

Physical activity in the classroom: Using RE-AIM to evaluate a national school reform – a mixed methods study

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Abstract

Background

In 2014, the Danish Government introduced a wide-ranging school reform that applied to all public schools in Denmark. A distinctive feature of the reform was that it became mandatory to implement an average of 45 minutes of daily physical activity within the curriculum. Using the RE-AIM framework as an evaluation tool, the objective of the current study was to evaluate the reach, effectiveness, adoption, implementation, and maintenance of mandatory physical activity within curriculum at ten Danish schools.

Methods

A complementary mixed methods approach using accelerometers, questionnaires, and semi-structured interviews was conducted. A total of 11 representative schools were invited to participate, including 993 students, 131 teachers, and 11 school managers. Students were invited to wear an accelerometer for seven consecutive days. Teachers were invited to participate in a questionnaire and school managers were encouraged to take part in a semi-structured interview.

Results

A total of 10 schools were included in the analysis, including 846 students, 76 teachers, and 10 school managers. Results showed that, on average, 45.2% of the students were active at least 45 minutes daily within curriculum. Teacher and school management interest in physical activity, competencies development, and shared decision-making were identified as central factors for adoption of the requirement. Scheduling physical activity within timetables and collaborations with external parties were found to influence the implementation dimension. Finally, internal coordination, motivated school staff, and school management priority were identified as central factors for maintenance.

Conclusions

This study provides an evaluation on a national physical activity requirement in Danish public schools. When introducing a wide-ranging national requirement on physical activity within curriculum, school managers need to prioritize and support the implementation process. Teachers need to be involved in the decision processes, in order to ensure motivation and local ownership. The study also highlights the benefits of an internal coordinator as well as development of a shared strategy among schools, municipalities, and other stakeholders in order to succeed with the implementation.

Background

Physical activity (PA) is well-known for many health benefits [27]. Recent studies have also shown a positive association between PA and academic performance [13, 36]. Schools are considered key settings for the promotion of PA in children as they provide convenient access to the majority of young people and feature core facilities,

personnel and ethos to engage children in PA [15]. Therefore, both local, regional, and national governments and international bodies have released guidelines or policies mandating structured PA in schools [2, 12, 26, 33].

A wide-ranging school reform were in 2014 introduced by the Danish Government [38]. The school reform applied to all 1095 public schools in Denmark, and the overall aim was to ensure that all children met their full learning potential [37]. As part of the school reform, it was, for the first time, made a requirement for all public schools to implement an average of 45 minutes PA within curriculum per day. The Danish school reform is, to our knowledge, one of the first policy-driven initiatives requiring all public schools to integrate a considerable amount of PA within curriculum.

Thus, it is highly relevant to take a thorough look at this particular dimension of the national school reform.

Ideally, developing guidelines or policies for schools is, among other things, focused on translating evidence into community practice [9]. However, research suggest that most schools fail to implement PA policies at scale [41]. Translating and disseminating health-related policies into a real-world context is often challenging, which call for a better understanding of the complex systems of contextual factors and practical implications driving both policy development and implementation [16, 20, 42]. The Reach, Effectiveness, Adoption, Implementation, and Maintenance framework (RE-AIM) has been deemed useful to evaluate internal and external validity of PA promotion programs, helping to provide a comprehensive evaluation [21, 22]. In particular the RE-AIM framework has been used to evaluate real-world programs focusing on the implementation of PA in a school context [10, 43, 49].

Using the RE-AIM framework as an evaluation tool, the objective of the current study was to evaluate the reach, effectiveness, adoption, implementation, and maintenance of mandatory PA within curriculum at ten Danish schools.

Methods

School context

In Denmark, public (state) schools are government (tax) funded and free of charge for all children between 6-16 years of age and mandatory unless attending private schools. Majority of children (77%) in Denmark attend public schools [38]. The main part of the remaining children attend private- or Danish free schools. Schools are typically organized in three tiers: pre-preparatory classes (grades 0-3, 5-9 years old), intermediate classes (grades 4-6, 9-12 years old), and lower secondary classes (grades 7-9, 12-15 years old). Children attend school 30-35 hours per week, of which approximately 60-75 minutes per day are dedicated to recess. As a mandate of the school reform, 45 minutes of daily PA is required to be integrated within academic classroom curriculums or as active breaks during lessons. The PA requirement also demand students to have at least 60-90 minutes of physical education (PE) per week depending on age group. PE is included as part of the 45 minutes of daily PA, whereas recess is not [37]. The Government made no requirements on how to implement the mandatory PA components.

Study design and objective

The present study is part of a larger study, the Physical Activity in Schools After the Reform (PHASAR) study, aiming to evaluate the implementation and effects of the nationwide school-based PA legislation [46]. The current

sub study adopts a complementary mixed methods design [23] to ensure a comprehensive understanding of the schools' reach, effectiveness, adoption, implementation, and maintenance of the mandatory PA components.

