

Udeskole—Pupils' Physical Activity and Gender Perspectives



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1 Introduction and Background

Inactivity and obesity pose is a general and increasing health problem in many western countries. There is an ongoing debate how and with which initiatives this problematic development can be counteracted. As children aged 6–16 spend many hours a day in school, it can be argued that the school system can and should play an important role in promoting daily physical activity (PA), health and well-being (Janssen & LeBlanc, 2010). In Denmark the Ministry of Education (2014) introduced a school reform in 2013, trying to compensate for the lack of PA through a longer school day which included an additional 45 min daily PA on top of the usual few hours of physical education (PE) per week and recess—unfortunately with limited success.

Depending on the chosen teaching activities, two well organised PE lessons per week might give pupils a certain amount of moderate to vigorous activity (MVPA). There might be additional PA during the more unstructured recess school periods, which take place in a continuum from sedentary to very high activity levels. Therefore, the weekly amount of PA can be of questionable value in terms of health promotion in a school context. Some pupils are completely inactive and others very active. In general, regular PA and resulting health effects are important factors that can prevent lifestyle diseases later in adulthood, but they can also create important links between PA and learning (Sibley & Etnier, 2003; Åberg et al., 2009). The question is to what extent the school system can contribute to increase PA. A consensus conference conducted by the Arts Council in 2011 and later expanded in 2016 (Consensus, 2016) concluded an important connection between PA and learning, regardless of age. In other words, PA holds many potentials from health and learning perspectives.

A number of studies have reported that boys are generally more physically active during a day compared to girls. For example, a study across five European countries

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found significantly lower levels of light, moderate and high PA among 10–12 year old girls compared to boys (Verloigne et al., 2012). Similarly, reported significant differences between boys and girls (mean 52 ± 14 min/day MVPA for boys and 37 ± 14 min/day for girls). A study by Nielsen et al. (2011) showed that gender differences of daily PA were due to girls' lighter levels of PA during disorganised play in the institutional and school context. Further, it became clear that 30% of girls and 17% of boys did not achieve the recommended daily amount of PA. This emphasizes the need for initiatives that can support and increase PA. This applies in particular to girls, children from ethnic minority backgrounds, children with obesity problems and children with disadvantaged socio-economic backgrounds.

It is not on the political agenda in Denmark to increase the number of PE lessons every week and a number of teachers have difficulties to create situations during the school day where they can introduce 45 min of daily PA. This raises the question whether there are other ways to increase physical activity. In this context, *udeskole*, i.e. regular weekly curriculum-based teaching outside the classroom, might be an important tool to increase PA and at the same time create important links to learning, motivation and well-being (see Barfod & Mygind “*Udeskole—Regular Teaching Outside the Classroom*” in this volume). This teaching method offers a more varied education outside the school buildings in nature and / or cultural settings. Case studies conducted in Denmark, Norway and Germany, where objective measurement methods were used (accelerometers and heart rate monitors), have shown increased PA levels (Mygind, 2007; Grønningseter et al., 2007; Becker et al., 2017).

Very little is known concerning children's PA or mental health, but use of natural environments appears to stimulate PA (Fjørtoft, 2004; Wood et al., 2014). A systematic review by Becker et al. (2017) recommended that more quasi-experimental design and longitudinal studies with a greater number of participants are conducted, and a high methodological quality is applied to further investigate these preliminary observations. Further, there is a limited knowledge about the connection between PA and *udeskole* and to what extent this teaching method has an impact on girls' and boys' PA. The purpose of this chapter is therefore to present the results of two larger Danish *udeskole* research projects, which investigated how a weekly *udeskole* day in primary school had an impact on pupils PA compared to other school days and specific domains.

2 The Søndermark School Study in Copenhagen

The purpose of the Søndermark School study in Frederiksberg, Copenhagen, was primarily to measure PA among girls and boys in grades 3–6 during a week, comparing one *udeskole* day with (1) the average of three standard school days without PE lessons and (2) one standard school day with two PE lessons (Mygind, 2016). Further, the study aimed to compare the impact of PA when pupils are taught in nature, in a green area or in cultural institutions. An additional aim was to examine

the PA levels during two PE lessons, after school time, and on weekends (for example in neighbourhoods).

The school management, teachers and parents received written and oral information about the project. Four teachers and one fourth, one fifth and two sixth grade classes accepted to participate in the study. All the data collection took place in four randomly selected weeks seven days in a row in each of the four participating classes. Each teacher and class got used to teach regularly outside the classroom for three months before data collection. The pupils completed regular self-assessment (log/diary) during the data collection period. They were instructed to record keywords and the kind of activity they have been involved in on an hourly basis. Diary notes were used in addition to the objective measurements.

Method

Students in grades 4-6 had a matchbox large accelerometer mounted in an elastic belt over the right hip (ActiGraph GT3x). The activity meter was worn for a week, but was taken off during water activities and while the student slept at night to avoid discomfort. The data collection was performed using raw acceleration with a sampling frequency of 30 Hz and data exported for 10 second epochs. At least 10 hours of recorded activity constituted a valid monitored day. A total of 96 students participated in the study. Illness and absence resulted in a reduction in the overall student population. In the end, data from 44 girls and 40 boys were accepted for comparison of different school contexts with a specific focus on days with *udeskole*, standard school days and school days with PE (Mygind, 2016).

