

Physical activity level in physical education among 13-year-old Norwegian adolescents

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Abstract

Physical education (PE) provides opportunities for adolescents' structured and regular physical activity (PA). The aims of this study were to examine how much of the PE time 13-year-old students were in moderate and vigorous physical activity (MVPA) level and differences between boys and girls PA level at PE. Furthermore, to examine associations between 13-year-old students' MVPA level in PE, and minutes of weekly PE, general weekly MVPA, gender, and sport participation. To examine the aims of the study, 200 students used accelerometers for a week, and answered a questionnaire. A main finding was that PE only makes a minor contribution to youths' fulfilment of PA recommendations, by comprising 4% of the adolescents' general weekly PA level. Furthermore, the results demonstrated that the students were in MVPA only 24% of the PE time. The boys had a higher general activity level in PE than girls, and lower sedentary activity and higher moderate activity in PE, compared to girls. Finally, the results showed that the MVPA level in PE was positively associated with more weekly minutes of PE, and activity level in general. Considering our findings, we argue that the PA level at PE contributes relatively little the adolescents' general weekly MVPA level, and therefore, PE should primarily be viewed as a tool to inspire exploration and learning, and the joy of movement in and through various physical activities among both genders, and not primarily as a source for adolescents PA.

Keywords: *physical education; adolescents; physical activity level; gender*

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Introduction

Previous research has shown that physical activity (PA) level during youth is positively related to several major health benefits, including positive changes in adiposity, cardiorespiratory fitness, skeletal health, and experiences of quality of life (Blair, 2009; Loprinzi et al., 2012; Marker et al., 2018). However, a major concern exists regarding the decline in PA during adolescence (Bélanger et al., 2009; Reilly, 2016;

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Steene-Johannesen et al., 2019), and the fact that many youths do not accumulate the minimum of 60 minutes of daily PA recommended for health (Bull et al., 2020; The Norwegian Directorate of Health, 2022).

As a mandatory subject in the Norwegian school's curriculum, physical education (PE) is a context for PA that includes every student – which is not the case in organized sports, where participation is voluntary. Thus, PE provides structured and regular PA through most parts of adolescence, and is therefore considered to be an important contributor to students' health and well-being (Calahorra-Cañada et al., 2017; Chen et al., 2014; Long et al., 2013; Pate et al., 2007).

In 2012, Sallis et al. highlighted the importance of establishing stronger policies supporting active PE and achieving wide acceptance of public health goals within PE. In the later work of both UNESCO (2015) and WHO (2018), international strategies and guidelines to ensure sufficient quality PA during school and PE have been published. This prominent health discourse in PE has in several years exerted influence on schools' PA policies and PE in many countries (Carlson et al., 2013; Mong & Standal, 2019; Quennerstedt, 2019). Accordingly, in an interview study of Norwegian PE teachers, Mong (2019) found that PE for the most are taught in traditional ways with teachers predominantly communicating a biomedical perspective of health to their students, especially focusing on the physical activity in PE, and less on the psychological and social resources of health. However, in the recent national curriculum for PE in Norway (The Norwegian Directorate for Education and Training, 2020), more attention has been directed towards students' processes of exploring and learning in and through movement and relational competence. Less attention has been given towards the public health goals for sufficient PA with moderate and vigorous intensity (MVPA). Consequently, minutes of PA or MVPA during school and PE are less emphasized as a specific aim in the curriculum (The Norwegian Directorate for Education and Training, 2020). PA with moderate and vigorous intensity is well proven to optimize the relation between PA and multiple health benefits (Bahr & Karlsson, 2015; WHO, 2010).

Despite of the less pronounced health discourse related to providing sufficient PA in PE in Norwegian schools (Vinje et al., 2023) and that the curriculum is focusing more upon other aspects (The Norwegian Directorate for Education and Training, 2020), research on students' MVPA behavior remains an important indicator on how health-related lifestyles play out among young people during schooltime. Furthermore, research on PA may also serve as an indicator on students' involvement in exploring and learning processes within PE.