A total of ten representative schools were included in the study (See Figure 1). Maximum variation was used in selecting the ten schools, employing the following criteria: geographic location, number of students, and socioeconomic status. Moreover, another criterion for selection of schools was, that students from grades 5-9 (10-15 years old) had participated in the PHASAR study. Globally more than eight out of ten adolescents are insufficiently physically active and PA levels among adolescents decreases significantly [25]. Strategies to counter this negative development are essential and thus, a focus on adolescents was chosen in the present study.

RE-AIM

The RE-AIM framework was used to guide the evaluation. Table 1 presents the definition of RE-AIM dimensions, outcome measures and data sources in the current study.

Table 1. Outline of the RE-AIM dimensions, definitions, outcome measures and data sources.

Dimension	Definition	Outcome measures	Data sources
<i>Reach</i>	The characteristics and representativeness of schools that participated in the study.	- Number of eligible schools that participated - Characteristics of participating schools	Geographic Information System and national statistics
<i>Effectiveness</i>	The effectiveness of the PA legislation.	- Percentage of students who on average reached the 45 minutes daily PA within curriculum - Average minutes of PA within curriculum - Range in minutes of daily PA	Accelerometer data (N=846)
<i>Adoption</i>	The commitment of participating schools regarding their decision to adopt the PA legislation and factors influencing that decision.	- Commitment and capacity for participating schools - Factors influencing adoption	Teacher questionnaire (N=76) Semi-structured interview with school managers (N=10)
<i>Implementation</i>	The extent to which teachers contribute to delivering the mandated volume of daily PA and factors influencing implementation.	- The extent of PA delivered within curriculum - Factors influencing implementation	Teacher questionnaire (N=76) Semi-structured interview with school managers (N=10)
<i>Maintenance</i>	The extent to which the schools have considered how to ensure maintenance.	- Factors influencing maintenance	Semi-structured interview with school managers (N=10)

Reach

The reach dimension was defined as the characteristics of the ten schools selected for participation. Reach was described to ensure representativeness in relation to schools that were included in the present study compared to the non-participating schools (N=21). School characteristics and representativeness was assessed using data on school area, geographic location, urban or rural location, municipal expenses per student, number of students per class, and parental income. School characteristics and representativeness were assessed using Geographic Information System (GIS) and Danish Database of National Statistics.

Effectiveness

In the current study, effectiveness was defined as the percentage of students who, on average, reached 45 minutes daily PA within curriculum. The students' PA was objectively measured using accelerometry. In the present study PA was defined as standing with movement, walking, and running. The definition was based on recently research, identifying sitting, standing, walking, running, and biking using accelerometers [8]. A more detailed effect evaluation of the PHASAR study is described elsewhere [46].

Adoption

Although all public schools in Denmark were required to implement mandatory PA within curriculum, there was no guarantee that school managers and teachers would and/or could adopt this. The adoption dimension reports on the schools' commitment to the mandatory PA within curriculum and factors influencing adoption. Adoption rates were measured through teacher questionnaire, whereas factors central for adoption were measured through semi-structured interviews with school managers.

Implementation

The implementation dimension reports on the schools' process of implementing the mandatory PA within curriculum. Implementation was defined as schools' PA initiatives (e.g. structuring PA within timetables). Furthermore, the dimension reports on factors influencing implementation of the mandatory PA within curriculum. The extent of PA delivered within curriculum was measured through teacher questionnaire and factors central for implementation were measured through semi-structured interviews with school managers.

Maintenance

During the data collection, conducted 3-4 years after the introduction of the reform, most schools indicated that implementation had started, but not fully completed. Thus, the maintenance dimension reports on the extent to which schools have considered how to ensure maintenance. Maintenance was measured through semi-structured interviews within school managers.

Data sources

Five data sources were collected: geographical information system (GIS), national statistics, accelerometer, questionnaire aimed at teachers and semi-structured interviews with school managers. Data sources covering the various RE-AIM dimensions is outlined in Table 1.

Geographic Information System (GIS) and Danish Database of National Statistics

GIS was used to assess the school area (m²) and to map geographic location (urban/rural) [7]. Danish Database of National Statistics was used to gather information on municipal expenses per student, average number of students

per class, and parental income. Information were conducted December 2018.

Accelerometer

The Axivity AX3 was used to assess objectively measured PA. Students in grades 5-9 were invited to wear an accelerometer for seven consecutive days. The accelerometer was mounted in a belt placed directly on the skin around the right front thigh. Using the thigh accelerometer provided an opportunity to calculate the duration spent on specific activity types. In this method, the acceleration is utilized in relation to the orientation of the subject's thigh, which enabled to distinguish very accurately between e.g. sitting and standing position. In addition, the method enabled to measure the extent of the acceleration, which allowed to determine time periods spent on different types of activities such as walking and running with high accuracy. The accelerometer data were collected from August 2017 until September 2018. Standardized testing protocols were made to ensure data quality and trained research assistants collected all data. Prior to the initiation of the study a pilot study was conducted to optimize all study procedures. In the present study PA was assessed during curriculum.

