)	Grade 8 (*n* = 152)	Grade 9 (*n* = 171)	All (*n* = 513)	ANOVA	Post-hoc		
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	*p* -value	Grade 7–8	Grade 7–9	Grade 8–9
Total steps	8054 (2156)	9036 (2618)	8625 (2421)	8535 (2418)	**.001**	**.001**	.057	.369
Running steps	843 (624)	796 (529)	547 (417)	730 (549)	**.000**	.856	**.000**	**.000**

The average number of running steps was 730 steps per measurement day. In running steps, the ninth-grade girls recorded the lowest number (547) among the grades. Compared to other girls the differences were significant: seventh-grade girls recorded an average of 843 daily running steps (*p* = 0.000), while the eighth-grade girls' average number of daily running steps was 796 steps (*p* = 0.000).

7.1.1.3 Comparison between the girls from grades 7, 8 and 9 (II)

In light physical activity, there were significant differences between seventh-grade girls compared to other grade girls light physical activity (Table 4). The seventh-grade girls were the most active in light PA, and eighth-grade girls in moderate and vigorous physical activity. The seventh-grade girls average daily light physical activity time of 3 hours 28 minutes was 34 minutes more than the girls from eighth grade (*p = 0.000*) and 30 minutes more than the girls from the ninth grade (*p = 0.000*). However, the differences between the grades in MVPA comprised a few minutes, and differences were not significant; the eighth-grade girls were at the MVPA level the most, for 1 hour and 15 minutes, the seventh-grade girls were at the MVPA level for 1 hour and 8 minutes, and ninth-grade girls for 1 hour and 11 minutes.

In total, 38% of all girls met the 60-minute physical activity recommendations every day. Half of the girls from Grade 8 reached the 60-minute daily recommendation, for the seventh- grade girls 35% reached the recommendation, while 28% of ninth-grade girls met the required physical activity levels.

TABLE 4 Participants' daily average time (hours and minutes) spent at different physical activity (PA) levels by grades (mean, *SD*, ANOVA *p* -value and Tamhane's post-hoc test).

	Grade 7 (190 days)	Grade 8 (152 days)	Grade 9 (171 days)	All	Post hoc			
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	ANOVA *p* -value	Grade 7–8	Grade 7–9	Grade 8–9
Light PA (1.5–2.9 MET)	3:28 (0:32)	2:54 (0:36)	2:58 (0:42)	3:08 (0:40)	**.000**	**.000**	**.000**	.834
Moderate PA (3–6 MET)	0:59 (0:16)	1:05 (0:23)	1:03 (0:21)	1:02 (0:20)	**.016**	**.016**	.193	.656
Vigorous PA (over 6 MET)	0:08 (0:07)	0:09 (0:06)	0:08 (0:06)	0:08 (0:06)	.110	.317	.937	.098
MVPA	1:08 (0:40)	1:15 (0:43)	1:11 (0:40)	1:11 (0:41)	.283	.315	.864	.755
Time spent standing	2:36 (0:47)	2:38 (1:02)	2:50 (0:57)	2:41 (0:55)	**.041**	.915	**.030**	.287
Time spent sitting	6:30 (1:05)	6:31 (1:07)	6:25 (1:04)	6:29 (1:05)	.667	1.000	.782	.864
Time spent lying	1:19 (1:13)	0:41 (0:35)	1:20 (1:08)	1:08 (1:05)	**.000**	**.000**	1.000	**.000**
Total sedentary (sitting and lying)	7:51 (2:01)	7:11 (1:18)	7:45 (2:02)	7:37 (1:52)	**.003**	**.001**	.970	**.008**

Regarding sedentary behaviour, the girls from the Grade 8 recorded the shortest time: the eighth graders spent time sedentary 7 hours 12 minutes, which is 38 minutes less than seventh-grade girls ($p = 0.002$) and 33 minutes less than ninth-grade girls ($p = 0.012$). These differences are mainly due to the time spent lying down: the eighth-grade girls spent 38 minutes less lying down than the seventh-grade girls did ($p = 0.000$) and 33 minutes less than the ninth-grade girls ($p = 0.000$).

7.1.1.4 Comparison between the activity groups (III)

The participants were divided into activity groups according to their total mean MET values, due to that, significant differences between the groups' physical activity levels were evident. Average MET values were 87.5 MET for the high-active girls' group, 78.0 MET for the middle-active group, and 67.2 MET for the low-active girls' group.

The high-active girls were more active in all intensity levels and had the lowest percentage of time in sedentary behaviour. For example, the high-active girls' light intensity physical activity values were significantly higher than those of the other groups of girls (low-high $p < 0.001$, middle-high $p = 0.002$). Furthermore, the group of low-active girls had significantly lower values than the middle and high-active groups ($p = 0.001$) at the vigorous intensity level. In total MVPA, all the groups significantly differed from each other.

7.1.1.5 After-school physical activity

Approximately 46% of daily activity was accumulated during after school hours, with the MET values during after school hours varying from 12.9 to 55.1 MET. The mean hourly afternoon MET value was an average of 4.2 MET per after-school hour, participants' physical activity intensity after school was spent at a moderate level (3–6 MET; Figure 2).

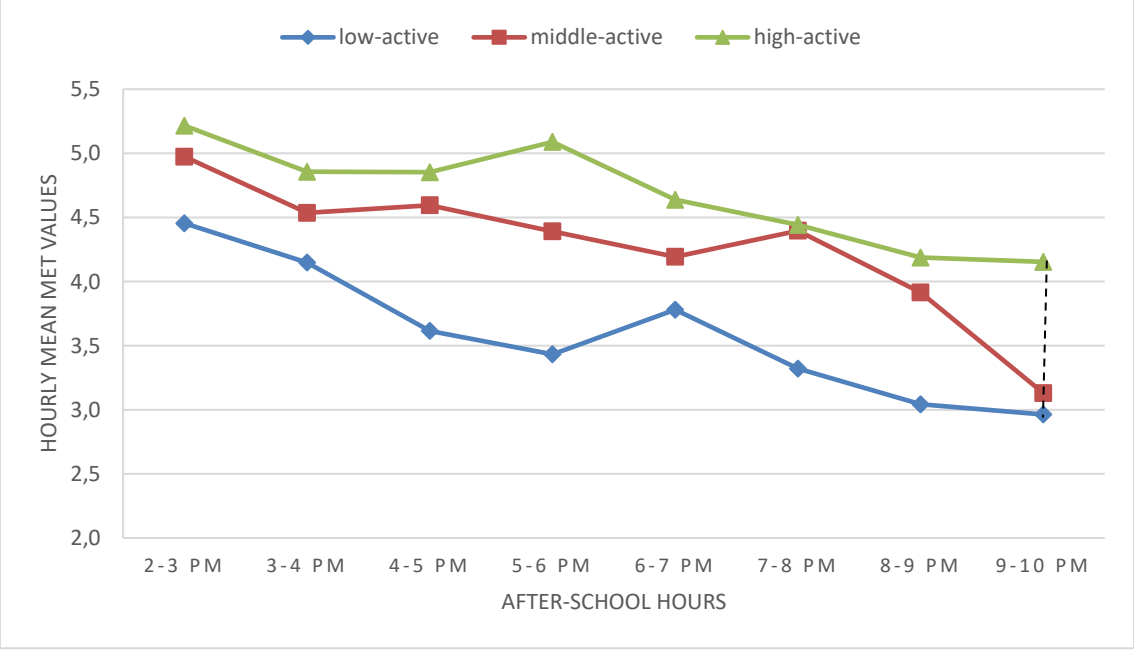

FIGURE 2 The hourly review of mean MET values after-school hours from high-, middle-, and low-active girls' comparison between the groups with Tamhane post hoc test.

For all participants, the first after-school hours were the most active ones. The high-active girls' physical activity level stayed over 4 MET during afternoon and evening. They had the highest peak MET value from 2 pm to 3 pm (5.22 MET),

and another time the MET value increased was from 5 pm to 6 pm (5.09 MET). The middle active girls' MET values remained steady between 4 and 5 MET during the entire evening, after 8 pm their MET values declined below 4 MET. On the other hand, the low-active group's physical activity declined below 4 MET as early as at 4 pm. Their physical activity level stayed low for the entire evening, they had one peak during the afternoon (3.78 MET) and their lowest point was reached at 9 pm (2.96 MET). The METs of the participants in the low-active group were significantly lower than the values of participants in the other groups during several afternoon and evening hours: 4 pm to 6 pm and 7 pm to 9 pm.

7.1.2 Self-reported physical activity

7.1.2.1 Self-reported physical activity patterns

The after-school physical activity of participants in different activity patterns varied depending on the intensity level of the group. The high-active girls' organized sports frequency (3.02 occasions/girl/week) was significantly higher compared to the other two groups ($p \leq 0.004$) (Table 5).

TABLE 5 After-school activities (frequency, *f*) /girl/week mean values (M) and standard deviation (*SD*) according to activity groups with a Tamhane post hoc test.

	high-active girls (*N* = 29) *f*	middle-active girls (*N* = 27) *f*	low-active girls (*N* = 26) *f*	total (*N* = 82) *f*	*p* -value high-middle	*p* -value high-low	*p* -value middle-low
organized sports activities M (*SD*)	3.02 (1.61)	2.36 (1.84)	2.02 (2.07)	2.47 (1.89)	**.004**	**.000**	.331
household activities M (*SD*)	2.82 (2.62)	3.24 (2.64)	3.58 (2.71)	3.21 (2.67)	.465	**.029**	.738
self-initiated activities M (*SD*)	2.87 (2.5)	2.59 (2.22)	2.45 (2.06)	2.64 (2.27)	.784	.296	1.000
PE homework M (*SD*)	1.97 (1.49)	1.96 (1.56)	1.77 (1.33)	1.9 (1.46)	1.000	.654	.770

The most popular after-school organized sports activities among participants were football, dance and dance-related sports, gymnastics, and the category "other ball games" (floorball, basketball, volleyball, and Finnish baseball). The low-active girls were mainly represented in the categories "no activities" or in the category of "other". "Other" included sports such as horseback riding, body-conditioning exercises, swimming, martial arts, strength training, and skating. The high-active girls were mainly represented in football and middle-active girls in category other ball games.

In household activities the frequencies varied between 3.58 occasions/girl/week from low-active girls to the 2.82 occasions/girl/week of high-active girls. In total, this pattern was the most frequent activity behaviour (3.21 occasions/girl/week). In this pattern, the most common household chore in all activity groups was cleaning, followed by taking the dog out and taking care of siblings.

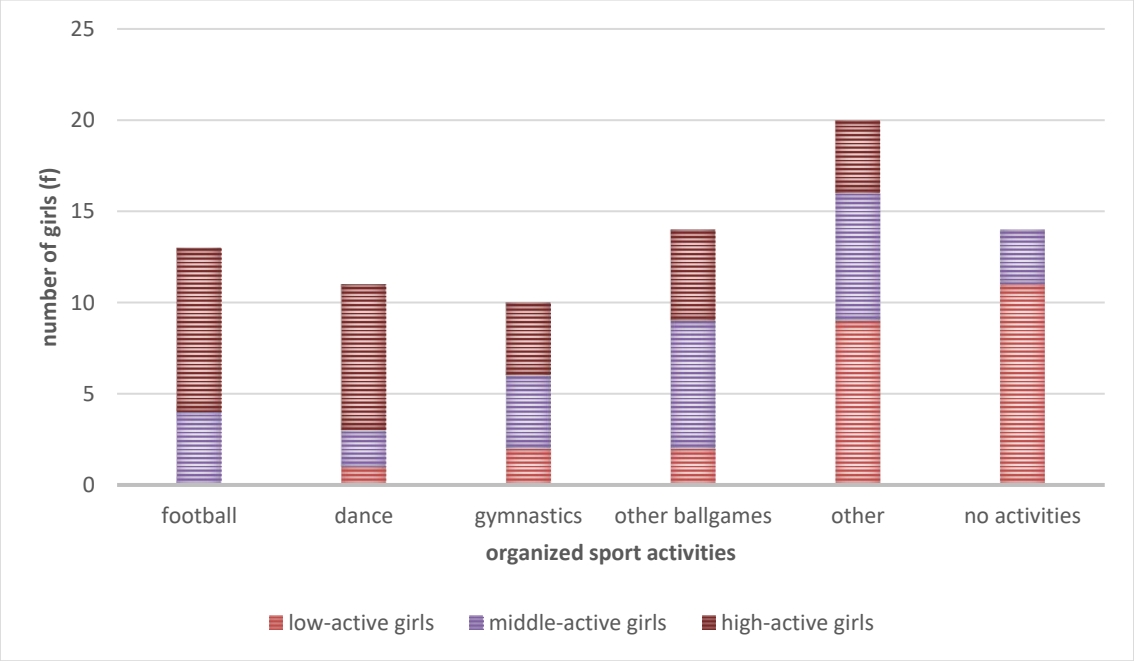

FIGURE 3 Organized sport (*f*) by activity group and average median MET values (mean MET value / hour).

For the self-initiated activities, the high-active girls had the most different types of activities and the highest frequency (2.87 occasions/girl/week) compared to the girls in the other groups (Figure 4). In this pattern, the most frequent reported choices were running or jogging, walking, body-conditioning exercises, and playing outside. In body-conditioning exercises the low-active girls were the most represented. The high-active girls' group was most represented in the categories of walking, no activities and "other", whereas middle-active girls' group was the biggest group in categories playing outside and in running or jogging.

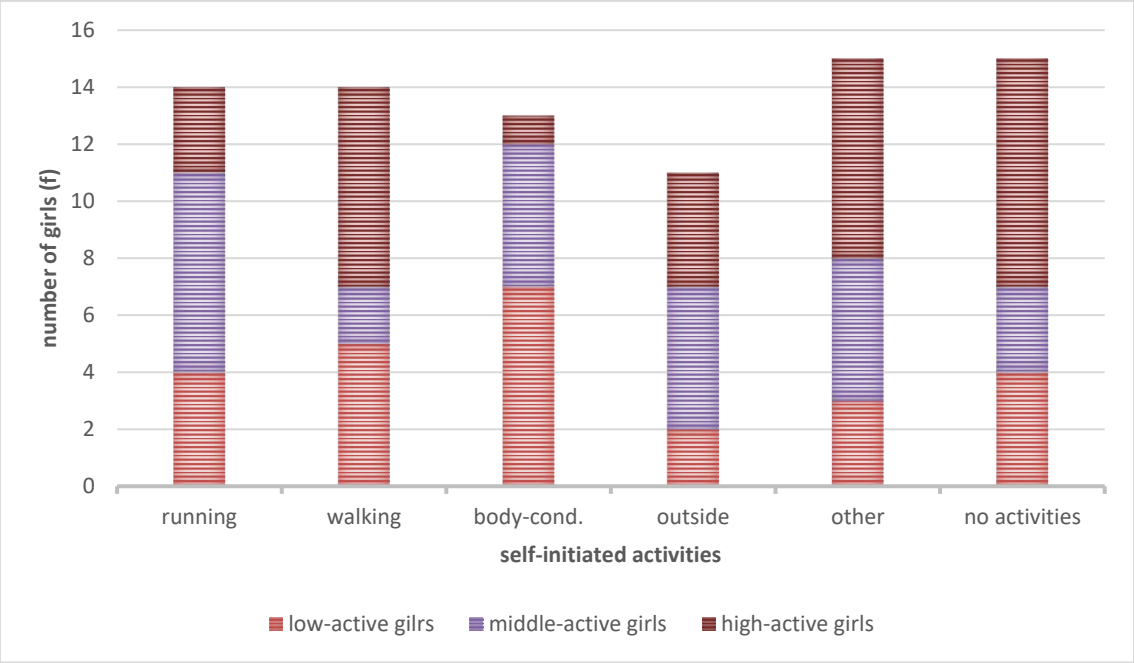

FIGURE 4 Self-initiated activities (*f*) by activity group.

7.1.2.2 Self-reported physical education homework

According to self-reported diaries, twice a week was an average frequency of doing physical education homework (1.94). The seventh-grade girls' homework frequency was 2.17 (± 1.81) and eighth-grade girls' 2.12 (± 1.66) occasions per week, while the ninth-grade girls amount of doing physical education homework assignments was on average 1.52 (± 1.01) times per week.

TABLE 6 Self-reported physical activity after school hours, frequency, and time in organized sports activities and in physical education homework, comparison between grades 7, 8 and 9 with ANOVA *p* -values.

	Grade 7	Grade 8	Grade 9	Total Mean	Grades 7–8 *p* -value	Grades 7–9 *p* -value	Grades 8–9 *p* -value
N	28	26	27	81			
Organized sport activities (frequency/ week)	2.90	2.11	2.07	2.36	.131	.157	.914
Organized activity (min/student/week)	322 (5h 22min)	193 (3h 13min)	231 (3h 51min)	251 (4h 11min)	.054	.168	.569
PA homework (frequency/ week)	2.17	2.12	1.52	1.94	.891	.117	.162
PA homework min/student/ week	20	51	32	34	**.005**	.274	.077

According to self-reports, physical education homework assignments added on average 34 minutes active time to the girls' week (Table 6). The eighth-grade girls spent an average 51 minutes per week on physical education homework, while the ninth grade spent 31 minutes and seventh-grade girls 20 minutes. In terms of total weekly time spent on physical education homework, the difference between the girls from the grades 7 and 8 was significant ($p = 0.027$).

When comparing doing physical education homework between the activity groups, the frequencies for the girls' activity groups were close to one other, and the differences were not significant. However, the high-active girls spent the most time on average engaging with the physical education homework assignments (41 minutes per week). For the low-active girls, weekly physical education homework time was 26 minutes, and the middle-active girls' time was 33 minutes per week.

7.1.2.3 Physical education homework and objectively measured physical activity

For comparing self-reported physical education homework frequency to objectively measured data, two groups were constructed using the physical education homework participation frequency: those who did the physical education homework assignments twice a week or more and those who did them once a week or

did not do them at all (Table 7). Differences in self-reported homework frequency and objectively measured MET -values comprised an average of 3 to 7 minutes, but the difference in average vigorous daily physical activity between the group who did physical education homework twice or more and the group that did less of it was significant (p = 0.000), in favour of the group who did more homework.

TABLE 7 Differences in self-reported homework frequency and hourly peak MET values (6 seconds) by independent-sample t -test.

	No PE homework or just once n = 238	PE homework twice or more n = 248	p -value	Cohen's d effect size
Light PA (1.5–3 MET) mean hour and minute (*SD*)	3:05 (0:39)	3:09 (0:40)	.796	.101
Moderate PA (3–6 MET) mean hour and minute (*SD*)	0:59 (0:19)	1:06 (0:20)	.341	.359
Vigorous PA (>6 MET) mean hour and minute (*SD*)	0:07 (0:05)	0:10 (0:07)	**.000**	.492

The same difference was seen in number of steps. Those who did physical education homework twice or more per week had 371 more daily running steps (p = 0.000) than those who did not do homework assignments that often (Table 8). In total daily steps the difference was 1,067 more total daily steps for those who did more homework assignments, but the difference was not significant (p = 0.107).

TABLE 8 Self-reported homework frequency and daily steps.

	Total steps	Aerobic steps
	Mean (*SD*)	Mean (*SD*)
No PA homework or just once (*N*=238)	8061 (2321)	559 (372)
PA homework twice or more (*N*=248)	9128 (2260)	930 (630)
ANOVA p -value	.107	**.000**

7.2 Experiences of physical active physical education homework

7.2.1 Experiences of students according to questionnaires

Participants (N = 117) reported doing physical education homework assignments very often, 80% did them always and almost 90% did them always or nearly always. According to the research diary, students commented on physical education homework assignments by saying "*Why not?*", referring to the fact that physical education is just one of the school subjects, and homework assignments suit physical education as well as they do any subject. The most popular way of doing physical education homework assignments was doing them alone (51.3%), while a quarter of participants (25.6%) did them with friends. Doing physical education homework assignments with parents was not so popular (12%), but it was common to talk about the physical education homework at home (59.8%). An example of physical education homework that had been remembered was one done with a mother: "When we had to do push ups, I remember it because I did them with mom."

Participants reported that students should have an opportunity to participate in decision-making concerning their physical education homework assignments. Overall, students thought that doing physical education homework assignments was easy and the teacher should check them afterwards as well. Even if the ninth-grade students' attitudes towards physical education homework assignments were positive, they had the most critical views compared to students from other grades. The girls from seventh grade were most eager to make physical education homework assignments mandatory for all.

Students who did the physical education homework assignments always liked them more and talked about them at home as well. They also thought that active physical education homework was useful and implied that physical education homework assignments increased their physical activity. Students wanted that doing physical education homework assignments should be controlled somehow, and they marked their doing physical education homework assignments in the teacher's notebook during the physical education lesson. Those students who did not do the physical education homework assignments so often did not care about checking the homework assignment afterwards.

Answers to open questions were contradictory, with similarities but as well as some differences. The most common reason for a memorable physical education homework assignment was that it was enjoyable or fun. Older students (eighth- and ninth graders) reported memorable assignments to be strength training tasks such as abdominal movements or squats, whereas younger students (sixth- and seventh graders) preferred running laps, "holiday assignments" and assignments that required activating someone else. The holiday assignments were not designed for adding physical activity, but were more like something suitable for vacation, something fun and easy, such as sleeping late, eating something delicious, meeting friends and/or relatives. The seventh-grade girls mentioned that memorable assignments were somehow different from usual physical

education homework assignments. For sixth-grade girls, balancing on one leg while brushing one's teeth was the memorable physical education assignment.

Students had an opportunity to participate in decision-making as well. They could participate in planning, choosing suitable assignments for them, and deciding the intensity scale and number of repetitions. Usually, students were stricter than the teacher was, so the assignments that students chose were more demanding and required more repetitions. Overall, the students were content with physical education homework assignments because they hoped for more similar assignments in the future. Some girls hoped for strength training (seventh- and eighth-grade girls), some mentioned that assignments should be voluntary (ninth-grade girls) in the future as well and some just wanted something fun and enjoyable (sixth- and eighth-grade girls) or easy (ninth-grade girls) assignments. All age groups of girls mentioned the appropriate level of tasks as an important feature, so that the assignments would be challenging enough for development.

7.2.2 Experiences of teacher-researcher according to diary

At first, assigning active physical education homework took 15 to 20 minutes from the physical education lesson. However, once the concept became familiar, the process accelerated. The skills related to active physical education homework were often practised during warm-up or students got instructions and tips for planning their homework assignment. The annual plan for physical education helped to integrate assignments into the schedule. For example, as the running test was approaching, students chose jogging for their physical education homework. Teacher-researcher diary: "I want to justify the physical education homework assignments for students, they always have a connection to curriculum, and I have planned them to benefit students." The type of sport had an influence on giving and checking physical education homework assignments as well, Track and field suited easily, but winter sports such as skiing or skating were more challenging. However, students got so used to having physical education homework that they reminded teacher about it if someone did not seem to remember. (Teacher-researcher diary)

The discussions with students while planning, choosing, and checking active physical education homework were interactive moments. The atmosphere was more relaxed than the actual physical education teaching part of the lesson and students seemed to be active and open to discussion. Enthusiasm was surprisingly high, and even students who are usually quite silent, participated in the discussion. "They took it so well, everyone wanted at least try!" Especially the student comment of "Why not?" delighted the teacher-researcher. It was the moment of enlightenment. The participating in decision-making was well received, which encourage the teacher to add the role of students over time. Especially younger students (sixth- and seventh-grade girls) participated in planning enthusiastically, but older students, especially ninth graders, wanted to give more decision-making power to the teacher, arguing that the teacher knows better.

Especially, checking the homework gave new information about the students. The teacher-researcher had originally decided not to check that the physical education homework assignments had been done, since they were voluntary. However, students wanted, that active physical education homework should be checked just like any homework because they wanted their effort to be acknowledged. They created a system where one plus sign meant the task had been fully done, two plus signs meant they did more repetitions than was agreed, and I - mark meant they did some but not all of the agreed amount of homework. They also wanted to share their experiences of doing the physical education homework assignment at hand, information such as whom they did the assignments with, comments from family, and how it felt. They told about siblings wanting to participate, pets they were jogging with, or parents that were surprised about such a thing as physical education homework. Even the "confessions" about not doing the physical education homework were shared and approved.

7.2.3 Experiences of students according to interviews

Students talked about physical education homework assignments to their family members, with 28 of 38 students reporting they had discussed the physical education homework assignments at home. However, doing physical education homework with family member was not so common: 13 students expressed doing physical education homework with parents, 7 with siblings and 4 with a pet. Mostly students did homework assignments alone (18/38). For example, students mentioned teaching proper squat technique to a family member as a popular physical education homework done together. Students preferred doing physical education homework assignments in nearby neighbourhoods (24/38) or at home (23/38). Doing physical education homework by incorporating it into organized sports activities, at school, while commuting or doing them in sports facilities, were also mentioned.

The most frequently mentioned facilitator for students was fun assignments (12/38). As fun assignments students reported brushing their teeth balancing on one leg, taking someone jogging, teaching squat technique to someone, using your "wrong" hand for tasks during the week, and fun and relaxing holiday homework assignments. Along with having fun as a main physical activity facilitator, perceptions of competence, acknowledgement of others and motivation were proposed as well. The fact that doing physical education homework assignments was recognized by the teacher somehow, was appreciated (11/38). Recognition or feedback for done physical education homework could be just receiving a plus on the school intranet pages (Wilma), which is an online communication system between teachers, parents, and students. Taking doing physical education homework into account in the evaluation was suggested as well. For example, raising the physical education grade due to homework activity was proposed. The interviewed students also valued a getting good feeling from doing physical education homework assignments (5/38) and motivational aspects (8/38), such as suitable level of assignments (8/38). For example, one student commented: "I liked it, because I was good at it." The physical education homework assignments

done without any equipment were also appreciated, and accelerometer measurements were motivational itself for three students. According to students, the physical education homework assignments did not take a lot of time, while most students (27/38) thought that physical education homework should be voluntary.

As reasons to not do the physical education homework assignments, students mentioned forgetting it (10/38), being sick or recovering (9/38), being too busy (5/38), not motivated (5/38), having too many organized sports activities already (4/38) or the pressure to do other homework assignments in academic school subjects (3/38).

7.2.4 Parents' perceptions of physical education homework

The feedback from parents about Physical Education Homework Study -project was almost exclusively positive. They reported their opinions via the school intranet, and their messages were enthusiastic and encouraging. Two parents asked about the consequences for not doing homework, but they were reassured that physical education homework assignments were always voluntary. One parent discussed the physical education teacher's influence on adolescents: "They listen to the physical education teacher much more than us parents when it comes to physical activity."

According to parent interviews (N = 5), their children had discussed physical education homework assignments at home. Even if, physical education homework seemed to be a new and unfamiliar thing to parents, they held accepting and positive attitudes towards the assignments. Interview answers included a total of 33 positive statements about it. However, only two of the parents reported supporting physical education homework by participating in it, with six mentions in total. Common exercises that do not need any special skills or arrangements, such as stretching or jogging, seemed to be exercises that parents were eager to join. Despite the low amount of parental participation, parents appreciated physical education homework assignments, which required doing something together with a family member, and they suggested these kinds of assignments in the future as well.

In parents' answers, the nearby environment as a place to perform physical education homework assignments was mentioned several times. As a barrier, parents mentioned that being active altogether at school might be challenging because of the element of being seen with your imperfections and comparing yourself to others, even when practicing active physical education homework assignments' tasks at school. They were pleased that physical education homework assignments provided an opportunity to work out alone. Parents valued versatile and voluntary assignments that enhance students' fitness, and the fact that no equipment or money was needed in doing physical education homework assignments. It was also important that the tasks were easy enough so that anyone could manage and the effect on evaluation and physical education grade.

8 DISCUSSION AND IMPLICATIONS OF FINDINGS

The aim of this study was to examine the physical activity of adolescent girls. The focus was on after-school hours and on physically active physical education homework, which aimed to increase physical activity of adolescents. The aim was also to explore the proportion of active physical education homework to the total physical activity, and the students' and their parents' reactions and opinions about physically active physical education homework. To get a broader view, the study included both objective and self-reported measurements. The framework of the study was the socio-ecological model, combining qualitative and quantitative methods allows approaching different levels of this multilevel framework along with interaction between the levels (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Elder et al., 2007; Figure 1, page 40). This framework is also used to frame the discussion of the findings.

8.1 Individual level of physical activity

8.1.1 Objectively measured physical activity

The physical activity level, attitudes, beliefs, and prejudices towards physical education homework assignments represents the individual level of the socio-ecological model (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Figure 1, page 40). The adolescent girls in this study were more active compared to those in other physical activity studies (Cohen, Ghosh-Dastidar & Lytle, 2014; Currie et al., 2008; Graham et al., 2014; Júdice et al., 2017; Kokko et al., 2019; Marques et al., 2015; Okely et al., 2011; Ruiz et al., 2011). Comparing results of this study to the results of a 9-country international study (Ruiz et al., 2011), the amount of MVPA was higher in this study than in others. In the study of nine European countries, adolescent girls' MVPA was 49 minutes, and 27.5% of girls met the current MVPA recommendation (Ruiz et al., 2011). American adolescent girls engaged in 43 minutes of MVPA per day (Graham et al., 2014), whereas Danish

adolescent girls' proportion of time spent in MVPA daily was 6.7% (Klinker et al., 2014). In the present study, sedentary time was less than in other studies (Cohen, Ghosh-Dastidar & Lytle, 2014; Marques et al., 2015; Okely et al., 2011). The average sedentary time was 7 hours 37 minutes. According to Marques et al. (2015), adolescent girls recorded an average MVPA of 34 minutes per day, with sedentary time being 9 hours 8 minutes. The recommendation of 60 -minutes of MVPA is associated with the advocated 10,000 to 11,700 steps per day for adolescents (Tudor-Locke et al., 2011). In this study, 31.6% met this guideline. The difference between the minimum of 4,645 total steps and the maximum of 14,089 total steps was large, which might partly explain the lower number of average total steps (8,535 steps per day).