[Previous research on MVPA in PE](#)

According to previous research, PE seems to play an important role in providing opportunities for PA among adolescents (Hollis et al., 2017; Mooses et al., 2017). Several other studies from the last two decades support these findings. Chen et al. (2014) found significant positive associations of minutes of MVPA in PE and minutes

of daily MVPA among 12-year-old students. Furthermore, an intervention study among girls revealed that those who were enrolled in PE, reported more MVPA than non-enrolled girls (Pate et al., 2007). The authors concluded that expanded enrollment in PE may increase adolescents' PA level. However, most international research finds that activity level during PE among primary and middle school students is somewhat low to medium, reaching from 27 to 47% of the time spent in MVPA (Chen et al., 2014; Fairclough & Stratton, 2005; Hollis et al., 2017; Meyer et al., 2013; Singerland et al., 2011; Viciano et al., 2016). All the studies showed thus a proportion of PE spent in MVPA, which was lower than the UK Association for Physical Education and the US Centre for Disease Control and prevention recommendation of 50%. Differences in time spent in MVPA during PE may be due to differences in the curriculums for PE in the different nations. However, the referred studies have explored the students's MVPA level in non-intervention classes – classes where PE have been conducted according to their statutory programs, focusing on knowledge, skills and understanding. A common finding in these studies, as in previous studies (Alderman et al., 2012; Calahorra-Cañada et al., 2017; Mayorga-Vega & Viciano, 2017), was that adolescents were more active on days with PE than on days without PE.

A Norwegian study among 15-year-old students revealed further that the time spent in MVPA at PE, contributed only 4.3% of the students weekly MVPA (Andersen, 2017). This is an important, but quite small contribution to the fulfilment of the weekly PE recommendations (The Norwegian Directorate of Health, 2022; WHO, 2010). The Norwegian finding are in line with Viciano et al. (2016), who found that students MVPA level were higher during after school time than in PE, but higher during PE than during the school's recess time.

Chen et al. (2014) found that the daily MVPA level was related to students' MVPA level in PE. Even if most studies using accelerometers do not examine gender differences, several studies shows that girls' activity level in middle school PE is lower than that for boys (Alderman et al., 2012; Andersen, 2017; Chen et al., 2014; Jago et al., 2009; Smith et al., 2009; Viciano et al., 2016). It has also been conclusively shown that students who participate in sport, have a higher activity level, in general, than students who do not participate in sport (Aarnio et al., 2002; Renfrow et al., 2011; Santos et al., 2005). However, knowledge of the association between students' sport participation and MVPA level at PE is lacking.

Even if some studies related to MVPA level in PE, gender differences, and factors associated with MVPA level in PE has been conducted, such studies are lacking from a Norwegian context. Building on the previous discussion, the aim of this study was to examine: *How much of the PE lessons are 13-year-old students in MVPA level, and are there e differences between boys and girls PA level at PE?* Furthermore, this study aimed to examine; *What are the associations between 13-year-old students' MVPA level in PE, and; minutes of weekly PE, general weekly MVPA, gender, and sport participation?*

Method

The study is based upon a cross sectional study design. Accelerometers were utilized to objectively measure PA levels, and a questionnaire was used to measure sex, and sport participation. From a health perspective, accelerometer-measures are recognized to be the most reliable method to estimate peoples PA (Kolle et al., 2012; Pedišić & Bauman, 2014; Steene-Johannesen et al., 2019). Approval to use the data and conduct the study at the high schools was granted by the Norwegian Social Science Data Services (NSD, project number 52552). Ethical standards were followed in accordance with the ethical guidelines of the Norwegian National Research Ethics Committees (2016) and the Declaration of Helsinki.

Participants

7th grade students from two municipalities in mid-Norway with all 19 lower secondary schools were selected with a stratified selection for a larger Ph.D. project on adolescents' relation to PA (Mikalsen, 2020). The employed data in the present study stems from this project's data-pool. The included municipalities are representative of most municipalities in Norway, with an equal sample of boys and girls, both "urban" and "rural" students, and students from different socioeconomic groups. One of the schools (a school with very few students) declined to participate in the study. Another school went on a bike ride in PE the week in which the data collection took place (bike activity is poorly measured by accelerometers), and a third school was excluded due to too many students with invalid accelerometer data. The data were based on students from 16 schools with 328 7th grade students. However, some students did not participate, and some students had invalid accelerometer data (probably had forgot to take on the accelerometer when they were changing to other clothes before their PE). The data analyses were based on the 100 girls and 100 boys (mean age = 12.7 years) with valid accelerometer data. These 200 students with valid data constitute a response rate of 61%, which is satisfactory in such a large project, including students from several schools and with high-quality-based procedures for valid accelerometer data (Baruch, 1999). An independent t-test showed that the MVPA at schooltime was not significantly different between students with or without valid data ($t = -1.2$, $p = 0.217$).