Results

PA in different educational contexts

Results from 84 girls and boys showed that *udeskole* days (23.1%; $p < 0.001$) and school days with PE (46.1%; $p < 0.001$) had significantly higher PA levels (counts per minute) compared to standard school days without PE lessons (Mygind, 2016). These results showed that on *udeskole* days (3.4%) and days with PE lessons (4.2%) MVPA was significantly higher compared to standard school days. Expressed in another way, MVPA was 6.7 min on standard school days, 8.5 min on *udeskole* days and 11.0 min for standard the school days with PE lessons. Although the MVPA levels might seem modest, *udeskole* did contribute to raise the level of high intensity PA in a school context. However, boys seem to cause the generally higher PA levels in all settings except for standard school days with PE lessons. This issue is addressed in the following section of the TEACHOUT *udeskole* study, where data include both light PA (LPA) and MVPA (Schneller, Duncan, et al., 2017).

Gender differences

The average PA measured in counts per minute including all 84 pupils showed a significant difference between boys and girls measured in the three different educational contexts, i.e. days with *udeskole*, average of three standard school days and one standard school day with two PE lessons (Fig. 1, Mygind, 2016). *Udeskole* days had a significantly higher level of activity than standard school days without PE. Breaks and after school activity showed that the boys were significantly more physically active compared to girls except on standard school days with PE. Unorganised play, which typically took place during breaks and after school time, showed a higher level of PA for boys. Free play in connection with the breaks in *udeskole* may also explain the gender difference found in this setting, although our expectation would be that organised education outside would stimulate both sexes equally. No difference was recorded on weekends, but only a tendency that the boys were more physically active in this context too (Fig. 1).

Udeskole in green areas and cultural institutions

Each of the *udeskole* days were organised based on 'a year wheel'. The site for teaching outside the school buildings was chosen based on whether the individual teacher found it appropriate in relation to the academic content and time of the year. An interesting question, which arose, was to investigate to what degree *udeskole* days in nature /green areas or visits to culture institutions contributed to PA. A further question was which outdoor educational setting the four teachers had decided to use in the week the data collection took place.

The teachers were informed about the data collection week a few days before and at this point, the teachers had planned where to do *udeskole*; i.e. green areas or culture institutions. One teacher decided to walk and teach a class (4e) in green areas (Søndermarken/Carlsberg's garden), while the other three classes visited cultural institutions at Frederiksberg City Hall (6d), Central Station (6a) and an art gallery (5d) (Fig. 2, Mygind, 2016). The results showed no significant difference in PA (counts per minute) on *udeskole* days in the three classes visiting cultural institutions compared to standard school days without PE ($p = 0, 12$) (Fig. 2). The class being taught in green areas had significantly higher PA levels compared to standard school days ($p < 0.001$), but also compared with a standard school days with PE (25.9%, $p < 0.01$) (Fig. 2). No differences were found between the four classes in leisure time after school. However, the variation between classes was very large on *udeskole* days, standard days with PE, weekends and specific domains like recess and PE lessons (see Fig. 2). For example, the activity in PE lessons and leisure in class 6d was between 21 and 32% lower, compared to the other three classes.

Discussion

The structure of the discussion is broken down into three sections. First, a discussion of how different *udeskole* settings influence PA among the four participating classes is conducted, including differences of gender. Next, the teachers' choice of *udeskole*