8.1.2 After-school objectively measured physical activity

Approximately 46% of total daily activity was accumulated during after-school hours, and the first after-school hours were the most active for all participants. The low-active groups' physical activity level declined below 4 MET as early as 4 pm and stayed low for the remainder of the evening. Active commuting from school and late afternoon lessons likely influenced the increase of physical activity during the first after-school hours. There are several inactive domains that compete for adolescents' time during after-school hours. For example, in De Baere et al. (2015), Flemish adolescents were unable to take advantage of the physical activity opportunities during the afternoon, and the domains of screen time, homework and inactive leisure were more prominent compared to the active domains of active leisure or sport (De Baere et al., 2015). The high-active girls' late-night physical activity is likely due to participation in organized sport, given that practices and games can last until evening hours (Koorts et al., 2011; Taverno Ross et al., 2013). After the practices, there is still commuting back home and taking care of their evening tasks, such as showering. After-school hours has the potential to be meaningful space in students' ability to accrue recommended levels of physical activity.

8.1.3 Self-reported physical activity patterns

In this study, the high-active girls were well represented in organised sport activities, and the self-initiated activities and household activities were frequently mentioned for the low-active girls. Similarly, in Taverno Ross et al. (2013), the low-active girls engaged in leisure time and educational sedentary activities more than high-active girls did. Even if prior studies indicate that increasing adolescent girls' participation in organized sports activities might help to increase and better sustain physical activity levels over time (Bélanger et al., 2009; Pate et al., 2010), informal and unstructured exercises may represent a less threatening alternative for adolescent girls who lack athletic competence (Lawler et al., 2017). In this study, the most popular self-initiated sports activities were the type of activities that are typically unstructured, non-competitive, spontaneous, and done at a low-intensity level, such as walking, body-conditioning exercises or

stretching. These kinds of activities might attract girls who are not interested in high-intensity activities or competitive sports. The low-intensity physical activities like walking are more sustainable than forms of MVPA throughout adolescence (Koorts et al., 2011; Pate et al., 2010). In addition, the special skills or abilities required for team sports or organised sport activities are less necessary in self-initiated activities such as walking, stretching, or non-competitive pursuits. The selection of different self-initiated activities was the most diverse among the high-active group of girls, therefore one effective strategy for increasing physical activity might be to offer a more diverse repertoire of choices to increase leisure time physical activity. By providing more opportunities for choice, such as selection of activities, might promote adolescents' perceived autonomy as well (Nogg et al. 2021).

In household activities, the frequencies of the low-active girls were the highest compared to other groups. Girls often accumulate their physical activity through a variety of means, such as through physical activities like performing occupational and household tasks (Pardo et al., 2014). Duties related to the home environment are often occupational and somewhat obligatory, therefore these activities do not decrease over time easily. The downside is that participating in these household activities might reduce the opportunities and time to participate in self-initiated activities or organized sports activities. However, identifying the preferred types of physical activities of adolescent girls might help influential adults to offer activities they enjoy. Opportunities to engage in alternative activities aside from the competitive team-based sports, single-sex activities and a focus on developing physical activity habits for lifelong engagement might help to increase physical activity of girls.

8.1.4 Physical education homework

Students' positive attitude towards active physical education homework assignments was clear. Even if physical education homework assignments were voluntary, students did the assignments very often (89.7%). Students also talked about their physical education homework assignments at home, which highlighted the meaning of them. Even if, during adolescence peer influence becomes more central to the socialization process, parents still play an important role in their teens' lives (Heitzler et al., 2010; Kirby et al., 2011). Overall, students' responses included more facilitators than barriers concerning the physical education homework. Helping to overcome the barriers could be a strategy for confronting the physical inactivity of adolescents (Dias et al., 2015). According to Elder et al. (2007), the key factors in facilitating the physical activity of adolescents are increasing the amount of positive feedback, involving family members and friends, removing barriers to physical activity, and finding ways to reduce sedentary time (Elder et al., 2007). The reason why students did physical education homework assignments actively, might be involving students in decision-making, involving significant people in doing the assignments and offering assignments that students are able to comprehend and implement.

In the present study, students participated in decision-making by deciding on some content of the physical education homework assignments, and they could choose their own intensity level and the amount of the activity as well. In students' opinion, they should have the opportunity to participate in planning the physical education homework assignments. Physical education homework assignments can also be valued in terms of increasing pupils' positive physical activity experiences and increasing their autonomy by involving them in planning (Deci & Ryan, 2000). Student participation in decision-making increases their commitment to tasks (Novak & Lynott, 2015). Autonomy has been shown to predict self-determined motivation for physical activity and intrinsic motivation, identified regulation, and introjected regulation are positively associated with adolescents' MVPA out of school (Deci & Ryan, 2000; Nogg et al. 2021). Students' enthusiasm for new activities or a need to impress the teacher might have increased the level of doing the physical education homework (Converse et al., 2019). However, the completion of physical education homework assignments remained at a high level during the entire study year.

The results about the average frequency of participation in physical education homework and the time spent on physical education homework assignments are from self-reported diaries, and therefore the intensity of physical education homework is unknown. The physical education homework assignments comprised an average of 34 minutes of active time per week, and the physical education homework has been shown in prior research to increase daily step counts for youth as well (Duncan et al., 2011). The girls who participate in homework had a higher average of daily physical activity and less of a decline in physical activity from Grade 6 to Grade 8 (Trilk et al., 2012). Learned habits of completing homework might help in sustaining at least light physical activity during the teenage years (Trilk et al., 2012). The active physical education homework added on average 26 minutes of activity time a week for the low-active girls. At least active physical education homework could replace some sedentary behaviours with more active and productive activities. Overall, it is not much, but replacing a minimum of 10 minutes of daily sedentary time with physical activity seems to be a good starting point to address the declining physical activity of adolescents (Corder et al., 2015). In addition, those who did active physical education homework assignments at least twice per week were more physically active than those students who did fewer physical education homework assignments. Those who did more physical education homework assignments might be more physically competent and more active in the first place. In any case, physical education homework assignments increased the time spent being physically active, at least in a small amount, of both those who participated more in physical education homework and those who participated less.

In addition to fun assignments, students' interviews revealed that students appreciated their effort to be acknowledged by an influential adult. They also found extra motivation for PA, and the assignments were seen to be adequately challenging. The enjoyment and having fun as the facilitators or primary variable in the participation of adolescent physical activity are mentioned in several

studies (Abdelghaffar et al., 2019; Heitzler et al., 2010; Martins et al., 2015; Silva et al., 2015). The participants appreciated the exercises that provided them an outlet from daily routines, which was confirmed by parents' responses as well. This aligns with Martins et al. (2015), who suggested that key physical activity facilitators were perceptions of competence and fun, the acknowledgement of significant people, and motivation (Martins et al., 2015).

Students preferred doing physical education homework alone. The school day, and physical education lessons as well, might be full of social interaction and collaboration, so it is possible that some students might just appreciate alone time while doing physical education homework. In addition, during adolescence health behaviours, such as physical activity choices, become increasingly self-initiated decisions (Silva et al., 2014), and doing physical education homework alone might highlight this autonomy.

Homework from academic subjects might be taken more seriously, physical education homework assignments were required to be inherently fun and not goal-oriented, which might reduce their credibility. Homework assignments are designed to help students practice and develop their own skills and time-management, with the goal for students to become eventually autonomous lifelong learners outside of formal educational settings (Cooper et al., 2000; Schunk & Zimmerman, 1994). This goal applies in physically active physical education homework as well. Acknowledging the full range of benefits of physical activity to adolescent girls could highlight the importance of physical activity (Corr et al., 2019), such as how the intensity of physical education lessons and increased physical activity might benefit cognitive performance and academic success as well (Ardoy et al., 2014). In Marttinen et al. (2018), it was found that girls met the recommendations mainly when they participated in physical education. Their study highlighted the importance of physical education for adolescent girls, and the physical activity students receive in and around the school day as well (Marttinen et al., 2018).

The curriculum-based physical education assignments also enable teachers to deliver health-related educational material without sacrificing formal learning objectives of students or their teaching obligations (Duncan et al., 2011). In Finland, students study health education as own subject at school, and the concentration on physically active physical education homework assignments instead of cognitive tasks, was a conscious choice. However, educating girls on the range of benefits of physical activity is also important (Corr et al., 2019), as health literacy aside from physical literacy in the form of physical education homework assignments might increase the importance of physical activity. Creating functional knowledge and teaching young girls how to be active on their own might result in lifelong healthy behaviour (Duncan et al., 2011). In contrast with prior physical activity studies (Abdelghaffar et al., 2019; Corr et al., 2019; Dias et al., 2015; Martins et al., 2015), in this study, time was not as significant of an issue for most of the girls as most mentioned that the physical education homework did not take a lot of time.

Students mentioned the fact they forgot to do the physical education homework assignment as a barrier. However, there are useful technological solutions, such as wearable digital technology, that could facilitate this barrier by assisting remembering assignments and even giving immediate feedback on completing the task (Marttinen et al., 2020b; Ng et al. 2020). Remote teaching and online delivery of physical education have created new possibilities to provide physical activity assignments, health, and physical activity literacy via digital tools (Kääpä & Huovinen, 2020; Webster et al., 2021). Even if physical education is best performed in real interaction with students, a digital platform for students, parents, and teachers to combine physically active assignments and educating health literacy might be worth trying in the future. The active physical education assignments in digital form might be a developmental proposal worth exploring in future experiments.

8.2 Immediate community level

The school, physical education teacher, sports clubs, and parents represent the interpersonal, also referred to as the immediate community, level of the socio-ecological model in this study (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Figure 1, page 40). The interaction between students and teacher was uncomplicated, while familiarity made the communication about physical education homework easy. Students' enthusiasm to participate in something new was obvious, and they shared their thoughts, ideas, and critical views freely. Discussions about physical education homework assignments as well as planning, checking, and doing them, were important moments of sharing for the teacher, perhaps for the students as well. In these short moments, the teacher got to know her students more. It was possible to hear about home situations, and about those people at home, for example siblings and pets, that do not usually come up at school. (Teacher-researcher diary) The teacher's supportive interaction with students appears to be an important aspect in generating an increase in physical activity.

Identifying the popular sports of adolescent girls may help teachers to offer those activities female youth prefer and enjoy. The most popular organized sports activities among all participants were football, dance, gymnastics, and other ball games (floorball, basketball, volleyball, and Finnish baseball). In self-initiated activities, the most frequent reported activity types were running or jogging, walking, body-conditioning exercises, and playing outside. Physical education teachers claim to follow the curriculum, but according to Banville et al. (2021), physical education teachers easily resort to the sports they love, such as team -sports and competitive tasks, instead of the content their students would benefit from the most to become physically literate (Banville et al., 2021). Encouraging girls to engage in the most popular sports might help those girls who are not motivated, are less skilled, or just do not like sports to be more physically active.

Parental contacts about active physical education homework assignments were very positive when they were informed about the study. Only one parent expressed concern about his conscientious daughters' would cope with schoolwork, several sport hobbies and now these physical education homework assignments. The parent calmed down when he was convinced that physical education homework assignments were voluntary. (e-mail conversation with the parent and teacher-researcher diary) By increasing physical education skill practice in after-school hours, teachers could convey information and knowledge of current physical education targets and the content of physical education curriculum to parents. Teachers might help parents to participate in doing physical education homework assignments with their children by communicating with parents about the importance of involvement (Cooper et al., 2006; Hoover-Dempsey et al., 2001). According to Hoover-Dempsey et al. (2001), parents are involved in homework insofar as they believe their children and teachers want them to, they think their involvement makes a difference and they assume they have a role to play (Hoover-Dempsey et al., 2001). Physical education homework assignments done with someone else were popular, and especially parents thought those were wanted tasks. Even if peer influence increases during adolescence, the encouragement by and even participation of influential adults might help promote taking part in physical activities (Trilk et al., 2012).

In the present study, parents support for physical education homework assignments meant they were interested in physical education homework assignments, acknowledged their children's effort in doing them, and even arranged a time to participate in doing physical education homework assignments together with their child. In adopting a lifelong habit of physical activity, it has been recommended to involve families and combine the home environment in physical activity assignments (Metzler et al. 2013; Williams & Hannon, 2013). However, as teens, children might no longer want to be physically active with their parents, and their interests also might start to differ from their parents' interests, as one father reported in this study. Adolescents start to prefer doing their leisure activities with their peers (Atkin et al., 2015; Kirby et al., 2011; Silva et al., 2015). Adolescents attach to support of their peer when engaging in behaviours, which highlights the importance of support from friends as a correlate of intentions to participate in physical activity (Pasi et al., 2021). In physical education homework assignments in this study, this was considered by giving participants freedom to choose their company (friend, parent, sibling, pet) in doing the active physical education homework.

Parents' wish for physical education homework to continue, with specific wishes about content of physical education homework assignments, reflected their positive attitude towards physical education homework. Physical education homework involving family or parents' participation were mentioned as a popular activity in both parents' and students' responses. As in prior research (Abdelghaffar et al., 2019; Martins et al., 2015), according to this study, parents hoped physical education homework assignments would be diverse, able to be performed without equipment at home or in a nearby environment, and suitable for

their child's fitness level. The assignments done without any equipment at home or nearby the home enable being physically active regardless of a student's socio-economic background (Gill et al., 2018). The parents also mentioned frequently that the assignments should be easy enough so that anyone can manage. Professional teachers who follow the content of the national physical education curriculum ensures that the active physical education homework assignments are suitable for students at each age.

8.3 Active physical education homework, given at school, done in nearby environments – Physical environment and community level

Physical education homework is given during physical education lesson by influential adult, the teacher, but performed at home or in a nearby environment. This chain connects the two most important communities of youth: home and school, the places they spend most of their time. The school of the girls in this study has the policy that it is mandatory to go outdoors during every recess. That policy might be one reason for higher physical activity levels during school hours, as even the most sedentary students engage in light activity during the breaks. At least in secondary school, the active transitions between different subject classrooms interrupt periods of sedentary behaviour with light intensity activity, which has positive effects on health (De Baere et al., 2015).

The adolescents' area of activity includes the nearby built and natural environment, nearby sports facilities, along with the accompanying commuting, security, and access issues. Adolescents already spread their circle of living further from home and school environments than children do. These places within adolescents' operating environments refer to their immediate physical environment and the community level of the socio-ecological model, where individual and interpersonal levels operate (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Figure 1, page 40).

In this study, at first, planning and developing the physical education homework took some effort and time from the teacher, after which the development process was done with the students. The active physical education homework assignments were designed to be done at home or in nearby environments, and no commuting to sports facilities was needed. This was appreciated by both students and their parents, since half of study school's students needs to use the bus to commute school, as the distance prevents active commuting. Since all adolescents need to commute to school, school-related travel has a potential to contribute to the total physical activity time. Not all students have the opportunity for active travel on foot or by bike, however, so investing in transport infrastructure and sidewalk networks near homes and schools along with encouragement from influential adults might increase the physical activity of adolescents as well. (De Baere et al., 2015; Mehtälä et al., 2020) Enabling doing active physical

education homework assignments at home might have encouraged some students to do them. Some active physical education homework assignments students started already at school, with students doing squats or standing on their toes in the dressing room, during recess or when queuing for lunch.

At first, giving active physical education homework assignments during physical education lesson took 15 to 20 minutes, but the process accelerated as the concept became familiar to students. In Bowser (2013), the success of active physical education homework strategy was due to how the physical education homework did not require any modifications to the school day, no additional time by teachers outside of the physical education lessons was needed, and assignments were done without any equipment from the school. This study project did not incur any cost to the school or for the students, participation was equal despite socio-economic status. It is important for students that physical activity opportunities have low-cost options and happen in easy-to-reach places and familiar environments (Corder et al., 2013).

According to students, the two most popular places performing active physical education homework were nearby neighbourhoods and home, especially self-initiated physical activities take place in a neighbourhood setting or at home. Parents mentioned the nearby environments often as well and emphasised nature sports. For those students that living in rural area or in suburbs, the opportunities for nature sports nearby face few limitations. In Finland everyman's rights give everyone an opportunity to relax and enjoy outdoors and nature. In Finland, it is also safe for children and adolescent to play, move and get around independently (Kallio et al., 2016; Statistics Finland, Liikenneturva 2021). By using a variety of nearby sports environments as well as built or natural environments, physical education teachers can help adolescents to become familiar with the accessible sports places and physical environments near to them, and students might even realize that home can be sports environment as well (Smith & Claxton, 2003; Williams & Hannon, 2013). Familiar places are easier to approach later on, which might lead to the use of sport facilities. In prior studies, the adequate conditions, access to physical activity facilities and equipment, and perceived neighbourhood safety are favourable to adolescents' physical activity (Gill et al., 2018; Martins et al., 2015). Furthermore, girls allowed to play outside without adult supervision are more likely to be active (Kirby et al., 2011). However, students or parents did not mention neighbourhood safety in the present study, which was expected as participants were living in a safe, rural area of a small town in Finland.

8.4 The role of physical education homework in public policy factors and societal environment level

The individual, immediate and physical environment levels are interacting with each other, but also interacting with public policy factors, the societal environment, and the organisational level of the socio-ecological model (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Figure 1, page 40.

After more than twenty years of working as a class teacher or physical education teacher with children and adolescents at school, it was eye-opening to realize the decreasing trend in physical activity of girls (Teacher-researcher diary). When the national curriculum allows, and even encourages, using leisure time as one resource to continue schoolwork at home, the active physical education homework project had the basic elements at hand. To develop the active physical education homework assignments to be as approachable, enjoyable, and useful for students as possible, it was necessary to get more information about girls' physical activity, after-school activities, and preferable activity patterns and types.

Both students and parents reported that active physical education homework should be useful, with some indicating usefulness in terms of the evaluation and physical education grade while others thought more about usefulness from a health perspective. At first, grading and feedback might be good motivation for physical activity, but in the long term it is not durable basis for building a lifelong habit (Abdelghaffar et al., 2019; Atkin et al., 2015; Sallis et al., 2000; Silva et al., 2015). The focus on the support to enhance intention to be physically active and physical activity through motivation might help physical education teachers to promote their students physical activity (Chicote-López et al., 2017; Deci & Ryan, 2000).

The physical activity of individual low-active girls showed that some girls were sedentary for the entire after-school period. However, even low-active girls' physical education homework time was on average 26 minutes per week. To promote physical activity, and a healthy lifestyle especially among those girls who are not interested in or do not have access to sport activities, efforts to promote self-initiated activities are particularly important. The repertoire of different self-initiated activities was the most diverse among the high-active group of girls. Diverse active physical education homework could be one strategy for increasing the physical activity of adolescents by offering a more diverse selection of choices to perform physical activities during leisure time. It is possible that later on, some girls substitute organized sports activities for spontaneous activities like body-conditioning exercises or jogging. Also interest in a heathy lifestyle might be attributed to heightened body awareness during adolescence (Meza & Marttinen, 2019; Sand et al., 2015). This is alongside the increase in the number of gyms and in knowledge of health benefits of training, which might influence adolescents' preference for certain type of activities (Coll et al., 2014; Koorts et al., 2011). The knowledge of effective ways to be physically active and the skills to train at home,

might be useful when reaching adult life. Even if children or adolescents would like to have a hobby, some organized sports activities might be too expensive for some families. In addition, Koorts et al. (2019) suggests that polices focused only on sport may have minimal impact on a population's physical activity levels. In addition to sport, the focus needs to be on active living, such as active transport and environmental infrastructure that increases recreational and incidental physical activity (Koorts et al., 2019).

The main intended audience of this research is those influential adults of adolescents: parents, teachers, and coaches. In addition, schools' other personnel, and heads of schools particularly, are in important positions in promoting physical activity at their schools. Physical education deserves a similar level of importance as curriculum core subjects have (McMullen & Rogers, 2020). In Finland, the perceptions of heads of schools (70%) about physical education was that it is just as important a subject as other subjects at school, and 66% support the idea of increasing the number of physical education lessons (Palomäki & Heikinaro-Johansson, 2010). Acknowledging the importance of physical activity as a major health benefit might help policymakers to exercise their influence to improve the status of physical education and make decisions to promote physical activity inside as well as outside of the school environment.

8.5 Implications of findings

Active physical education homework assignments allow physical education teachers to reach students' after-school time with physically active tasks and utilize the skill development that takes place outside of instructional time. One student even reported that she remembers one physical education homework especially because "it became a habit". The physical education homework assignments give teachers an opportunity to extend physical education skill practice into after-school hours (Gabbei & Hamrick, 2001; Williams & Hannon 2013). When the teacher's promotion, encouragement and interactions reach students in their daily live, in the form, for example, of physical education homework assignments, it might turn sedentary behaviour into more active behaviour and increase the physical activity of students.

To utilize the expertise of highly trained physical education teachers, their knowledge should be expanded into the after-school hours as well. They can adapt their teaching according to the latest research results to benefit their students. Improving offerings for an array of activities and creating positive physical activity experiences, might motivate girls to engage with physical activities in the future as well. Physical activity in the school context can be aligned with the girls' own preferences and promote their autonomy (Martins et al., 2015). In comprehensive schools, co-operation with classroom teachers and physical education teachers on physical activity breaks, including physical activities in other subject lessons, and active homework is recommended (McMullen et al., 2014). Developing collaboration and creating a supportive network with other teachers might

help in updating knowledge with evidence-based research, managing physical activity promoting projects inside and out-side of school, and coping with resistance to change. Physical education teachers have to believe in their own goal, behave like professionals, and model the active lifestyle themselves as well. (Cloes, 2017) Experimenting active physical education homework assignments in digital form might help students but this kind of platform might be helpful in cooperation with teachers and schools as well.

On the basis of the results of this study, adding active physical education homework assignments to the content of physical education and even in the curriculum is recommended. Some local curriculums, such as in the city of Tampere, have already recommended physical education homework be added to the content of physical education. The highly respected Finnish school system is proud of being equal for all (Finnish National Core Curriculum, 2014). The active physical education homework assignments can be adjusted to serve the abilities and physical fitness of each student, and due to that, they can be used to smooth out the differences and equalize adolescents' different family backgrounds.

Involving students in decision making fosters their autonomy and self-determination (Chicote-López et al., 2017; Deci & Ryan, 2000; Ferriz et al., 2016; Nogg et al., 2020; Pasi et al., 2021) The efforts by educators, parents or policy makers to promote healthy lifestyles in adolescents that could maintain across the life span might benefit from including autonomy and intrinsic motivation in delivering their message (Deci & Ryan, 2000; Ng et al., 2012). Due to this, alongside with the Bronfenbrenner's (1979) socio-ecological model as a main framework, some aspects of self-determination theory (Deci & Ryan, 2000) was utilized in this study as well.

Physical education homework could be a potential approach to influence the physical activity of the student population by involving school curriculum and wellness policies. The schools need to select strategies that have the highest success rate, the best likelihood of being implemented effectively, and are possible to be maintained for years. Those strategies that use existing resources within the school day and focus on physical education class, have the highest level of implementation and maintenance to address opportunities for physical activity opportunities in schools (Bowser, 2013).

8.6 Strength and limitations

The idea and need for this study arose from everyday school life. The experiment was carried out with normal students in a common school. The goal was to develop one easily approachable way to prevent the decreasing physical activity of adolescents. The strength is that the research is very down to earth, the study population participated in the research during their normal school year, and even their comments are authentic. The active physical education homework assignments are available for any physical education teacher to use.

An additional strength is also in the combination of methods. Incorporating several sources of data (students and parents) with several measurements (questionnaire, accelerometers, self-reported diaries, and interviews) and combining qualitative and quantitative approaches provide a broader view of adolescent after-school physical activities (Ekelund et al., 2011; Pate & O'Neill, 2009). Objectively measured physical activity allows for accurate data on the intensity, frequency, and duration of physical activity, and due to that, increases the verifiability of high-quality objective data concerning the quantity and type of physical activity being performed. Previous studies have confirmed that the accelerometer records all ambulatory activity and that accelerometers are reliable in assessing gait parameters in children and adolescents (Ekelund, Tomkinson, & Armstrong, 2011). For example, it is more reliable to make conclusions about the predictors and health impacts of intensity-specific physical activity using accelerometer methods (Aittasalo et al., 2015; Brandes et al., 2006).

The self-reported physical activity data and interviews provide a source of information that cannot be accessed by accelerometers. The self-reported physical activity data from diaries and from interviews provide a rich context for understanding adolescents' activities during after-school hours. On the other hand, the outcome from self-reported diaries or interviews might have been affected by biases such as problems with recall, social desirability, over-reporting of frequencies or over-reporting of time spent doing physical education homework. However, the open questions were well answered in this study, only two "whatever" answers were reported. A combination of contextual self-reported data, interviews, and accelerometer-assessed physical activity is a desirable surveillance mechanism for collecting data concerning adolescents' physical activity during after-school hours. These sources allow researchers to provide meaningful findings. (Biddle et al., 2011) In addition, using both types of MET values and steps adds reliability and variety to the results and enable comparison between studies with the same measurement variables (Vähä-Ypyä et al., 2015a, 2015b). The classification used in this study was the APE algorithm, which compares the accelerometer orientation in relation to the identified upright position at the end of each 6-second epoch (Vähä-Ypyä et al., 2018). This 6-second epoch calculates more moving data compared to, for example, values measured at the end of each 1-minute epoch. In comparison with other studies, this is something to be considered. The excitement of participating in the study and wearing the accelerometer might increase the girls' physical activity.

The cross-sectional nature of the case-study is a limitation and might preclude conclusions being made about the adolescent girls' behaviours of physical activity participation and the directions of effects between their physical activity. Comparing those who did more physical education homework with those who did less should also be addressed. The students' background factors were not standardized, and no experimental and control group was formed. Those who participated more in physical education homework might be more active and more physically competent in the first place. However, according to students' self-reports, active physical education homework added physical activity time,

at least a small amount, to those who did more homework and to those who did it less.

Because of the small sample size and selected sample containing only girls from one lower secondary school in Finland, the data cannot be considered representative, which could be a limitation and might preclude the detection of significance. The question of transferability regarding all aspects is relevant, even at the international level. In Finland, schools and physical education are quite similar nationwide, schools follow the same curriculum, and the number of lessons is comparable. As such, the replication of the study is possible in other schools. Given similar Westernized practices and schooling, it is likely that the physical activity patterns and types are reflective of those of Finnish lower secondary school girls across the country.

There were no withdrawals or dropouts during the study. This could be due to the school structure and the influence schools and teachers have on girls of this age (Kohl III & Cook, 2013). The voluntary nature of active physical education homework might have helped, in addition to fact that participating was quite effortless and not very time-consuming for students and did not even require a long-term commitment from them. The novelty and the idea of continuing to work on task that was not expected to last long might have increased students' motivation as well (Converse et al. 2019). Studies, in which the students' own teacher conducts the research, contain both advantages and disadvantages. It is possible that granting the consent to participate in a study leads to a heightened awareness of targeted behaviours (Beets et al., 2009). Students might also exaggerate their physical activity behaviour in diaries, with the desire to impress their physical education teacher. However, a familiar and confidential relationship between the teacher-researcher and the participants might encourage students to take the study seriously.

9 CONCLUSION

The intention of this research was to provide evidence for a much-needed improvements in the physical activity of adolescent girls. This research introduced the use of physically active physical education homework as an easily approachable tool to increase physical activity of adolescent girls after school hours and replace some sedentary activities with more active tasks. The aim was to contribute research knowledge of physical activity levels and behaviours among teenage girls and promote their physical activity with the Physical Education Homework Study intervention targeted at them. The aim was also to explore students' and their parents' perceptions of physically active physical education homework. The study utilized multiple levels of the socio-ecological model for approaching physical activity and health benefits.

The results of this study increases the knowledge base of the status of adolescent girls' physical activity by offering a picture of the diverse nature of the physical activity of secondary school girls and identifies the variety of behaviours and types of physical activity they perform during after-school hours. During after-school hours students accumulated 46% of their daily physical activity, which shows the potential for after-school spaces to be meaningful in adolescents' ability to accrue 60 minutes of MVPA throughout the day. The high-active girls participated most frequently in organized sport activities whereas the low-active girls were most active in participating in the household chores. The most popular self-initiated sports activities were the type of activities that are typically unstructured, non-competitive, spontaneous, and done at a low-intensity level, which are the activities that might attract girls who are not interested in high-intensity activities or competitive sports. For the self-initiated activities, the high-active girls had the most different types of activities, therefore one effective strategy for increasing physical activity might be to offer a more diverse repertoire of choices to increase leisure time physical activity.