Table 1 shows the number of participants from each school that participated with valid data, and the number of students that did not had valid data because they that not participated or had invalid accelerometer or questionnaire data. Descriptive data of MVPA in PE in the different schools are also included in the study.

Procedures

The measurements occurred during April and May 2017. The students were given an accelerometer to measure activity level measured in counts per minute (CPM) and minutes of MVPA. ActiGraph GT1M accelerometers (ActiGraph, Fort Walton

Table 1. Descriptive data of the 7th grade participants related to minutes of MVPA in PE in the different schools included in the study

School number	Mean	Standard deviation	Number of students included/not included	Percentage students with valid data
1	26.7	13.3	13/14	93%
2	22.7	7.9	15/15	100%
3	43	17.6	30/35	86%
4	20.3	9.8	26/31	84%
5	26.5	15.9	8/12	67%
6	16	17.2	20/31	65%
7	22	7.8	7/9	78%
8	22.6	8.4	8/9	89%
9	5.2	3	5/7	71%
10	24.4	10.3	21/24	88%
11	48.4	11.1	14/40	35%
12	20.3	3.4	4/17	24%
13	60.9	22.4	8/15	53%
14	51.3	12.5	3/7	53%
15	24.5	7.1	6/25	24%
16	15.6	9.3	12/37	32%

Beach, FL, USA) were employed to objectively measure the 13-year-olds’ PA over seven consecutive days, which is recommended by several researchers (Addy et al., 2014; Penpraze et al., 2006; Trost et al., 2005), and the same type of accelerometer and length of study were also applied in a large population study of Norwegian 15-year-olds (Kolle et al., 2012). According to the procedures of Norwegian population studies of adolescents (Kolle et al., 2012), the students should wear the accelerometer on a belt on their right hip for one week, only removing it when going into water or sleeping. The ActiGraph GT1M is validated and reliability-tested against the global PA recommendations, and used in Norwegian population studies (Hansen et al., 2014). It is a very suitable measurement of young people’s PA behaviour, that is acceptable in relation to defining their PA intensity level.

After one week, the accelerometers were collected by the test leader by meeting the students in the classroom at their respective schools. The students did also answer a questionnaire, that included questions about gender and their physical activity behavior during the recent week (i.e. How many times during the week you wore the accelerometer did you bicycle for more than ten consecutive minutes? Was the week you wore the accelerometer less [...] more active than weeks in general?).

The data from the accelerometers were downloaded into the program Actilife v6.13.3 (ActiGraph, LLC, Pensacola, FL, USA) and analyzed. In line with the protocol, 10-second epochs were used, and missing data were defined as continuous

periods of 20 min or more with no counts (Kolle et al., 2012). All activity during the night (24:00-06:00) was deleted according to the same test protocol. Each day had to include at least 480 min of recorded data to become valid, and each student had to have at least two valid days to be included in the analyses. Count thresholds for the various intensities were defined following Norwegian population studies. Activity with less than 100 CPM was interpreted as sedentary, while light activity was defined as 100–1999 CPM (Kolle et al., 2012). PA between 2000 and 5998 CPM was considered as moderate intensity, while the count threshold for vigorous activity was defined as 5999 CPM (Kolle et al., 2012). MVPA was minutes with moderate and/or vigorous PA. Furthermore, the main teachers of the students were asked to provide information about when the students had PE and how long they had PE – data that were used to define minutes of weekly PE, but also to identify the PA level in PE for each class in Actilife. The tests were carried out by the same test leader, with the same equipment, and with the same test procedures.

Statistical analyses

The descriptive results are presented by mean, standard deviation, percentage (%), and scatter plots. The assumptions of parametric test were met (O'Donoghue, 2012), and parametric tests could be used. Independent t-tests were used to examine differences in PA level between boys and girls, and differences in MVPA at schooltime between students with or without valid data (O'Donoghue, 2012). Linear regression was used to examine associations between 13-year-old students' MVPA level in PE, and minutes of weekly PE, general weekly MVPA, gender, and sport participation, respectively (O'Donoghue, 2012). The data was checked for invalid data (outliers, missing plots, and wrong plots), and removed or replaced. The level for significance was set at $p < .05$. Statistical analysis was performed with SPSS, version 28.0 (IBM, Armonk, NY, U.S.A.).