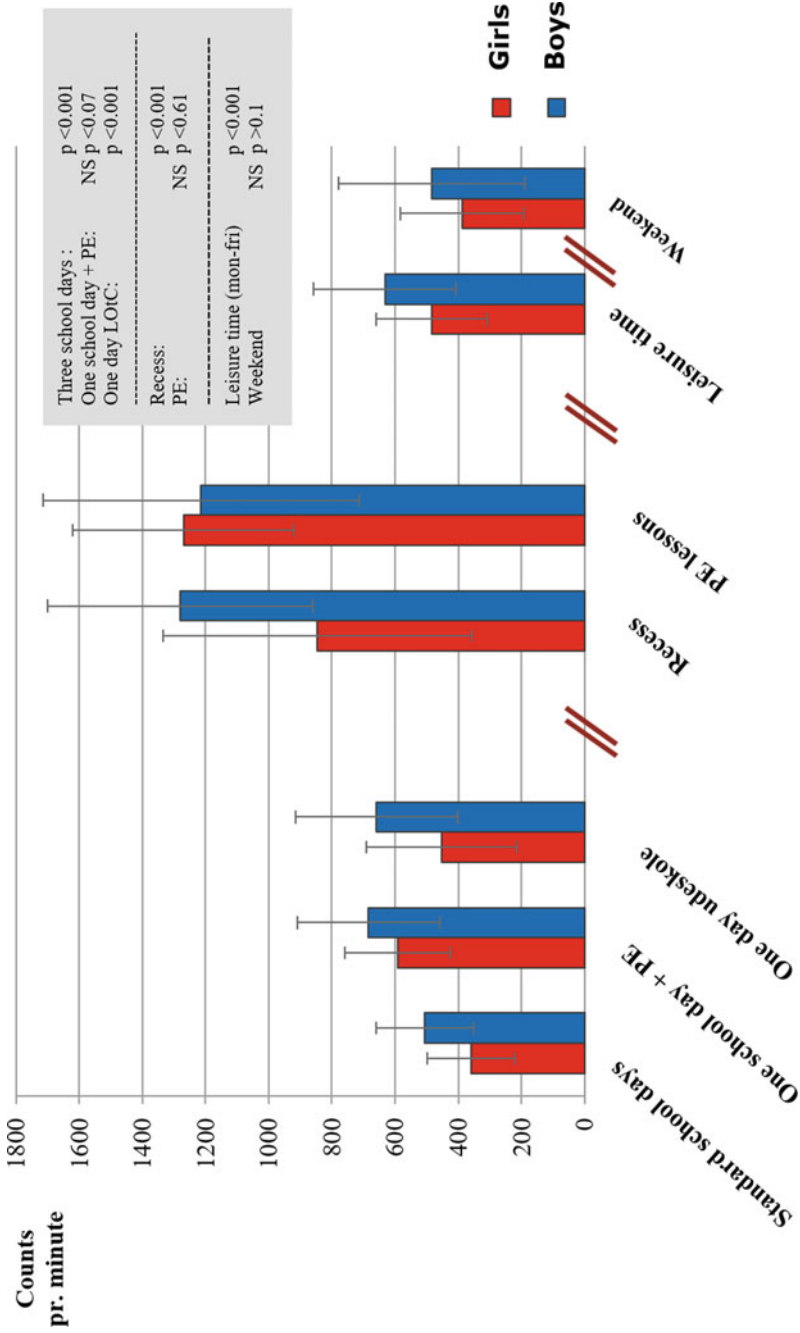
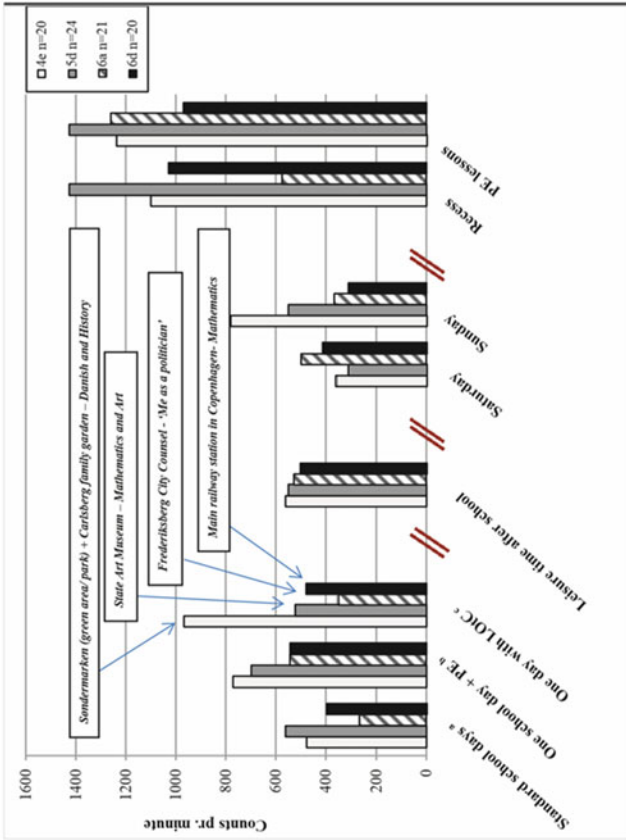


Fig. 1 Physical activity, gender, different school days and domains—Data are shown as means \pm SD in counts per minute. Levels of physical activities (PA) among girls and boys are depicted from the mean of three standard school days without PE, one day with *udeskole* and one day with PE. Further, comparisons are made between recess and the two PE lessons, leisure time after five school days and weekends. Significant differences are shown in legends, p < 0,05 (from Mygind, 2016)

Figure 2
PA in 4 Classes Using Different Culture and Nature Settings



Note.
 The mean physical activity (PA) levels measured on standard school days, a day with PE and one day with LOtC in 4 classes in different urban settings, during weekends and recess and PE (see legends).