The study showed that students did the voluntary active physical education homework very often, almost 90% did the homework always, and the frequency was twice a week. The physical education homework was a small aspect of adolescents' whole-day physical activity, averaging 34 minutes per week. According

to students and parents diverse, fun, interesting, and challenging physical activity opportunities should be provided at flexible schedules outside of school hours with family support in physical education homework assignments. Utilizing these results can help influential adults encourage adolescent girls to be active in a way they chose and improve the opportunities and variation of activities with the types of physical activity girls might be motivated to try in the future.

The schools have a unique opportunity to promote physical activity and healthy lifestyles, which is why it is important that heads of schools, teachers, school's other personnel, parents and policymakers recognize all the possibilities the school environment has to offer in the fight against the declining physical activity of adolescents. With the deeper understanding of the specific needs of adolescent girls' physical activity this research provides, it is possible to create successful ways to increase physical activity and health benefits through school-based efforts, through curriculum or otherwise.

YHTEENVETO (SUMMARY IN FINNISH)

YLÄKOULUIKÄISTEN TYTTÖJEN FYYSISEN AKTIIVISUUDEN EDISTÄMINEN – LIIKUNNALLISET KOTITEHTÄVÄT OSANA KOULULIIKUNTAA

Johdanto

Yhä useammat nuoret eivät saavuta suositusten mukaisia liikkumismääriä, huoli nuorten liikkumisen vähenemisestä on yhteinen (Currie ym. 2008; Husu ym. 2019; Pate & O'Neill, 2009). Erityisesti liikkuminen vähenee murrosiässä, ja monissa tutkimuksissa tyttöjen liikkumisen on havaittu olevan poikia vähäisempää (ACSM, 2018; Dias ym. 2015; Gill ym. 2018; Hallal ym. 2019; Júdice ym. 2017; Kirby ym. 2011; Morrisey ym. 2015; Ruiz ym. 2011; Sallis ym. 2000; Silva ym. 2014). Terveellisten elintapojen, kuten fyysisen aktiivisuuden, pohja luodaan lapsuudessa ja nuoruudessa, jolloin ollaan erityisen herkkiä lähiympäristön vaikutuksille (Abdelghaffar ym. 2019; Atkin ym. 2015; Kirby ym. 2011; Lounassalo ym. 2021; Pardo ym. 2014; Sallis ym. 2000; Telama ym. 2005). Nuorten liikkumisen edistäminen on haasteellista, koska siihen vaikuttavat monet tekijät, kuten esimerkiksi läheisten tai vertaisten tuki, ympäristön haasteet ja mahdollisuudet, pätevyyden kokemukset, asenteet sekä motivaatio (Martins ym. 2015; Silva ym. 2014). Sosiaaliset motiivit ja perheen tuki liikkumiselle ovat erityisen merkityksellisiä tytöille (Henriksen ym. 2016; Kopcakova ym. 2015; Morrisey ym. 2015). Toimiviksi ovat osoittautuneet interventiot tai ohjelmat, jotka toteutetaan kouluissa, perustuvat tutkimustietoon ja ovat riittävän pitkäkestoisia. Edistämistoimien suuntaaminen monipuolisesti ja esimerkiksi perheiden huomioiminen liikunnan edistämiseksi parantavat vaikuttavuutta. (Abdelghaffar ym. 2019; Cook-Cottone ym. 2009; Kriemler ym. 2011; Mears & Jago, 2016; Okely ym. 2011; Owen ym. 2017)

Koulu ja liikunnan opetus tavoittaa lähes kaikki lapset ja nuoret, joten kouluissa tapahtuva liikkumisen edistäminen huomioi tasapuolisesti kaikki lapset ja nuoret (Abdelghaffar ym. 2019; Beets ym. 2009; Palomäki ym. 2017; Scruggs, 2007; Siekkinen ym. 2019). Aiemman tutkimuksen mukaan liikunnanopetuksella voidaan vaikuttaa nuorten liikkumisen määrään päivinä, jolloin koululaisilla on liikuntatunteja (Mooses ym. 2017). Koululiikuntaan osallistuvat oppilaat ovat fyysisesti aktiivisempia kuin koululiikuntaan osallistumattomat (Cheung, 2019; Mayorga-Vega ym. 2018; Mooses ym. 2017; Pate ym. 2007). Liikunnanopetuksen tulisi tukea oppilaiden autonomiaa, motivaatiota ja opettajien ja oppilaiden välistä vuorovaikutusta (Mitchell et al., 2015), sekä tarjota oppilaille heille sopivia liikkumismahdollisuuksia sekä mahdollisuuksia pätevyyden kokemuksiin (Corr ym. 2019; Marttinen ym. 2020a). Koululiikunta ei kutenkaan yksin riitä suositusten mukaisen liikkumismäärän saavuttamiseksi (Fairclough & Stratton, 2005; Gråstén ym. 2015; Hollis ym. 2017; Pfitzner ym. 2013) eli koululaisten täytyisi liikkua paitsi koulupäivän aikana niin myös koulupäivää ennen tai sen jälkeen (Siekkinen ym. 2019). Liikunnalliset kotitehtävät tarjoavat yhden mahdollisuuden lisätä liikkumista koulupäivän jälkeen (Gabbei & Hamrick, 2001; Kääpä ym.

2017; Williams & Hannon, 2013). Suomalainen perusopetuksen opetussuunnitelma mahdollistaa, ja jopa kannustaa, käyttämään koulun ulkopuolista aikaa opetuksen resurssina (Perusopetuksen opetussuunnitelman perusteet, 2014).

Tämä väitöstutkimus perustuu Liikuntaläksyprojektiin (Finnish Physical Education Homework Study project), jossa yläkouluikäisten tyttöjen fyysistä aktiivisuutta tutkittiin sekä objektiivisilla mittauksilla että itse raportoiden eli kyselyihin perustuen. Yhtenä tavoitteena oli tutkia sitä, millainen osuus liikunnallisilla kotitehtävillä oli tyttöjen kokonaisaktiivisuudessa. Oppilaiden mielipiteitä liikuntaläksyistä kerättiin kyselylomakkeella sekä haastatteluilla. Lisäksi vanhempien haastatteluaineisto täydensi kokonaiskuvaa liikuntaläksyistä. (Kääpä ym. 2017; 2019; 2021)

Tutkimuskysymykset

Tutkimuskysymykset neljässä osatutkimuksessa (I–IV) olivat:

1. Yläkouluikäisten tyttöjen fyysisen aktiivisuuden kuvaaminen (II, III).
   1.1. Millainen oli tyttöjen objektiivisesti mitattu fyysinen aktiivisuus sekä paikallaanolon määrä? (II, III)
   1.2. Mitkä olivat itseraportoidun tiedon mukaan tyttöjen liikkumisen tavat koulupäivän jälkeen? (III)
   1.3. Mikä oli liikunnallisten kotitehtävien osuus tyttöjen kokonaisaktiivisuudesta koulupäivän jälkeen? (II, III)
2. Oppilaiden ja vanhempien käsitykset liikunnallisista kotitehtävistä
   2.1. Miten oppilaat kokivat liikunnalliset kotitehtävät ja millaisia olivat heidän käsityksensä niistä? (I, IV)
   2.2. Miten vanhemmat kokivat liikunnalliset kotitehtävät ja millaisia olivat heidän käsityksensä niistä? (IV)

Aineisto, muuttujat ja mittausmenetelmät

Väitöstutkimus koostui neljästä osatutkimuksesta I-IV, joihin kaikkiin aineisto kerättiin keskisuomalaisesta keskikokoisesta (300–350 oppilasta) yläkoulusta lukuvuosina 2016–2020. Kaikki koulun 12–15-vuotiaat tyttöoppilaat saivat liikunnallisia kotitehtäviä liikuntatunneilla, mutta tutkimukseen osallistuminen oli vapaaehtoista ja 84,7 prosenttia tytöistä osallistui tutkimukseen.

Tutkimuksessa käytettiin sekä määrällisiä että laadullisia menetelmiä, ja kokoavana teoriakehyksenä toimi Bronfenbrennerin (1979) sosio-ekologinen malli. Ainestoa kerättiin useilla menetelmillä: objektiiviset mittaukset tehtiin viikon seuranta-ajalta kiihtyvyysantureilla ja samana ajanjaksona oppilaat täyttivät puolistrukturoitua päiväkirjan tyyppistä kyselylomaketta. Kyselylomakkeilla kerättiin oppilaiden käsityksiä liikunnallisista kotitehtävistä ja kuvaa käsityksistä täydennettiin oppilaiden ja vanhempien haastatteluilla (n = 43). Lisäksi opettajatutkijan päiväkirjamerkinnät täydentävät tuloksia. Koska tiedonkeruumenetelmiä oli useita, myös tiedon käsittelyn ja analysoinnin menetelmät vaihtelivat artikkeleittain.

Koulun oppilaat olivat saaneet liikunnallisia kotitehtäviä jo aiemminkin, mutta vasta tutkimuksen myötä liikuntaläksyjä alettiin antaa säännöllisesti kerran viikossa liikuntatunnilla. Liikunnalliset kotitehtävät olivat koululiikunnan tavoitteisiin ja sisältöihin sopivia, ilman välineitä kotona tai kodin lähiympäristössä toteutettavissa, vapaaehtoisia ja usein myös muita perheenjäseniä aktivoivia tehtäviä. Oppilaat osallistuivat läksyjen suunnitteluun sekä saivat valita toteutustapoja ja läksyjen määriä itse. He myös toivoivat tehtävien tarkistamista. Tarkistaminen toteutettiin oppilaiden omatoimisella merkkaamisella opettajan vihkoon yhdessä sovitulla liikkumisen määrän huomioivalla tavalla. Liikunnallinen kotitehtävä saattoi olla esimerkiksi kyykyn tekniikan opettaminen jollekin perheenjäsenelle, väärän käden viikko, jolloin pyrittiin tekemään arkisia toimintoja heikommalla kädellä, hampaiden harjaus yhdellä jalalla seisten, jonkun perheenjäsenen vieminen lenkille tai varpaillenousut.

Kiihtyvyysanturit ja niihin liittyvät puolistrukturoidut päiväkirjat jaettiin ohjeistuksineen liikuntatunnilla. Laitteita ja päiväkirjaa oli tarkoitus pitää viikon ajan. Tutkimukseen hyväksyttiin tiedot oppilailta (N = 88), joilta tietoa oli tallentunut kiihtyvyysanturitietoa vähintään neljän päivän ajalta, ja päiväkohtaista mittausaikaa oli vähintään 10 tuntia (Mattocks ym. 2008; Troiano ym. 2008). Yhteensä oppilailta saatiin 513 mittauspäivää. Päiväkirjoihin (N = 81) oppilaat kirjasivat osallistumisensa organisoituihin liikuntaharrastuksiin, kotitöihin, omaaloitteiseen liikkumiseen sekä liikunnallisiin kotitehtäviin. Organisoitujen liikuntaharrastusten ja liikunnallisten kotitehtävien osalta he arvioivat myös kestoajan. Kyselylomakkeiden (N = 117) avulla selvitettiin oppilaiden käsityksiä ja mielipiteitä liikunnallisista kotitehtävistä. Oppilaat vastasivat väitteisiin sekä avoimiin kysymyksiin, joiden avulla selvitettiin mm. liikuntaläksyjen tekemisaktiivisuutta, kenen kanssa läksyjä tehtiin, niiden hyödyllisyyttä ja vapaaehtoisuutta, oppilaiden osallisuutta sekä tulevaisuuden toiveita. Opettaja-tutkijan päiväkirjamerkinnöissä liikuntaläksyistä oli oppilaiden kommentteja ja ajatuksia sekä opettajan pohdintoja läksyjen suunnittelusta, valitsemisesta, niiden antamisesta oppilaille, tarkastamisesta sekä jatkokehittelystä. Haastatteluja oli yhteensä 43, joista 38 oli oppilashaastattelua ja 5 vanhempien haastattelua. Haastatteluissa käsiteltiin liikunnallisiin kotitehtäviin osallistumista, kotien roolia liikuntaläksyissä, esteitä ja kannustimia liikuntaläksyjen tekemisessä, tehtävien tekemisen ympäristöä ja seuraa sekä tulevaisuuden toiveita.

Kiihtyvyysantureista saatiin tietoa osallistujien fyysisen aktiivisuuden tasosta. Mittaus perustuu asennonmuutoksien mittaamiseen, joten tuloksista saadaan MET arvojen lisäksi (kevyt, reipas ja rasittava liikkuminen), askelmäärät (kokonaisaskeleet ja juoksuaskeleet), seisomiseen, istumiseen ja makuulla olemiseen käytetty aika. Oppilaiden fyysisen aktiivisuuden määriä verrattiin toisiinsa sekä luokka-asteiden välillä, MET arvojen mukaan tehtyjen aktiivisuusryhmien välillä, että liikunnallisten kotitehtävien tekemisaktiivisuuden mukaisesti. Vertailuissa käytettiin varianssianalyysia (ANOVA), t-testiä ja Cohenin d:tä, post-hoc testeinä Tukey ja Tamhane. Organisoidun liikunnan ja omaehtoisen liikkumisen tapoja vertailtiin aktiivisuusryhmien kesken Kurskall-Wallisin testillä, post-hoc Bonferroni.

Itseraportoidulla aineistolla täydennetty objektiivisesti mitattu aineisto luokiteltiin liikkumistapojen mukaisesti organisoituun liikkumiseen, kotitöihin, omaehtoiseen liikkumiseen sekä liikunnallisiin kotitehtäviin ja näihin liikkumistapoihin osallistumiskerrat kirjattiin. Organosoidusta liikkumisesta ja liikunnallisista kotitehtävistä kirjattiin myös kestoaika. Myös kyselylomakkeiden aineisto analysoitiin tilastollisin menetelmin, frekvenssit, ristiintaulukointi, keskiarvovertailut t-testillä ja varianssianalyysillä. Kyselylomakkeiden vastaukset luokiteltiin liikunnallisten kotitehtävien tekemisaktiivisuuden mukaan, luokittain sekä tehtävien saamisen tavan mukaisesti. Opettaja-tutkija-päiväkirjaan merkittiin analysointiprosessissa merkityksellisimmät ja kuvaavimmat kommentit ja niillä täydennettiin tuloksia.

Haastattelut analysoitiin Schreierin (2012) laadullisen sisällönanalyysin menetelmällä (QCA). Oppilaiden haastattelumateriaalin luokitteli ja koodasi kolme henkilöä, millä pyrittiin varmistamaan koodauksen luotettavuutta. Luokittelun pääkriteerit sovittiin yhdessä, ja ne noudattelivat tutkimuskysymyksiä ja haastattelujen teemoja. Pääteemana oli perheen tuki liikunnallisissa kotitehtävissä. Vanhempien haastattelujen koodauksen teki vain yksi henkilö, ja luotettavuutta lisättiin toistamalla aineiston käsittely useampaan kertaan, jolloin kategorioita saattoi tarkastella ja muokata tarpeen mukaan. Aineistosta haettiin toistuvia aihealueita (myös toistomääriä laskettiin), yhtäläisyyksiä ja eroavaisuuksia, joka toimivat myös raportoinnin ohjenuorana.

Tulokset

Osallistujien kiihtyvyysanturidatan keskimääräinen päivittäinen mittausaika oli 14 tuntia 30 minuuttia, josta paikallaanoloa oli 7 tuntia 37 minuuttia (II, III). Päivittäinen MET arvo vaihteli 43,8 ja 158,6 MET arvojen välillä. Fyysisen aktiivisuuden osalta osallistujille kertyi eniten kevyttä liikkumista (3 tuntia 8 minuuttia), joka oli 13,9 prosenttia valveillaoloajasta. Seitsemännen luokan tytöille kertyi kevyttä liikkumista eniten (3 tuntia 28 minuuttia) ja erot muiden luokkien tyttöjen määriin olivat tilastollisesti merkitseviä. Seitsemäsluokkalaiset liikkuivat kevyellä tasolla 34 minuuttia 8.luokan tyttöjä enemmän (p = 0.000) ja 30 minuuttia enemmän kuin 9. luokan tytöt (p = 0.000). Reipasta ja rasittavaa liikuntaa osallistujilla oli 11,2 prosenttia valveillaoloajasta (1 tunti 2 minuuttia). Vaikka 8. luokan tytöillä oli reipasta ja rasittavaa liikkumista enemmän kuin muilla, erot olivat vain muutamien minuuttien luokkaa. Paikallaanoloa kertyi keskimäärin 7 tuntia 37 minuuttia, josta istumista oli 6 tuntia 29 minuuttia. Kahdeksannen luokan tytöille kertyi paikallaanolonaikaa vähiten (7 tuntia 12 minuuttia), joka oli 38 minuuttia vähemmän kuin 7. luokan tyttöjen aika (p = 0.002) ja 33 minuuttia vähemmän kuin 9. luokan tyttöjen aika (p = 0.012). Kokonaisuudessaan 38 prosenttia osallistujista saavutti 60 minuutin suosituksen mukaisen päivittäisen liikkumismäärän.

Keskimääräinen askelmäärä oli 8 535 askelta päivässä, askelmäärät vaihtelivat 4645 ja 14 089 välillä (II). Kolmasosa (32 %) osallistujista saavutti 10 000 askeleen päivittäisen suosituksen määrän (Adams, Johnson, & Tudor-Locke, 2013; Tudor-Locke ym. 2011). Kahdeksasluokkalaisten tyttöjen keskimääräinen

päivittäinen askelmäärä oli suurin (9 036), heistä 44 prosenttia saavutti 10 000 askeleen suosituksen. Juoksuaskelien osalta 9. luokan tyttöjen juoksuaskelten määrä (547) oli muiden luokka-asteiden tuloksiin verrattuna alhaisin ja erot olivat tilastollisesti merkitseviä. Seitsemäsluokkalaisilla tytöillä oli keskimäärin 843 päivittäistä juoksuaskelta (ero 9.lk tyttöihin $p = 0.000$) ja 8. luokan tytöillä juoksuaskelten määrä oli 796 ($p = 0.000$).

Osallistujat jaettiin myös liikkumisaktiivisuuden mukaisiin ryhmiin MET arvojen mukaan. Raja-arvot olivat paljon liikkuvilla tytöillä 87,5 MET, keskivertoliikkujilla 78 MET ja vähän liikkuvilla 67,2 MET (III). Ryhmien erot aktiivisuustasojen osalta olivat ryhmäjaon mukaisesti merkitseviä. Kokonaisaktiivisuuteen suhteutettuna liikkumisesta 46 prosenttia kertyi koulupäivän jälkeen. Kaikkien aktiivisuusryhmien osalta ensimmäiset tunnit koulupäivän jälkeen olivat aktiivisimpia. Paljon liikkuvien tyttöjen aktiivisuutaso pysyi yli 4 MET koko iltapäivän ja illan ajan. Heidän osaltaan iltapäivään mahtui kaksi yli 5 MET ajankohtaa, klo 14–15 (5,22 MET) ja klo 17–18 (5,09 MET). Keskivertoliikkujien MET taso pysyi 4–5 MET koko illan, alle 4 MET aktiivisuus laski klo 20 jälkeen. Vähemmän liikkuvien tyttöjen ryhmän MET arvo laski alle 4 MET jo klo 16 ja heidän aktiivisuustasonsa pysyi alhaisena koko illan. Heidän aktiivisuustasonsa oli tilastollisesti merkitsevästi alhaisempi verrattuna muihin ryhmiin illan aikana klo 16–18 ja klo 19–21.

Eri aktiivisuustasoryhmien tytöt liikkuivat eri tavoin koulupäivän jälkeen (III). Paljon liikkuvat osallistuivat eniten organisoituihin liikuntaharrastuksiin ja myös hieman enemmän omaehtoiseen liikkumiseen, kun taas vähemmän liikkuvien ryhmän tytöt tekivät enemmän kotitöitä kuin muiden ryhmien tytöt. Liikuntaharrastuksista suosituimpia olivat jalkapallo, tanssi, voimistelu sekä muut pallopelit (salibandy, koripallo, lentopallo ja pesäpallo). Liikuntaharrastuksiin käytettiin keskimäärin 4 tuntia 11 minuuttia viikossa. Vähän liikkuvia tyttöjä oli eniten ”ei liikkumista” ja ”muu” kategorioissa. ”Muu” liikkuminen sisälsi ratsastusta, kehonhuoltoa, uintia, itsepuolustuslajeja, kuntosalitreeniä ja luistelua. Eniten liikkuvien tyttöjen osuus oli suurin jalkapallossa ja keskivertoliikkujien osuus suurin kategoriassa muut pallopelit. Kotitöistä tehtiin eniten siivousta, koiran ulkoilutusta ja lasten (sisarusten) hoitamista. Omaehtoisessa liikunnassa eniten liikkuvilla tytöillä oli laajin valikoima erilaisia liikkumisen tapoja. Suosittuja omaehtoisen liikkumisen tapoja olivat lenkkeily, kävely, kehonhuolto ja ulkopelit.

Liikunnallisia kotitehtäviä tehtiin keskimääri kaksi kertaa viikossa (1,94). Aikaa liikuntaläksyihin käytettiin keskimäärin 34 minuuttia viikossa, ajat vaihtelivat 8. luokan tyttöjen 51 minuutin ja 7. luokan 20 minuutin välillä. Läksyjentekoaktiivisuuden mukaan muodostettuja ryhmiä vertailtaessa erot olivat pieniä, tilastollisesti merkittävä ero kahden läksyjentekoaktiivisuuden mukaisen ryhmän välillä oli rasittavan liikkumisen kohdalla enemmän liikunnallisia kotitehtäviä tehneiden ryhmän hyväksi ($p = 0.000$). Sama tilastollisesti merkitsevä ero oli havaittavissa vertailtaessa askelmääriä läksyjen tekemisaktiivisuuden mukaan. Enemmän liikunnallisia kotitehtäviä tehneiden ryhmällä (9 128 askelta) oli keskimäärin 1 067 askelta enemmän päivittäin kuin vähemmän liikuntaläksyjä

tehneiden ryhmällä (8061 askelta). Tilastollisesti merkitsevä ero havaittiin kuitenkin juoksuaskelien määrässä. Vähemmän liikunnallisia kotitehtäviä tehneillä (559 juoksuaskelta) oli 371 juoksuaskelta vähemmän kuin enemmän liikuntaläksyjä tehneiden ryhmällä (p = 0.0000).

Osallistujat tekivät liikunnallisia kotitehtäviä usein, eli tytöistä 80 prosenttia teki annetut läksyt aina ja aina tai lähes aina 90 prosenttia (I). Osallistujat kommentoivat opettaja-tutkija-päiväkirjan mukaan tehtävien tekemiseen: ”Miksi ei?”. Tällä he viittasivat siihen, että olihan kaikista muistakin oppiaineita kotitehtäviä, miksi sitten liikunnasta ei voisi olla. Yleisimmin liikunnalliset kotitehtävät tehtiin yksin (51,3 %), neljäsosa teki ystävän kanssa (25,6 %) ja 12 prosenttia teki vanhemman kanssa. Yli puolet oppilaista (59,8 %) kertoi liikuntaläksyistä kotona. Oppilaiden mielestä heidän tulisi saada osallistua liikuntaläksyjen suunnitteluun. He pitivät liikuntaläksyjä helppoina ja arvostivat sitä, että opettaja tarkistaa tehdyt tehtävät. Erityisesti eniten liikunnallisia kotitehtäviä tehneet oppilaat pitivät tehtäviä hyödyllisinä ja heidän mielestään ne myös lisäsivät heidän liikkumistaan. Mieleenpainuviksi liikuntaläksyiksi osallistujat mainitsivat hauskat tehtävät, voimaharjoittelutehtävät, jollakin tapaa erilaiset tehtävät, juoksulenkit, tehtävät, joissa piti liikuttaa jotakuta muuta ja lomatehtävät, jotka olivat aina jotakin kevyttä ja mukavaa. Oppilaat toivoivat jatkossa sisällöltään samanlaisia tehtäviä kuin ennenkin. Lisäksi he toivoivat liikuntaläksyjen olevan tasoltaan sopivan haastavia ja vapaaehtoisia jatkossakin.

Opettaja-tutkija-päiväkirjan mukaan liikunnallisten kotitehtävien antamiseen ja tarkistamiseen sisältyi usein hyviä keskusteluhetkiä oppilaiden kanssa (I, IV). Oppilaat halusivat jakaa kokemuksiaan liikuntaläksyistä ja samalla opettajan oppilaantuntemus lisääntyi. Oppilaiden osallistuminen suunnitteluun vaihteli, mutta oman sopivan tekemisen tason määrittämistä ja valinnanmahdollisuuksia arvostettiin. Tehtävien vapaaehtoisuus mahdollisti myös sen, että läksyjen tekemättömyydestä ja sen syistä saatettiin keskustella avoimesti.

Oppilashaastattelujen perusteella liikunnallisia kotitehtäviä tehtiin melko harvoin vanhempien kanssa (13/38), mutta jonkun toisen kanssa tehdyistä tehtävistä kuitenkin pidettiin (IV). Liikuntaläksyt tehtiin useimmiten kotona (23/38) tai kodin lähiympäristössä (24/38). Liikunnallisten kotitehtävien tekemiseen oppilaita kannustivat hauskat tehtävät, onnistumisen ja pätevyyden kokemukset, liikuntamotivaatio, tehtävien tarkistaminen koulussa, sopivan tasoiset tehtävät, mahdollisuus tehdä tehtävät ilman välineitä, vapaaehtoisuus sekä se, että niiden tekeminen ei vie paljon aikaa. Tehtävien tekemättömyyden syiksi oppilaat mainitsivat unohtamisen, toipilaana olemisen, muut kiireet, motivaation puutteen, harrastusten runsaan määrän sekä muiden oppiaineiden kotitehtävien luomat paineet.

Vanhempien mielipiteet liikunnallisista kotitehtävistä olivat lähes yksinomaan positiivisia, ja vain tehtävien vapaaehtoisuus aiheutti muutaman kysymyksen (IV). Vaikka vanhempien suhtautuminen liikunnallisiin kotitehtäviin oli myönteistä, vain kaksi vanhempaa kertoi osallistuneensa lapsensa kanssa liikuntaläksyjen tekemiseen. Vanhempia osallistavia tehtäviä kuitenkin toivottiin tulevaisuudessakin. Vanhemmat arvostivat monipuolisia, kehittäviä, sopivan tasoisia ja vapaaehtoisia tehtäviä. He pitivät myös tärkeänä, että liikunnallisten

kotitehtävien tekemiseen ei tarvittu välineitä tai rahaa. Vanhempien mielestä liikunnallisten kotitehtävien tekemisen voisi myös huomioida liikunnan arvioinnissa.

Tutkimuksen vahvuudet ja rajoitteet

Tämän tutkimuksen vahvuus on käytännön koulutyöstä noussut tarve. Kokeilussa pyrittiin löytämään toteuttamiskelpoinen liikkumista lisäävä kouluarkeen sopiva menetelmä. Kokeilu toteutettiin tavallisessa keskisuomalaisessa koulussa normaalin koulutyön lomassa. Toteutus oli helposti lähestyttävä sekä opettajalle, oppilaille, heidän vanhemmilleen sekä kouluyhteisölle. Voidaankin arvioida, että samankaltaisen toteutuksen toistaminen muissa kouluissa olisi liikunnan opettajille kohtuullisen vaivatonta ja siten mahdollista tulevaisuudessa.

Tutkimuksen vahvuutena on myös menetelmien monipuolisuus. Oppilaat, vanhemmat sekä opettajatutkija antoivat omat näkemyksensä aiheeseen. Erilaisilla aineistonkeruumenetelmillä saatiin toisiaan täydentävää tietoa nuorten liikkumisesta eli objektiivisten mittausten aineiston yhdistäminen itsearvioituun liikkumiseen rikastuttaa tuloksia (Biddle ym. 2011; Corr ym. 2019; Martins ym. 2015). Myös laadullisen ja määrällisen aineiston yhdistelmä monipuolistaa tulosten tarkastelua.

Rajoitteena voidaan pitää tapaustutkimustyyppistä interventiotutkimusta. Yhden koulun oppilasmäärä on pieni ja lyhyeltä ajanjaksolta kerätty aineisto ei ole kovin kattava eikä yleistettävä. Vaikka kyselylomake kokeiltiin myös toisen koulun oppilailla, ei interventio- ja kontrolliryhmiä ollut erikseen. Kaikki koulut kuitenkin noudattavat Suomessa samaa valtakunnallista opetussuunnitelmaa ja myös nuorten suosituimmat liikkumismuodot ovat samankaltaisia eri puolilla maata

On mahdollista, että oppilaat saattoivat liioitella vastauksiaan oman liikunnanopettajan toimiessa tutkijana. Myös itse mittausten aiheuttama innostuneisuus saattoi näkyä fyysisen aktiivisuuden tuloksissa (Converse ym. 2019). Toisaalta se, että oppilaat ja opettajatutkija tunsivat toisensa, saattoi myös edesauttaa myönteistä suhtautumista tutkimukseen, lisätä osallistumisinnokkuutta sekä itseraportoinnin luotettavuutta.