Results

Table 2 shows descriptive data in relation to examine the first two parts of the aim of the study; How much of the PE time are 13-year-old students in MVPA level? In relation to PA level, the analyses showed that boys had higher daily MVPA ($t = -2.5$, $p = .012$), higher CPM at PE ($t = -2.3$, $p = .026$), lower sedentary activity in PE ($t = -2.2$, $p = .026$), and higher moderate activity ($t = -2.2$, $p = .031$), than girls. The students spent 21% (SD = 12) of their time at PE in MVPA. Further calculations show that, in general, PE minutes of MVPA comprised approximately 4% of the adolescents' weekly MVPA level. However, the variation of minutes of PE per week varied greatly, from 90 to 205 minutes (SD = 32).

According to the third part of the aim of the study, the study aimed to examine associations between 13-year-old students' MVPA level in PE, and; minutes of weekly PE, general weekly MVPA, gender, and sport participation. These variables

Table 2. Descriptive data MVPA, CPM, activity zones, and minutes of PE of the boys (n = 100) and the girls (n = 100) participating in the study

PA	Boys	Girls	Total
	M (SD)	M (SD)	M (SD)
Daily MVPA ^a	98 (29)	87.2 (23.8)	92.6 (27)
Minutes of PE per week	136 (32)	138 (31)	137 (32)
MVPA at PE	30 (19.7)	26.4 (16.7)	28.2 (18)
Average CPM	812.2 (218.4)	782.7 (231.9)	797.4 (225.2)
CPM at PE ^a	1336.3 (629.1)	1149.9 (539.3)	1243.1 (591.9)
Sedentary activity level time at PE (%) ^a	40 (816)	44.8 (14)	42.4 (15.3)
Light activity level time at PE (%)	34.7 (8)	33.7 (8.8)	34.2 (8.5)
Moderate activity level time at PE (%) ^a	21.1 (10)	18.2 (8.7)	19.7 (9.4)
Vigorous activity level time at PE (%)	4.1 (4)	2.9 (3.1)	3.5 (3.8)

Note. ^a = significant differences between boys and girls at a .05 level. PA = physical activity. M = mean. SD = standard deviation. MVPA = moderate and vigorous physical activity. PE = physical education. CPM = counts per minute

were included as independent variables in a regression analysis, using MVPA level at PE as the dependent variable. The results of the regression analysis in Table 3 show that both minutes of weekly PE ($b = 0.22, p < .001$) and students' general weekly MVPA level ($b = 0.11, p < .05$) were associated with MVPA level at PE. The unstandardized regression coefficient shows that 10 minutes more weekly PE, increases the MVPA level at PE with 2.2 MVPA, and that 10 more minutes of weekly MVPA, increases the MVPA level at PE with 1.1 MVPA.

Table 3. Factors associated with adolescents' MVPA level at PE

Variables	Model b (95% CI), p
Minutes of weekly PE	.22 [.14, .29], $p < .001$
Weekly MVPA minutes in general	.11 [.02, .20], $p < .05$
gender	2.84 [-1.72, 7.41], $p > .05$
Participation in sport	5.46 [-1.55, 12.46], $p > .05$
Constant/R ²	-18.45/.22

Note. b = unstandardized regression coefficient. CI = confidence interval. MVPA = moderate and vigorous physical activity. PE = physical education.

Discussion

The first main finding is related to the first part of the aim of the study: How much of the PE lessons are 13-year-old students in MVPA level? The results show that the students were in MVPA level 21% of the PE time. In comparison, this is approximately the same as students from Spain (Viciano et al., 2016), and lower than students from many other countries, such as the US, Switzerland, and the Netherlands (Chen et al.,

2014; Hollis et al., 2017; Meyer et al., 2011; Singerland et al., 2011). It is appropriate to highlight that our results show that the MVPA level in PE vary a lot between the 16 schools included in our study, and also between the students within each school. We assert that variation in MVPA level for one week, is natural because different activities require various intensity levels, as they do in for example yoga and five-a-side soccer. Indeed, it is highly probable that the 16 schools had different activities during the week of measurements, but also that this variation may reflect the natural variation of the general weekly MVPA level in PE among 13-year-old students in school. Even if the results are based on standard procedures of one week of data collection, including one or two PE lessons, one may criticize that not several PE lessons were included. Our findings show that PE minutes of MVPA accounted for only 4% of the adolescents' weekly PA level. This is in line with another study among Norwegian 15-year-old students. This study reported that the time spent in MVPA comprised only 4.3% of the students' weekly MVPA (Andersen, 2017). The time in MVPA level at PE in these studies among Norwegian students, is sharply contrasted with students from The Netherlands (Singerland et al., 2011) and Switzerland (Meyer et al., 2011), where PE minutes of MVPA accounted for 10% and 12% of adolescents' weekly PA level, respectively. Some of this contribution is due to more moderate and high intensity activity during PE, as well as more minutes of PE per week. Jago et al. (2009) argue that PE can be modified so that students spend more than 50% of the time in MVPA. However, even with the use of such a modification, PE will still only comprise 8% of the adolescents' weekly PA level. This low contribution of PA on a weekly basis is in accordance with Chen et al. (2014), who determined that the contribution of weekly MVPA from PE was minimal (2.2%).

