Physically Active Lessons in Secondary School
An Intervention Study

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Background: This article describes an intervention study examining the effect of physically active lessons on both educational outcomes and the teachers’ perspective on integrating PA into academic lessons in secondary school.

Methods: A 12-week physically active lessons program using the MIT-approach, Movement Integrated into Teaching. The study outcome was 1) change in math and reading performance 2) the teachers motivation for implementing PA in academic lessons focusing on barriers and opportunities, collected through group interviews with teachers.

Results: The study showed no effect on reading and math scores. However, reading improvements in the intervention group was higher than in the control group, but due to differences in baseline scores, a linear regression showed a ceiling effect. The physically active lessons engage and motivate more students, and it increases the students’ on-task behavior. Integrating PA in the lessons is a challenge, because of the time pressure and strong curriculum demands in secondary school. The teachers see the MIT-approach as a more systematic way of using physically active lessons making the teaching more active and varied.

Discussion: The results of the study are expected to provide schools and policy-makers with new insights into the potential of physically active lessons in secondary school.

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Introduction

Schools are considered an important setting for the promotion of children’s physical activity (Bangsbo, 2016). There are several different arenas for children to be physically active during the school day, e.g. Physical Education, physical exercise, active transportation to/from school, free play in recess and physical activity (PA) integrated in the academic lessons (Pedersen, 2016). The traditional classroom lessons are characterized by sedentary and mandatory physically inactive lessons seven-eight hours a day (Mantjes, 2012), but PA integrated as part of academic teaching is a promising initiative and provides another way for children to be active at school.

Physically active lessons is a rather novel teaching technique that introduces PA into the school learning environment (Kibbe, 2011). The interest from researchers and education professionals in the potential for classroom-based PA to positively impact academic-related outcomes has increased over the last years (Watson, 2017).

The combination of movement and learning through physically active lessons shows well-supported associations between PA and learning outcomes (Tomporowski, 2011). PA has been associated with many cognitive and physical benefits and a reduction of PA does not enhance children’s academic achievement (Fedewa, Ahn, 2011; Donelly, 2016). Implementation of PA in the academic lessons aim to promote both well-being and the students’ academic achievement. A systematic review of studies assessing physically active lessons shows that educational outcomes either significantly improved or were no different compared to physically inactive teaching (Norris, 2015). A recent review concludes that physically active lessons offers a promising strategy to improve the students’ on-task behavior and may have a positive impact on academic-related outcomes (Watson, 2017). However, the review concludes that it is not possible to draw definitive conclusions due to the level of heterogeneity in interventions components and academic-related outcomes assessed (Watson, 2017).

Research also shows that physically active lessons studies need to assess potential difficulties as part of their development and process evaluation phases (to allow potential barriers and challenges to be tackled) (Kibbe, 2011). Teachers will need to be more included in the development of future physically active lessons to ensure that content is both fun and relevant in the teaching environment, and to ensure that the physically active lessons will have the support of teachers and, by that, are more likely to be introduced at curriculum level (Norris, 2015). Implementing physically active lessons
is a challenge worldwide due to a lack of time associated with competing curriculum demands (Watson, 2017), and research shows that we have the same challenges in Denmark, especially in secondary school (Jørgensen and Troelsen, 2017). On the other hand, physically active lessons are considered as unique, because it does not compete for instructional time, and it may be a potentially appealing option for schools as it offers a time-efficient strategy to promote physical activity (Watson, 2017). Furthermore, physically active lessons have the potential to reduce school sedentary time whilst maintaining educational value (Norris, 2015).

While there are no set definitions for classroom-based PA in general, we use the following definition to maintain consistency and clarity. Classroom-based PA is PA carried out during regular class time and can occur either inside or outside the classroom (e.g. hallway, playground) and is distinct from school recess/lunch break times. The classroom-based PA can take three forms. The first two focus on active breaks (breaks from academic instruction and curriculum-focused active breaks), but we focus on the third form: physically active lessons; the integration of physical activity into lessons in key learning areas other than physical education (e.g. mathematics) (Watson, 2017). In this article we use the term physically active lessons referring to the last form, and we add a didactical perspective on these activities explained later in the ‘MIT-approach’.

Academic achievement is defined as a student’s performance on school-related tasks; in this paper measured by national standardized tests.