Fig. 2 PA in *udeskole* settings and gender perspectives in the Søndermark School study (from Mygind, 2016)

setting and the importance of transport to the chosen destination is considered and finally, the last section contains a summary and critical look at the study. The teachers' goals, program or choice of outdoor setting (nature / green area or cultural institution) were not known in advance. The weeks, where the measurement took place after three months preliminary *udeskole* experience in the four classes, were randomly chosen. On average, the *udeskole* days provided a significantly higher level of PA, adding 12–13 min of MVPA compared to standard school days without PE. The picture is more nuanced if one compares the three classes that were taught in urban culture institutions with the one class taught in urban green areas. The latter had a significantly higher average PA level compared to the three classes visiting cultural institutions (Frederiksberg Town Hall (6d), Central Station (6a) and the National Gallery of Art (5d) (Fig. 2). All four classes included PA through walking to and from the destination, but judging from the teachers' notes, the more modest PA during visits to cultural institutions might be due to the lower PA taking place during hours spent inside. In the three cultural institutions, there is an expectation not to run around—in fact, to keep calm and move only when necessary or instructed. A visit to nature and green areas often invite to be physical active—both through the teacher planned learning activities and not the least during breaks. Walking to and from the destinations on *udeskole* days added some PA compared to standard school days, but in particular, class 4e who visited green areas caused a significant increase of PA in the study (Fig. 2).

The very high PA activity level in this class is in line with the results of the case study with 12 girls and 7 boys from Rødkilde school project, where several accelerometer measurements in a forest summer and winter *udeskole* were compared to standard school days. Further, the level of PA corresponded to a standard school day including two lessons with PE (Mygind, 2007). This is also supported by a Norwegian *udeskole* case study with heart rate measurements in nature settings (Grønningseter et al., 2009). The mean percentage of time with heart rate ≥ 160 beats/minute was 5% for a standard school day and 18% for a day in the forest ($p < 0.001$). In other words, visiting cultural institutions does not appear conducive to PA to the same extent, as does the use of green areas.

The results showed that girls' average PA was significantly lower compared to boys in all measured school contexts, except for standard school days with PE lessons (Fig. 2). This was a bit surprising because it was expected that the teacher-managed and organised learning activities during *udeskole* days and transport to the destination would have an equal impact on girls and boys PA patterns as during PE lessons. This was not the case. One explanation might be that also in *udeskole* boys use recess and free time more to be physically active.

The importance of how unorganised and non-teacher supervised situations affect PA among girls and boys in school is underlined in a Spanish study of play in recreational areas (Martínez-Gómez et al., 2014). It was concluded that more effort should be undertaken to increase girls' activity levels. A Danish study by Nielsen et al. (2011) also showed similar gender differences. Girls were lower in everyday institutional contexts during disorganised play, school free time, and day care after school. More worryingly, about 30% of girls and 17% of boys did not live up to

the recommended daily amount of PA. The results of the Søndermark School study are in line with a study by Verloigne et al. (2012), which found that objectively assessed levels of moderate and vigorous PA among 10–12 year old girls were lighter, compared to boys across five European countries. Similarly, the study by Van der Niet et al. (2015) showed significant daily differences between boys and girls (mean 52 ± 14 min MVPA for boys and 37 ± 14 min for girls).

In conclusion, schools and teachers in general should consider how to conduct organised play in recess that especially motivates girls. *Udeskole* teachers might reflect on how to combine PA and learning activities to a higher degree. *Udeskole* might be an important tool for children who do not usually participate in organised recreational activities; especially girls with ethnic minority backgrounds and children with obesity problems as well as children from disadvantaged socio-economic backgrounds. There is a need for more research to shed light on how teachers in primary schools, for example, can balance academic learning and PA through *udeskole* for the benefit of both sexes.

Udeskole—the setting and PA

The teacher's choice of place (natural or cultural) is obviously crucial for how physically active the pupils are. In organizing *udeskole* the teacher can put more or less emphasis on PA, e.g. how transport to and from the destination is organised. The weeks in which the measurements took place were randomly selected, because a structured design with equal amount of classes visiting both cultural institutions and green areas was not possible at the time being. The four teachers focused on academic learning and not specifically on integrating PA in *udeskole*, but according to their notes, they preferred to walk with their class to and from the chosen destination (Mygind, 2016).

The teachers' notes from the *udeskole* days were very important to understand the quite significant variations between classes (see Mygind, 2016). Of course, the teachers' choice of teaching methods affects the general PA level in each class, i.e. location, academic content and tasks, travel (walking, biking, taking a bus or train), distance to the destination, safety considerations, and the pupils' free time to play during the day. Cultural visits (based on the teachers notes) offer some explanations on why the fifth and two sixth classes had relatively similar levels of activity, while the fourth grade (4e) average PA level was twice as high. This class walked from school through a nature / park area (Søndermarken), visited the Carlsberg family garden and walked back again. In this way, they reached a PA amount 25, 9% higher than on a school day with PE lesson (Fig. 2). The PE activity in this specific week was high. One explanation for the very high level in 4e could be the many active hours, characterised by a lot of walking and running travelling back and forth, during teaching in the Carlsberg family garden and not least that the pupils had two periods of free play on green playgrounds. Further, it is well known that younger children are more physically active compared to older children / adolescents, and here a fourth grade class was compared to a fifth grade and the two sixth grade classes (Fig. 2).

Summary and critical remarks

The Søndermark School study provides support for other case studies, which found that combining academic learning and PA in nature and green settings yields positive results. However, it is questionable whether visits to cultural institutions contribute positively to PA, when length and type of journey to and from the destination seem to be the dominating PA factor. Unorganised leisure and recess during *udeskole* seem to benefit boys, but not to the same degree girls.