Considering our finding related to PE as a contributor to students' weekly MVPA, other research seems to overestimate the importance of PE, as a context for significant contribution to young peoples' general MVPA level. Indeed, even if several studies found that adolescents were more active on days with PE than on days without it (Alderman et al., 2012; Chen et al., 2014; Meyer et al., 2011), the impact on weekly PA level seems minimal. This may primarily be because Norwegian 13-year-olds have only approximately two hours per week of PE. Meyer et al. (2011), on the other hand, highlighted that PE plays a considerable role in providing PA, and found that MVPA in PE accounted for approximately 18 minutes of MVPA daily. This is in line with a study of 12-year-old American students. The study demonstrated that the average time spent in MVPA during PE was approximately 16 minutes (Chen et al., 2014). Our finding related to MVPA level in PE indicates that the students ought to have at least two hours of PE every weekday if PE should be an important contributor to Norwegian adolescents total MVPA.

The second main finding is related to the second part of the aim of the study: Are there differences between boys and girls PA level in PE? The results showed that boys had higher CPM at PE than girls. The results also showed lower sedentary activity and higher moderate activity in PE among boys, compared to girls. Our findings are

in line with previous studies, showing that girls' activity level in PE middle school is lower than that for boys (Alderman et al., 2012; Andersen, 2017; Chen et al., 2014; Jago et al., 2009; Mayorga-Vega et al., 2017; Smith et al., 2009; Viciano et al., 2016).

The third main finding is related to the third part of the aim of the study: What are the associations between 13-year-old students' MVPA level in PE, and; minutes of weekly PE, general weekly MVPA, gender, and sport participation? The results show that MVPA at PE is significantly associated with more weekly minutes of PE. Although this finding may not seem surprising, this study contributes objective knowledge to the research area. The findings indicate that more minutes of PE in school will contribute more to adolescents' general weekly MVPA level, and thereby increase the possibility to achieve the daily PA recommendation. However, as previously argued, the number of minutes must increase dramatically to have an appreciable impact. In light of the results, we argue that minutes of MVPA should not constitute the major "PE effect." The findings that PE contributes to only 4% of the adolescents' weekly MVPA level, and that more minutes of PE or a higher activity level in PE will not increase this contribution tremendously, indicates that PE should not be primarily viewed as a tool for minutes of MVPA. Conveying and inspiring movement exploration and learning, knowledge, and understanding are vital to approaching PE's overall aim of lifelong enjoyment of PA (The Norwegian Directorate for Education and Training, 2020). Still, we assert that it is essential that some of the learning takes place at the MVPA level. This is because students need to learn how to exert themselves physically to the point that they sweat and breathe heavily, and to experience how vigorous PA can affect them psychologically within a continuum of positive and negative emotions. As Whitehead (2010) puts it: "through exercise and challenge of the powers of the embodied dimension, individuals celebrate a unique aspect of humanness [...] Effective deployment of the human capability is a holistic and rewarding experience" (p. 33). Having some of the PE at the MVPA level should thus be a part of the distinctive character of PE, in order for students to become physical literate (UNESCO, 2015; Whitehead, 2010). Having some of the PE at the MVPA level is a part of the distinctive character of PE and is especially critical for the well-being in PE of some groups of students (Bjerke et al., 2016). However, from a critical point of view we are aware of Quennerstedt (2019), who argue that PE is in danger of becoming a mere doing of sport, fitness instruction, PA facilitation or obesity prevention – a strategy based upon a biomedical perspective, focuses on teaching health through increasing the level of PA in PE (Mong & Standal, 2019). We are also aware of the strengthened discourse of education in PE, as a result of the new curriculum in PE (The Norwegian Directorate for Education and Training, 2020).