Purpose and research question

Physical activity can take place in many arenas and forms in schools, such as Physical Education, active breaks, physical exercise, active transportation to/from school, free play in the break times and PA integrated in the academic lessons (Pedersen, 2016). This study focuses only on the latter, using the MIT-approach (see below) with the purpose of answering the following two research questions:

1. Does a 12-week intervention of the MIT-approach affect reading and math skills in 13–15 years old students?
2. What are the main barriers and opportunities for implementing the MIT-approach in the teachers’ perspective?
Design

To answer the research questions this study was conducted using a mixed methods design consisting of both quantitative and qualitative data generation each designed to answer one of the two research questions. The mixed methods design enables us to combine generality (the effect) with particularity (teachers experiences) (Cohen, Manion, & Morrison, 2017, p. 24). The study was targeting Danish students in 8th grade (13–15 years old) and was carried out between August and December 2017 in 3 schools in the southern region of Denmark. Two of the schools were chosen as intervention school and one school as control school, comprising a total of 281 students.

The intervention was a 12-week physically active lessons program integrating PA into the academic lessons using the MIT-approach. Students in both intervention and control schools continued with their normal PE schedule (90 minutes / week). All classroom teachers in 8th grade in the intervention schools participated in an initial workshop, received materials containing ideas for activities and received supervision on how to integrate 45 minutes of physically activity into academic lessons. The teachers were also provided teaching material including suggestions for activities and content for each of the five types of PA in the MIT-model. The teachers were supervised by researchers with extensive MIT-experience six times during the 12-week intervention period. Teachers in control schools were instructed to continue to use traditional classroom instruction/teaching.

The quantitative data generation and analysis

To document the duration of each of the MIT-categories, as well as the total time spent on MIT-activities, teachers wrote down every day on a form located at the school how many minutes they had implemented the different MIT-categories that day and in which lessons.

To assess the effect of the intervention, a school-based quasi experimental controlled trial was conducted. Math and reading performances by 159 pupils (47% boys) in the intervention school, and 122 pupils (54% boys) in the control school were tested pre- and post the intervention using standardized national tests validated by the Danish Ministry of Education (Styrelsen for It og Læring). These tests have been developed specifically for this age group. Math and reading tests yielded a score for each student between 0 and 100.
For the initial statistical analysis an unpaired t-test was used (Kirkwood & Sterne, 2003, p. 66). However, the reading test scores showed a statistically significant difference in the pre-test scores between intervention schools and control schools. This produces a risk of a “ceiling effect” where the unpaired t-test shows a positive effect, but the result is due to the difference in baseline scores and not the intervention. To test if the difference in reading scores was due to baseline performance or the intervention, a linear regression was used with the reading score after the intervention as the dependent variable and the reading score before, and if the pupil were in the intervention or control group, as explanatory variables. (Kirkwood & Sterne, 2003, p. 316).

All statistical analyses were performed using SPSS 25.

The qualitative data generation and analysis

The qualitative data was generated primarily through semi structured group interviews with the teachers, but also through recorded informal conversations during supervision session (Cohen, 2017, p. 432). All interviews and supervision sessions were conducted at the local school. Interviews were conducted using an interview guide developed on the topics and themes emerging throughout the supervision sessions and informal interviews during the 12-week intervention. Interviews were transcribed from recorded files and analyzed using a grounded theory inspired approach (Charmaz, 2006, p. 42). The initial coding was performed “close to the data” without preconceived theoretical codes or categories. After the initial coding process, several categories emerged as the most important and frequent codes. Data was then coded once again in a “focused coding” (Charmaz, 2006, p. 57) using these new categories. The most interesting and important codes became the themes of this paper.
The intervention – the MIT-approach as the groundwork for physically active academic lessons

The intervention was a 12-week physically active lessons program integrating PA into the academic lessons using the MIT-approach. The teachers were provided teaching material including suggestions for activities and content for each of the five types of PA in the MIT-model.