Questionnaire

A questionnaire was designed to measure how often teachers employed PA within curriculum.

Danish, Mathematics, and English courses take up a little more than half (53%) of the total teaching time in Danish public schools. Thus, teachers were eligible to participate in the questionnaire if they taught Danish, Mathematics or English in one of the participating classes.

Several steps were taken to heighten the content validity of the questionnaire. Initially the questionnaire was developed by two authors from this study. Subsequently, the questionnaire was tested and discussed by several members of the PHASAR research group before pilot testing. The online procedure and the questionnaire were pilot tested with a group of teachers not included in the study to ensure face validity.

The questionnaire was designed and collected through the worldwide system Research Electronic Data Capture (RedCap). The use of electronic questionnaires made it possible to activate additional questions on specific answers, thereby ensuring that participants did not receive irrelevant questions. At the end of most questions, teachers were given the opportunity to add additional comments. The questionnaire was administered electronically and the participating teachers were emailed a hyperlink to the questionnaire. Reminders were e-mailed to participants who did not respond (three times with 1 week between each reminder). Questionnaire data were collected between December 2017 and October 2018.

Semi-structured interviews

Ten interviews with school managers were conducted (one from each school). Interview participants were recruited through purposeful sampling [29] to ensure knowledge from key respondents having insight into the implementation process of the PA requirement. The ten school managers consisted of three school heads, four deputy heads, and three leading teachers with school management responsibilities. The interview guide was based on the Practical, Robust Implementation and Sustainability Model (PRISM) [17]. In particular, the interview focused on the adoption, implementation, and maintenance dimensions.

Interviews were conducted during a one-day visit to each of the ten schools between April and September 2018. All interviews were conducted one-on-one by the lead author and lasted between 25 and 60 minutes. Verbal consent

was obtained from each participant to audio record the interview.

Data analysis

Quantitative data analysis

STATA 16 (College Station, TX) were used to handle the quantitative data. Descriptive statistics were produced for the accelerometer data in order to gather information on the number of students who on average reached 45 minutes of daily PA. Students with non-wear or with less than one valid school day were excluded from the analysis. The activity types were analyzed in intervals of two seconds duration [8]. On this basis, PA was defined as the sum of the activity types stand with movement, walking, and running. Thus, sitting and standing were excluded during data processing.

Due to the paucity of responses in the questionnaire, 5-point Likert scale values were collapsed into two categories; “agree” and “disagree” and 7-point Likert scale values were collapsed into four categories; “every day”, “weekly”, “monthly”, and “yearly or newer”. Descriptive statistics were produced on questionnaire data and data from the Danish Database of National Statistics. To analyze the reach component, two-sample t-tests were used to investigate the potential difference between participating and non-participating schools on school area, municipal expenses per student, number of students per class and disposable household income. The level of significance was set at $p < .05$.

Qualitative data analysis

The interviews were transcribed by the lead author to ensure consistency. All interviews were transcribed verbatim directly into NVivo. Data were analyzed using a three-step qualitative thematic analysis [34]. First, all interviews were read through by two authors (SK and CSP) to ensure data familiarization. Coding was then conducted by both authors separately by marking all phrases concerning adoption, implementation, and maintenance, respectively. Secondly, all codes within the adoption, implementation, and maintenance dimension were read through. An open coding was then conducted, letting data speak for itself [3]. As a result, themes were developed within the adoption, implementation, and maintenance dimension, respectively. Lastly, the findings were discussed among the two authors. Any discrepancies were resolved by consensus between the two authors [4].

Ethical considerations

Prior to the data collection, students and their parents or guardians received information about the study. Consent took form as an oral and written informed passive consent from parents or guardians and students entailing that all students were included in the study unless parents, guardians or students decided to withdraw, which they were able to do at any time. Written consent was obtained from all school heads, deputy heads, and leading teachers participating in the semi-structured interview. They were informed that they could withdraw from the study at any time. Schools and participants were anonymized by giving the schools numbers and changing the interview participants names.

Results

The results of each of the RE-AIM dimensions are presented in the following sections and summarised in Table 2.

Table 2
Results related to each outcome of the RE-AIM dimensions

RE-AIM dimension	Outcome measure	Results
Reach	Characteristics of schools	Eight schools were from the Region of Southern Denmark. There was no significantly difference between participating schools and non-participating schools on municipal expenses per student, average number of students per class, disposable household income, and school area.
Effectiveness	1) Percentage of students who on average reached the 45 minutes daily PA within curriculum 2) Average minutes of PA within curriculum 3) Range in minutes of daily PA	1) On average, 45.2% of the included students were active at least 45 minutes daily within curriculum. At the school with highest effectiveness, 82.6% of the students reached the requirement, whereas 4.5% of the students did at the school with lowest effectiveness. 2) Students were on average active 48.5 minutes per day within curriculum. 3) Minutes of PA within curriculum ranged from 5.2 minutes to 115.4 minutes per day.
Adoption	1) Commitment of schools 2) Factors influencing adoption	1) 94.3% of the participating teachers believed that PA within curriculum were important, 90.3% agreed that PA could advance student learning, and 69.0% generally acknowledged that including PA in curriculum activities had positive impacts. Moreover, all ten school managers interviewed found the mandatory PA within curriculum meaningful. 2) Factors influencing adoption were; teacher and school management interest in PA, competencies development, and shared decision-making of what and how to deliver PA within curriculum.
Implementation	1) The extent of PA delivered within curriculum 2) Factors influencing implementation	1) PA were delivered on a daily basis by 9.5% and weekly by 53.4% of the participating teachers. 2) Factors influencing implementation were; scheduling PA within timetables, and collaborations with external parties.
Maintenance	Factors influencing maintenance	Factors influencing maintenance were; internal coordination, motivated school staff, and school management priority.