Our findings also show that a positive correlation exists between the students general weekly MVPA, and MVPA in PE. Overall, students that are active outside PE are also more active in PE. This finding is in accordance with Chen et al. (2014), who found that daily MVPA level, in general, influenced students' MVPA level at PE. Because of this, PE increase inequality according to PA level among school

adolescents. In this way, the PE subject might contribute to the creation of even larger differences concerning low-active and high-active adolescents. This phenomenon is also documented in preschools (Kippe & Lagestad, 2018).

Finally, the results show that minutes of MVPA in PE are not associated with gender or sport participation. According to the extant literature, these findings are somewhat surprising, but also very positive. Several studies from numerous countries have demonstrated that girls' general activity level in PE is lower than that for boys (Alderman et al., 2012; Andersen, 2017; Chen et al., 2014; Smith et al., 2009; Viciano et al., 2016). The results from another study with the same population (Kristiansen et al., 2020), found a significant association between gender and MVPA during schooltime. The findings of higher MVPA during schooltime (Kristiansen et al., 2020) and our finding related to no gender differences related to MVPA in PE, may indicate that boys have a higher MVPA level at recess. Although we know that students that participate in sport have a higher activity level in general than students who do not participate in sport (Aarnio et al., 2002; Renfrow et al., 2011; Santos et al., 2005), the non-significant association between MVPA level in PE and sport participation in this study indicate that PE do not contribute to such differences.

Strength and limitations of the study

The present study possesses several advantages. It includes a large number of participants, in which the distribution of adolescents gender distribution is equal, reflecting the actual gender distribution in Norwegian schools. The participants come from two Norwegian municipalities with both large and small schools, urban schools and village schools – which constitutes a representative sample of Norwegian schools. In addition, objective measurements of PA levels obtained with accelerometers offer a major advantage, as they decrease subjectivity (Sirard & Pate, 2001). Use of accelerometers also offers opportunities to compare findings with other studies, as accelerometers have been widely utilized over the last two decades (Troiano et al., 2014). The present study's use of accelerometry is based on high-quality standard procedures (Kolle et al., 2012).

Nevertheless, the present study is not without limitations. The response rate is 61% (ranging from 24% to 100%), and a higher response rate would have been preferable for increased generalizability of the findings. In addition, although accelerometry is considered to be a preferable measurement when assessing general PA in free-living conditions, it underestimates cycling or riding vehicles (Sirard & Pate, 2001). Our study found that percentage of PE time that students spent in MVPA in the included schools varied greatly, and we asserted that such variations would be natural during one week of school. Furthermore, even if the included 16 of the total 19 lower secondary schools in two municipalities in mid-Norway probably represents Norwegian students, randomly selected Norwegian schools had been preferable. To identify the schools' different contributions to MVPA in the future, PE data from one full year should be examined in future studies, and socioeconomic factors should be

included as control variables. Adolescents MVPA level at PE is clearly important, but precisely how the PE subject can inspire students to sustain a physically active lifestyle throughout their lives, constitutes a much more critical question. This question should be addressed in future research.

Conclusion

The study demonstrated that large differences existed between schools regarding MVPA in PE, and we assert that this is natural due to different activities. Furthermore, in general, the students were in MVPA level only 24% of the PE time, and PE comprised only 4% of the adolescents' weekly PA level. The study indicates that the PE contribution may have been overestimated according to youths' fulfilment of PA recommendations. The results also show that there were no significant differences between girls and boys according to MVPA in PE, light activity in PE and vigorous activity in PE. However, boys had higher CPM in PE than girls, and lower sedentary activity, and higher moderate activity in PE compared to girls. Furthermore, MVPA level in PE increases with more weekly minutes of PE, which is not surprising. The findings indicate that more minutes of PE in school will contribute to adolescents total MVPA level. A positive correlation was also found between MVPA outside PE and MVPA in PE, revealing that PE increases inequality according to PA level among adolescents. However, minutes of MVPA in PE were not associated with gender or sport participation. The practical implication of our study is that if PE should contribute significantly to adolescents weekly MVPA, considerably more minutes of PE should be offered. However, we will argue that minutes of MVPA should not be considered as a major "PE effect." Instead, students should be inspired to sustain a physically active lifestyle throughout their lives, as emphasized in the national curriculum in Norway. On the other hand, we agree with Green (2014), who claims that to better elucidate the PE effect, more longitudinal and biographical research is needed. Furthermore, PE should continue to be organized in a way that decreases gender differences related to PA level.

Disclosure statement

No potential conflict of interests was reported by the authors.

Author biographies

Pål Lagestad is a professor in physical education and sport at Nord University. One of his research areas is related to physical activity level and inclusion among adolescents at school and at leisure.

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