Johtopäätökset

Tavoitteena oli tutkia yläkouluikäisten tyttöjen fyysistä aktiivisuutta sekä objektiivisilla mittauksilla että itseraportointimenetelmin. Tutkimuksessa keskityttiin erityisesti koulupäivän jälkeiseen aikaan ja liikunnallisten kotitehtävien osuuteen kokonaisaktiivisuudesta. Lisäksi kerättiin oppilailta ja heidän vanhemmiltaan käsityksiä liikunnallisista kotitehtävistä.

Tämän tutkimuksen nuorista tytöistä 38 prosenttia saavutti 60 minuutin päivittäisen liikunta suosituksen, eli he olivat fyysisesti aktiivisempia kuin ikätoverinsa useissa muissa tutkimuksissa (Cohen, Ghosh-Dastidar & Lytle, 2014; Currie ym. 2008; Graham ym. 2014; Júdice ym. 2017; Kokko ym. 2019; Marques ym. 2015; Okely ym. 2011; Ruiz ym. 2011). Myös paikallaanoloaika oli tässä tutkimuksessa pienempi kuin useissa vastaavissa tutkimuksissa (Cohen, Ghosh-Dastidar & Lytle, 2014; Marques ym. 2015; Okely ym. 2011). Päivittäisestä

kokonaisaktiivisuudesta 46 prosenttia kertyi koulupäivän jälkeen, ja ensimmäiset tunnit koulun päätyttyä olivat aktiivisimmat kaikille aktiivisuusryhmien tytöille. Tämä voi selittyä koulumatkojen liikkumisella fyysisesti aktiivisella tavalla tai myöhäisen iltapäivän koulutuntien aktiivisuudella. Vähemmän liikkuvien tyttöjen aktiivisuus oli alhaisella tasolla koko illan. Nuorten aktiivisesta valveillaoloajasta kilpailevat paikallaanoloa lisäävät toimet, kuten media ja kotitehtävät (De Baere ym. 2015). Paljon liikkuvat tytöt olivat eniten edustettuina organisoiduissa liikuntaharrastuksissa, ja liikuntaharrastukset saattoivat pitää heitä aktiivisina myöhäiseen iltaan asti (Koorts ym. 2011; Taverno Ross ym. 2013). Siirtyminen harrastuksista kotiin ja erilaiset iltatoimet vielä sen niiden jälkeen saattoivat lisätä heidän ilta-aktiivisuuttaan. Kuten aiemmissakin tutkimuksissa (Pardo ym. 2014; Taverno Ross ym. 2013), tässäkin tutkimuksessa kotitöitä tekivät eniten vähän liikkuvat tytöt. Kotitöiden tekemiseen käytetty aika saattaa olla pois liikuntaharrastuksista tai omaehtoisesta liikkumisesta. Vaikka organisoidun liikunnan tiedetään lisäävän ja myös ylläpitävän fyysistä aktiivisuutta (Bélanger ym. 2009; Pate ym. 2010), saattavat omaehtoisen liikkumisen tavat tuntua vähän liikkuvasta nuoresta helpommilta lähestyä (Lawler ym. 2017). Tässä tutkimuksessa suosituimmat omaehtoisen liikkumisen tavat olivat kävely, lenkkeily, kehonhuolto, venyttely, ulkopelit ja tanssipelit. Tämän tyyppinen liikkuminen ei vaadi erityistä osaamista tai kilpailemista, on luonteeltaan spontaania ja järjestäytymätöntä sekä toteutetaan usein kevyen liikkumisen tasolla, mikä saattaa vedota tyttöihin, jotka eivät kaipaa kilpailua tai rasittavalla tasolla liikkumista. On myös havaittu, että kevyellä tasolla suoritettu liikkuminen pysyy helpommin arjessa mukana läpi nuoruuden (Koorts ym. 2011; Pate ym. 2010). Paljon liikkuvien tyttöjen valikoima omaehtoisia liikkumismuotoja oli suurempi kuin muiden tyttöjen. Yksi tapa aktivoida vähän liikkuvia nuoria voisi olla se, että heille tarjottaisi monipuolinen valikoima mahdollisia omaehtoisen liikkumisen muotoja, vaikkapa juuri liikunnallisten kotitehtävien muodossa. Kun tunnetaan tytöille mieluisat tavat liikkua, voidaan heille opettaa juuri sellaisia liikuntamuotoja, joista he pitävät ja sitä kautta he ehkä myös jatkavat näiden liikkumismuotojen parissa myöhemmin aikuisuudessa (Corr ym. 2019).

Kotitehtävistä kerrottiin kotona ja jotkut vanhemmat osallistuivat liikunnallisten kotitehtävien tekemiseen. Yhdessä tehtävistä liikuntaläksyistä pidettiin ja niitä toivottiin tulevaisuudessakin. Vaikka nuorten elämässä vertaisten rooli kasvaa, on vanhemmilla edelleen merkittävä osa heidän elämässään (Heitzler ym. 2010; Kirby ym. 2011). Liikunnallisten kotitehtävien tekemisen kannustimia oli estäviä tekijöitä enemmän, kannustimina mainitut hauskuus, sopivan tasoiset tehtävät ja tekemisen huomioiminen nousevat esiin myös aiemmassa tutkimuksessa (Abdelghaffar ym. 2019; Heitzler ym. 2010; Martins ym. 2015; Silva ym. 2014). Liikunnallisten kotitehtävien haluttiin olevan hauskoja, mikä saattoi vaikuttaa siihen, että liikunta oppiaineen kotitehtäviä ei mielletty muiden oppiaineiden kotitehtävien kaltaiseksi. Kotitehtävien tarkoitus on harjoituttaa ja kehittää koulussa opittuja taitoja ja ajanhallintaa, ja niiden on tarkoitus opettaa oppilasta itsenäiseen elinikäiseen oppimiseen myös koulun ulkopuolella (Cooper ym. 2000; Schunk & Zimmerman, 1994). Tämä tavoite pätee myös liikunnallisiin

kotitehtäviin. Liikkumisen terveyshyötyjen tiedostaminen ja niiden opettaminen oppilaille saattaisi myös lisätä myös koululiikunnan ja siihen liittyvien liikunnallisten kotitehtävien merkitystä (Ardoy ym. 2014; Corr ym. 2019; Duncan ym. 2011). Myös hyvinvointi- ja kehotietoisuuden lisääntyminen voi lisätä tietyn tyyppistä liikkumista nuorilla (Coll ym. 2014; Koorts ym. 2011; Meza & Marttinen, 2019; Sand ym. 2015). Vanhempien osallistumista liikunnallisiin kotitehtäviin voisi lisätä tiedottamalla heidän roolinsa tärkeydestä (Cooper ym. 2006; Hoover-Dempsey ym. 2001). Esteiden osalta ainakin liikuntaläksyjen tekemisen unohtamiseen voisi löytyä apua teknologiasta, sillä erilaisia mittareita ja sovelluksia liikkumisen seurantaan ja muistamisen avuksi on jo runsaasti (Marttinen ym. 2020b; Ng ym. 2020). Myös koronapandemiaan liittynyt etäopetusaika monipuolisti opettajien mahdollisuuksia liikunnallisten tehtävien tarjoamiseen myös sähköisesti (Kääpä & Huovinen, 2020; Webster ym. 2021). Vaikka liikunnanopetus perustuu vahvasti kontaktiopetukseen, teknologian hyödyntämistä liikunnallisissa kotitehtävissä voisi tutkia jatkossa lisää. Elderin ym. (2007) mukaan nuorten fyysisen aktiivisuuden lisäämiseksi tulisi lisätä positiivisen palautteen määrää, osallistaa vanhempia ja ystäviä, poistaa liikkumisen esteitä ja löytää keinoja paikallaanolon vähentämiseksi. Sekä oppilaat että vanhemmat toivoivat liikunnallisten kotitehtävien huomioimista liikunnan arvosanassa. Vaikka hyvän liikuntanumeron muodossa saatu ulkoinen palaute voi kannustaa liikunnallisten kotitehtävien tekemiseen aluksi, ei arvosanalla huomioiminen ei ole kovin hyvä tai ainakaan riittävä perusta ja kannustin liikunnallisen elämäntavan rakentamisessa (Abdelghaffar ym. 2019; Atkin ym. 2015; Sallis ym. 2000; Silva ym. 2014).

Oppilaita osallistavat liikunnalliset kotitehtävät lisäsivät opettajan ja oppilaiden välitöntä vuorovaikutusta oppitunneilla sekä kasvattivat opettajan oppilaantuntemusta. Turvallisen aiheen äärellä keskustelut olivat usein välittömiä ja oppilaiden autonomiaa tuettiin antamalla heille päätäntävaltaa tehtävien sisällöstä, toteutustavasta, tasosta ja määrästä. Oppilaiden osallisuuden katsotaan lisäävän oppilaiden myönteisiä kokemuksia tehtävästä, autonomian kokemusta sekä sitoutumista tehtävään (Deci & Ryan, 2000; Novak & Lynott, 2015). Opettajan kannustava vuorovaikutus oppilaiden kanssa vaikuttaa olevan merkittävä tekijä fyysisen aktiivisuuden lisäämisessä (Behrens ym. 2015). Korkeasti koulutettujen liikunnanopettajien osaamista voidaankin liikunnallisten kotitehtävien avulla ulottaa myös oppilaiden vapaa-ajalle (Gabbei & Hamrick, 2001; Williams & Hannon 2013).

Vanhempien tuki tässä tutkimuksessa tarkoitti sitä, että he olivat kiinnostuneita liikunnallisista kotitehtävistä, huomioivat lastensa liikuntaläksyjen tekemisen sekä toisinaan osallistuivat niiden tekemiseen. Liikunnallisen elämäntavan omaksumiseen tarvitaan kotien ja vanhempien tuki (Metzler ym. 2013; Williams & Hannon, 2013). Teini-iässä itsenäinen toiminta ja vertaisten merkitys myös liikkumisessa kasvaa (Silva ym. 2014), ja siksi liikunnallisissa kotitehtävissä oli mahdollisuus valita, tekeekö tehtävät yksin vai yhdessä jonkun kanssa. Vanhempien liikunnallisten kotitehtävien toiveet koskivat sosioekonomisesta asemasta riippumattomuutta, sekä sitä, että tehtävät saattoi tehdä ilman erityisiä välineitä kotona tai kodin lähiympäristössä. Vanhemmat toivoivat monipuolisia ja

sopivan tasoisia tehtäviä. Koska liikunnalliset kotitehtävät noudattivat perusopetuksen opetussuunnitelman sisältöjä, olivat harjoitteet ikätasolle sopivia ja monipuolisia. Osallistamalla vanhempia liikunnallisiin kotitehtäviin voidaan myös päivittää heidän tietämystään tämän päivän liikunnanopetuksen sisällöistä (Williams & Hannon, 2013).

Oppilaat tekivät liikunnallisia kotitehtäviä keskimäärin kaksi kertaa viikossa. Aikaa liikuntaläksyihin käytettiin keskimäärin 34 minuuttia viikossa, aktiivisuusryhmien välinen vaihteluväli oli 20–51 minuuttia. Koska tulos on itseraportoitu, ei kotitehtävien aikana tapahtuneen liikkumisen intensiteettiä tiedetä. Liikuntaläksyillä on saatu fyysistä aktiivisuutta lisääviä tuloksia myös aiemmista tutkimuksista (Duncan ym. 2011; Trilk ym. 2012). Opittu tapa tehdä liikunnalliset kotitehtävät saattavat auttaa ylläpitämään ainakin kevyttä liikuntaa teini-iässä (Trilk ym. 2012). Vaikka liikunnallisiin kotitehtäviin käytetty aika ei ollut suuri, jo 10 minuutin paikallaanoloajan korvaamisella liikkumisella näyttäisi olevan merkitystä (Corder ym. 2015).

Nuorten elinpiiri laajenee lapsiin verrattuna ja myös liikuntapaikkojen valikoima laajenee. Liikkumisen mahdollistaminen nuorille kustannustehokkaasti, helposti saavutettavassa ja tutussa paikassa on tärkeää (Corder ym. 2013). Sekä vanhemmat että nuoret itse arvostivat sitä, että liikunnalliset kotitehtävät oli mahdollista tehdä kotona tai kodin lähiympäristössä tarvitsematta erikseen siirtyä liikuntapaikoille. Bowserin (2013) mukaan onnistuneen liikuntaläksystrategian takana on se, ettei toiminta vaadi koululta koulupäivän uudelleenorganisointia eikä opettajilta lisäaikaa tai muuta lisä resursointia. Tämä liikuntaläksykokeilu ei vaatinut koululta lisäresursseja, mutta liikunnanopettajan tuli käyttää hieman aikaa suunnitteluun sekä noin 15 minuuttia liikuntatunneista liikuntaläksyjen antamiseen ja tarkistamiseen. Kustannustehokkaasti toteutettu fyysisen aktiivisuuden lisääminen liikunnallisten kotitehtävien avulla voi jatkua koululla vuosia (Bowser, 2013). Vaikka nuorten elinpiiri laajenee, vietetään kotona ja koulussa suurin osa nuorten ajasta. Liikkumisen lisääminen sekä koulupäivään, että sen jälkeen ja sitä ennen on tärkeää (Marttinen ym. 2018; McMullen ym. 2014). Koulussa, jossa tämä tutkimus toteutettiin, oppilaat viettivät välitunnit ulkona, ja aineenopettajajärjestelmässä oppitunnit ovat eri luokissa, jolloin pitkät istumisjaksot katkeavat ainakin siirryttäessä paikasta toiseen tuntien välissä (De Baere ym. 2015). Liikunnallisilla kotitehtävillä voidaan myös tehdä lähiliikuntapaikkoja tutuksi (Smith & Claxton, 2003; Williams & Hannon, 2013). Tuttuihin liikuntapaikkoihin on helpompi mennä jatkossakin, jolloin liikuntapaikan käyttö saattaa jatkua.

Tulevaisuudessa fyysisen aktiivisuuden edistämisessä tulisi urheiluharrastusten rinnalla keskittyä aktiivisen liikunnallisen arjen rakentamiseen, huomioiden hyötyliikunta, omaehtoinen liikkuminen sekä työ- ja koulumatkaliikkuminen (Koorts ym. 2019). Tämä tutkimus antoi lisätietoa nuorten tyttöjen liikkumisesta ja mahdollisuuksista edistää tyttöjen fyysistä aktiivisuutta. Liikunnalliset kotitehtävät voivat olla yksi tapa lisätä tyttöjen liikkumista koulupäivän jälkeen. Tutkimuksen tulosten perusteella voidaan suositella liikunnallisten kotitehtävien liittämistä osaksi liikunnanopetusta.

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APPENDICES

Appendix 1. Active physical education homework questionnaire.
Choose the most suitable option and mark it in on the form. The scale is 1 = completely agree, 2 = agree, 3 = almost agree, 4 = quite disagree, 5 = disagree and 6 = completely disagree.

Statements	1	2	3	4	5	6
It is useful to do physical education homework.						
I like physical education homework.						
Doing physical education homework has increased my leisure-time physical activity.						
Doing physical education homework should be checked by physical education teacher.						
I prefer doing physical education homework alone.						
Homework assignments are not suitable for physical education.						
Physical education homework assignments are useless.						
Doing physical education homework is laborious.						
I do physical education homework often with a friend.						
Doing physical education homework is easy.						
I like to be physically active on my leisure-time.						
I like to do physical education homework with a parent.						
Students should have an opportunity to participate in planning physical education homework assignments.						
Physical education homework should be voluntary.						
I talked about the physical education homework at home.						
I almost always did the physical education homework.						

What is the physical education homework assignment you remember especially? Why is that?

_____

_____

What should physical education homework be like in the future?

_____

_____

Appendix 2. **Self-reported physical activity diary** for one week. Mark the days you did the activity in sentence.
Name and class: _____

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
I commute actively (e.g. walking, riding a bike) to school in the morning.							
I commute back home actively.							
I was physically active during the school day at least for half an hour.							
I did the physical education homework.							

What time did you do the physical education homework? Mark the starting and ending time, for example, Tuesday 18:15–18:50.

_____

_____

Did you do physically active household chores?

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
cleaning							
taking the dog out							
shovelling snow							
taking care of siblings (children)							
something else, what?							

What kind of organized activities/hobbies are included in your week? Write your hobby/hobbies on the line and mark the day/days you go to that hobby.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun

How long did your organized activity/hobby last? (For example, Wednesday swimming from 18 to 19 pool time, Thursday gymnastics from 17:45 to 19:15)

_____

_____

_____

What kind of self-initiated activities do you do? Write your activities on the line and mark the day/days you did that activity.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun

ORIGINAL PUBLICATIONS

I

LIIKUNTATEHTÄVIÄ KOTILÄKSYINÄ: KOULUN ULKOPUOLELLA TAPAHTUVA OPPIMINEN OPETUKSEN TUKENA TYTTÖJEN LIIKUNNASSA

by

Kääpä, M., Hirvensalo, M., Palomäki, S., & Valleala, U.M. 2017

Liikunta & Tiede, 54(2–3), 74–82

https://www.lts.fi/media/lts_vertaisarvioidut_tutkimusartikkelit/2017/lt2-317_tutkimusartikkelit_kaapa_lowres.pdf

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LIIKUNTATEHTÄVIÄ KOTILÄKSYINÄ: KOULUN ULKOPUOLELLA TAPAHTUVA OPPIMINEN OPETUKSEN TUKENA TYTTÖJEN LIIKUNNASSA

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TIIVISTELMÄ

Kääpä M., Hirvensalo M., Palomäki S. & Valleala U.M. 2017. Liikuntatehtäviä kotiläksyinä: Koulun ulkopuolella tapahtuva oppiminen opetuksen tukena tyttöjen liikunnassa. Liikunta & Tiede 54 (2–3), 74–82.

■ Tässä liikuntaläksykokeilussa tutkittiin, miten erilaiset liikunnalliset kotitehtävät, liikuntaläksyt, toteutuivat koululiikunnan osana ja miten oppilaat kokivat liikuntaläksyt sekä oman osallisuutensa niiden tekemisessä. Liikuntaläksykokeilu toteutettiin lukuvuonna 2015–2016 keskisuomalaisessa koulussa 6.–9.-luokan tyttöjen kanssa, yhteensä 117 tyttöä. Liikuntaläksykokeilun päätteeksi tehdyn oppilaskyselyn vastaukset analysoitiin frekvenssien, ristiintaulukoiden (khiin neliötesti) ja keskiarvovertailujen avulla (varianssianalyysi ja t-testi). Kyselylomakkeen avoimet vastaukset järjestettiin luokka-asteittain ja läksytyypeittäin.

Oppilaskyselyn vastausten mukaan liikuntaläksyjä tehtiin ahkerasti. Lähes 90 prosenttia oppilaista teki läksyt aina (89,7 prosenttia). Yli puolet (51,3 prosenttia) vastanneista teki läksyt mieluiten yksin ja neljännes teki ne kavereiden kanssa. Läksyjentekoaktiivisuudessa havaittiin muiden muuttujien suhteen merkittäviä eroja. Läksyt aina tehneet tytöt pitivät läksyistä enemmän, he pitivät läksyjen tekemistä hyödyllisempänä kuin läksyjä vähemmän tehneet tytöt. Heidän mielestään läksyjen tekeminen on lisännyt heidän liikuntaansa ja heille vapaa-ajalla liikkuminen oli mieluisampaa kuin muille tytöille. Vähemmän läksyjä tehneet tytöt eivät pitäneet tärkeänä läksyjen tarkistamista. Oppilaiden mielestä heidän tulisi voida vaikuttaa liikuntaläksyihin.

Asiasanat: liikuntaläksyt, nuoret, opetussuunnitelma, kaverit, vanhemmat

ABSTRACT

Kääpä M., Hirvensalo M., Palomäki S. & Valleala U.M. 2017. Active Homework in Physical Education: Girls Physical Activity after School Hours as a Resource. Liikunta & Tiede 54 (2–3), 74–82.

■ The purpose of this study was to explore how active homework could function in physical education and how the students react on this kind of homework. Student participation was part of the homework planning, how did more participation affect to the opinions about the homework. In study it was also explored that did students prefer doing the homework alone, with friends or with parents, and did they inform about the physical homework at home.

The study was executed in Finnish medium sized school in autumn 2015 and spring 2016, study population consisted 117 girl students from 6th grade to 9th grade. At the end of the school year girl students filled in the questionnaire, to explore the associations the frequency, t-test, analysis of variance and cross-tabulation were used. Open replies were categorized by the grades and by the way the homework were given to them.

Students did the active homework very often, almost 90% did the homework always. Most popular way to do the homework was to do them alone (51,3%), quarter did them with a friend. Students who did the homework always also liked them more and thought that homework were useful. They also implied that active homework did increase their physical activity and they like to do sports after school hours. Those who did not do the homework so often didn't care about checking the homework afterwards. Over all students opinion was that students should have opportunity to participate in planning the homework.

Key words: active homework, youth, curriculum, friends, parents

JOHDANTO

Liikunta-aktiivisuus vähenee erityisesti yläkouluiässä sekä fyysisen kokonaisaktiivisuuden että vapaa-ajan hengästyttävän liikunnan ja urheiluseuratoimintaan osallistumisen osalta (Aira ym. 2013). Suomessa suositellaan alakoululaisille 1 ½–2 tuntia liikkumista päivittäin ja yläkoululaisille vastaava suositus on 1–1 ½ tuntia (Heinonen ym. 2008). Kuitenkin vain noin viidennes 5.–9.-luokkalaisista liikkuu vähintään tunnin päivittäin (Kokko ym. 2015). Liikkuva koulu -ohjelman pilottivaiheessa havaittiin, että reippaan liikkumisen tunnin minimitavoite täyttyi yläkoululaisista vain 17 prosentilla (Tammelin ym. 2013).

Useissa suomalaisissa ja kansainvälisissä tutkimuksissa on havaittu, että pojille päivittäistä aktiivisuutta kertyy tyttöjä enemmän (Chung ym. 2012; Currie ym. 2012; Kokko ym. 2015) ja lisäksi poikien urheiluseuraharrastaminen on usein intensiivisempää kuin tyttöjen (Blomqvist ym. 2015). Yläkouluikäisten tyttöjen päivään sisältyy liikkumatonta aikaa keskimäärin 40 minuuttia enemmän kuin poikien (Tammelin ym. 2013). Toisaalta erittäin vähän hengästyttävää liikuntaa vapaa-ajalla harrastavien tyttöjen määrä on vähentynyt viimeisen kymmenen vuoden aikana (2006–2015) 40 prosentista 22 prosenttiin (THL 2015).

Perusopetus tavoittaa koko ikäluokan, joten koulun vaikutus fyysisen aktiivisuuden lisääjänä on merkittävä (Tammelin ym. 2013). Liikuntatuntien lisäksi fyysistä aktiivisuutta voidaan pyrkiä lisäämään oppilaiden arjessa esimerkiksi välituntiliikunnalla sekä erilaisilla toiminnallisilla työtavoilla ja toteuttamalla oppiaineiden opetusta luokkahuoneen ulkopuolella lähiympäristössä. Liikkuminen ja hyvinvointia edistävät yhteiset toiminnot ovat luonteva osa jokaista koulupäivää (Perusopetuksen opetussuunnitelman perusteet, OPS 2014, 27).

Valtakunnallisen perusopetuksen opetussuunnitelman perusteiden (OPS 2014, 433) mukaan oppilaan tulee liikunnanopetuksessa saada eväitä terveytensä edistämiseen ja fyysisten ominaisuuksiensa harjoittamiseen. Oppilaan tulisi oppia motorisia perustaitoja sekä saada tietoja ja taitoja eri liikuntatilanteissa toimimiseen (OPS 2014, 434). Liikunnalliset kotitehtävät eli liikuntaläksyt, voivat osaltaan antaa lisää mahdollisuuksia näiden tavoitteiden saavuttamiseksi. Kotitehtävät tai läksyt ovat muissa oppiaineissa osa normaalia opiskelua, mutta toiminnallisia, fyysisiä tehtäviä eli liikuntaläksyjä ei nykykoulussa ole yleensä tapana oppilaille antaa. Opetussuunnitelman perusteissa mainitaan koulun ulkopuolella tapahtuva oppiminen yhtenä opetustyön resursseista (Perusopetuslaki 2§ ja valtioneuvoston asetus (422/2012) 2–4§, OPS 2014, 19). Kun lähialueen liikuntamahdollisuudet tulevat tutuiksi liikunnallisten kotitehtävien avulla ja nuorelle karttuu kokemuksia liikkumisesta omassa lähiympäristössään, liikunnallisen elämäntavan siirtyminen oman arjen osaksi on luontevampaa (Williams & Hannon 2013; Smith & Claxton 2003).

Liikuntaläksyjen käytöstä liikunnanopetuksen tukena on olemassa lähinnä yhdysvaltalaista tutkimusta. Annetut liikuntatehtävät liittyvät useimmiten koululiikunnan sisältöihin ja ne pyritään tekemään oppilaille merkityksellisiksi ja hyödyllisiksi (Hart 2001; Mitchell ym. 2000). Kotitehtävien avulla on tarkoitus esimerkiksi valmistautua tulevan taidon harjoitteluun, harjoitella juuri opittua toistojen kautta erilaisissa ympäristöissä tai soveltaa opittua tietoa ja taitoa omaan elämään (Gabbei & Hamrick 2001). Kotitehtävien liikuntalaji- ja liikevalinnoissa on hyvä olla vaihtoehtoja, että jokainen voi löytää itselleen sopivan liikkumisen tavan ja tehon (Jorgenson ym. 2001; Novak & Lynott 2015). Suomessakin liikuntaläksyjä on kokeiltu ja käytetty joissakin kouluissa, mutta tutkittua tietoa niistä on vain muutamassa pro gradu -tutkielmassa (Erikson 2007; Kiviaho & Vuori 2011; Pasanen & Rajala 2016). Kiviaho ja Vuori (2011) esittelivät työssään yhden opettajan monipuolisia liikuntatehtäviä, ja Erikson (2007) tutki oppilaiden ja vanhempien käsityksiä liikuntaläksyistä. Tutkielmien tekijöiden mukaan liikuntaläksyt ovat liikunnanopettajille hyvä mahdollisuus lisätä nuorten liikunta-aktiivisuutta. Pasasen ja Rajalan (2016) yläkoulun valinnaiskurssilla toteutetun pro gradu -tutkielman mukaan liikunnan kotitehtävien tekemistä tehostaa tehtävien merkityksellisyys joko itsensä kehittämisen kannalta tai hyödyn kokemisena liikunta -oppiaineessa, merkityksellisyyden puute vastaavasti aiheutti usein tehtävien tekemättömyyttä.

Uuden opetussuunnitelman mukaan oppilaan pätevyydenkokemuksia ja sosiaalista yhteenkuuluvuutta tuetaan oppilaslähtöisillä ja osallistavilla työtavoilla, sopivilla tehtävillä ja rohkaisevalla palautteella (OPS 2014, 435). Kun oppilas saa itse vaikuttaa toimintaansa, hän saa autonomian kokemuksia, jotka ovat tärkeitä liikuntamotivaation kehittymisessä (Deci & Ryan 2000). Oppilaiden osallistaminen myös liikuntaläksyjen suunnitteluun voi lisätä oppilaiden motivoitumista ja sitoutumista tehtäviin. Jotta koululiikunnasta kaiken kaikkiaan jäisi myönteisiä ja liikuntamotivaatiota tukevia kokemuksia, tulisi sen vastata oppilaiden koetun autonomian, sosiaalisen yhteenkuuluvuuden ja koetun pätevyyden tarpeisiin (Deci & Ryan 2000). Kansainvälisissä tutkimuksissa liikuntaläksyjen suunnitteluun osallistumisesta on vaihtelevia näkemyksiä. Jorgensonin ym. (2001) mielestä opettajan valitsemilla harjoitteilla on oma tärkeä roolinsa, erityisesti silloin, kun pyritään tukemaan koululiikunnassa meneillään olevia tavoitteita ja sisältöjä. Toisaalta silloin, kun oppilas saa itse vaikuttaa läksyn sisältöön, hyvänä puolena on se, että hän voi valita omalle taito- ja kuntotasolleen sopivia harjoituksia (Novak & Lynott 2015).