Reach

Denmark consists of five regions and despite the criteria of variation in geographical location in the school selection process, eight schools were located in the region of Southern Denmark and two schools were located in the Capital region. Thus, schools in the region of Southern Denmark were overrepresented in the present study. Five schools were located in rural areas and five in urban areas. There was no significantly difference in municipal expenses per student ($p > 0.98$), average number of students per class ($p > 0.73$), or disposable household income between participating and non-participating schools ($p > 0.57$). The included schools' area (m²) ranged from 25,000 m² to 172.000 m². There was no significantly difference in school area (m²) between participating and non-participating schools ($p > 0.22$).

Effectiveness

A total of 846 students were included in the analysis; 475 girls and 371 boys. On average, almost half of the participating students (45.2%) were active at least 45 minutes daily within curriculum, and thus reached the reform's PA requirement. Large differences were, however, observed between schools. At the school with the lowest effectiveness (school 3) only 4.5% of students reached 45 minutes daily PA within curriculum, while 82.6% of students at the school with the highest effectiveness (school 2) reached the requirement. Students were, on average, active 48.5 minutes daily within curriculum. Large differences were seen between students, ranging from 5.2 minutes to 115.4 minutes of daily PA within curriculum. An overview of accelerometer results is presented in Table 3.

Table 3
Accelerometer results on school level.

School	Total	1	2	3	4	5	6	7	8	9	10
Grade	5–9	5–6	5–6	9	9	9	5–8	5–8	5–8	6–8	5–8
% students reaching 45 min. daily PA within curriculum	45.2	80.8	82.6	4.5	35.3	33.3	32.3	40.7	73.6	30.4	38.8
Average daily PA within curriculum (minutes)	48.5	56.1	60.1	32.3	38.5	39.2	40.7	41.9	57.3	42.8	42.5
Range (min/max) of PA within curriculum (minutes)	5.2-115.4	15.3–84.8	28.4-102.5	10.7–45.3	11.3–68.0	16.7–56.6	5.2–76.0	11.5-103.1	13.7-115.4	22.8–95.9	18.7–76.7

Adoption

Results from the teacher questionnaire (N = 76) revealed a general commitment to the mandatory PA component with 94.3% of all participating teachers believing that daily PA within curriculum was important. In addition, 90.3% agreed that PA could advance student learning and 69.0% generally acknowledged that including PA in curriculum activities had positive impacts.

From the interviews four key-findings for adoption of the mandatory PA components were found; teacher and school management interest in PA, school management support, competencies development, and shared decision-making. All ten school managers interviewed found the mandatory PA within curriculum meaningful, and at four schools (school 1, 2, 8, and 9) PA was already a central part of school culture before the 2014-reform. During interviews, however, school managers generally stated that some teachers were skeptical about the mandatory PA within curriculum:

"I think it depends on your interests. There are some (teachers, red.) who absolutely do not believe that PA does any good. That it's rather a disturbing element". (Leading teacher, school 3)

The individual teacher's interest in PA seemed crucial for commitment to the mandatory PA within curriculum. Also, managerial support was important in order to take responsibility for developing a school culture supporting the delivery of PA within curriculum.

"It's about making them [teachers, red.] think it's a good idea. And to do so, I need to be dedicated to it. And I need to take responsibility for the process in order to make it grow". (Deputy head, school 6)

Furthermore, most school managers had experienced teachers who, from the outset, were poorly prepared for handling PA within curriculum, challenging the adoption of the PA requirement. At five of the included schools (school 1, 2, 3, 4, and 9), it was therefore prioritized that all teachers participated in either a course or a workshop to strengthen their skills in how to include PA within curriculum. The interviews showed that in particular workshops or courses conducted by internal coordinators were useful for school adoption of the requirement, giving teachers the opportunity to continuously develop their competencies through ongoing follow-up workshops or courses.