The strength of the Søndermark School study were the teachers' notes and the knowledge of how each *udeskole* day and academic program took place, making it possible to understand and explain the PA results. A weakness was the few and randomly chosen four weeks from a whole *udeskole* year, but time and financial constraints as well as limitations on additional support by the school did not allow more data collection. Only a single week was analysed in each class and a stronger picture would have appeared if, for example the four classes could have been analysed in four green as well as four cultural settings—winter and summer. Measurements carried out in other weeks may well have resulted in higher or lower PA values in the same classes depending on the *udeskole* teachers' choice of transport and academic content at the destination. Finally, a weakness is the lack of information about sedentary time and LPA. This raises an important question whether use of green areas and cultural institutions in urban settings contribute to a decrease in sedentary schoolwork and to an increase in LPA. The latter is taken into account in the TEACHOUT study, with the inclusion of significantly more classes and pupils.

3 The TEACHOUT *Udeskole* Project

The purpose of the TEACHOUT study¹ was to investigate the importance of regular weekly education outside the classroom (EOtC) or *udeskole* during a year (2014–2015) and included a high number of pupils compared to previous case studies (Nielsen et al., 2016). The study investigated how *udeskole* had an impact on PA and health, learning, motivation and well-being. *Udeskole* can be regarded as movement integration (MI) in the school context, and has shown to increase children's PA in case studies. Increased PA is a potential secondary outcome or perhaps a means to achieve the teaching aim. The TEACHOUT study design and rationale can be found in the study protocol paper (Nielsen et al., 2016). More in-depth information on *udeskole* activities in Denmark can be found in an inventory of the use of *udeskole* practice in schools across Denmark conducted in 2014–15 (Barfod et al., 2016).

¹ The overall aim of the Danish TEACHOUT research project was to generate knowledge about the strengths and weaknesses of practicing *udeskole* compared to mainstream education under the framework of the new school reform (2013). *Udeskole* is a broad term referring to curriculum-based teaching outside the school buildings in natural as well as cultural settings on a regular basis. TEACHOUT investigated physical activity, learning and social relations.

In Danish primary and secondary schools, teachers are allowed “freedom of methods” to achieve the curricula targets decided by the Danish Ministry of Education within each subject taught (Danish Ministry of Education, 2014). A new public school reform was implemented across Danish schools in August 2014. This reform included initiatives such as requiring school staff and children to spend 5.5 to 8.5 h more in school every week, to provide pupils with an average of 45 min of daily PA, e.g. for schools to seek more active cooperation with local sports clubs, and for teachers to empower children to more actively engage in the educational activities.

School demographics in Denmark and control classes

In Denmark, children are randomly assigned to a class within the school district where they live at enrolment in grade 0. This means that the demographic characteristics of children in two parallel classes can be expected to be comparable (Danish Ministry of Education, 2017). In the TEACHOUT study, data were collected from children who were sampled into *udeskole* intervention classes and control / parallel classes at the same school and grade level, based on the willingness of teachers to participate in the study. As such, approximately half the children from whom data were obtained attended a comparison class in which *udeskole* was not supposed to be a regular curriculum-based activity. All data from participating children were pooled and analysed as the amount of *udeskole* varied greatly between participating classes. (Schneller et al., 2017).

The present chapter focus on a subset of the TEACHOUT study, i.e. on gender perspectives and PA in standard classroom teaching, which seem to be a promising opportunity for children to increase PA. The aim was to investigate the effects of *udeskole* on children’s PA by segmenting weekly activity-related behaviour into a range of day types, domains and PA levels among girls and boys analysing the extent of LPA and MVPA as indicators of the importance to health (see Schneller et al., 2017). Further, the aim was to evaluate how *udeskole* affects daily PA in a larger sample of school-aged children, including a control group (parallel class): a research approach, which has been in short supply up until now. Specifically, the proportion of time spent in different PA intensities between different day types and within certain domains specific to both school (i.e. *udeskole*, classroom activities, PE, and recess) and leisure time, i.e. after school days and weekend days, differentiated by gender.

Method

Pupils from 3rd to 6th class wore two motion meters (accelerometer model Axivity AX3) mounted on the front of the thigh and the back of the loin.

The accelerometer was worn for 9-10 days continuously. The data collection was performed using raw acceleration at a sampling rate of 50 measurements/second and translated into an estimated energy consumption second by second. To be included in the analyses, a pupil would have seven consecutive days of measurements with 24 hours of continuous recording (Schneller et al., 2017). 637 pupils wore accelerometers, but after drop-offs and absence due to sickness, holiday, etc. 346 pupils had usable measurements, which formed the basis for the comparisons at week, day and activity level. The participating classes were recruited in pairs, i.e. an *udeskole* and a control/parallel class. For day- and activity-level analyses, time periods were included in different categories based on information collected via diaries—completed by each class (for more detailed information see Schneller et al., 2017).