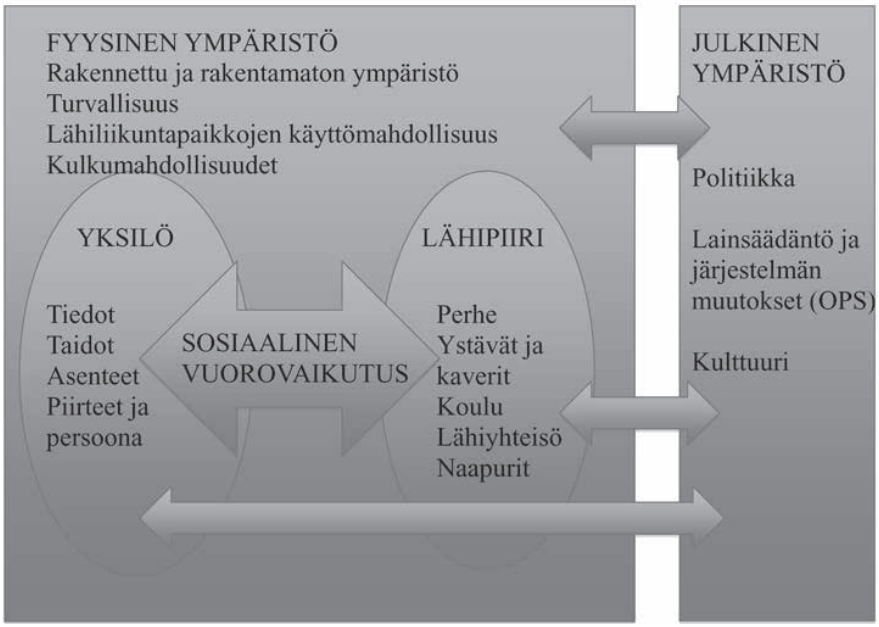
Sosiaalista yhteenkuuluvuutta liikuntaläksyjen teossa voi pyrkiä hyödyntämään ja edistämään siten, että liikunta-aktivoinnin kohteena ovat oppilaan ohella esimerkiksi sisarukset, vanhemmat, naapurit, ystävät, isovanhemmat tai muut sukulaiset (Williams & Hannon 2013). Yhdysvaltalaisessa koululaisten fyysisen aktiivisuuden lisäämiseen tähtäävässä HOPE-ohjelmassa pidettiin erityisen tärkeänä vanhempien roolia liikunta-aktiivisuuden siirtymisessä kotioloihin ja sitä kautta osaksi arkielämää (Metzler ym. 2013).

Tässä artikkelissa kuvataan liikuntaläksykokeilua, joka toteutettiin lukuvuonna 2015–2016 keskisuomalaisessa koulussa 6.–9.-luokan tyttöjen kanssa. Liikuntaläksykokeilussa tutkittiin, miten erilaiset liikunnalliset kotitehtävät, liikuntaläksyt, toteutuivat koululiikunnan osana ja miten oppilaat kokivat liikuntaläksyt sekä oman osallisuutensa niiden tekemisessä. Tutkimuksessa tarkasteltiin sitä, tehtiinkö läksyjä kavereiden ja vanhempien kanssa sekä sitä, erosivatko oppilaiden kokemukset läksyjentekoaktiivisuuden mukaan tai luokka-asteiden välillä?

Sosioekologinen malli tutkimuksen viitekehyksenä

Tutkimuksen havaintoja tarkastellaan tietystä määritellystä näkökulmasta eli teoreettisesta viitekehyksestä (Alasuutari 2011, 60). Tässä tutkimuksessa viitekehykseksi on valittu Bronfenbrennerin (1979, 2006) sosioekologinen malli, jota pidetään soveltuvana kuvaamaan esimerkiksi ihmisen terveyteen liittyviä ilmiöitä (Golden ym. 2015). Mallin lähtökohtana on se, ettei ihminen elä tyhjiössä, vaan ympäristö ja sen sosiaaliset kontaktit muokkaavat meitä. Olennaista on yksilön kehittyminen ja kasvu vuorovaikutuksessa sosioekologisen mallin eri tasojen välillä, tasoja ovat lähipiirin kokemukset (microsystem), lähipiirin vuorovaikutusympäristö (mesosystem), elämään vaikuttavat tapahtumaympäristöt (exosystem) sekä yhteiskunnalliset järjestelmät ja ideologiat (macrosystem). (Bronfenbrenner 1979, 2006.)

Mallia on käytetty aikaisemmin esimerkiksi interventiossa, jossa tyttöjen fyysistä aktiivisuutta pyrittiin edistämään yksilön, lähiympäristön, yhteiskunnan ja poliittisen tason toimenpiteiden avulla (Elder ym. 2007). Tässä tutkimuksessa huomioituja yksilötason (microsystem) muuttujia olivat tutkittavien tyttöjen ikä, suhtautumi-



KUVIO 1. Sosioekologisen mallin eri tasojen välinen vuorovaikutus, mukailtu Bronfenbrennerin (2010) ja Elderin ym. (2007) mukaan.

nen liikuntaläksyihin sekä liikuntaläksyjen tekemisen halukkuus ja useus. Kiinnostuksen kohteena oli myös liikuntaläksyjen tekeminen lähipiirin vuorovaikutusympäristössä (mesosysteemi) kavereiden ja vanhempien kanssa. Muiden tutkittavien elämään vaikuttavien tapahtumaympäristöjen roolia (exosystem) liikkumisessa ja liikuntaläksyjen tekemisessä ei selvitetty tässä tutkimuksessa. Jatkossa esimerkiksi harrastusympäristöjä ja mobiiliympäristöjä tullaan tarkastelemaan mahdollisuutena tutkittavien tyttöjen liikunnan edistämisessä.

Perusopetuksen uuden opetussuunnitelman perusteiden (OPS 2014) tahtotilat ja tavoitteet ovat tässä tutkimuksessa sosioekologisen mallin makrotasolla vaikuttavia tekijöitä. Perusopetuksen opetussuunnitelmassa (OPS 2014) laaja-alaisen osaamisen tavoitteet sekä toiminnallinen oppiminen ovat tärkeinä lähtökohtina oppilaan aktivoimisessa itseohjautuvaksi omia tavoitteitaan asettavaksi oppijaksi. Myös koulun ulkopuolisen toiminnan hyödyntäminen opetuksen resurssina tuodaan opetussuunnitelmassa esiin (OPS 2014, 20–24, 281–285, 19). Tutkimuksessa halutaan mallintaa fyysisen aktiivisuuden lisäämistä oppilaiden arjessa siten, että he myös itse osallistuvat toiminnan suunnitteluun.

Sosioekologisessa mallissa myös eri tasojen välinen merkityksellinen vuorovaikutus on olennaista intervention onnistumiseksi (kuvio 1). Eri tasojen aktivointi ja vuorovaikutus yhteisen päämäärän suuntaisesti tukee yksilötason tavoitteiden saavuttamista (Elder ym. 2007). Jos ylhäältä annetut määräykset tai organisatoriset interventiot huomioivat yksilön tarpeet ja toimintatavat huonosti, herättää se helposti vastustusta ja interventio epäonnistuu yksilön muutostarpeen kohtaamisessa. Terveyttä edistävä muutos onnistuu paremmin jos yhteisön eri toimijat, kuten tässä tutkimuksessa opettaja, oppilaat ja vanhemmat, ovat yhdessä asian takana (Schneider & Stokols 2009).

TUTKIMUSAINEISTO JA MENETELMÄT

Tutkimus toteutettiin keskisuomalaisessa yli 300 oppilaan yhtenäiskoulussa. Tutkijaopettaja oli antanut oppilaille liikuntaläksyjä satunnaisesti useiden vuosien ajan, joten täysin uusi asia eivät liikuntaläksyt oppilaille olleet. Järjestelmällisesti liikuntaläksytoiminta alkoi syksyllä 2015, ja keväällä 2016 kokeiltiin erilaisia läksyjenantotapoja. Kaikki oppilasryhmät päättivät osallistua liikuntaläksykokeiluun kuultuaan liikuntaläksyidean esittelyn opettajalta. Tutkijaopettaja pyrki varmistamaan kysymyksillä, että oppilaat tiesivät, mitä kokeilu pitää sisällään. Lasten ja nuorten kanssa toimittaessa täytyy varmistaa, että käsitteistö on heille tuttua ja ohjeistus yksiselitteisesti ymmärrettävissä (Eskolan & Suoranta 1998, 152-162).

Aineisto kerättiin keväällä 2016 tutkijaopettajan koulun 6.–9. luokkien tytöiltä (n = 117), joten otos oli harkinnanvarainen ja tarkoituksenmukainen (taulukko 1). Tutkimus on osa laajempaa väitöskirjaksi tarkoitettua tutkimuskokonaisuutta, jossa suunnitellaan koululiikuntaan erilaisia omatoimisen liikunnan lisäämiseen tähtääviä toimintamalleja. Tässä artikkelissa oli kyseessä toimintatutkimuksen ensimmäinen sykli eli liikuntaläksykokeilu, jota kuvattiin ja arvioitiin tutkijaopettajan päiväkirjan ja oppilaskyselyn avulla.

Tutkijaopettaja keräsi tutkimuspäiväkirjaansa (perinteinen ruutuvihko) muistiinpanoja mm. tilanteista, joissa läksyjä suunniteltiin ja annettiin oppilaille tai oppilaat kertoivat niiden toteutuksesta opettajalle. Liikuntaläksyistä tiedotettiin sähköisen kodin ja koulun yhteistyöjärjestelmän Wilman kautta myös vanhemmille. Joiltakin vanhemmilta saatiin myös palautetta, sillä kymmenen vanhempaa reagoi opettajan Wilma -viestiin vastaamalla myönteisesti ja innostuneesti.

TAULUKKO 1. Tutkimukseen osallistuneiden oppilaiden määrä (n) ja luokka-asteittainen (6.–9.-luokka) prosenttiosuus (%).

Luokka-aste	n	%
6	20	17,1
7	32	27,4
8	29	24,8
9	36	30,8
Yhteensä	117	100

Toukokuussa 2016 oppilaille annettiin vastattavaksi kyselylomake, jonka täyttivät kaikki paikalla olleet tytöt liikuntatunnin alussa pukuhuoneessa (viikko 20). Lomakkeen täyttäminen oli vapaaehtoista. Osa oppilaista oli tällöin Erasmus -hankkeen tapahtumassa, joten poissa oli 24 tyttöä, osallistumisprosentti oli 83 prosenttia. Kyselylomakkeessa oli 16 väittämää, joihin vastattiin kuusiportaisella Likert -asteikolla (1 = täysin samaa mieltä, 2 = samaa mieltä, 3 = lähes samaa mieltä, 4 = melko eri mieltä, 5 = eri mieltä, 6 = täysin eri mieltä). Kysymyksillä haettiin tietoa siitä, tehtiinkö läksyt yksin vai jonkun kanssa, pidettiinkö läksyistä, koettiinko ne hyödyllisiksi ja liikuntaan sopiviksi, lisäsivätkö liikuntaläksyt vapaa-ajan liikkumista sekä mitä mieltä oppilaat olivat läksyjen vapaaehtoisuudesta ja oppilaiden vaikutusmahdollisuuksista läksyihin. Lisäksi oppilailta kysyttiin kolmella avoimella kysymyksellä, mikä liikuntaläksy heille oli jäänyt mieleen ja miksi sekä millaisia liikuntaläksyjen heidän mielestään tulisi olla. Kyselyihin vastattiin nimettöminä, eikä analysointi- ja tulkintavaiheessa yksittäisen oppilaan vastaus erotu kokonaisuudesta (Eskola & Suoranta 1998, 162).

Oppilaskyselyn tulokset analysoitiin frekvenssien, ristiintaulukoiden (khiin neliötesti) ja keskiarvovertailujen avulla (varianssianalyysi ja t-testi) SPSS -ohjelmassa (versio 18). Koska oppilaiden kokemuksia tarkasteltiin myös sen mukaan, miten aktiivisesti he olivat liikuntaläksyjä tehneet, jaettiin heidät kahteen luokkaan ”Tein liikkaläksyt aina” -väittämän perusteella. Luokkaan ”Aina” kuuluivat oppilaat, jotka olivat väittämän kanssa täysin samaa tai samaa mieltä ja luokkaan ”Ei aina” oppilaat, jotka olivat antaneet muun vastauksen (eri mieltä – lähes samaa mieltä).

Kyselylomakkeen avoimet vastaukset järjestettiin luokka-asteittain ja läksytyypeittäin kahteen luokkaan 1) opettajan ehdottamiin ja 2) oppilaiden itse suunnittelemiin. Vastaukset pelkistettiin ja käsitteellistettiin sekä ryhmiteltiin teemoittain. Taulukoiduista vastauksista haettiin toistuvia mainintoja ja niiden määriä. Sisällön erittelyllä laskettiin kvantitatiiviseen tapaan, kuinka usein mainintaa oli käytetty (Eskola & Suoranta 1998, 123, 134). Kvalitatiivisen ja kvantitatiivisen analyysin yhdistämistä voidaan ajatella jatkumona, menetelmät eivät ole toisiaan poissulkevia (Alasuutari 2011, 26). Eskolan ja Suorannan (1998) mukaan laadullisessa analyysissa tulkinta ja analyysitavat nivoutuvat vuoropuheluna yhteen, joten koko aineisto on tärkeää tuntea hyvin ennen tulkintoja. Tutkijapäiväkirjan noin kymmenen sivun laajuista materiaalia ja oppilaskyselyjen vastauksia käytettiin rinnakkain, erilaisia aineistoja käyttämällä pyrittiin saamaan kokonaisvaltaisempi kuva tutkittavasta aiheesta (Eskola & Suoranta 1998, 102–103, 109–110, 116, 152–162; Alasuutari 2011, 36).

Eskolan ja Suorannan (1998, 107) mukaan tutkijapäiväkirja on jo tulkintaa tutkittavasta asiasta. Tutkijaopettaja on pyrkinyt irrottautumaan arkiymmärryksestään liittämällä havaintonsa aikaisempaan tutkimukseen ja teoreettisiin tulkintoihin. Tätä prosessia on tukenut myös muiden artikkelien kirjoittajien osallistuminen aineiston analysointiin ja tulosten kirjoittamiseen. Kokeilun toteutumisesta kertovassa tulososassa päiväkirjasitaateilla kuvataan tutkijaopettajan tekemiä käytännön valintoja ja tulkintoja (Eskola & Suoranta 1998, 130, 142). Tulososan oppilassitaattien avulla pyrittiin avaamaan oppilaiden aitoja ajatuksia liikuntaläksykokeilusta. Sitaatit ovat syntyneet oppilaiden kouluarjessa, esimerkeiksi valittiin mahdollisimman kuvaavia, tyypillisiä vastauksia (Schreier 2012, 100–101). Toisaalta myös vastausten eroavuudet olivat kiinnostavia ja merkityksellisiä, sillä ne ohjasivat näkemään oppilaiden erilaisia käsityksiä asioista (Alasuutari 2011, 34). Tutkimusta raportoitaessa on pyritty yksityiskohtaisuuteen ja aitoon kuvaukseen.

TULOKSET

Liikuntaläksykokeilun toteutuminen

Aluksi läksytoimenpiteet veivät liikuntatunnista 15–20 minuuttia, mutta toimet nopeutuivat asian tullessa tutuksi. Alkulämmittelyssä harjoiteltiin valmiiksi läksyliikkeitä tai oppilaat saivat vinkkejä oman läksyn suunnitteluun. Liikunnan jaksosuunnitelma auttoi läksyn liittämisessä liikuntaohjelmaan. Esimerkiksi 1500 metrin juoksutestin lähestyessä halusi moni oppilasryhmä ottaa läksykseen lenkkeilyä. *”Yritän selvästi aina perustella läksyn: miksi juuri se läksy, mitä se kehittää… Haluan myös antaa oppilaille kuvan, että läksy on mietitty, heidän parhaakseen suunniteltu.”* (Tutkijanpäiväkirja 2016, vko 8.)

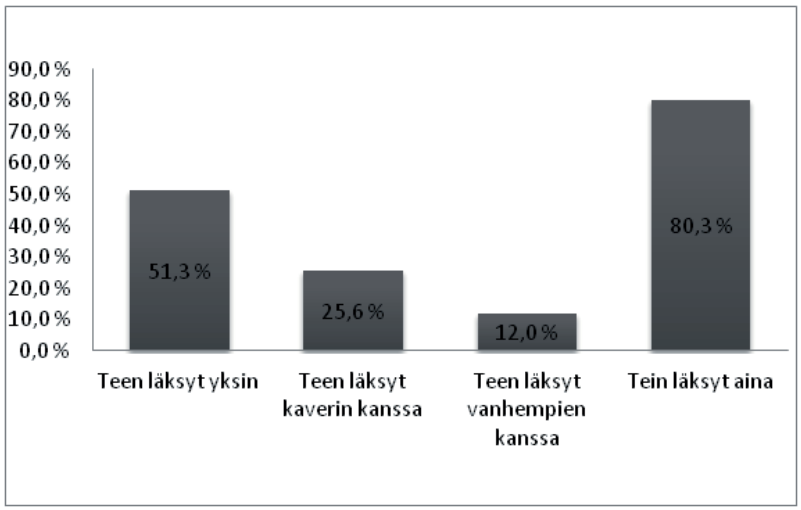
Liikuntatunnin sisällöillä ja opetusolosuhteilla oli tutkijaopettajan mukaan vaikutusta siihen, miten helppoa tai luontevaa liikuntaläksyjen antaminen ja tarkistaminen oli. Yleisurheilujakson aikana liikuntaläksyt oli helppo liittää tuntien tavoitteisiin ja aiheisiin. Tunnin alussa urheilukentän laidalla tarkistettiin edellisen kerran liikuntaläksy ja annettiin tai suunniteltiin uusi läksy. Haasteellisin liikuntaläksyjen kannalta oli talviliikuntajakso, jolloin välineiden kanssa siirtymiset ja pakkassää vaikeuttivat läksyjen hoitamista liikuntatuntien aikana. *”Pienemmät oppilaat huolehtivat liikuttavan hyvin läksyistä ja siitä, että opettaja muistaa antaa läksyn. Hiihtotunneilla tahtoo unohtua kaikessa hässäkässä.”* (Tutkijanpäiväkirja 2016, vko 6.)

Osa oppilasryhmistä sai liikuntaläksyt opettajan valitsemana. Esimerkiksi telinevoimistelujakson aikana opettaja ehdotti oppilaille tasapainoharjoituksena hampaiden harjaamista aamuin illoin yhdellä jalalla seisten. Osa oppilasryhmistä valitsi itse läksyjen pääaihealueen, ja opettaja antoi tähän valintaan liittyvän läksyn, esimerkiksi jalkojen lihaskuntoharjoitteluun 100 kyykkyä. Osa ryhmistä valitsi läksynsä itse tai parin kanssa. Ohjeistuksena oli valita sellaista liikkumista, mitä oma keho juuri sillä viikolla tarvitsi. Tällöin läksyn kontrolloi pari ja suoritus merkittiin koulussa yhdessä parin kanssa opettajan listaan.

Läksyjen tarkistustapa kehittyi kevään aikana yhteistyössä oppilaiden kanssa. Tehty läksy kirjattiin + -merkillä ja tekemätön poikkiviivalla. Myöhemmin oppilaat halusivat, että myös se huomioitaisiin, jos

TAULUKKO 2. Esimerkki avointen vastausten pelkistämisestä ja käsitteellistämisestä. Oppilaiden perusteluja läksyjen mieleen jäämiselle.

Alkuperäisilmaisu	Pelkistetty ilmaus	Käsitteellistäminen
Koska siinä samalla tuli liikuttua yhdessä jonkun kanssa	Yhdessä jonkun kanssa	Yhdessä jonkun toisen kanssa tehty tai suunniteltu läksy on jäänyt mieleen.
Oli hauskaa liikkua kaverin kanssa.	Kaverin kanssa	
Koska tein osan äidin kanssa	Äidin kanssa	
Kaverin kanssa saa päättää, mitä tekee	Kaverin kanssa päätetty	
Koska olin äidin kanssa tunnin lenkillä	Äidin kanssa	



KUVIO 2. Liikuntaläksyjen tekemisaktiivisuus ja läksyjen tekemisen sosiaalinen konteksti 6.–9.-luokkalaisilla tytöillä (täysin samaa mieltä ja samaa mieltä vastaukset prosentteina).

läksyjä oli tehnyt annettua enemmän (”tuplaplussa”) tai jos läksyistä oli tehnyt vain osan (pystyviiva). Läksyjen tarkistustilanne muodostui ajan myötä mukavaksi keskusteluhetkeksi. Opettaja saattoi osoittaa kiinnostusta oppilaiden tekemisiin turvallisen ja tutun aiheen tiimoilta, ja oppilaat pääsivät jokainen halutessaan ääneen.

Yhden oppilasryhmän kanssa kokeiltiin läksyjen merkitsemistä koulun internetsivuille. Järjestely ei toiminut kovin hyvin, sillä oppilaat eivät muistaneet tarkistaa läksyä koulun sivuilta. Oppilaiden omien läksyjen suunnittelua rajoitti jossakin määrin se, että usein tytöt olivat kuulleet jo edellisiltä oppilasryhmiltä heidän läksyistään, ja he valitsivat helposti samoja tehtäviä kuin aiemmilla ryhmillä.

Oppilaskyselyn vastausten mukaan liikuntaläksyjä tehtiin ahkerasti, sillä 80 prosenttia tytöistä kertoi tehneensä läksyt aina (kuvio 2). Kun lisätään mukaan ”lähes samaa mieltä” -vastanneet, nousee tekemisprosentti lähes yhdeksäänkymmeneen (89,7 prosenttia). Hieman yli puolet (51,3 prosenttia) vastanneista teki läksyt mieluiten yksin ja neljännes teki ne kavereiden kanssa. Läksyistä kerrottiin varsin yleisesti kotona (59,8 prosenttia), vaikkakin vanhempien kanssa liikuntaläksyjä kertoi tekevänsä vain pieni osa oppilaista (12 prosenttia). Avoimissa vastauksissa kaksi tyttöä kertoi, että erityisesti mieleen olivat jääneet sellaiset läksyt, jotka he olivat tehneet äitiensä kanssa. *”Kun piti tehdä 100 ojentajapunnerrusta, koska tein osan äidin kanssa.”*

TAULUKKO 3. Oppilaiden vastaukset liikuntaläksyihin liittyviin väittämiin (asteikko 1 = täysin samaa mieltä… 6 = täysin eri mieltä). Luokka-asteittaiset keskiarvot ja keskihajonnat sekä varianssianalyysin p-arvo (ANOVA).

	6. lk	7. lk	8. lk	9. lk	ANOVA
Kyselylomakkeen väittämät	**Ka (Kh)**	**Ka (Kh)**	**Ka (Kh)**	**Ka (Kh)**	**p-arvo**
Liikuntaläksyjen tekeminen on hyödyllistä	1,6 (0,7)	1,6 (0,9)	1,6 (0,8)	2,2 (1,0)	0,018
Koen liikkaläksyt hyödyttömäksi.	5,3 (1,2)	5,4 (0,9)	5,4 (1,0)	4,7 (1,3)	0,010
Läksyjen tekeminen on lisännyt vapaa-ajan liikuntaani.	2,6 (1,1)	3,2 (1,7)	2,7 (1,4)	3,5 (1,6)	0,083
Pidän liikuntaläksyistä	1,8 (0,9)	1,9 (1,1)	1,9 (0,9)	2,6 (1,3)	0,017
Läksyt eivät sovi liikuntaan.	5,2 (1,3)	5,3 (1,2)	5,5 (0,9)	4,4 (1,2)	0,001
Liikkaläksyjen tekeminen on työlästä.	4,7 (1,4)	4,8 (1,3)	4,7 (1,1)	4,5 (1,2)	0,551
Liikkaläksyjen tekeminen on helppoa.	2,3 (1,2)	2,2 (1,0)	2,0 (0,9)	2,1 (0,8)	0,089
Opettajan pitää tarkistaa liikuntaläksyjen tekeminen.	2,1 (1,1)	2,7 (1,4)	2,4 (1,3)	2,9 (1,2)	0,058
Oppilaiden tulisi voida vaikuttaa liikuntaläksyihin.	2,2 (1,1)	2,3 (1,1)	2,2 (0,9)	1,8 (0,9)	0,159
Liikuntaläksyjen pitää olla vapaaehtoisia.	2,6 (1,5)	4,0 (1,6)	3,0 (1,3)	2,6 (1,3)	0,000

Oppilaiden kokemukset liikuntaläksyistä

Luokka-asteiden väliset erot oppilaiden kokemuksissa eivät olleet suuria (taulukko 3). Kaikkien luokka-asteiden oppilaat pitivät liikuntaläksyjen tekemistä helppona. Tytöt olivat sitä mieltä, että oppilaiden tulisi voida vaikuttaa läksyihin ja opettajan tulisi tarkistaa ne. Yhdeksännen luokan oppilaat olivat hieman kriittisempiä, ja heidän mielestään liikuntaläksyt eivät olleet niin hyödyllisiä kuin muiden oppilaiden mielestä. Vaikka yhdeksännenkin luokan tyttöjen suhtautuminen liikuntaläksyihin oli positiivista, olivat he jonkin verran yleisemmin sitä mieltä, etteivät läksyt sovi liikuntaan. Jostakin syystä seitsemännen luokan oppilaat eivät halunneet läksyjen olevan vapaaehtoisia.

Oppilaiden kokemuksia liikuntaläksystä tarkasteltiin myös sen suhteen, miten aktiivisesti oppilas kertoi läksyjä tehneensä. Liikuntaläksyt aina tehneet oppilaat pitivät läksyistä enemmän ja he pitivät läksyjen tekemistä hyödyllisempänä kuin läksyjä vähemmän tehneet oppilaat (taulukko 4). Vähemmän läksyjä tehneet oppilaat eivät pitäneet niin tärkeänä läksyjen tarkistamista kuin läksyjä ahkerammin tehneet. Aina läksyt tehneiden oppilaiden mielestä läksyjen tekeminen oli helppoa ja ne olivat myös lisänneet heidän liikkumistaan vapaa-ajalla. Oppilaat kertoivat yleisesti liikkuvansa mielellään, mutta läksyt aina tehneille vapaa-ajalla liikkuminen oli mieluisampaa. Molempien ryhmien mielestä oppilaiden tulisi voida vaikuttaa liikuntaläksyihin. Oppilaat, jotka tekivät läksyt aina, olivat kertoneet läksyistä yleisemmin kotona.

Avointen kysymysten vastauksissa oli paljon yhteneväisyyksiä oppilaiden välillä, mutta joitakin kiinnostavia erojakin. Oppilaille mieleen jääneistä läksyistä yleisimpiä olivat yläluokkalaisilla (8.–9. lk) erilaiset lihaskuntoliikkeet kuten vatsalihasliikkeet tai kyykyt, ja alemmilla luokka-asteilla (6.–7.lk) mieleen olivat jääneet ns. lomaläksyt, lenkit ja muiden liikuttamista vaatineet tehtävät. *”Kun piti pyytää jotakin toistakin mukaan urheilemaan”*. Lomaläksyt olivat aina helppoja, hauskoja, lomalle sopivia läksyjä. Liikuntatehtävien sijaan lomaläksyissä keskityttiin yleensä hyvinvointiin, läksyinä esimerkiksi herkuttelu, pitkään nukkuminen, kavereiden ja sukulaisten tapaaminen ja ulkoilu. Kuudennen luokan oppilaille oli parhaiten jäänyt mieleen tehtävä, jossa piti harjoittaa tasapainoa harjaamalla hampaita yhdellä jalalla seisten. *”Hammasharjan kanssa tasapainoilu hampaita harjatessa, sillä se treenasi tasapainoani ja se oli hauskaa”*.

Kaikilla luokka-asteilla yleisin syy läksyn mieleen jäämiseen oli se, että läksyt oli koettu kivoiksi tai hauskoiksi. Seitsemännen luokan tytöt mainitsivat läksyjen mieleen painumisen syyksi usein myös läksyn erilaisuuden ja esimerkkinä mainittiin Macarena -musiikkikappaleen mukaan tehdyt vatsalihasliikkeet, päkiöille nousut sekä lomaläksyt. Yksi seitsemännen luokan oppilas muisti venyttelyläksyn, ja pohti sen hyödyllisyyttä: *”Ainakin venyttelyläksy, koska en tykkää siitä kauheasti mutta tiedän sen olevan tosi hyödyllistä, joten se oli hyvä läksy.”*

Toisessa seitsemännen luokan liikuntaryhmissä läksyt olivat useimmiten oppilaiden itsensä tai parin kanssa päätettyjä, ja toisessa ryhmässä läksyt oli päättänyt enimmäkseen opettaja. Oppilaiden omia valintoja olivat esimerkiksi kaksikymmentä linkkuveitsi-vatsalihasliikettä joka päivä, 30 min venyttely kolmena päivänä, viisisataa X-hyppyä, sataseitsemänkymmentä ojentajapunnerrusta tai viiden kilometrin kävely. Opettajan antamia läksyjä olivat esimerkiksi kolme ulkoilua, kaksi kertaa jonkun toisen ihmisen liikuttaminen tai 3 minuutin pysyminen lankkuasennossa neljä kertaa viikon aikana. Oppilaiden itse valitsemat läksyt olivat vaativampia kuin opettajan määräämät, myös määrät olivat suurempia. Omavalintaisissa läksyissä oppilaat valitsivat usein parin kanssa yhdessä saman läksyn, ja useille läksy olikin jäänyt mieleen juuri kaverin kanssa tekemisen vuoksi. Muita syitä läksyjen mieleen jäämiseen oli se, että oppilas oli kokenut olleensa läksyissä hyvä tai että läksy oli myöhemmin *”jäänyt tavaksi”*.