"It is our teachers who planned the pedagogical day, which means that after these workshops teachers know from whom they can be aided or inspired by.... Instead of hiring an external course organizer, who will leave afterwards along with the information. This way the information stays at the school, so that we continuously can get hold of it, which motivates teachers to take active part in it". (Head of school 3)

Delivering PA within curriculum required that some teachers renewed learning formats - challenging their professional identity and calling for new or, at least, adjusted approaches to teaching. Some teachers were of the opinion that a heightened focus on PA threatened the academic standard of their teaching:

"Renewing your teaching is a really, really huge challenge. (...) It's difficult because it's a change of so many habits and working methods, which you (teachers, red.) think that students will learn a lot from". (Head of school 3)

Five schools (school 1, 2, 7, 8, and 9) developed principles, meeting structures, or conducted workshops in order to achieve motivation for delivering PA within curriculum, intending to heighten school staff commitment. These initiatives were all developed through shared decision-making between school managers and teachers, ensuring that the school developed a shared vision for how to deliver PA within curriculum: *"I think it's about developing a culture...a shared vision...and a common mindset about the importance of PA". (Deputy head, school 7)*

Implementation

Results from the teacher questionnaire showed that 9.5% of the participating teachers delivered PA within curriculum on a daily basis, whereas 53.4% delivered PA within curriculum on a weekly basis. Results showed a general consistency between schools. From the interviews two key-findings for implementation of PA within curriculum were found; scheduling PA within timetables and collaborations with external parties. Six schools had scheduled PA within timetables to ensure that PA was delivered on fixed timepoints throughout the week. At three of six schools (school 4, 7, and 8) PA was scheduled as short daily lessons of 15–30 minutes dedicated to PA. The other three schools (school 1, 2, and 9) had integrated more physical education (PE) within timetables, having four or six weekly lessons of PE compared to the norm of two lessons. Scheduling PA/PE into timetables was done to support teachers, for whom PA was not natural to integrate within curriculum: *"I think that scheduling PA into*

timetables helps. Well, it helps to know that if you forget all about PA you at least have a lesson dedicated for PA". (Head of school 4)

Seven schools collaborated with external parties as part of their PA implementation. Two schools (school 2 and 6) collaborated with the municipality or a national sports organization, participating in PA promotion projects. Five schools (school 2, 4, 6, 8, and 9) had established collaborations with local sports associations, inviting sports associations to organize workshops for the students or take part in PE lessons. All school managers collaborating with external parties found it beneficial in order to implement PA within curriculum:

"We have established a collaboration with an athletics club and a cycling club. (...) We have some facilities and opportunities here at the school, but the collaborations are also about being able to thrive on associations with other facilities and opportunities than what we have here". (Head of school 4)

Thus, collaboration with external parties helped schools accomplishing the mandatory PA components, putting facilities and instructors at disposal.

Maintenance

From the interviews four key-findings for maintenance of PA within curriculum were found; internal coordinators, motivated school staff, school management priority, and municipal support. Six school managers (school 2, 3, 4, 5, 9, and 10) stated that internal coordination was essential for maintenance. The coordinators were, among other things, important for sharing hands-on knowledge and inspiring teachers to deliver PA in new and different ways:

"In order to continue delivering PA within curriculum we will continue having PA coordinators at all bases [year groups, red.]. And if one of those leave another one will take its place". (Deputy head, School 9)

Having teachers especially motivated for PA was another important factor for maintenance. Two schools (school 2 and 9) even stated that, when hiring, they searched for teachers interested in PA. In order to ensure maintenance, several school heads also stated that PA needed to be a school management priority, allocating resources for PA education and materials, and leading a common strategy for delivering PA within curriculum: *"I think there are things that are essential for sustainability. One thing is that it has to be a management priority".* (Deputy head, School 2)

Interviews showed, however, that school managers felt a lack of support from the municipality in order to maintain PA initiatives within curriculum. Local politics were perceived to change and evolve continuously and schools were obligated to support policy developments on a huge number of areas – PA being just one of these. At times the sheer volume of new initiatives made it difficult for school managers to dedicate adequate resources for one area like PA:

"In our municipality we are required to produce something called focus areas. I think I am about to produce the sixth focus area within one and a half year. And if you continue to introduce a new focus area every second or third month, you will lose focus on the focus area you worked with 9 months ago". (Head of school 3)

Discussion

The objective of the current study was to evaluate the reach, effectiveness, adoption, implementation, and maintenance of mandatory PA within curriculum at ten Danish schools. The RE-AIM evaluation tool identified

central factors discussed further below.

Commitment and school culture

Generally, the results showed that both school managers and teachers were interested in the PA requirement, finding it meaningful, believing that PA within curriculum were important, and that PA could advance student learning. This has been reflected by others as an advantage for the implementation process, since it ensures that both teachers and school managers already having an awareness of the importance of the requirement [16, 42, 51].

At four of the included schools (school 1, 2, 8, and 9) PA was already a central part of the school culture before the 2014-reform. The extent to which the requirement fits within an organization's mission, priorities, and values has previously been pointed out as impacting the commitment towards realizing the implementation [11, 16, 50, 51]. Three of those schools were the schools with highest effectiveness (school 1, 2, and 8), whereas the last school had the second lowest effectiveness (school 9). Thus, existing school culture might be an important factor for the degree of implementation.