Results

PA over a whole week

As a basis for comparing *udeskole* and control classes, pupils from 33 classes were included. 17 classes had 4 h of *udeskole* in the measured weeks and 201 pupils' measurements of PA met the inclusion criteria (see text box). In total, 16 comparison classes attended with an average of 64 min of *udeskole* in the measured week including 160 pupils. In other words, the results reflect a comparison of classes with nearly 5 h of *udeskole* and control classes who on average did about an hour of *udeskole* instead of the expected zero hour of outdoor school. This may be because the TEACHOUT study was completed at the same time as the start of the new school reform in 2014 with a requirement for 45 min of physical student activity. Teachers in the control classes may also have been inspired by *udeskole* teachers to do some outdoor learning. The *udeskole* concept seemed to be an excellent opportunity and a practice that lay outside our control in this real life research project.

We found a significantly greater amount of weekly MVPA for boys in *udeskole* classes compared to boys in their control classes. Quite precisely, this increase was 19 min extra a day. For girls, no difference was found between *udeskole* and parallel classes seen over the week as a whole. There was no statistically significant difference in neither MVPA nor LPA between girls in *udeskole* and girls in control classes (Table 1). Another significant observation was that boys obtained 47 min more MVPA, but at the same time, 29 min less LPA per day compared to girls (see Table 1). We also saw a marked decrease in PA at increasing grade levels, corresponding to 13 min less MVPA and 18 min LPA per day per progression to a higher class grade.

PA among girls and boys by day type

Figure 3 gives an overall picture of the proportions (%) of MVPA and LPA, respectively, of all pupils divided into girls and boys and into four day types.

Table 1 Comparing groups during a week at moderate to high and light intensity PA

Groups being compared	Moderate to high intensity PA		Light intensity PA	
	Minutes/day (95% CI)	<i>p</i>	Minutes/day (95% CI)	<i>p</i>
<i>Udeskole</i> /EOtC versus control classes	76 (71–81) versus 68 (64–72)	0.01	388 (379–397) versus 389 (381–398)	0.86
Boys vs girls	95 (90–101) versus 48 (45–51)	< 0.01	374 (365–383) versus 403 (395–411)	< 0.01
<i>Udeskole</i> /EOtC, boys versus boys in control classes	105 (96–114) versus 86 (80–93)	0.01	369 (355–384) versus 378 (367–389)	1.00
<i>Udeskole</i> /EOtC, girls versus girls in control classes	47 (43–51) versus 49 (45–54)	1.00	408 (400–417) versus 398 (384–411)	1.00

p indicates the statistical probability that the numbers are different and the limit value is set to $p < 0.05$. 95% confidence intervals (CIs) indicate the values that 95% of the measurements in a group are statistically expected to be within

Boys had a significantly higher MVPA level in all four types of days, compared to girls (boys 7.8%; girls 3.8%) and standard school days without PE lessons (boys 6.7%; girls 3.8%). Both genders achieved the most MVPA intensity on days of PE (boys 8.5%; girls 4.6%) and the least on weekend days (boys 5.4%; girls 3.0%) (Fig. 3).

Girls generally had a higher proportion of LPA. The proportion was highest on *udeskole* days (girls 32.0%; boys 29.8%) and slightly lower on standard school days (girls 29.5%; boys 27.5%) and days with PE lessons (girls 29.8%; boys 27.5%). The lowest level of LPA was on weekend days (girls 23.9%; boys 22.1%). *Udeskole* days showed the highest level of LPA among both sexes compared to days with and without PE and weekends.

On school days with PE lessons, MVPA intensity was higher among girls and boys compared to *udeskole* days, standard school days without PE and weekends.

PA in six specific school contexts

Figure 4 presents an overall picture of the proportions of MVPA and LPA (%) obtained by all pupils divided into girls and boys in six specific domains.

In general, the boys in all six specific activity types had a significantly higher MVPA level compared to girls (Fig. 4—top row of bars). The boys spent a statistically significant higher proportion of *udeskole* in MVPA (14.9%) compared to teaching in the classroom (9.4%).

For girls, it was slightly different, as no statistical difference (albeit a trend) was found at MVPA intensity in *udeskole* (6.3%) compared to classroom teaching (4.4%). In general, girls had a higher LPA level in five of the six domain types (bottom bars of Fig. 4) Teaching in *udeskole* triggered a significantly higher LPA compared to classroom teaching.