Figure 1. The Movement Integrated into Teaching (MIT)-model:

The physically active academic lessons were based on the didactical model “Movement Integrated into Teaching (MIT) model” (EMU, 2017). The model is developed for the Danish Ministry of Education and defines and systematizes the types of physical activities that can be used to integrate
physical activity into academic subjects in secondary school. The MIT model is divided into five categories to provide an overview of the different ways in which the teacher can integrate physical activity into academic subject teaching in secondary school. The model illustrates how PA can be included as active elements in the learning process as playful, practical, applied and creative teaching practices – therefore helping to make teaching more versatile and varied.

The five categories in the model are explained below, with examples of how a given MIT-activity can be introduced into many different academic subjects and suggestions for various types of academic subject content.

1. Games/playful

This category includes games, to which academic subject content is added. Games are particularly suitable when working with specific skills-related aspects of academic subjects, in which the students have an opportunity to repeat and practice the academic subject content.

**Activity: “Who am I?”**
(materials: Images, e.g. from newspapers, magazines, the internet or notes with academic concepts/terms)

*Instructions:* Each student has the image of a person (e.g. in social studies, a picture of a politician) on his or her back. He or she cannot see, who that person is. Students mingle. The students must discover the identity of the person pictured on their back by asking questions to other students, who may answer only Yes or No. To vary, the students guess academic subject-related terms.

*Variations:* Biology (e.g. plant species), Religion (e.g. the Nordic gods), History (e.g. American presidents, Physics/chemistry (e.g. acids/alkalis in the home), English/German (nouns, names of cities or famous people, about which/whom the students may only ask questions in English/German).
Activity: “Quick off the mark”
(no materials)

Instructions: The students sit in a circle on chairs. One of them stands in the middle. The teacher has given each student a part of speech (language teaching), i.e. noun, verb or adjective. The student in the middle of the circle says a word, e.g. “bicycle”. The “noun” students must find a new chair, and the student in the middle must rush to find himself/herself a chair. The student, who does not have a chair, stands in the middle. The student in the middle may also choose to say, “all parts of speech”, signaling that everyone must find another chair to sit on.

Variations: Geography (countries, cities and islands), Biology (fish, birds and snakes), Social studies (socialism, liberalism and conservatism, the student in the middle can name either a politician or a party.)
2. Structuring the teaching

This category explains how to structure teaching to ensure that the students stand up and move around. The classroom as a space is incorporated into work with academic subject content, without implicating the aspect of play (as in the case of the first category), for example, new and active ways of organizing group work and class discussion.

Activity: “Speed dating”
(no materials)

Instructions: Half of the students form a circle and stand with their backs to the center. The other half of the students form a circle outside the first circle, standing face-to-face in pairs. The teacher asks an academic subject-related question. Each pair discusses their response (e.g. for 2 min.). When the time is up, the outer circle moves one place to the left. The teacher now asks the first question or a new question, which the students discuss with their new partner. It is a good idea to ask academic subject-related questions or tasks that require some conversation or explanation. If not, the students may finish too quickly. The questions should be suitable for discussion with more than one partner. In this way, the student brings knowledge from previous conversations into play in conversation with subsequent partners.

Variations: Questions: Social studies (e.g. why Denmark should continue or not continue to be a member of the European Union?). Religion (e.g. is it ok to wear a headscarf in school?) History (e.g. what role in history did the Vikings play?), Biology (e.g. how can we best help save endangered species?)

Figure 3.1. “Speed dating”
Activity: “For or against”
(no materials)

Instructions: The teacher makes a statement that refers to attitudes, values and dilemmas. The students form a line across the classroom. The scale covers “totally agree” at one end and “completely disagree“ at the other end. The students must then discuss and argue their point of view.

Variations: Social studies (e.g. the age of criminal responsibility should be reduced to 14 years?), Geography (e.g. climate change is exclusively man-made?), History (e.g. active involvement in the war in Iraq was the right choice to make?), Biology (e.g. animal cloning is a good idea?).

Figure 3.2. “For or against”

3. Physical manifestation of the academic subject

This category contains activities in which the students physically enact the academic subject content they have read about or worked with during lessons.

Activity: “Prepositions”
(materials: ball, pencil, eraser or similar)

Instructions: 1. The teacher asks the students to take up a physical position relative to their chair: under, in front of, on, etc. 2. The students work in pairs. They take turns to place the ball different places in the classroom, e.g. on the table, beside the cupboard or behind the door. When a student has
uttered a sentence in which the preposition is correct, e.g. “The ball is lying under the chair”, it is his/her turn to put the ball in a new place.