Organisation of PA within curriculum

The implementation of PA within curriculum was delivered on a daily or weekly basis by 9,5% and 53,4%, respectively. Durlak and Dupre (2008) state that positive outcome results often are obtained with implementation levels around 60% - with few studies having obtained levels greater than 80% implementation degree.

The PA requirement did not demand teachers to deliver PA within curriculum on a daily basis. The requirement did only demand students to be active at least 45 minutes daily within curriculum. This could be reached through extra PE lessons or by making a weekly PA plan with a daily responsible teacher. However, the goal of all students being active 45 minutes daily within curriculum was not achieved at any of the included schools, with effectiveness ranging from 4.5% to 82.6%, regardless of 62.9% of teachers delivering PA within curriculum on at least a weekly basis. Thus, the implementation seemed to some degree to be initiated, but not fully completed.

Results from the interviews showed two key suggestions particularly related to implementation of the mandatory PA within curriculum; scheduling PA within timetables and collaborations with external parties. Introducing a mandatory PA requirement strongly urges school staff to adhere to the requirement. At the same time, there has been an increasing pressure placed on teachers to improve academic performance, and some teachers perceive time spent on academic work to be more beneficial compared with time spent on PA [44]. Prioritizing becomes even more strained. Scheduling PA/PE within timetables helps, thus, ensure that students achieve the mandatory amount of PA within curriculum, while teachers can be content focusing on the academic teaching in the remaining lessons. Of the six schools, that in the present study scheduled PA within timetables, three schools reached an effectiveness greater than 70% (school 1, 2, and 8) whereas the remaining three schools reached an effectiveness of 30-40% (school 4, 7, and 9). Two schools with an effectiveness greater than 70% (school 1 and 2) had tripled the amount of weekly PE, whereas the last school (school 8) had dedicated 30 minutes daily, within timetables, for PA. For some schools scheduling PA/PE within timetables, thus, seemed beneficial in order to accomplish the daily mandatory PA within curriculum. This is also reflected in previous studies, highlighting scheduling of PA within timetables as a facilitator to implementation of PA policies in schools [40]. Moreover, well-defined program components and an extensive teacher manual to support implementation has also been regarded as important for program implementation [14, 51].

Another way to help schools accomplishing the PA requirement could be through collaborations with external parties (e.g., local or national sports clubs or consultant or instructor from the municipality). This finding is reflected in previous studies, showing that cooperation and collaboration among local agencies (e.g. partnerships, networking) are beneficial, bringing different perspectives, skills, and resources to bear on the implementation [16, 18, 47]. This is also supported by de Meij et al. (2013) indicating that involvement and support of experts in sports, health, and education was a facilitating factor for implementation at the user level.

Motivation of school staff

Most school managers had experienced teachers who, from the outset, were poorly prepared for handling PA within curriculum, highlighting the importance of competencies development. Competencies development is often defined as development of skills necessary for implementation, but to an equal extent about having a fundamental mindset about how to handle the implementation [18, 24, 50]. In addition, Durlak and Dupre (2008) state, that development of competencies also is about developing motivation and self-efficacy. Such qualities affect future performance [16]. Thus, motivated school staff is an important factor for the implementation process and has been identified to affect both adoption, implementation, and maintenance [35, 51]. This is in line with Nielsen et al. (2018), highlighting the importance of training in order to ensure teachers level of skills and self-efficacy, both affecting their motivation and dedication to the innovation.

In order to ensure motivated school staff, internal coordinators were in the present study highlighted as favourable agents to include, taking care of workshops, competencies development, and ongoing training for teachers. One of five schools, stating that internal coordinators were essential for maintenance, was the school with highest effectiveness (school 2). At this school they had a team of coordinators, mostly consisting of PE teachers, responsible for making a common thread for integration of PA, ensuring that all teachers, independent of PA competencies, were able to deliver qualified PA within curriculum. The four other schools, highlighting the importance of an internal coordinator, reached an effectiveness between 30-38% (school 4, 5, 9, and 10). Those schools were, however, just in the tentative beginnings of organizing internal coordinators.

Internal coordinators or program champions has been pointed out by others as an advantage in ensuring a successful implementation process [11, 16, 19]. Program champions, particular those who are highly placed in an organization and have the respect of other staff, can do much to help orchestrate an innovation through the entire diffusion process from adoption to maintenance [16].

School management support and priority

School management support was found to be of vital importance for developing a school culture supporting the delivery of PA within curriculum. This is supported by others, reporting that leader support is a clear enhancement in securing motivation to PA programs [14, 16, 51]. Moreover, in a school-based mental health program Kam et al. (2003) showed a significant association between principal support and teacher's fidelity of the implementation on student outcomes. Students improved significantly on all outcomes when both principal support and teacher's fidelity of the implementation were high. Several negative changes were, however, found when principal support was low. This underlines the importance of school management support of the innovation [28].