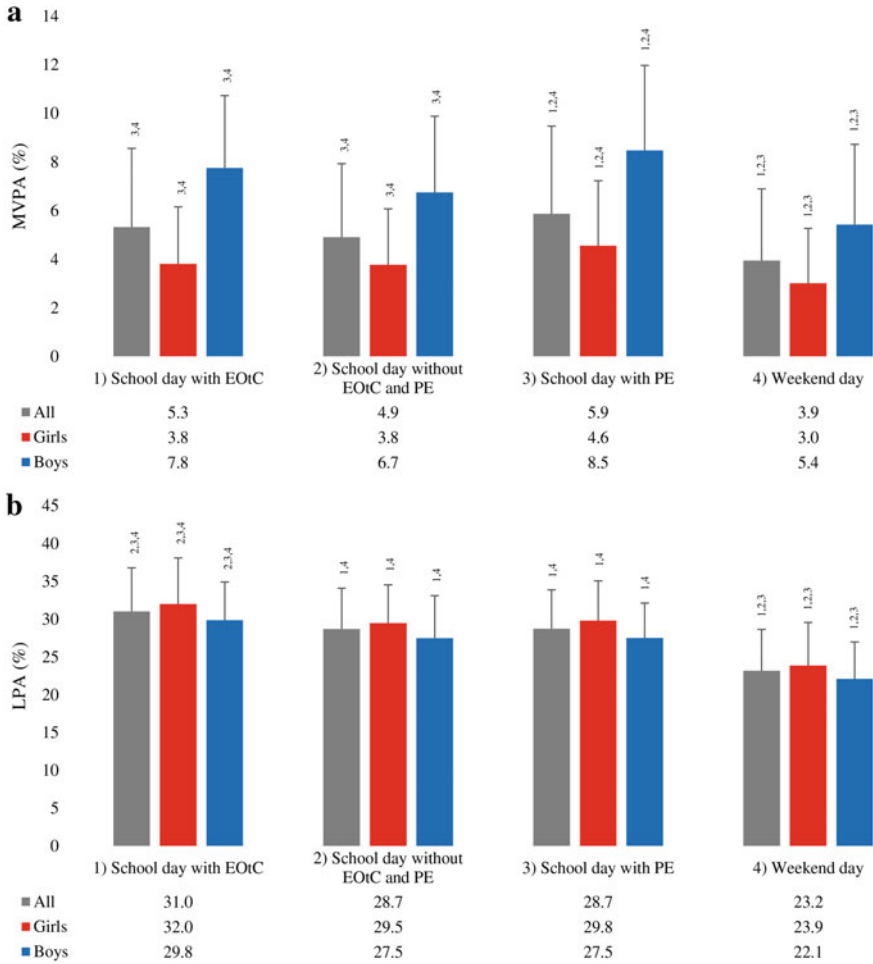


Fig. 3 Percentage of light and moderate / vigorous physical activity among girls and boys by four day types. Bars represent the differences and similarities between boys and girls and in four day types and represent the average proportion of moderate to high PA (top bars) and light PA (lower bars) measured % (\pm standard deviation express the spread in between measurements). There was significant difference between girls and boys within the same day type in all cases. Numbers above standard deviation bars in both **a** and **b** denote significant difference (mixed-effects regression with identity link) in the proportion of time spent in the PA intensity for the sample (all, girls or boys) (from Schneller et al., 2017)

Not surprisingly, the MVPA level was significantly higher in PE lessons and recess periods for both genders compared to the other four types of activity. Boys achieved approximately equal proportions of MVPA after school and in PE (29.9% and 31.0%, respectively). Moreover, it is worth noting, that girls had a significantly higher level of activity in PE (22.3%) compared to recess domain (13.9%). So organised and