*Variations:* Other languages (e.g., English, German, French, Spanish).

![Figure 4.1. “Prepositions”](image)

**Activity:** **“Rope Geometry”**

(materials: rope)

*Instructions:* The students form groups of about five. Each group has a length of rope/string. Each member of the group has their hands on the rope.

*Variations:* **Mathematics:** Each group must make the following with the rope: e.g. a circle that is X cm in diameter, a rectangle with a perimeter measuring X cm, an equilateral and a right-angled triangle.

![Figure 4.2. “Rope Geometry”](image)
4. In situ activities

The fourth category comprises physical activities in which the students work with academic subject content, that is applied in a context or situation, that is appropriate for the subject in question. This category uses working methods that involve nature, outdoor pursuits and the local environment.

Activity: “Applied mathematics”
(materials: tape, rulers)

Instructions: Working in small groups, the students are asked to use mathematics in practice, e.g. to calculate and measure in their local environment: The area of the school yard, volume of a playhouse, perimeter of the sandbox, height of a swing frame and cycle shed roof pitch (as a percentage).

Variations: Mathematics: Draw a cylinder, cone, prism, pyramid, ball, parallelogram, pentagon, trapezium, etc. Then take pictures of these figures as they appear in nature, the local area or urban spaces.

Figure 5.1. “Applied mathematics”

5. Creative and aesthetic learning activities

The fifth category comprises physical activities that have special focus on creative, aesthetic activities. These activities work with academic subject content in alternative and innovative ways, e.g. via drama, music and other expressive activities.

Activity: “School Subject Theatre”
Instructions: The students sit in a large circle. The stage is in the middle. They dramatize, play role play or shadow theatre in different academic subject-related categories.

Variations: History (e.g. dramatizing the occupation of Denmark during World War II or The Colonial Era and slave trading), Social studies (dramatizing themes, e.g. identity and the social media, lifestyle and consumption), Danish (dramatizing different genres, e.g. a fairytale. The dramatization could be an alternative ending to it or transposing it into another genre, e.g. science fiction).

Figure 6.1. “School Subject Theatre”

Regarding the MIT-approach it is generally true to say of the five types of physical activities that, in practice, teachers will often find that the categories overlap, i.e. that an individual physical activity may contain elements from several categories.

Ethics

Data collected for the study did not involve personally sensitive information, and all data were anonymous. The study complied with the Danish Data Protection Agency (The Danish Ministry of Justice 2000). Given the nature of the data no approval was needed.
Results – quantitative

On average, intervention schools implemented PA on 36.4 out of the 60 possible days during the 12-week period. The 24 days where MIT-activities were not implemented, this was due to different schooldays, e.g., project week, school sport days, science days, company visit and other alternative schooldays, which means that physical activity appeared in other ways, but not as MIT-activities.

The MIT-activities were implemented throughout the school day. 25% of the minutes containing MIT-activities were in math lessons, 42% in Danish/reading lessons and 43% in other subjects.

On the 36 days where PA was implemented, the average was 40 minutes of PA per day. The distribution of minutes by the five different MIT-categories are shown in table 1.

**Table 1.** Average minutes og PA implemented daily.

<table>
<thead>
<tr>
<th>Type of PA/MIT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structuring the teaching</td>
<td>13.8</td>
</tr>
<tr>
<td>Games/playful</td>
<td>8.3</td>
</tr>
<tr>
<td>In situ activities</td>
<td>9.1</td>
</tr>
<tr>
<td>Creative learning activities</td>
<td>5.9</td>
</tr>
<tr>
<td>Physical manifestation</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

“Structuring the teaching” accounts for the most (13.8) minutes, while “Physical manifestation” accounts for the least (2.9) minutes.

Changes in math and reading scores before and after the intervention can be seen in table 2.