Results from the interviews showed that school managers experienced some teachers were skeptical towards the mandatory PA components, which could be due to the additional workload following the requirement. Previous research show that, when introducing new innovations, teachers are concerned about potential additional workload,

challenging them to priorities possibilities and obligations [1, 42, 45]. In order to oblige this, the present study showed the importance of shared decision-making, as teacher involvement heightened commitment to the innovation. Involvement of teachers in decision-making processes (e.g. development of a PA implementation strategy) has previously been shown to facilitate motivation innovations, uniting organizational members regarding the value and purpose of the innovation [10, 16, 51]. This further clarify the importance of school management support, taking responsibility for leading the implementation process through teacher involvement and dialogue in order to ensure motivation and ownership for the implementation.

School management priority was in the present study highlighted as a central factor for maintenance. Results further showed, that the two schools searching for teachers interested in PA when hiring reached an effectiveness greater than 70% (school 2 and 8). The importance of school management priority is also shown in previous research in respect of creating coherence and prioritize in situations where consensus about what exactly should be done many time is only partial [16, 18, 35, 48]. A review by Cassar et al. (2019), among others, also found that active involvement of leaders, supporting and prioritizing the PA program, was a key determinant for both implementation and maintenance [6, 31, 32, 51].

Municipal support

Results from the interviews showed that schools felt a lack of support from the municipality in order to maintain PA initiatives. One school highlighting this was the school with lowest effectiveness (school 3). Schools felt that, at times, the sheer volume of new initiatives made it difficult to dedicate adequate resources for one area like, for instance, PA. Schools and the educational system are busy with the core business of learning. This premise affects specific agendas on, for instance, increasing the volume of curriculum based PA [52]. The need for continued municipal support is frequently highlighted – stressing that allocation of resources to schools (e.g., time for schools to develop an PA strategy or support regarding facilities) is needed [16, 30, 39]. Moreover, a study by Skovgaard & Johansen (2020) highlighted the importance of managers (both school and district managers), employees, and other core stakeholders developing a shared strategy for the area and set ambitious goals, which are realistic to achieve. Such strategy could help both schools and municipalities, reaching a common understanding of the implementation process – that it takes times and that schools are not able to implement new startegies every second month.

In the present study, the two schools reaching the highest effectiveness (school 1 and 2) were located in the same municipality. Results from the interviews revealed that all schools in that municipality were economically supported by the municipality if the schools chose to become part of their municipal PA programme, tripling the amount of weekly PE. This case is a great example of a successful implementation process, with active involvement of both schools and municipalities, developing a shared strategy [43].

Methodological considerations

A strength of this study was the use of multiple data sources including accelerometer, questionnaire, and interviews, as it provided a more comprehensive understanding of the RE-AIM dimensions and strengthened the external validity, credibility, and transferability of the study [5, 23]. We recognize, however, that this study has some limitations. Generally, eight of the included schools were located in the region of Southern Denmark and two schools were located in the Capital region. Inclusion of schools from other regions would have been beneficial, ensuring greater national representiveness. Due to the study design of the PHASAR study, this was not a possibility, though [46].

Another general limitation was the inclusion of students from different grades, which made it difficult to compare schools. Consequently, the results indicates that students in lower grades are more active than students in upper grades. Ideally, students from same grades were included at all of the participating schools. Unfortunately, this was not at possibility due to the study design. Exclusion of grade 1 to grade 4 students were chosen, though, as the PA level among the youngest student vary a lot from the older students. Some steps were, thus, taken in order to reach a comparable sample, but age still seem to be of considerable importance.

Another limitation is that recall bias may have emerged, since the interviews were conducted three-four years after introduction of the school reform.

Finally, it is important to acknowledge that the present study only represents teachers through questionnaire. The teachers were unfortunately not able to take part in the interviews due to limited time allocated for taking part in the study.

Conclusions

Using the RE-AIM framework, this study provides an evaluation on a major legal requirement regarding integration of physical activity at Danish public schools. When introducing this type of wide-ranging, national requirement, school managers need to carefully monitor, prioritize, and support the implementation process - taking the lead on establishing a school culture centered around physical activity. Teacher involvement in local decision processes also seem to be of importance, in order to ensure teacher motivation and ownership.

Moreover, the study highlight the benefit of appointing an internal coordinator or a coordination team, responsible for teacher competence development, inspirational materials easy for teachers to use within curriculum, and ongoing training. Finally, it seems beneficial for municipalities, school managers, teachers, and other stakeholders to develop a shared strategy for the implementation process and to set ambitious goals, which are realistic to achieve. This is a central step in order to succeed with widespread and solid implementation of a legal requirement of this sort.

Abbreviations

PA: physical activity, PE: physical education, RE-AIM: Reach, Effectiveness, Adoption, Implementation and Maintenance, PHASAR: Physical Activityt in Schools After the Reform, GIS: Geographic Information System, Redcap: Research Electronic Data Capture, PRISM: Practical, Robust Implementation and Sustainability Model.