Tulevaisuuden toiveena oppilaat totesivat yleisimmin, että läksyt voisivat olla samanlaisia kuin aiemminkin. Lisäksi toivottiin monipuolisia tehtäviä ja erityisesti seitsemännen ja kahdeksannen luokan oppilaat toivoivat lihaskuntoliikkeitä. Läksyjen vapaavalinnaisuutta oli tuotu esiin erityisesti seitsemänsien ja yhdeksänsien luokkien vastauksissa, kun taas kahdeksannen ja kuudennen luokan oppilaat toivoivat jatkossa ”kivoja tai hauskoja tehtäviä”. Yhdeksäsluokkalaiset olivat ajatelleet myös läksyjen käytännön toteutusta tai niiden

TAULUKKO 4. Oppilaiden vastaukset väittämiin liikuntaläksyjen tekemisaktiivisuuden mukaan. Aina = (1) täysin samaa mieltä tai (2) samaa mieltä väittämän ‘tein liikkaläksyt aina’ kanssa, Ei aina = (3) lähes samaa mieltä, (4) melko eri mieltä, (5) eri mieltä tai (6) täysin eri mieltä. Ryhmien keskiarvot ja keskihajonnat sekä t-testin p-arvo.

	Aina*	Ei aina*	
	Ka (Kh)	Ka (Kh)	T-testi (p-arvo)
Liikuntaläksyjen tekeminen on hyödyllistä.	1,6 (,8)	2,5 (1,0)	0,000
Pidän liikuntaläksyistä.	1,9 (,9)	2,9 (1,4)	0,002
Liikuntaläksyjen tekeminen on lisännyt vapaa-ajan liikuntaani.	2,8 (1,5)	3,8 (1,3)	0,005
Opettajan pitää tarkistaa liikuntaläksyjen tekeminen.	2,4 (1,2)	3,3 (1,3)	0,001
Läksyt eivät sovi liikuntaan.	5,2 (1,1)	4,6 (1,4)	0,034
Koen liikkaläksyt hyödyttömäksi.	5,4 (,9)	4,3 (1,5)	0,002
Liikkaläksyjen tekeminen on työlästä.	4,8 (1,1)	4,1 (1,2)	0,011
Liikkaläksyjen tekeminen on helppoa.	2,0 (,9)	2,8 (1,2)	0,002
Liikun mielelläni vapaa-ajalla.	1,5 (,9)	2,3 (1,3)	0,010
Oppilaiden tulisi voida vaikuttaa liikuntaläksyihin.	2,1 (1,0)	2,0 (1,0)	0,820
Liikuntaläksyjen tulisi olla vapaaehtoisia.	3,2 (1,5)	2,4 (1,3)	0,023
Kerroin liikuntaläksyistä kotona.	3,0 (1,7)	4,3 (1,8)	0,002

vaatimaa aikaa, he toivoivat helposti toteutettavia tehtäviä. Kaikilla luokka-asteilla oli pohdittu tehtävien vaativuutta tai helppoutta, ja tuotiin esiin se, että tehtävien tulee olla sopivan tasoisia. Opettajan tehtävä on löytää tehtäviin sopiva taso kullekin ikäryhmälle oppilaiden pätevyyden kokemuksen lisäämiseksi. Lisäksi toivottiin tehtävien olevan hyödyllisiä sekä kehittävän kuntoa ja urheilullisuutta. Kaikki tytöt eivät olleet avoimiin kysymyksiin vastanneet, mutta vain kaksi murrosikäisille tyypillinen *"ihan sama"* -vastausta oli joukossa.

Vanhemmilta saatu palaute oli yksinomaan myönteistä. Yksi vanhempi pohti sitä, että liikunta-asioissa *"Opettajan sana painaa enemmän, eihän ne vanhempia kuuntele samalla tavalla"*. Kaksi vanhempaa tiedusteli, haittasiko läksyjen tekemättömyys, jos lapsella oli muutenkin paljon liikuntaharrastuksia. Heille tiedotettiin vielä erikseen läksyjen vapaaehtoisuudesta.

POHDINTA

Tutkimuksessa tarkasteltiin, miten erilaiset liikuntaläksyt toteutuivat liikunnanopetuksen osana ja miten oppilaat kokivat liikuntaläksyt. Tulosten mukaan 6.–9.-luokkalaiset tytöt tekivät liikuntaläksyjä ahkerasti ja suhtautuivat niihin myönteisesti. Liikuntaläksyjä tehtiin yleisimmin yksin, mutta avointen vastausten mukaan paritehtävät koettiin mieluisina kuten myös jonkun toisen ihmisen liikuttaminen. Vanhempien kanssa liikkuminen ei ollut kovin suosittua, joskin osalle tytöistä olivat äidin kanssa tehdyt läksyt jääneet parhaiten mieleen.

Liikuntaläksytehtävät olivat helposti toteutettavia ja ilman välineitä tehtäviä, joten jokainen oppilas pystyi tekemään läksyt kotiolosuhteissa tai ulkona. Läksyissä korostuivat erilaiset oman kehon painolla tehtävät lihaskuntoliikkeet ja lähiympäristössä liikkuminen. Myös yksin tai parin kanssa päätetyt liikuntaläksyt noudattivat tätä samaa linjaa. Vanhempien ja sisarusten aktivoimista mukaan liikkumaan suositellaan mm. aiemmissa kansainvälisissä tutkimuksissa (Gabbei & Hamrick 2001; Hart 2001; Mitchell ym. 2000). Myös tämän tutkimuksen viitekehyksenä oleva sosioekologinen malli korostaa vuorovaikutusta lähiympäristön kanssa tekijänä, joka vahvistaa toiminnan pysyvyyttä, sillä sekä ympäristön mahdollisuudet että vanhempien tuki vaikuttavat merkittävästi nuorten fyysiseen aktiivisuuteen (Martin ym. 2011). Vanhempien ja kavereiden esimerkki ja kannustus ovat vapaa-ajanviettotapojen valinnassa tärkeitä tekijöitä (Palomäki ym. 2016). Elder ym. (2007) peräänkuuluttavat fyysisen aktivoinnin tueksi kotien ja kaveripiirin lisäksi koko koulun henkilökuntaa ja lähiympäristön toimijoita. Avainasioita fyysisen aktiivisuuden lisäämisessä ovat positiivisen palautteen lisääminen, liikkumisen esteiden purkaminen sekä liikkumattoman elämäntavan vetovoiman vähentäminen (Elder ym. 2007).

Jatkossa on tärkeää huomioida se, ettei liikuntaläksyjen tekeminen ole varusteisiin tai maksullisiin liikuntapaikkoihin sidottua, vaan oppilailla säilyy tasavertaiset mahdollisuudet läksyjen tekemiseen. Erilaisten liikuntaympäristöjen suhteen suomalaiset ovat kansainvälisesti verraten hyvässä asemassa, sillä rakennettujen liikuntaympäristöjen lisäksi monien kotien lähistöiltä löytyy luontoympäristöä, ulkoilureittejä ja kevyenliikenteenväyliä, joiden käyttö on aina mahdollista ja ilmaista. Kehitettävää on esimerkiksi lähiliikuntapaikkojen ja koulujen pihojen suunnittelussa ja varustelussa siten, että ne voisivat palvella alueen eri-ikäisiä asukkaita mahdollisimman monipuolisina liikkumisympäristöinä (Kokko & Hämylä 2015, 93). Liikunnallisilla kotitehtävillä lähiympäristön liikuntamahdollisuudet voidaan tehdä tutuiksi (Marcus ym. 2009; Williams ym. 2013). Kyse on myös siitä, ovatko näiden ympäristöjen mahdollisuudet lapsille ja nuorille kaikilta osin avoimia, riittävän houkuttelevia ja onko niitä opittu käyttämään.

Oppilaat pääsivät myös itse vaikuttamaan liikunnallisiin kotitehtäviin, sillä aikaisemmassa kirjallisuudessa oppilaan osallisuuden merkitystä on korostettu mm. sitoutumista edistävänä tekijänä (Novak & Lynott 2015). Tässä tutkimuksessa osallistamisella ei havaittu olevan vaikutusta esimerkiksi oppilaiden läksyjentekoaktiivisuuteen, sillä kaikki oppilasryhmät tekivät läksyjä ahkerasti. Sopivan tason löytäminen kotitehtäviin vaatii opettajalta oppilaantuntemusta sekä vaihtoehtoisten tehtävätasojen tarjoamista, jotta oppilaiden pätevyyden kokemukset voivat vahvistua. Oppilaat toivat avoimissa vastauksissa esiin mieltymyksensä yksin tai parin kanssa sovittuihin tehtäviin ja niitä toivottiin jatkossa lisää. Kun oppilaat ovat oppineet tekemään liikuntaläksyjä, he todennäköisemmin osaavat myös ohjatusti suunnitella itse omia, toimivia ja sopivan haasteellisia, liikunnallisia kotitehtäviä. Toimintatutkimusta on tarkoitus jatkaa siten, että oppilaiden osallisuutta läksyjen suunnittelussa lisätään uuden opetussuunnitelman ohjeiden suunnassa. Perusopetuksen opetussuunnitelman mukaan oppilaita kannustetaan huolehtimaan niin omasta kuin toistenkin hyvinvoinnista ja terveydestä (OPS 2014, 22). Näin pyritään synnyttämään sosiaalista yhteenkuuluvuutta. Oppilaslähtöisillä ja osallistavilla työtavoilla koulussa tapahtuvaa oppimista voidaan laajentaa toiminnaksi sosioekologisen mallin seuraaville tasoille (meso- ja exosysteemi) ja vuorovaikutukseen yksilön ja hänen elinpiirinsä kanssa.

Oppilaat kokivat liikuntaläksyt hyödyllisiksi ja heidän mielestään läksyt sopivat liikuntaan. Hyödyllisyyden kokemusta saattoi lisätä läksyjen tarkistaminen, sillä oppilaiden mielestä opettajan tuli tarkistaa läksyjen tekeminen. Myös aikaisemmissa tutkimuksissa on havaittu, että läksyjen tarkistaminen on tärkeää motivaation säilymisen kannalta (Gabbei & Hamrick 2001; Mitchell ym. 2000; St. Ours & Scrabis-Fletcer 2014). Yhdeksäsluokkalaisten kriittisempi suhtautuminen ja hieman vähäisempi itsearvioitu liikkuminen läksytehtävien parissa ei tullut tutkijaopettajalle yllätyksenä. Yhdeksäsluokkalaisille on perusopetuksen aikana saattanut muodostua jo vakiintunut käsitys läksyttömästä liikunnanopetuksesta, joten tästä syystä uuteen käytäntöön suhtautuminen saattoi olla kriittisempää. Murrosiän myötä monen nuoren suhtautuminen liikkumiseen muuttuu, sillä liikunta-aktiivisuuden väheneminen iän myötä on havaittu useissa tutkimuksissa (Kokko ym. 2016) ja myös omien liikuntataitojen arviointi muuttuu kriittisemmäksi (Hirvensalo ym. 2015). Vaikka liikuntaläksyt selvästi innostivat oppilaita liikkumaan, tarvitaan vähän liikkuvien ja vanhempien tyttöjen aktivoimiseksi vielä lisää tukea ja tehokkaampia toimia.

Tutkimusprosessi toteutettiin aidossa oppimisympäristössä autenttisten toimijoiden eli oppilaiden kanssa. Tuloksia tulkittaessa on huomioitava, että läksyjentekoaktiivisuutta analysoitiin tutkimuksessa perustuen oppilaiden omaan arvioon. Tutkimuksessa toteutettiin liikuntaläksykokeilu, joka poikkesi oppilaille aiemmin satunnaisesti annetuista liikuntaläksyistä siten, että läksyt annettiin järjestelmällisesti joka viikko. Säännöllisesti annetut liikuntaläksyt olivat uusi kokemus oppilaille, joten läksyjen tekemisen innokkuus voi osaltaan selittyä uutuuden viehätyksellä. Toisaalta on huomattava, että innokkuus läksyjen tekemiseen säilyi kuitenkin lukuvuoden loppuun asti.

Liikuntaläksykokeilu oli osa koulun liikunnanopetusta, joten se koski kaikkia oppilaita. Toimintatutkimuksessa tutkijaopettajan ollessa subjektiivisesti läsnä tutkimuksen eri vaiheissa, nousee esille haaste opettajan valta-aseman tuomasta vaikutuksesta tutkittavien toimintaan (Eskola & Suoranta 1998, 211). Vaikka oppilaille korostettiin liikuntaläksyjen ja vastaamisen vapaaehtoisuutta, on ymmärrettävää, että oppilaat saattoivat opettajan valta-asemasta johtuen antaa toivottuja vastauksia. Tutkijaopettaja pyrki kaikissa tutkimuksen vaiheissa kunnioittamaan oppilaiden yksityisyyttä ja kuuntelemaan heidän mielipiteitään.

Yhtä koulua koskevassa tutkimuksessa ei voida pyrkiä laajaan yleistettävyyteen (Eskola & Suoranta 1998, 45–47). Tulokset voivat kuitenkin olla hyödyksi kehitettäessä käytännön koulutyötä muissakin oppimisympäristöissä (Heikkinen ym. 2006, 27–36). Suomalainen

koulujärjestelmä on melko yhtenäinen koko maassa, ja perusopetusta ohjaa yhteinen valtakunnallinen opetussuunnitelma. Liikuntaläksykokeilu voitaisiin todennäköisesti toteuttaa monissa kouluissa samansuuntaisin toimintatavoin ja tuloksin, vaikka koulukohtaisten omien sovellusten syntymistä voidaan myös pitää toivottavana. Tässä tutkimuksessa oli mukana vain tyttöjä, poikien tai sekaryhmien liikunnanopetukseen voisi muodostua erilaisia sovelluksia jo senkin takia, että tuntien liikuntasisällöt ovat hieman eri tavalla painottuneita (Palomäki & Heikinaro-Johansson 2011).

Opetussuunnitelman tavoitteiden ja sisältöjen on tarkoitus toteutua jokaisen suomalaisen koulun opetuksessa, sosioekologisen mallin mukaisesti opetussuunnitelman (makrotason) jalkauttaminen oppilaan arkeen toteutuu pääosin opettajien toiminnan kautta. Tässä tutkimuksessa voitiin todeta, että Elderin ym. (2007) peräänkuuluttama kaveripiirin ja kotien tuki fyysiselle aktiivisuudelle oli tärkeää. Vaikka vanhempien kanssa liikkuminen ei ollut yleisesti tyttöjen keskuudessa kovin suosittua, olivat muutamat tytöt kokeneet erityisesti äidin kanssa liikkumisen merkityksellisenä. Kasvava huoli liikkumattomuudesta haastaa kaikki lasten ja nuorten kanssa toimivat tahot pohtimaan erilaisia keinoja arjen fyysisen aktiivisuuden lisäämiseksi. Oppilaiden itsensä mukaan liikuntaläksyt innostivat heitä liikkumaan vapaa-ajalla, mutta jatkossa on tarpeen kerätä asiasta tietoa myös objektiivisilla mittauksilla siten, että nähdään, millainen vaikutus liikuntaläksyillä voi olla oppilaiden arjen kokonaisaktiivisuuteen.

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II

THE ROLE OF PHYSICAL EDUCATION HOMEWORK TO ADOLESCENT GIRLS' PHYSICAL ACTIVITY IN FINLAND

by

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The Role of Physical Education Homework to Adolescent Girls' Physical Activity in Finland

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Abstract

Introduction: There is an urgent need for active strategies to promote physical activity (PA) among female adolescents, as they are at greater risk of physical inactivity. In addition to Physical Education (PE) in school, to reach adequate levels of PA, young people need to participate in PA during the school day and/or after-school hours and/or in the before-school period. One week of objectively measured and self-reported information enlightens the status quo of adolescent girls' PA and the role that PE homework plays. **Purpose:** The purpose of this study was to examine girls' objectively measured PA in a lower secondary school as part of the Physical Education Homework Study, a project conducted in Finland. An additional aim was to provide insights into physical education (PE) homework as part of PA. **Methods:** Different levels of PA (i.e., light, moderate, vigorous), sedentary time, number of total steps and running steps were measured using accelerometers among girls in the 7th, 8th and 9th grades, aged between 12 and 15 years ($n = 88$) for a period of 1 week. In addition, self-reported structured diaries were used to gather information about after school activities, including PE homework. An analysis of variance (ANOVA) and Tamhane's post-hoc test was used to compare the different grades on the basis of participants' PA levels and sedentary time. Data from self-reported PE homework frequencies and time spent on PE homework were analysed using the independent-samples t-test. **Results:** The PE homework was a small aspect of the participants' whole-day PA, averaging 34 minutes per week (7th grade girls 20 minutes, 8th grade girls 51 minutes, and 9th grade girls 32 minutes). Half of the girls from the 8th grade reached the 60-minute PA recommendation every day; 38% of all the girls met the recommended levels of PA. For the 7th grade girls, 35% met the recommendation, while 28% of the 9th grade girls reached the PA guidelines. The 7th grade girls recorded an average daily light PA time of 3 hours 28 minutes; this was 34 minutes more than the girls from 8th grade ($p =$

0.000) and 30 minutes more than the girls from the 9th grade (p = 0.000). **Conclusion:** The PE homework provided a variety of PA for the adolescent girls' after-school hours, even if the role of homework was not time-consuming (20 - 51 minutes per week). A possible way of promoting active time among adolescents during after-school hours is to assign them PE homework, hence, active PE assignments could replace sedentary activities in adolescent girls' lives.

Keywords

Physical Activity, Adolescent Girls, PE Homework, Accelerometer, Self-Report

1. Introduction

In most countries, physical activity (PA) participation radically decreases during lower secondary school, especially among girls (Currie et al., 2008: pp. 105-107; Ekelund et al., 2012; Haapala et al., 2017). As a result, many adolescents fail to meet the recommended levels of PA (Currie et al., 2008; Pate & O'Neill, 2009; Husu, Vähä-Ypyä, & Vasankari, 2016). According to the Finnish National Physical Activity Recommendations, adolescents should be physically active more than 60 minutes per day (Tammelin & Karvinen, 2008). In Finland, only 10% - 17% of adolescents aged between 13 and 15 attain moderate-to-vigorous levels of PA, with the most radical decline in PA occurring among girls aged between 11 and 15, in their transition from childhood to adolescence (Kokko et al., 2015; Tammelin, Laine, & Turpeinen, 2013). According to Pate & O'Neill (2009), the objectively measured PA of adolescent girls declines at a rate of approximately 4% annually. This means that with time, the level of PA among girls recedes further from current PA guidelines.

Nearly half of young people's total daily PA accumulates after school, although the levels of after-school activity start to decrease gradually during preadolescence, while sedentary exposure increases as early as ages 9 to 11 (Wickel, Issartel, & Belton, 2013). Since female adolescents seem to be at greater risk of physical inactivity, there is an urgent need for effective strategies to promote PA among them (Aelterman et al., 2012). The after-school period represents a segment of the day in which adolescents' health-enhancing levels of PA should be promoted (Beets et al., 2009). However, adolescents, particularly girls, accumulate low levels of moderate-to-vigorous physical activity (MVPA) during after-school hours, and their MVPA levels decline at a faster rate (Okely et al., 2011; Pate & O'Neill, 2009). According to Atkin et al. (2008), technology-based sedentary behaviour is the most prevalent activity among adolescents in after-school hours; the sedentary time of girls lasted for 35 minutes per day. Meanwhile, the times spent physically active amounted to 19 minutes for girls per day (Atkin et al., 2008).

School is an important institution for PA promotion, as the vast majority of youths attend school. Thus, physical education (PE), as a structured school activity, has great potential in terms of public-health reach (Scruggs, 2007). There have been calls for schools to expand their efforts to increase PA-related opportunities to obtain higher levels of PA in adolescents, particularly adolescent girls. Even if school PE lessons are well organized and PA levels during these lessons are adequate, PE lessons do not exert a sufficient influence over adolescents' PA and health (Fairclough & Stratton, 2005). MVPA is performed most often during leisure time, while school sports contribute only marginally to MVPA (Pfitzner et al., 2013). In Finland, a great deal of effort has been set into activating school days, for example, the Finnish Schools on the Move (Haapala et al., 2017). In addition to school PE, to reach adequate levels of PA, children and young people need to participate in PA during the school day and/or during after-school hours and/or in the before-school period. A possible way of promoting PA among youths is to assign PE homework (Gabbei & Hamrick, 2001; Williams & Hannon, 2013; Kääpä et al., 2017). Homework assignments could be designed to practise activities learned earlier at school; to be effective, the practicing should take place during after-school hours. Physical homework provides an opportunity for students to apply and practice the skills learnt in PE lessons (Gabbei & Hamrick, 2001; Williams & Hannon, 2013). According to Kääpä et al. (2017), students can find PE homework enjoyable and beneficial. For example, students enjoyed PE homework that included practicing with family member. In addition, it has been found that Finnish students enjoy participating in planning PE homework (Kääpä et al., 2017). The Finnish National Core Curriculum allows and even encourages the use of leisure time to practice skills learnt during lessons (Finnish National Core Curriculum, 2014). PE homework assignments can be implemented in nearby sporting environments or facilities. Becoming familiar with the physical environment and facilities while undertaking PE homework helps to make PA part of one's lifestyle (Williams & Hannon, 2013; Smith & Claxton, 2003).

The purpose of this study was to examine the objectively measured PA levels of adolescent girls in a lower secondary school in Finland and provide insights into the role of PE homework as part of adolescent girls' PA. The participants' MVPA, sedentary time, and the number of total steps and running steps were reported, and compared to PE homework-participation. Using both types of steps and the MET values add variety and reliability to the results and enable comparison between the step-based studies as well.

2. Materials and Methods

2.1. Design of the Study

This study is part of the Physical Education Homework Study, a project that began in Finland in 2015. The purpose of the study was to attempt to increase adolescents' PA time by giving them active PE homework during PE lessons (Kääpä

et al., 2017). This week-long cross-sectional study, conducted in autumn 2016, concentrated on gathering information about adolescent girls' PA and the role of PE homework by using objective measurements and self-reported methods.

2.2. Participants

The participants for this study were girls in the 7th, 8th and 9th grades in a lower secondary school in central Finland. The girls were aged between 12 and 15 years. The half of the girls live near the school and half of them commute to school by buss. From a total of 124 girls, 105 (84.7%) agreed to participate in the study. Girls and their parents were informed about the study beforehand, and informed consent was obtained from the parents/guardians. According to the layer of the University Ethical Board, this protocol covers needed ethical permissions concerning this type of research. The study consisted of week-long objective PA measures using accelerometers and structured self-report diaries during the measurement week. There were missing data from 17 participants as a result of students (12) who were absent from school during the measurement week, and some accelerometer problems that were encountered. The actual study data consists of information from participants who had at least 4 days of accelerometer data (n = 88) and questionnaires concerning their self-report diaries (n = 81). In self-reported data, the division was 28 girls from the 7th grade, 26 girls from the 8th grade and 27 girls from 9th grade. In the objectively measured data analysis, to get the most comprehensive overview about the adolescents' physical activity, all of the participants acceptable (at least 4 days, 10 h minimum/day) accelerometer data were used (n = 513). For this reason, the measurement days consisted of 190 days of data from the 7th grade girls, 152 days of data from the 8th grade girls and 171 days of data from the 9th grade girls. Girls' who had both objectively measured and self-reported data were included in analyses of compound measurement results (No PE homework n = 238, PE homework twice a week or more n = 248).

2.3. Setting

In Finland, the school day usually begins at 8:00 am and ends at 3:00 or 4:00 pm. The normal school-day structure consists of 7 to 8 lessons lasting for 45-minute each, with a 15-minute break between the lessons and a 30-minute lunch break at noon. The Finnish Schools on the Move program has concentrated on activating students during the school day and using the breaks in an active way (Haapala et al., 2017). The PE Homework Study focuses on activating after-school hours (Kääpä et al., 2017). During the study period, the lower secondary school students had 2 × 45 mins PE lessons in a row (lasting 90 minutes) once a week. In Finland, this double classes one day a week is normal national standard. In Finland, organized after-school sport activities for adolescents usually take place in sport clubs and in teams. According to Blomqvist et al. (2015), over half (53%) of the Finns in their study aged between 9 and 15 took

part in sports-club activities at least once a week. Their participation declined as they aged, with low levels of participation among 15-year-old (Blomqvist et al., 2015).

The PE teacher (first author) had occasionally given the girls in the lower secondary school PE homework in past years; thus, the concept of PE homework was familiar to them. PE homework was an aspect of PE that was undertaken by all of the girls. Homework assignments followed PE requirements, and they were given to all students in every PE lesson once a week during the study year. This meant that PE homework was given between 30 and 40 times per school year. PE homework assignments often consisted of body-conditioning exercises such as push-ups, squats or ab crunches; jogging with a family member or friend; stretching; or some skill or activity from the PE lesson. An example of PE homework is balance practices, where the student stands on their right foot in the morning while brushing their teeth and on their left foot at night while brushing their teeth. PE skill practices consisted of tasks practiced in PE lessons that they had to practice for PE homework (e.g., throwing and catching a ball). An example of PE homework combining skill practice and parental involvement is teaching the correct performance of squats to a family member. Involving the students in planning their PE homework was sometimes part of the PE lessons' "cooling-down" session. Often, the students could choose the scale or complexity of the homework themselves and they had an influence on the activity. Improving the girls' autonomy and self-determination was the main goal in involving them in planning, choosing the scale and deciding on the amount of PE homework (Deci & Ryan, 2000). Girls participated in their PE homework assignments actively, 89.7% of the girls always completed their PE homework (Kääpä et al., 2017).

2.4. Self-Reported Data

The students' self-reported PA was assessed using a structured diary questionnaire. The aim was to identify the frequency and type of PA that girls engaged in. The diary questionnaire consisted of categorized structures where students marked their activity frequency, level of self-initiated PA, organized sport activities, occupational activities and PE homework in which they participated within the study week. In addition, they estimated the time spent on PE homework. In this study, only self-reported PE homework reports were used. Girls this age are expected to be able to fill out this kind of structured diary that does not require a lot of creativity or writing. Self-reported data supplements the objectively measured data identifying the context of physical activity.

2.5. Accelerometer Data

A tri-axial accelerometer, UKK RM42 (UKK-Institute, Tampere, Finland), was selected because of its small-sized and light monitor. It can easily be worn for 24 hours a day and can collect and store data over the course of a week without

needing to be charged. These accelerometers measure accurate information concerning the duration, intensity and pattern of PA and inactive periods, posture and postural changes and the number of total and running steps and enable the comparison of accelerometer results between different studies also in adolescents (Aittasalo et al., 2015). The ability of accelerometers to also record incidental PA is important, as this might be difficult to recall in self-reports, especially for children and adolescents. The accurate information on the metabolic equivalent (MET)-values of PA levels broadens the results from the pedometer' step counts (Vähä-Ypyä et al., 2015a, 2015b). The time spent standing still, sitting and lying, PA levels and the number of daily steps and running step were categorized separately. The total number of steps includes walking and running steps. Using both types of steps along with the MET values adds variety and reliability to the results.

2.6. Procedures

The accelerometer- and diary-based measurements were implemented in November 2016, 3 months following the beginning of the semester, meaning that several PE homework assignments had already been completed. The teacher delivered the devices during PE lessons and instructed the girls to wear the flexible (elasticated) belt with the accelerometer around their waist, placing the monitor on the right hip. The teacher gave oral instructions, and written instructions were attached to the diary questionnaire, which was delivered during the same lesson. The girls were instructed to wear the belt for seven consecutive days during their waking hours, apart from during water-based activities such as showering or swimming. The girls started the monitoring straight away and tested the accelerometers; if a malfunction was detected, the device was replaced immediately.

The girls returned the accelerometers and their self-report diaries a week later, during their following PE lesson, fulfilling instructed seven consecutive days requirement. To obtain a comprehensive overview, only the data from the participants who used the accelerometer for at least 4 days during the week and at least 10 hours each day were accepted for the study, and the data were analysed in 6-second epochs (Troiano et al., 2008). In studies with large sample, reliability can be achieved with 3 days of recording. Studies with smaller sample sizes like this, it is recommended to measure a greater number of days to improve measurement precision (Mattocks et al., 2008). Monitoring is also recommended to be performed over an entire day (Trost et al., 2000). The average measurement time was 14 hours 30 minutes per day; the minimum time was 12 hours 8 minutes, while the maximum was 19 hours 47 minutes. PE homework was given when the group had their PE lesson; the time period for completing the assigned task was a week. PE homework assignments could be performed at any time during girls' leisure time, on account of this, the weekdays or weekends were not separated.

2.7. Analysis

The tri-axial acceleration data, collected at a 100 Hz sample rate in raw mode (in g-units), were uploaded and stored, and a statistician from the UKK -institute transferred the data into Excel spreadsheet for further analysis. The collected data were analysed in 6-second epochs and the mean amplitude deviation (MAD) of the resultant acceleration signal was calculated for each epoch (Vähä-Ypyä et al., 2015b). Further, the measured MAD values were converted to MET values in a validated way (Vähä-Ypyä et al., 2015a). MET values were used to categorize PA into different intensity levels: Light PA was defined as activity corresponding to 1.5 - 2.9 METs, moderate activity as 3.0 - 6.0 METs and vigorous activity was more than 6 MET. Body posture was classified as standing, sitting or lying for epochs of low movement intensity (<1.5 MET). The classifications were based on the Angle for Posture Estimation (APE) algorithm, which compares the accelerometer orientation in relation to an identified upright position at the end of each 6-second epoch (Vähä-Ypyä et al., 2018).