**Table 2.** Math and reading scores before and after the intervention (standard deviation).

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n=159)</th>
<th>Control (n=122)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>End</td>
<td>Change</td>
<td>Baseline</td>
<td>End</td>
<td>Change</td>
</tr>
<tr>
<td>Math score</td>
<td>43.8</td>
<td>54.7</td>
<td>7.8</td>
<td>49.1</td>
<td>58.6</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>(20.6)</td>
<td>(19.7)</td>
<td>(11.3)</td>
<td>(19.2)</td>
<td>(19.3)</td>
<td>(9.3)</td>
</tr>
<tr>
<td>Reading score</td>
<td>50.6</td>
<td>69.7</td>
<td>18.5</td>
<td>64.1</td>
<td>73.3</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>(18.0)</td>
<td>(15.6)</td>
<td>(14.6)</td>
<td>(17.4)</td>
<td>(16.5)</td>
<td>(17.6)</td>
</tr>
</tbody>
</table>
The initial statistical analysis used was an unpaired t-test (Kirkwood & Sterne, 2003, p. 66) showing a significantly higher improvement in the intervention group in reading score compared to the control group, indicating that the intervention had a positive effect on reading score. There was no significant difference between the improvement in the intervention and control group in math score. However, due to the difference in baseline reading scores a possible “ceiling effect” could be in effect. To test if the difference in reading score improvements was due to baseline performance or the intervention, a linear regression was used with reading score after the intervention as the dependent variable and the reading score before, and if the pupil were in the intervention or control group as explanatory variables. (Kirkwood & Sterne, 2003, p. 316).

Table 3. Regression results for reading scores after the intervention (standard error).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Significance (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline reading score</td>
<td>&lt; 0.000 (0.52)</td>
</tr>
<tr>
<td>Intervention / control school</td>
<td>0.345 (1.993)</td>
</tr>
</tbody>
</table>

The linear regression showed that the difference in reading improvements between intervention and control schools indeed was due to baseline differences and not the intervention.

Results – qualitative

The following analysis is based on the group interviews with the teachers from both intervention schools.

In the analysis of the teachers’ motivation and understanding of implementing PA in the academic lessons, three overall themes emerged and characterizes the teachers view on barriers and opportunities regarding the implementation of PA in the academic lessons.

Planning and time

The teachers point out that the planning of the PA is very important. The teachers experience that PA is often planned just before the lesson, which means a lack of quality compared to when they plan the PA at the same time.
as they plan the academic content. By implementing the PA in the early stages, the teachers experience, that PA makes more sense and is integrated in a more meaningful way.

It was much easier when we planned the PA in the beginning of a new course or subject, because then the PA was not something that I should ‘put in’ afterwards. That PA was integrated from the beginning made it easier and more meaningful. (Teacher, 8th Grade)

The teachers also mention that they feel a time pressure in secondary school, because of the academic tests and the tight time frame. It means that the teachers are focusing on the academic content and therefore use more traditional classroom activities, because, as the teachers say, they feel safer using traditional teaching methods. This challenge is like the findings in a new review of barriers and opportunities of implementation of PA in Danish schools in the teachers’ perspective (Jørgensen and Troelsen, 2017) that also shows that academic pressure and lack of time in general is a big challenge regarding the implementation of physically active lessons in secondary school. As mentioned in the introduction of this article, there is the same challenge internationally, where classroom-based PA can be difficult to implement due to a lack of time associated with competing curriculum demands (Watson, 2017). Because of the teachers experience of lack of time, it is an important finding in this project, that PA needs to be as easy as possible to implement for the teachers in the lessons and not require much additional preparation time.

**Students motivation**

The teachers experience that the physical activities engage and motivate more students in the lessons;

It is interesting, how many students I have activated in my academic teaching, and how verbal contributions have increased among the students by organizing the teaching in new and different ways by implementing different physical activities in the lessons. (Teacher, 8th Grade).
The teachers point out that it is especially the quieter students that speak up in for example the verbal class discussions, because the activities make it possible to create new ways of organizing these activities.

The teachers experience, that the PA lessons create more on-task behavior, which aligns with other studies (Norris, 2015). The activities motivate the students, and especially the ones that are not active in the more traditional teaching methods in the classroom.

The teachers also experience that the physical activities contribute to new and other ways of learning, which also increases the students’ motivation;

Before, the students would almost just use paper and pencils. Now they learn through new experiences using the body and movement in the academic learning activities. (Teacher, 8th Grade).

The teachers also mention that the physically active lessons have a positive influence on the social relations between the students, and they point out that if they involve the students in the implementation of PA lessons, then the students get more motivated. It does not mean, that the students must determine the content and forms of PA, but if the students experience that their ideas and opinions are heard, then they get more motivated.