Declarations

Ethics approval and consent to participate

The need for ethical approval was waived by the Regional Scientific Ethical Committee (The Region of Southern Denmark, Regionshuset, Damhaven 12, 7100 Vejle), since no intervention was provided by the research team and the study did not contain any human biological material (cf. the guidelines from the National Scientific Ethical Committee). The project was notified and approved by the Danish Data Protection Agency (2015-57-0008), who also gave legal advice and confirmed the legal basis of the informed passive consent. All data are stored and treated in accordance with Danish law for protection and the General Data Protection Regulation.

Consent for publication

Not applicable.

Availability of data and materials

The dataset supporting the conclusions of this article are available at the time of publication upon application to the PHASAR Steering Committee (ktlarsen@health.sdu.dk). If approved by the Steering Committee and the Danish Data Protection Agency, data will be available.

Competing interests

The authors declare no competing interests.

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Authors' contributions

SK, CSP, JT and TS participated in the development of the study design. NHP and SK participated in the data collection and NHP processed the accelerometer data. CSP and SK conducted the coding and the analysis of the qualitative data. SK initiated this paper and wrote the draft. All authors contributed to the writing of the manuscript and critically reviewed its content. All authors approved the final version before submission.

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Figures

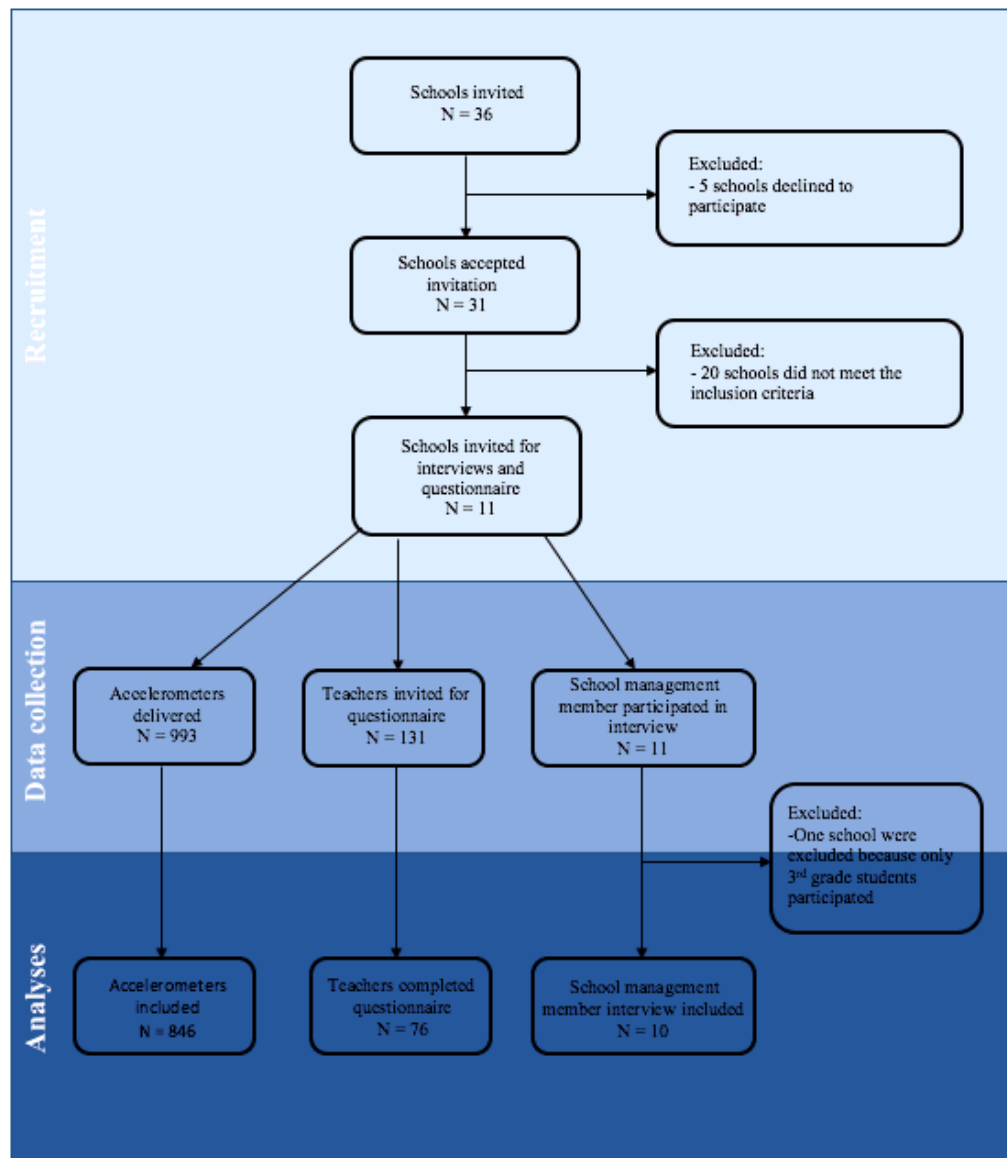


Figure 1

Flowchart of recruitment and measures