The analyses were implemented using SPSS software. The recorded PA levels and sedentary time of each girl from the measurement days were compared. Means and standard deviations in light, moderate, vigorous and MVPA MET values, along with standing and sedentary behaviour (i.e., sitting and lying) were analysed using analysis of variance (ANOVA) and Tamhane's post-hoc test. The MET values were smoothed by calculating a 1-minute exponential moving average for each epoch; the peak hourly MET value was analysed from the smoothed MET values. In addition, the mean values and standard deviations from the number of average total and running steps per day of the girls from the 7th, 8th and 9th grades were compared by means of ANOVA and Tamhane's post-hoc test. An ANOVA and Tamhane's post-hoc test were used to compare the 7th, 8th and 9th graders in terms of their self-reported data on the frequency and time spent doing their PE homework. The girls were further divided into 2 PE homework groups: Those who did not do PE homework at all or did it only once a week and those who did it at least twice a week. Independent-sample T-tests were used to compare two groups' daily running and total steps with the objectively measured PA levels. For the independent-samples t-tests, Cohen's d was determined by calculating the mean difference between the two groups and then dividing the result by the pooled standard deviation. Cohen's d is the appropriate effect -size measure when 2 groups have similar standard deviations and are of similar size, as in these data. The significance level was set at $p < 0.05$.

3. Results

3.1. Physical Activity Levels

The participants' objectively measured and combined light, moderate and vigorous average PA time of the participants was 4 hours 18 minutes (SD ± 1 hours 6 minutes). The light PA coverage of 3 hours 8 minutes (±40 minutes) was transcendent compared to a moderate-to-vigorous coverage of 1 hour 2 minutes

(±20 minutes) and 8 minutes (±6 minutes) of vigorous PA per day (Table 1). The average measurement time per day was comprehensive, 14 hours 30 minutes, and the average sedentary time was 7 hours 37 minutes (±1 hour 52 minutes), representing 52% of the total measurement time. The participants spent an average of 2 hours 41 minutes (±55 minutes) standing still, 6 hours 29 minutes (±1 hour 5 minutes) sitting and 1 hour 8 minutes (±1 hour 5 minutes) lying down on each measurement day.

The 7th graders recorded greater levels of daily light PA than those from other grades. The 7th grade girls recorded an average daily light PA time of 3 hours 28 minutes (±32 minutes); this is 34 minutes more than the girls from 8th grade (p = 0.000) and 30 minutes more than the girls from the 9th grade (p = 0.000). Regarding daily moderate PA, there was a significant difference between the girls from the 7th and 8th grades (p = 0.017), with a 6-minute time differential benefitting the 8th graders. The half of the girls from the 8th grade reached the Finnish 60-minute PA recommendation; 38% of all girls met the recommended levels of PA. For the 7th grade girls, 35% met the recommendations, while 28% of the 9th grade girls reached the 60-minute PA recommendations every day.

The 9th grade girls spent more time standing than others. There was a significant difference in time spent standing between the girls from the 7th and 9th grades (p = 0.038), with a 12-minute differential between these grades.

Regarding sedentary behaviour (i.e., sitting and lying), the girls from the 8th

Table 1. Participants' daily average time (hours and minutes) spent in different physical activity (PA) levels, including combined level of moderate and vigorous physical activity (MVPA), by grades (mean, std. deviation, ANOVA p-value and Tamhane's post-hoc test).

	7th grade (190 days)	8th grade (152 days)	9th grade (171 days)	All (513 days)	All	Post-hoc		
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	ANOVA p-value	7-8th grade	7-9th grade	8-9th grade
Light PA (1.5 - 2.9 MET)	3:28 (0:32)	2:54 (0:36)	2:58 (0:42)	3:08 (0:40)	**0.000**	**0.000**	**0.000**	0.834
Moderate PA (3 - 6 MET)	0:59 (0:16)	1:05 (0:23)	1:03 (0:21)	1:02 (0:20)	**0.016**	**0.016**	0.193	0.656
Vigorous PA (over 6 MET)	0:08 (0:07)	0:09 (0:06)	0:08 (0:06)	0:08 (0:06)	0.110	0.317	0.937	0.098
MVPA	1:08 (0:40)	1:15 (0:43)	1:11 (0:40)	1:11 (0:41)	0.283	0.315	0.864	0.755
Time spent standing	2:36 (0:47)	2:38 (1:02)	2:50 (0:57)	2:41 (0:55)	**0.041**	0.915	**0.030**	0.287
Time spent sitting	6:30 (1:05)	6:31 (1:07)	6:25 (1:04)	6:29 (1:05)	0.667	10.000	0.782	0.864
Time spent lying	1:19 (1:13)	0:41 (0:35)	1:20 (1:08)	1:08 (1:05)	**0.000**	**0.000**	10.000	**0.000**
Total sedentary (sitting and lying)	7:51 (2:01)	7:11 (1:18)	7:45 (2:02)	7:37 (1:52)	**0.003**	**0.001**	0.970	**0.008**

grade recorded the shortest time. The time spent sedentarily by the 7th grade girls' (7 hours 50 minutes) was 38 minutes more than that spent by the girls in 8th grade (7 hours 12 minutes) ($p = 0.002$). Moreover, the girls in the 9th grade recorded a sedentary time of 33 minutes more than that of the girls in the 8th grade ($p = 0.012$). There was a significant difference in time spent lying down: The 8th graders spent 38 minutes less lying down than the 7th graders ($p = 0.000$) and 33 minutes less than the grade 9th graders ($p = 0.000$).

3.2. Steps per Day

The girls averaged 8535 steps per day (Table 2), and the average number of running steps per measurement day was 730. The number of total steps per day varied from a minimum of 4645 steps to a maximum of 14,089 steps. One-third (32%) of the girls reached the average 10,000-step recommendation per day (Tudor-Locke et al., 2011; Adams, Johnson, & Tudor-Locke, 2013). The differences between the girls from the different grades were prominent, especially in terms of running steps. The average daily running steps recorded for the 9th grade girls was the lowest (547) among the grades; the 7th grade girls recorded an average of 843 daily running steps ($p = 0.000$), while the 8th grade girls recorded an average of 796 daily running steps ($p = 0.000$). The girls from 8th grade recorded the highest number of total steps (9036), and over 44% of them reached the average recommendation of 10,000 steps. The girls from the 7th grade averaged 8054 steps. The difference in the total number of steps between the 7th and 8th graders was almost 1000 (982) steps ($p = 0.001$).

3.3. Self-Reported PE Homework

The 7th and 8th graders did their PE homework more than twice a week on average, 7th grade girls' homework frequency was 2.17 ± 1.81 and 8th grade girls' 2.12 ± 1.66 occasions per week. Meanwhile, the 9th graders reported a frequency of 1.5 ± 1.01 occasions a week (Table 3). PE homework added on average 34 minutes active time to the girls' week. The girls from 8th grade spent an average of 51 minutes per week on PE homework, while the girls from 7th grade spent 20 minutes and the girls from 9th grade spent 32 minutes. The difference between the girls from the 7th and 8th grades was significant ($p = 0.027$) in terms of total time spent on PE homework per week.

Table 2. Average total steps and running steps per day by grade (mean, std. deviation, ANOVA p value with Tamhane's post-hoc test).

	7th grade ($n = 190$)	8th grade ($n = 152$)	9th grade ($n = 171$)	All ($n = 513$)	ANOVA	Post-hoc		
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	p value	7 - 8th grade	7 - 9th grade	8 - 9th grade
Total steps	8054 (2156)	9036 (2618)	8625 (2421)	8535 (2418)	**0.001**	**0.001**	0.057	0.369
Running steps	843 (624)	796 (529)	547 (417)	730 (549)	**0.000**	0.856	**0.000**	**0.000**

Table 3. Self-reported PE homework frequency/week and minutes/student/week: Comparisons between the 7th, 8th and 9th grades using ANOVA *p* values and Tamhane's post-hoc test.

	7th grade *n* = 28 Mean (SD)	8th grade *n* = 26 Mean (SD)	9th grade *n* = 27 Mean (SD)	All *n* = 81 Mean (SD)	ANOVA *p* value	Post-hoc 7 - 8th grade	7 - 9th grade	8 - 9th grade
PE homework (frequency/week)	2.17 (1.81)	2.12 (1.66)	1.52 (1.01)	1.94 (1.55)	0.228	0.999	0.271	0.326
PE homework (minutes/student/week)	20 (19)	51 (53)	32 (38)	34 (40)	**0.017**	**0.027**	0.415	0.365

Those who did PE homework twice or more per week had 371 more daily running steps ($p = 0.000$) and 1067 more total daily steps ($p = 0.107$) than those who did not do homework as often (Table 4).

The difference in objectively measured average vigorous daily PA between the groups who did PE homework more often and those who did not was statistically significant ($p = 0.000$) (Table 5). The differences comprised an average of 3 to 7 minutes, but the difference favoured the group who did more PE homework.

4. Discussion

As a part of the Physical Education Homework Study, adolescent girls' objectively measured PA and self-reported PE homework were examined. The girls were more active compared to those in other PA studies (Ruiz et al., 2011; Cohen, Ghosh-Dastidar, & Lytle, 2014; Marques et al., 2015); 38% of the girls reached the 60-minute MVPA recommendations (Currie et al., 2008). The PE homework comprised an average of 34 minutes of active time per week. As a whole, those who did PE homework at least twice per week were more physically active than those who did less PE homework. There was a statistically significant difference in vigorous PA and running steps between the PE homework groups.

On average, girls spent 1 hour 2 minutes daily on moderate PA (3 - 6 MET) and 8 minutes on vigorous PA (over 6 MET), with MVPA averaging 1 hour and 11 minutes. Comparing these results to those of a 9-country international study (Ruiz et al., 2011), the amount of MVPA was higher in this study than in others. According to Ruiz et al. (2011), European adolescent girls' (aged 12.5 - 17.5 years) MVPA was 49 minutes per day. In the study of the 9 European countries, 27.5% of girls met the current MVPA recommendations (over 60 minutes per day). In the present study, 35% of girls from 7th grade, 50% of girls from 8th grade and 28% of girls from 9th grade reached the 60-minute recommendation, even if MVPA was on average 1 hour and 11 minutes. The differences between the grades in MVPA comprised a few minutes, but the 7th-grade girls were the most active when light, moderate and vigorous activities were compounded. Particularly with light PA, there were significant differences between the 7th graders and the other grades. The girls in this study were more active than in the study of Cohen, Ghosh-Dastidar, & Lytle (2014) and in that of Marques et al. (2015). In the present study, the average MVPA of the 8th-grade girls was 75

Table 4. Differences in self-reported homework frequency and daily steps and running steps by independent sample t-test.

	No PE homework or just once $n = 238$	PE homework twice or more $n = 248$	p value	Cohen's d effect size
Total steps mean (SD)	8061 (2321)	9128 (2260)	0.107	0.465796
Running steps mean (SD)	559 (372)	930 (630)	**0.000**	0.717128

Table 5. Differences in self-reported homework frequency and in MET-values in Light, Moderate and Vigorous activity levels by independent-sample t-test.

	No PE homework or just once $n = 238$	PE homework twice or more $n = 248$	p value	Cohen's d effect size
Light PA (1.5 - 3 MET) mean hour and minute (SD)	3:05 (0:39)	3:09 (0:40)	0.796	0.101258
Moderate PA (3 - 6 MET) mean hour and minute (SD)	0:59 (0:19)	1:06 (0:20)	0.341	0.358856
Vigorous PA (>6 MET) mean hour and minute (SD)	0:07 (0:05)	0:10 (0:07)	**0.000**	0.491553

minutes, while in Cohen, Ghosh-Dastidar, & Lytle (2014) study, their average was 22.2 minutes per day. The study of Marques et al. (2015) had the same continuum in their results: Girls aged between 10 and 18 recorded an average MVPA of 34 minutes per day, with sedentary time being 9 hours 8 minutes. In the present study, the average sedentary time was 7 hours 37 minutes, which is less than in other studies. Even if the MVPA in this study is higher than in others, the most revealing element remains the low time recorded for sedentary behaviour. What is noteworthy is that the 8th-grade girls recorded only 7 hours 12 minutes of sedentary time. In a study by Okely et al. (2011), which investigated 1518 adolescent girls, only 1.5% met the current PA recommendations; the girls spent less than 5% of their waking hours in MVPA and 60% spent time being sedentary. In this study, PA levels during school hours might be partly due to the policy of the school. It is mandatory to go outdoors during every recess, which means that even the most sedentary students engage in light activity during breaks when moving outside and then back to their classes for the next lesson.

According to methodology and research, there is a great range of variation in step-count guidelines for adolescents: Numbers vary from 9000 to 16,000 steps per day (Silva et al., 2015). The guidelines of Tudor-Locke et al. (2011) are well known and recommendations are directed to adolescent girls. To maintain an adolescent's health, the minimal recommendation of 60 minutes of MVPA is associated with the advocated 10,000 - 11,700 steps per day for adolescents (Tudor-Locke et al., 2011), which was reached by 31.6% of the girls in this study. The average number of steps per day was 8,535, which was clearly less than in MacDonald et al.'s (2017) study, where the mean daily step count for adolescent girls (aged 12 to 15) was 10,287. In this study, the difference between the mini-

mum of 4645 steps and the maximum of 14,089 steps was extensive, which might explain the lower number of average total steps.

On average, the frequency of the participants' PE homework was twice weekly. The time spent on PE homework varied from 20 minutes to 51 minutes among the different grades. The PE homework added averaging 34 minutes active time per week to the girls' after-school hours. PE homework might lower the accumulation of sedentary time throughout the afternoon by turning sedentary behaviour into more active behaviour. Moreover, some PE homework assignments required activating other persons, preferably family members. Getting parents to participate in PE homework gives them an opportunity to familiarize themselves with the content and tasks of PE (Williams & Hannon, 2013). Parents' perceptions of PE can be sometimes outdated; thus, PE homework could provide them an overview of the current contents of PE. In addition, PE skills-practice may have been extended during after-school hours through PE homework (Gabbei & Hamrick, 2001; Williams & Hannon, 2013). PE homework is also valued in terms of involving students in planning, increasing their autonomy and increasing positive PA experiences (Deci & Ryan, 2000). The study of Behrens et al. (2015), found that the teacher's supportive interaction with participants appear to be important aspect in generating an increase in PA. In their study, when teachers promoted PA, a positive relationship with MVPA was noted (Behrens et al., 2015). If the teacher's interactions and promotions can reach students in daily life (e.g., in the form of PE homework), it could increase their PA levels.

Strengths and Limitations

The strength of this study is the combined use of an objective assessment tool and a self-reported diary questionnaire. The use of accelerometers increases the verifiability of high-quality objective data concerning the quantity and type of PA being performed. Previous studies have confirmed that the accelerometer records all ambulatory activity and that accelerometers are reliable in assessing gait parameters in children and adolescents (Ekelund, Tomkinson, & Armstrong, 2011). For example, it is more reliable to make conclusions about the predictors and health impacts of intensity-specific PA using accelerometer methods (Aittasalo et al., 2015; Brandes et al., 2006). However, self-reported PA data provide a source of information that cannot be reached by accelerometers. On the other hand, the outcome from self-reported diaries might have been affected by biases such as problems with recall, social desirability, over-reporting of frequencies or over-reporting of time spent doing PE homework. A combination of contextual self-reported data and accelerometer-assessed PA is a desirable surveillance mechanism for collecting data concerning adolescents' PA during after-school hours; these sources allow researchers to provide meaningful findings.

The classification used in this study was the APE algorithm, which compares the accelerometer orientation in relation to the identified upright position at the

end of each 6-second epoch (Vähä-Ypyä et al., 2018). This 6-second epoch calculates more moving data compared to, for example, values measured at the end of each 1-minute epoch. In comparison with other studies, this is something to be considered. The excitement of participating in the study and wearing the accelerometer might add to the girls' PA. In this study, the predicted decline in PA did not occur: The 8th grade girls' moderate PA and MVPA were higher than the PA of girls in the other grades. Comparing the PA research results from Finland to other countries is tough to make as Finland has different approach to PA during school breaks.

Comparing those who did more PE homework with those who did less requires addressing. Those who participated more in PE homework might be more active and more physically competent in the first place. However, PE homework added PA time, at least a small amount, to those who did more homework and to those who did them less.

The small sample could be a limitation and might preclude the detection of significance; however, this selected sample only contained girls from one lower secondary school in Finland. The question of transferability regarding all aspects is relevant. In Finland, schools and PE are quite similar nationwide. In addition, in the Western world, PE and teaching styles are comparable. As such, the replication of the study is possible in other schools. There were no withdrawals or dropouts during the study. This could be due to the school structure and the influence schools and teachers have on girls of this age (Kohl II & Cook, 2013).

Studies, in which the students' own teacher conducts the research, imply both advantages and disadvantages. It is possible that granting the consent to participate in a study leads to heightened awareness of targeted behaviours (Beets et al., 2009). Students might also exaggerate their PA behaviour in diaries, with the desire to impress their PE teacher. However, a familiar and confidential relationship between the teacher/researcher and the participants might encourage students to take the study seriously.

5. Conclusion

Promoting a physically active lifestyle requires reaching beyond the PE lessons. In this study, PE homework provided an opportunity to embed active assignments into the adolescent girls' daily lives replacing sedentary activities. In addition, homework requirements were used to engage families, add knowledge about the content of the PE targets and increase the time spent practicing various skills. Referring to the results of this study, adding active PE homework to the content of PE is recommended. Future studies should target the additional facilitators of active PE assignments to more thoroughly understand the role of PE homework.

This study aimed to determine the influence of organizational and pedagogical changes in school by using PE homework as a tool to influence the PA of adolescent girls. Increasing PA outside of PE has implications also for public

health policies, the makers of which could participate in the discussion regarding the use of this practice on a wider scale. Educational policy-makers and school administrators can use these findings to guide curriculum planning and development, as schools are the focal point for interventions designed to incorporate health-enhancing PA in after-school hours.

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Conflicts of Interest

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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III

FINNISH ADOLESCENT GIRLS' ACTIVITY PATTERNS AND THE EFFECTS OF AN ACTIVITY-BASED HOMEWORK INTERVENTION ON THEIR PHYSICAL ACTIVITY

by

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RESEARCH

Finnish Adolescent Girls' Activity Patterns and The Effects of an Activity-Based Homework Intervention on Their Physical Activity

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Purpose: The insufficient physical activity (PA) of adolescents is a global challenge, and there is a need to find opportunities to engage youth in active lifestyles. The majority of adolescents do not meet the recommended guidelines of physical activity, and especially females have low levels of activity as they approach adolescence. The goal of this study was to obtain insight into Finnish adolescent girls' objectively measured physical activity by evaluating the effects of an activity-based homework intervention on low, medium, and high-active girls during after-school hours.
Method: A physical activity homework intervention was put into place for female adolescent girls. Physical activity was measured by accelerometers and a self-reported diary from 87 girls aged 13 to 15 years.
Results: Results indicated that high-active girls maintained their activity until the last measurement hour (10 pm), while the moderate- and low-active girls' activity declined towards the evening hours. The high-active girls participated the most frequently in organized sports activities, and the low-active girls were the most active in participating in household chores. The PE homework intervention increased girls' activity time an average of 34 minutes per week.
Conclusion: This study offers a picture of the diverse nature of the physical activity that adolescent girls engage in during after-school hours and shows the potential of PE homework assignments to reduce sedentary time and thereby increase physically active time during after-school hours.

Keywords: physical activity; after-school; lower secondary school girl students; Physical Education homework intervention

Introduction

Global recommendations state that adolescents should engage in 60 or more minutes of moderate-to-vigorous physical activity (MVPA) each day (ACSM, 2018). In addition, recommendations suggest that youth should regularly engage in specific physical activities, such as aerobic-based activity, resistance training, and stretching and flexibility exercises. In Finland, similar to the United States, only one-third of children and adolescents meet these global standards; Finnish adolescents in particular spend more than half of their waking hours engaged in sedentary activities (Husu et al., 2019; Kokko et al., 2016; Tammelin et al., 2007). Globally, including in Finland, girls are particularly at risk of falling short of the guidelines (ACSM, 2018; Hallal et al., 2012; Husu et al., 2019; Pate et al., 2009). Adolescence is a particularly vulnerable time, as this transition marked with biological changes coincides with a significant decrease in physical activity for youth, especially girls (Abdelghaffar et al., 2019; Martins et al., 2015). There is a considerable amount of research to date that suggests

girls are at particular risk of physical inactivity (Judice et al., 2017; Ruiz et al., 2011). Given that physical activity is an important determinant of health and that health-enhancing habits of an active lifestyle are established in youth (Atkin et al., 2015; Pardo et al., 2014), adolescence is a critical time to intervene to prevent the sharp decline in physical activity that occurs during this developmental period.

After-School Activities

Despite the relationship between physical activity and increased academic achievement in youth (Fedewa & Ahn, 2011), the reduction of physical activity opportunities, including recess and physical education, have been replaced in most countries with increased academic instructional time (U.S. Department of Health and Human Services, 2012). Thus, since many activities during the school day do not reach the recommended levels of physical activity (Grao-Cruces et al., 2019), after-school activities are an effective means of accumulating the daily recommended 60 minutes of activity (Beets et al., 2009; Mears & Jago, 2016; Pate & O'Neill, 2009). In the United States, approximately a quarter of school-aged youth participate in after-school activities (After School Alliance, 2014). In Finland, half of Finnish youth between the ages of 9 and 15 engage in sports club activities at least once a week (Blomqvist et al., 2019). Given that opportunities to be active are insufficient during school hours, after-school activities to promote physically active behaviours among youth are increasingly more important (Society of Health and Physical Educators, 2016) and make a significant contribution to children's overall daily physical activity levels, particularly as children reach adolescence (Arundell et al., 2016).

Research suggests that after-school activity types, however, differ between low- and high-active girls (Koorts et al., 2011; Taverno Ross et al., 2013; Trilk et al., 2012; Zimmermann-Sloutskis et al., 2010). In Taverno Ross et al. (2013), high-active adolescent girls reported more physical activity outside of school in team sports and individual sports than low-active girls. The low-active girls reported engaging in leisure time and educational sedentary activities more than high-active girls (Taverno Ross et al., 2013). Koorts et al. (2011) found that the more active adolescents reported activities such as outdoor games and sports, which is likely how these youth achieved their higher activity levels. Even if sport club membership has a strong effect on moderate physical activity in both boys and girls (Trilk et al., 2012; Zimmermann-Sloutskis et al., 2010), it is important to note that research has found that girls often accumulate their activity through different means, particularly through leisure-time physical activity such as performing occupational and household tasks (Pardo et al., 2014).

Evidence for Activity Homework Interventions

The use of homework in physical education (PE) is relatively uncommon compared to academic homework, and for this reason, the evidence of PE homework assignments is relatively limited (Hill, 2018). There are few studies concerning homework in PE, and in those studies, it is clear that active homework assignments can be effective in increasing levels of physical activity (Claxton & Wells, 2009; Duncan et al., 2011; Duncan et al., 2019; Fairclough et al., 2013; Kriemler et al., 2011). Some physical educators have suggested that homework assignments could be used as a way to meet PE curriculum learning objectives and recommendations for maintaining an active lifestyle (Hill, 2018). Homework might allow teachers to reach students' after-school time with physically active assignments and focus on skill development outside of instructional time. Teachers, therefore, might be able to use homework as a tool to add skill practice outside of school hours and increase parents' knowledge about PE learning objectives and practices (Hill, 2018). The multicomponent school-based interventions that include families such as PE homework are the most promising and effective strategies for increasing overall physical activity (Kriemler et al., 2011).

Purpose of Present Study

Although adolescent physical activity has been examined in the literature, less attention has been paid to the physical activity levels of youth during after-school hours and, in particular, how the specific activities vary among adolescents by gender. This is important because adolescence is a time when health behaviours, such as physical activity, are established and then maintained into later adolescence and even adulthood (Atkin et al., 2015; Pardo et al., 2014). It is important to understand physical activity behaviours among this crucial age group so that effective interventions can be put in place, particularly given the significant decline in activity among adolescent females. All adolescents participate in school and physical education, a situation that provides tremendous potential to influence physical activity and youth attitudes toward physical activity. School-based multicomponent interventions could therefore be the most effective way to change the physical activity of adolescent girls in a positive direction (Okely et al., 2011; Owen et al., 2017).

The present study was conducted as a part of the PE Homework Study project in Finland, where lower secondary school girls' physical activity was studied and promoted by PE homework (Kääpä et al., 2017). The study focused on the patterns and types of physical activity of adolescent girls during after-school hours. The study had two guiding aims: (a) to evaluate the timing and variety of physical activity patterns of adolescent females with low, medium, and high activity levels during after school hours and (b) to determine whether a PE homework intervention increased the level of physical activity for youth after school hours.

Methods

Procedures

This study was conducted in a moderate-sized lower secondary school in Central Finland. All of the girls attending grades 7 to 9 (ages 13 to 15) in this school were invited to participate ($N = 124$). Participants and their parents were informed about the study beforehand, and informed consent was obtained from the parents/guardians. Participation in the study was voluntary. Of the total of 124 pupils, 105 (84.7%) agreed to participate in the study project. According to the Ethical Committee of the University of Jyväskylä, the study protocol met the required ethical permissions established by the Helsinki Declaration concerning this type of research.

The study consisted of 1 week of objective physical activity measures with accelerometers and a half-structured self-reported diary. Altogether, out of 124 youth, 87 girls had complete accelerometer data. The accelerometers measure accurate information on the duration, intensity, and pattern of PA and inactive periods, posture and postural changes, and the number of steps on the metabolic equivalent (MET) – values of PA levels (Aittasalo et al., 2015; Vähä-Ypyä et al., 2015a, 2015b). Physical activities are frequently classified by their intensity, using MET as an indicator of exertion, a practice that was also followed in the present study. MET refers to metabolic equivalent, and 1 MET is the rate of energy expenditure while sitting at rest. Hence, activities that do not significantly increase resting energy expenditure are classified as sedentary behaviours. The conventional energy expenditure is an oxygen uptake of 3.5 millilitres per kilogram of body weight per minute. MET values express the energy cost of physical activities as a multiple of the resting metabolic rate and were used as the metric for the present study (Pate et al., 2008). The participants were divided into three activity groups ($n = 29$ in each group) according to their objectively measured mean MET values. In total mean MET values, there were daily peak MET values from the measurement week, and those total mean MET values of the groups were as follows: 57.2 to 73.4 for low-active girls, 74.2 to 81.7 for moderately active girls, and 82.1 to 97.2 for high-active girls (**Table 1**). The variety of activities during after-school hours was studied according to these three activity groups.

The measurements were implemented in November 2016. Both accelerometers and diary questionnaires were delivered during the PE lessons with oral and written instructions and were returned 1 week later. The data in the study were from participants who had used the accelerometer for at least 4 days during the week, at a minimum of 10 hours per day (Mattocks et al., 2008; Troiano et al., 2008), with 82 completed self-reported diaries. In Finland, the duration of the school day is usually 6 to 8 hours starting between 8:00 am and 9:00 am and ending between 2:00 pm and 4:00 pm. Note that students may have different schedules, and a few students might have class after 2:00 pm. However, in this study, the after-school time period was defined as starting at 2:00 pm and ending at 10:00 pm.

Self-Reported Physical Activity

The information on girls' after-school activities was obtained by a half-structured, self-reported diary questionnaire developed by the teacher-researcher and tested in two different lower secondary schools in Central Finland. The diary questionnaire has shown to produce adequate test-rest coefficients ranging from .690–.996. The participants reported the type (e.g., dance lesson, walking, cleaning) and the frequency of activities in organized sports, self-initiated activities, household activities, and PE homework. In addition, the participants estimated the time spent in organized sports and PE homework during the week. Focusing on these two behaviours was pre-determined based on previous research of Finnish adolescent activity preferences, as many girls participate in organized sport activities (Paakkari et al., 2017; Tammelin et al., 2016), which are usually held at the same time every week for the same duration. In organized sport activities and self-initiated sport activities, participants responded to open-ended questions, in contrast to the PE homework assignments and household activities, which were structured. Each specific activity type reported was recorded as one occasion of activity. The survey answers of students across the two schools were compared with a *t*-test to ensure that frequency and time used in PE homework did not differ, which was the case ($p = 0.656$ and $p = 0.655$), indicating that the PE homework questions could be used in a transferable manner.

Table 1: Percentage of low-, middle- and high-active girls' physical activity levels (light, moderate and vigorous) during waking hours; standing and sedentary behaviour, variance by ANOVA, Tukey and Tamhane post hoc tests. Mean daily values in proportion to daily measurement time.