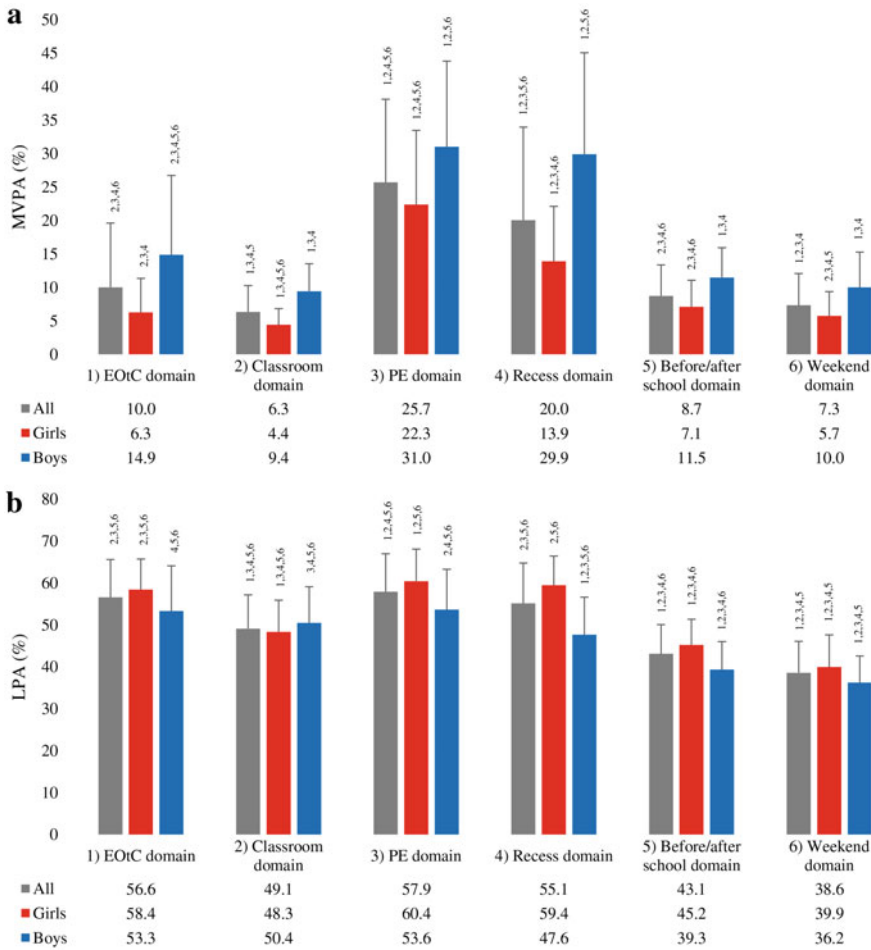


Fig. 4 Percentage of MVPA and LPA in six specific domains in the TEACHOUT study. Proportion of time spent in MVPA and LPA by domain. **a** shows mean \pm sd proportion of time spent in MVPA in specific domains by sample (all, girls and boys). **b** shows mean \pm sd proportion of time spent in LPA in specific domains by sample (all, girls and boys). Numbers above standard deviation bars in both **a** and **b** denote significant difference (mixed-effects regression with identity link) in the proportion of time spent in the PA intensity for the sample (all, girls or boys) in a domain compared to the other five domains (from Schneller et al., 2017)

structured teaching means a lot. Recreational activities after school and on weekends were low in terms of PA and most of all to be compared to the activity level of classroom teaching.

In summary, for all pupils *udeskole* (58.4%) triggered a higher level of LPA compared to classroom teaching (48.3%). Leisure before and after school as well as weekends showed a generally lower level of LPA compared to the more specific types of activity in school settings. A significantly higher MVPA level was found among

boys having *udeskole* during a week compared to boys in their parallel control classes and girls in all day types. On the other hand, girls in *udeskole* achieved a higher LPA level compared to boys in this setting and classroom teaching situations (Fig. 4).

4 Summary Discussion and Perspectives

Gender similarities and differences in the TEACHOUT and Søndermark School studies

The TEACHOUT study and the Søndermark School study included a relatively higher number of pupils compared to previous case studies, which allow a presentation of results describing the impact of *udeskole* for both sexes. Previous case studies have not been able to comment on gender perspectives related to PA due to low number of participants. Both studies underline that boys in all day types and specific domains had significantly higher MVPA compared with girls, i.e. days with *udeskole*, days with and without PE lessons, recess domain, PE lessons and after school time and weekends. The only exception was that on days with PE girls were just as active as the boys in the Søndermark School study, whereas the TEACHOUT study showed that the boys were also the most active in this domain.

The TEACHOUT study showed that girls achieved a higher level of LPA in most types of activity compared with boys and that *udeskole* caused this increase in PA. It is characteristic that boys in recess and free time spend more time in MVPA mode, which again has an important health aspect due to the stimulation of the heart and vascular system. The increased higher LPA seen among girls in *udeskole* might have a positive impact on children with a general and very sedentary life style. In that sense, through combining academic learning and PA schools can contribute to 'kill two birds with one stone'.

The Danish studies are very much in line with the gender differences reported in European studies (Verloigne et al., 2012; Van der Niet et al., 2015; Nielsen et al., 2011). The TEACHOUT study showed that girls on *udeskole* days benefited in terms of LPA. However, it also showed that gender differences in the total amount of daily PA could be explained by girls' low level of physical activity during disorganised play in institutional and school contexts. Conditions that continue to cause concern are that approximately 1/3 of girls and almost 1/5 of boys do not reach the recommended daily amount of PA, highlighting the need for alternative approaches that can support and increase PA. This problem is particularly prominent in children with an ethnic minority background, children with obesity problems and children from disadvantaged socio-economic backgrounds. There is much to indicate that *udeskole* or regular EOtC can make a positive contribution to increasing PA.

Value of *udeskole*

Both Danish studies show that *udeskole* increases the weekly amount of PA for both sexes—in particular for boys. However, it is more questionable to what degree

udeskole are beneficial for girls even if the teaching takes place in organised form. The Søndermark School project showed that the *udeskole* setting in nature surroundings did make a difference, while visits to cultural institutions did not contribute to a big change in PA as compared to a standard school day. Use of green space in *udeskole* was also analysed in TEACHOUT. Based on explorative, cross-sectional data this study showed that school days with an *udeskole* session in green space and without a PE lesson was associated with more light physical activity and less sedentary behaviour compared with school days with an *udeskole* session in cultural and societal institutions or companies and without a PE lesson. Green space seems beneficial to both girls' and boys' LPA (Bølling et al., 2021). More research is needed to assess whether nature and green spaces as well as cultural institutions are meaningful to the learning process from both academic and health perspectives.

There is still a general need for more research to shed light on how primary school teachers can balance academic learning and PA, and in particular how they can motivate girls. Finally, it should be considered how to introduce *udeskole* courses in initial and continuous teacher training and how to integrate academic learning and PA when combining in- and outdoor teaching.

Recommended Further Reading

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