	Low-Active Girls	**Middle-Active Girls**	**High-Active Girls**	**Total**	***p* Value Low-Middle**	***p* Value Middle-High**	***p* Value Low-High**
Total mean peak MET value	57.2–73.4	74.2–81.7	82.1–97.2				
	N = 29 (SD) %	*N* = 29 (SD) %	*N* = 29 (SD) %	*N* = 87 (SD) %			
Total daily	67.2	78.0	87.5	77.6	**.000**	**.000**	**.000**
(SD)	(5.1)	(2.4)	(4.5)	(9.3)			
After-school	30.8	36.3	40.3	35.8	**.005**	.253	**.000**
(SD)	(4.6)	(7.4)	(10.2)	(8.6)			
Light PA (1.5–2.9 MET)	12.7 (2.9)	13.3 (2.4)	15.8 (2.6)	13.9 (2.9)	.662	**.002**	**.000**
Moderate PA (3–6 MET)	8.3 (2.3)	9.8 (2.5)	11.6 (2.0)	9.9 (2.6)	**.047**	**.008**	**.000**
Vigorous PA (<6 MET)	0.6 (0.4)	1.6 (0.8)	1.8 (0.7)	1.3 (0.9)	**.000**	.384	**.000**
MVPA	8.9 (2.19)	11.3 (2.83)	13.4 (2.02)	11.2 (2.97)	**.001**	**.004**	**.000**
standing	17.4 (6.0)	16.7 (5.1)	17.1 (5.0)	17.1 (5.3)	.850	.940	.977
sitting	50.4 (4.9)	46.3 (6.1)	46.0 (5.0)	47.6 (5.7)	**.012**	.980	**.007**
lying	10.6 (6.2)	12.5 (8.4)	7.7 (4.7)	10.2 (6.8)	.700	**.033**	.152
sedentary = sitting & lying	61.0 (6.6)	58.7 (6.8)	53.7 (5.9)	57.8 (7.1)	.386	**.011**	**.000**

Organized sports activities were activities led by coaches or instructors. Participants were asked to report the activity types per week they engaged in during after-school hours. The time spent in organized sports activities during the week was reported in minutes as well. ***Household activities*** were duties related to the home environment, such as babysitting younger siblings or performing household chores. The household activities included optional household chores to choose from: cleaning, walking the dog, taking care of siblings, and other chore-related activities around the house. In the "other" category, participants reported activities they performed such as shovelling snow, delivering newspapers, or raking leaves. ***Self-initiated sports activities*** included non-organized leisure time activities that girls performed in without supervision. Participants were asked to report the activity types per week they engaged in during after-school hours.

PE Homework

PE homework included physically active assignments given by a PE teacher related to the content of PE lessons. The assignments had different tasks, such as practicing motor skills, involving parents in the activities, adding students' own decision making and self-determination, and varying exercises that included endurance and moderate to intense physical activities (Kääpä et al., 2019). The PE homework was part of the PE undertaken by all the girls; homework assignments were given to all students in each PE lesson. Even if the PE homework was not mandatory, most of the students (89.7%) did the assignments (Kääpä et al., 2017). The PE homework assignments often involved strength training such as squats or abdominal crunches, jogging with a family member, or a sport skill such as throwing a tennis ball against the wall. For the PE homework, participants reported the frequencies and time spent doing PE assignments in minutes**.**

Accelerometer Data

The participants wore a tri-axial accelerometer UKK RM42 (Urho Kekkonen Fitness Institute Foundation; Tampere, Finland) for 7 consecutive days. The UKK RM42 is easy to use because it is small and lightweight and has shown to produce accurate estimates of youth activity levels (Vähä-Ypyä et al., 2017). A comparison between accelerometer brands (Hookie and Actigraph) showed excellent agreement and assured reliable use in studies of adolescents' physical activity and sedentary behaviour as well (Aittasalo et al., 2015). In addition, this accelerometer can be used for over a week without recharging.

Analysis

The tri-axial accelerometer data were uploaded and stored. After the data were uploaded, a statistician from the UKK Institute transferred the data into Excel form. The collected data were analysed in 6-second epochs, and the mean amplitude deviation (MAD) of the resultant acceleration signal was calculated for each epoch (Vähä-Ypyä et al., 2015b). Furthermore, the measured MAD values were converted to metabolic equivalents (MET) in a method established in prior literature (Vähä-Ypyä et al., 2015b). The amounts of time spent standing still, sitting, and lying, as well as physical activity levels, were separated into unique variables; in addition, the number of daily steps was separately calculated. The classifications were based on the angle for posture estimation (APE) algorithm, comparing the accelerometer orientation in relation to an identified upright position at the end of each 6-second epoch (Vähä-Ypyä et al., 2018).

The reported data from the self-reported diaries complemented the accelerometer data. All the data were analysed using SPSS software. The total daily measurement time varied between activity groups (low-active girls 13 hours 53 minutes, moderately active girls 15 hours 5 minutes, and high-active girls 14 hours 37 minutes). To compare METs between activity groups, the total MET values are presented in proportion to the participants' daily measurement time. Proportioned MET values in light, moderate, vigorous physical activity and MVPA, along with standing and sedentary behaviour (sitting and lying), were compared between the low, medium, and high activity groups using analysis of variance (ANOVA) with Tukey and Tamhane post-hoc tests. The mean frequencies per week of organized sport activities and self-initiated activities were compared using ANOVA with Tamhane post hoc test between the low, medium, and high activity groups. An independent-samples Kruskal-Wallis test with a Bonferroni post-hoc test was used to compare the small sample sizes in the frequencies by type: organized sport and self-initiated type.

Results

Daily Total Physical Activity

Individual daily total MET values varied between 43.8 and 158.6 METs, and average values were found to be 67.2 METs for the low-active girls' group, 78.0 METs for the moderately active group, and 87.5 METs for the high-active girls' group (see **Table 1**). Participants spent most of their physically active time at a light activity level. The light activity accounted for 13.9% of their total waking hours, while moderate-to-vigorous physical activity (MVPA) accounted for 11.2% of their total waking hours. The participants were divided into activity groups according to their total mean MET values. Significant differences between the groups' physical activity levels were evident. The high-active girls were more active in all intensity levels and had the lowest percentage of time in sedentary behaviour. The high-active girls had significantly more light intensity physical activity than the other groups of girls (moderate-high $p = 0.002$, low-high $p < 0.001$). At the vigorous intensity level, the group of low-active girls had significantly lower values than the moderate and high-active groups ($p < 0.001$). In total MVPA, all the groups significantly differed from each other. For example, the low-active girls' MVPA was 8.9% of daily measurement time compared to 13.4% ($p < 0.001$) of the high-active girls' measured time.

After-School Physical Activity

Approximately 46% of daily activity was accumulated during after school hours. During after-school hours, the participants' METs varied between 12.9 and 55.1; the average values of the low, moderate, and high active groups were 30.8, 36.3, and 40.3 METs, respectively (see **Table 1**). Altogether, the mean hourly afternoon MET value was an average of 4.2 METs per after-school hour. On average, the participants' physical activity intensity after school was spent at a moderate level (3–6 METs) (see **Figure 1**). The high-active girls averaged 4.7 METs during after-school hours, while the moderately active girls' average was 4.3 METs, and the low-active girls averaged 3.6 METs (high-moderate $p = 0.253$, moderate-low $p = 0.005$, low-high $p < 0.001$).

In total, the first after-school hours were the most active ones for all participants. The low-active group's physical activity declined below 4 METs as early as at 4 pm and stayed low for the remainder of the evening, reaching its lowest intensity level (2.96 METs) at 9 pm. The low active girls had only one peak during the

afternoon hours, from 6:00 pm to 7:00 pm, reaching 3.78 METs. The METs of participants in the low-active group were significantly lower than the values of participants in the other two groups during several afternoon hours: 4:00 pm to 6:00 pm and 7:00 pm to 9:00 pm. The moderately active girls' activity level remained steady between 4 and 5 METs during afternoon hours, and their MET values declined below 4 METs after 8:00 pm. The high-active girls' peak MET value was from 2:00 pm to 3:00 pm (5.22 METs), then declined slightly, but increased again at 5:00 pm to 6:00 pm (5.09 METs). The high-active girls' physical activity level stayed over 4 METs during the entire evening.

Self-Reported Physical Activity

The participants' after-school physical activity in different activity patterns (organized sport activities, household activities, self-initiated activities, PE homework) varied, depending on the activity group (see **Table 2**). ***Organized sports*** frequencies varied from the high-active girls' 3.02 occasions/girl/week to the low-active girls' 2.02 occasions/girl/week, reflecting significant differences in sport involvement between the high-active group compared to the other two groups ($p \leq 0.004$).

Among all participants, football, dance and dance-related sports, gymnastics, and "other ballgames" were the most popular after-school ***organized sports*** activities (**Figure 2**). The high-active girls were mainly represented in football and dance, moderately active girls in other ball games (floorball, basketball, volleyball, and Finnish baseball), and low-active girls in the "no activities" section. In addition, the low-active

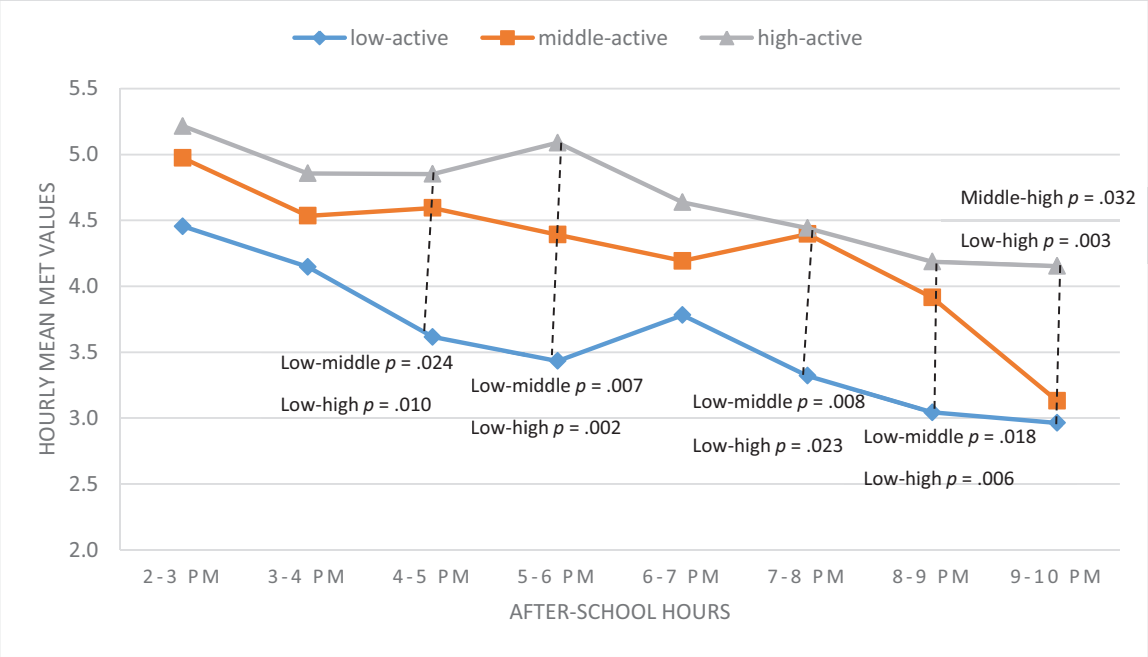

Figure 1: Comparison with Tamhane post hoc test of mean MET values during after-school hours among high-, middle-, and low-active girls'. Significant differences are included in the figure.

Table 2: After-school activities (frequency, f) /girl/week and standard deviation, SD according to activity groups with a Tamhane post hoc test.

	High-Active Girls	Middle-Active Girls	Low-Active Girls	Total	*p* Value	*p* Value	*p* Value
	(*n* = 29) *F*	(*n* = 27) *F*	(*n* = 26) *F*	(*N* = 82) *f*	High-Middle	High-Low	Middle-Low
organized sports activities (SD)	3.02 (1.61)	2.36 (1.84)	2.02 (2.07)	2.47 (1.89)	**.004**	**.000**	.331
household activities (SD)	2.82 (2.62)	3.24 (2.64)	3.58 (2.71)	3.21 (2.67)	.465	**.029**	.738
self-initiated activities (SD)	2.87 (2.5)	2.59 (2.22)	2.45 (2.06)	2.64 (2.27)	.784	.296	1.000
PE homework (SD)	1.97 (1.49)	1.96 (1.56)	1.77 (1.33)	1.9 (1.46)	1.000	.654	.770

girls were well represented in the category of "other," which included sports such as horseback riding, body-conditioning exercises, swimming, martial arts, strength training, and skating.

For the ***self-initiated activities***, the high-active girls showed the highest frequency of involvement (2.87 occasions/girls/week) and had the most different types of activities compared to the girls in the other groups. Although the differences were not statistically significant, the high-active girls were the ones who sought out additional activities that were physically demanding. In ***self-initiated activities***, the most frequent reported choices were running or jogging, walking, body-conditioning exercises, and playing outside (see **Figure 3**). The high-active girls were most represented in the categories of walking, "other", and no activities. The moderately active girls were the biggest group in running/jogging and in playing outside. The low-active

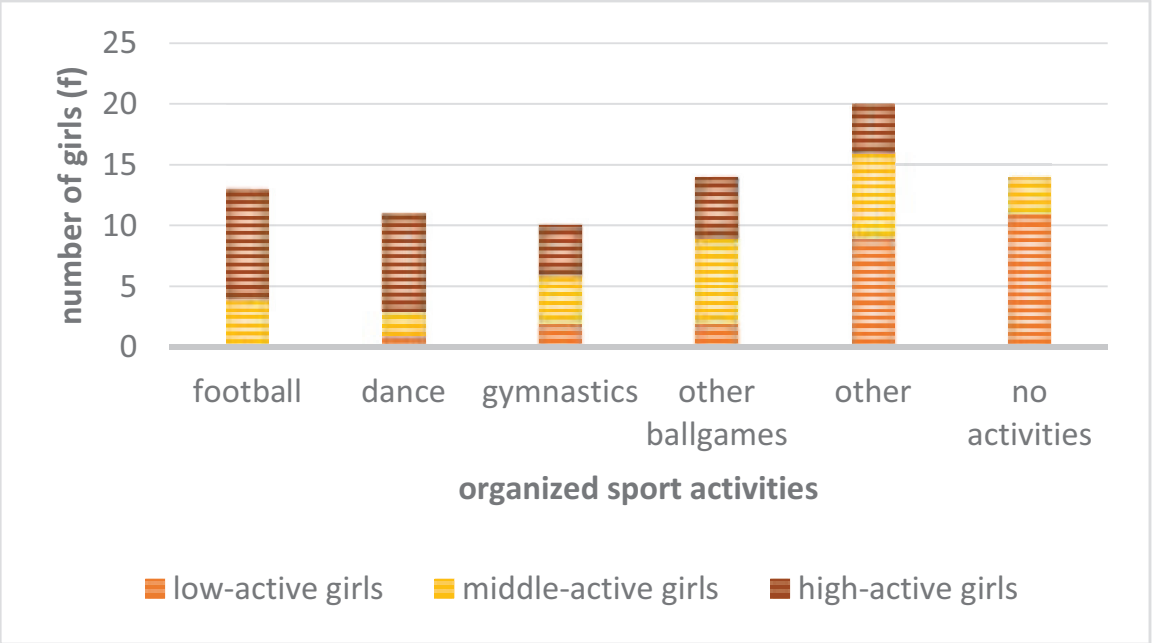

Figure 2: Organized sports (*f*) by activity group.

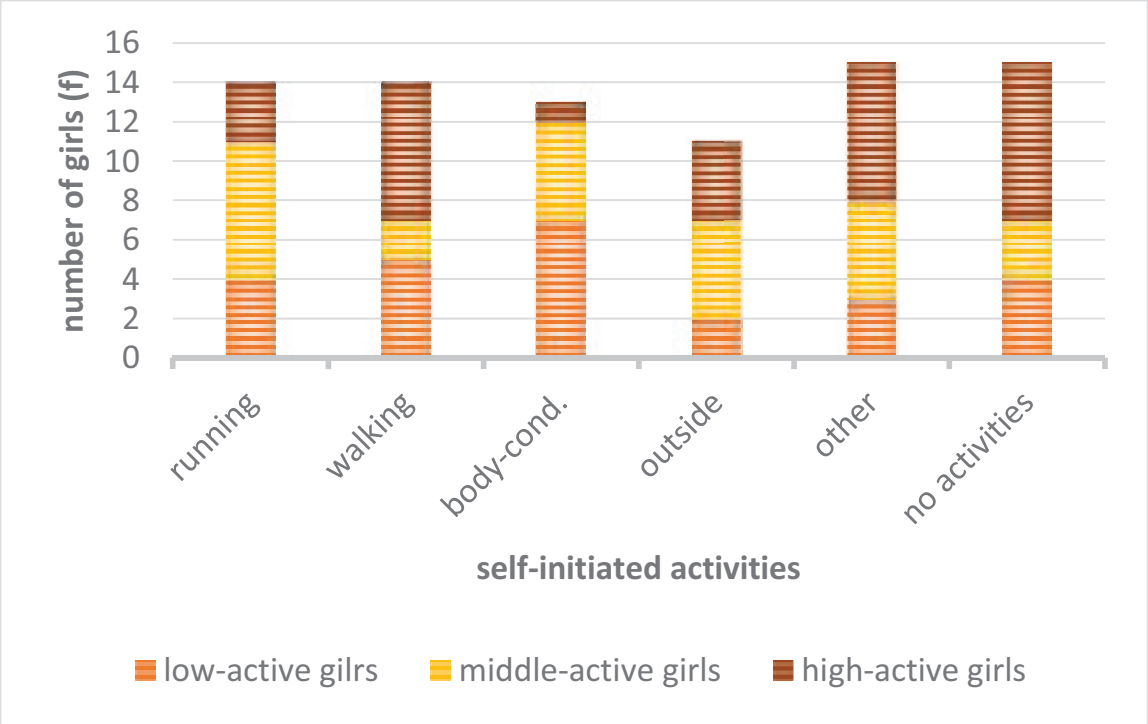

Figure 3: Self-initiated activities (*f*) by activity group.

girls were most represented in body-conditioning exercises. The most frequent activity behaviour in total was ***household activities*** (3.21 occasions/girl/week); frequencies varied from the low-active girls' 3.58 occasions/girl/week to the high-active girls' 2.82 occasions/girl/week ($p = 0.029$). The most common household chore in all activity groups was cleaning, followed by taking the dog out and taking care of siblings.

The total activity frequency of doing ***PE homework*** was 1.9 occasions per girl each week. In this behaviour, the frequencies for the girls' activity groups were close to one other. In terms of duration, girls' PE homework time was, on average, 34 minutes per week for each girl. The low-active girls' weekly PE homework time was, on average, 26 minutes per week. For the moderately active girls, it was 33 minutes per week, and for the high-active girls, it was 41 minutes per week. The differences between the groups were not significant but indicate that the high-active girls spent the most time on average engaging with the PE homework.

Discussion

The present study sought to understand the physical activity patterns of adolescent girls during after-school hours, as well as the effects of a PE homework intervention to increase girls' activity levels. During the after-school hours, the timing and variety of activities differed considerably between the low-active, moderately active, and high-active girls. Thus, this study brings new information about girls' physical activity timing and types in different activity groups for the promotion of physical activity.

After-School Activity Patterns

It was clear that after parsing out the data, the high-active adolescent girls had the greatest intensity of activity that also remained fairly stable throughout the after-school period. During the last hour of measurement, the high-active girls were still significantly more active than the others were, likely due to participation in organized sports, commuting back home, doing some active chores around the house, and taking care of their evening tasks, for example showering. For the low and moderately active youth, however, the level of activity dropped considerably; the most significant MET value differences occurred from 4 pm to 6 pm and 7 pm to 9 pm. This is likely due to the differences across groups in organized sports participation given that practices and games can last until the evening hours (Koorts et al., 2011; Taverno Ross et al., 2013). Thus, it might be late when students commute back home and complete their necessary evening tasks, such as chores and showering. Getting to and from activities are factors that may moderate adolescent girls' physical activity (Lytle et al., 2009). Lytle et al. (2009) suggested that addressing the barrier of getting to and from activities by making them easily accessible could increase levels of physical activity for low active youth when the barrier to participation could be accessibility to the organized sport.

In the after-school period, the first after-school hours were the most active ones for all three activity groups. Active commuting from or school and some late afternoon PE lessons likely had an effect on the increase in after-school hours of physical activity. In Finland, physically active commuting home is common, even during the wintertime when over half of school aged children or adolescents (52 %) choose active school transportation (walking or cycling) over motorized non-active transportation (Mehtälä et al., 2020). Active transport in youth has been observed to predict health benefits, such as lower weight status and higher adult physical activity, especially in early midlife (Yang et al., 2014). Investing in sidewalk networks near the homes and schools of youth as well as developing transport infrastructures that attract youth to take part in active transport would also serve as key catalysts to increasing activity in children and adolescents (Mehtälä et al., 2020).

In terms of total MET values during the day, MVPA comprised 11.2% of the girls' day, which is higher than prior international studies have found (Graham et al., 2014; Júdice et al., 2017; Klinker et al., 2014; Kokko et al., 2018). According to Graham et al. (2014), American adolescent girls engaged in 5 hours/week (43 minutes/day) of MVPA. In Klinker et al. (2014), Danish adolescent girls' proportion of time spent daily in MVPA was 6.7%. Sitting took most of the participants' time (47.57% of the day). Although the time spent being sedentary is more than the World Health Organization recommendations (Currie et al., 2008), this appears lower than other countries, which have found rates as high as 61% in adolescents (Okely et al., 2011). The analysis of individual low-active girls showed that some adolescent girls were sedentary for the entire after-school period. To support a healthy lifestyle and physical activity for those girls who are not interested in or do not have access to sports activities, efforts to promote self-initiated and household activities are particularly important. According to a study by Corder et al. (2013), among adolescents, the familiarity of an environment for physical activity might be important, and the most common activities take place at home or in a neighbourhood setting. The self-initiated activities (2.64 occasion/girl/week) or household activities (3.21 occasion/girl/week) were frequently mentioned in this study for low-active youth.

These unstructured and informal exercises may represent a less threatening alternative for adolescents who lack athletic competence (Lawler et al., 2017) and encourage adolescent girls to be more active outside of school and in the home environment (He et al., 2013).

PE Homework Effectiveness

Although not surprising to note that low and moderately active youth did not engage in as much after-school activity as the high-active group, it is important to note that the PE homework intervention *did* increase the amount of physical activity each girl engaged in during after-school hours. This is one of the few studies to suggest that PE homework in adolescent girls could increase the amount of physical activity time they accumulate each day. PE homework added an average of 34 minutes per week to the physical activity of each girl during after-school hours and has been shown in prior research to increase daily step counts for youth as well (Duncan et al., 2011). Because the results are from self-reported diaries, the intensity of PE homework is unknown. Adding PE homework to girls' after-school lives could lead to some sedentary behaviours being replaced by more active and productive activities, however. For the low-active girls, PE homework added on average 26 minutes of activity time in a week. Replacing at least 10 minutes of daily sedentary time with physical activity appears to be a minimal starting point to combat declining physical activity in youth (Corder et al., 2015). In an earlier study from the United States, Trilk et al. (2016) found that girls who participated in homework had a higher average of daily minutes of physical activity and less of a decline in physical activity from grades 6 to 8. Learned habits of completing homework may help to sustain at least light physical activity during adolescence. Creating functional knowledge and teaching adolescents how to be active on their own might result in lifelong healthy behaviour (Duncan et al., 2011); PE homework may be one such way to improve daily physical activity habits in adolescents and thereby increase healthy behaviours over the lifespan.

In the present study, PE homework assignments were related to the Finnish national PE curriculum (Finnish National Core Curriculum, 2014). Due to the relatively short school days in Finland, homework is a common way of adding practice time in many school subjects, but assignments in PE are rare. However, when they are given such assignments, students in Finland complete them with a high degree of compliance (89%; Kääpä et al., 2017). In the present study, the pupils participated in decision-making concerning the content of PE homework assignments, and they could decide the amount and intensity level of the activity in the assignment themselves (Kääpä et al., 2017). Fostering perceptions of ownership over participation in physical activity and creating opportunities for decision-making may enable girls to be active in a way they choose (Corder et al., 2013; Deci & Ryan, 2000; Lawler et al., 2017). Reinforcement by influential adults, such as PE teachers and coaches, may support pupils' involvement in sporting activities (Trilk et al., 2012). By including popular sports in PE homework, the PE teacher can advocate for sports participation outside of school and add skill practice outside of the class to lower the threshold for participation in sports as well. Introducing active homework activities into existing curriculum is a cost-effective way to utilize the expertise of trained teachers (Duncan et al., 2011). The curriculum-based assignments also enable teachers to effectively deliver health-related educational material without sacrificing their formal teaching obligations and learning objectives (Duncan et al., 2011).

Types of After-School Activities

In organized sports activities, the frequencies of the high-active girls were clearly higher compared to other groups. In terms of specific sports, the high-active girls were mainly represented in football and dance, moderately active girls in other ball games, and low-active girls were the main group in the no activities section. Encouraging female youth to engage in the more popular organized activities among adolescents might help those youth who do not like sports, are less skilled, or perhaps not motivated at competitive sports to be more physically active. In addition, increasing adolescent girls' participation in organized sport activities might help to better sustain physical activity levels over time (Bélanger et al., 2009; Pate et al., 2010). The most popular self-initiated sports activities were jogging, walking, body-conditioning exercises, playing games outside, stretching, and dancing with video games. Many of these behaviours are typically done at a low-intensity level, spontaneous and unstructured, and they might attract girls who are not interested in high-intensity activities or competitive sports. The special abilities or skills that are often required for organized sport activities or team sports are less necessary for taking part in self-initiated physical activity such as walking, jogging, or non-competitive pursuits. It is possible that some older girls substituted organized sport activities for spontaneous activities (such as walking, running, or body-conditioning exercises). Interest in a healthy lifestyle, including physical activity, might be attributed to heightened body awareness during

adolescence (Sand et al., 2015). The increase in the number of gyms, knowledge about the health benefits of training, and concern with one's body may be important factors regarding adolescents' preference for certain types of activities (Coll et al., 2014; Koorts et al., 2011). Identifying the adolescent girls' preferred types of physical activity may help influential adults to offer activities the adolescents enjoy. In addition, earlier studies have shown that low-intensity physical activities such as walking are more sustainable than forms of MVPA throughout adolescence (Pate et al., 2010; Trilk et al., 2012). The girls from all activity groups participated in self-initiated activities, which are easy to access. The selection of different self-initiated activities was the most diverse in the high-active group of girls, and thus, an effective strategy for increase MVPA among low and moderately active youth might be to offer a more diverse repertoire of choices to increase physical activity during leisure time.

The frequency of the low-active girls was the highest in household activities. Cleaning, taking the dog out, and taking care of siblings were the most popular household activities. Duties related to the home environment are usually occupational and more or less obligatory; due to this, these activities do not usually decrease over time. However, these duties might reduce the time and opportunities to participate in organized sport or self-initiated activities that would allow adolescents to increase the amount of time spent in MVPA. It is important to note that low-active girls have shown lower odds of active transportation (Mehtälä at al., 2020). Thus, one implication from the present study would be to add active transportation as a PE homework assignment given the sharp drop in activity that occurred for the low-active girls after school. Further, in Finland, physical activity during school hours (particularly at recess) has been a target of national interventions (Haapala et al., 2014). According to Haapala et al. (2014) and the *Finnish Schools on the Move* study, organized recess activities, student recess activators, equipment provision, the development of sports facilities, and gender-specific physical activities have all contributed to significant gains in youth activity. A 15-minute break after every 45-minute lesson in Finland also provides youth with consistent opportunities to be active during the school day. In the schools from the present study, it is mandatory to go outside to the schoolyard during recess breaks. This could likely activate even the low-active girls during school hours and can be a further target of intervention to increase activity among low-active youth.

Strengths and Limitations

This study incorporated several sources of data, providing a broader view of adolescent after-school physical activities (Ekelund et al., 2011; Pate & O'Neill, 2009). Objectively measured physical activity data and the self-reported physical activity measure allow for accurate intensity, frequency, and duration data for physical activity, while the self-report measure provides a rich context for understanding adolescents' activities during after-school hours. However, the cross-sectional nature of the case study is a limitation and precludes conclusions being made about the direction of effects between adolescent girls' physical activity and the behaviours of physical activity participation. Because of the small sample size, the data cannot be considered globally representative. However, given similar Westernized practices and schooling, it is likely that the physical activity patterns and types are reflective of those of Finnish lower secondary school girls across the country.

Conclusion

This study offers a picture of the diverse nature of the physical activity of secondary school girls and identifies the variety of behaviours and types of physical activity that girls perform during after-school hours. Utilizing these results can help influential adults encourage girls—especially low-active girls—to be active in a way they choose to be, as well as improve offerings for an array of activities that girls may be more motivated to engage with in the future. An effective approach to promoting physical activity could be to experiment with school-based programs that target girls in after-school hours with the types of physical activity they prefer. It is important that researchers and policymakers recognize the school environment as a vehicle for changing girls' physical activity levels during after-school hours. School reaches all adolescents, so it can play a central role in delivering effective physical activity programming. As demonstrated in this study, PE homework assignments may have the potential to replace sedentary time and thereby increase physically active time for female youth.

Competing Interests

The authors have no competing interests to declare.

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IV

THE ROLE OF PARENTAL SUPPORT AND THE STUDENTS' OPINIONS IN ACTIVE PHYSICAL EDUCATION HOMEWORK IN FINLAND

by

Kääpä, M., Palomäki, S., Valleala, U.M., Fedewa, A., & Hirvensalo, M.

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