_The teachers’ experiences with the MIT-approach_

In general, the teachers see the MIT-approach as a new and more systematic way of using PA and movement in the academic lessons.

Out of the five types of the MIT-approach, ‘structuring the teaching’ was most implemented (see table 2). The teachers explain that this type of MIT is easier to implement because they have more experience with this teaching method compared to the other categories. The teachers say that it makes good sense to organize the students’ group work in more active ways, and these activities are rather easy to implement in all the different academic lessons and subjects. According to the teachers, this category engages more students in the verbal discussions in the classroom, because some of the students seem to be safer to participate in a verbal academic conversation with just one or two other classmates, compared to participating in a class discussion with 28 other students.

The second most implemented category was ‘in situ activities’ (see table 2), and the teachers’ experience are that this category is best implemented in
a subject like science, because it makes sense that the academic content in these subjects involves teaching in natural outdoor environments.

The category ‘games and playful’ (see table 2) is implemented almost just as much as the category above, and the teachers experience that this category is possible to implement in all subjects and lessons. They point out that this category mostly was suitable to work with specific skills-related aspects of academic subjects, and train and repeat well-known academic content. The students were very active and had fun playing while training the academic content in the games. As the teachers express, sometimes it was difficult to add academic content in the games that was not academically too easy for the students.

The activities in the category ‘creative and aesthetic learning activities’ were best implemented in the humanities, e.g., the subjects Danish and English, and the teachers mention, that activities as roleplay and theater activities involved more students in the lessons, and hereby increased the students’ motivation and engagement. On the other hand, it was difficult for the teachers to implement this category meaningfully in subjects like math and science.

The category ‘physical manifestation of the academic subject’ was clearly the most difficult category to implement for the teachers. They point out, that it was difficult to find relevant activities that could match the academic level in secondary school. On the other hand, the teachers did have some good examples of when it was successfully implemented, e.g., working with geometry in math or prepositions in English, where the students, in the teachers’ perspective, better remembered the academic content because they used their body in the learning process. In general, the teachers say that it was difficult to implement all five categories, and they did it differently. The MIT-approach takes time to implement successfully, and the teachers felt a lack of competence in periods. On the other hand, the teachers point out that they all had individual competences, and by teamwork and supervision they experienced that the MIT-approach made the teaching more varied and versatile.

As one teacher said in the interview:

MIT-activities make sense in different academic content, and here we have to do better to implement the MIT-approach. And then there is other academic content, where it doesn’t make good sense to use MIT-activities. (Teacher 8th Grade)
This point is in line with the intention of the MIT-approach. The teachers have free rein to integrate the MIT-activities in a meaningful way, and it is up to the teachers’ pedagogical and didactical considerations to implement MIT, where it makes sense and is in line with the educational goals.

Some of teachers thought it was difficult to teach and implement the MIT activities because of lack of competence, which is a challenge for teachers in general (Jørgensen and Troelsen, 2017). The teachers suggest that the implementation of the MIT-activities should start already in the beginning of primary school, because then it is easier for the teachers to continue this way of active teaching in secondary school, and the students are more familiar with the activities. Fortunately, many schools have fully qualified teachers, who have a strong professional physical activity profile, and therefore it is very important, that schools give free rein to use these competences, so they can supervise and guide colleagues who are not so familiar with implementing MIT-activities.

Finally, the teachers say, that the MIT-activities need only little or no materials, which they see as a strength in the project. This easy and low economical implementation gives positive perspectives, if the MIT activities should be implemented in other schools and settings.

Given that physically active lessons are still relatively novel (Norris, 2015, Watson 2017), and that only few studies have assessed academic outcomes following the integration of PA in the lessons, we hope that this study contributes to new insights on this important field.

Limitations

This study is built on a 12-week intervention, which is recommended as a minimum time period to target physically active lesson work (Norris, 2015). However, it would be beneficial to make a study on this field in a larger scale and for a longer time period using the MIT-approach.

As mentioned earlier, this study used standardized national tests in math and reading to determine the intervention effects on academic achievement. However, a recent review shows that interventions of shorter duration are more likely to show an improvement in academic achievement, if a progress monitoring tool is used, rather than the national standardized test used in this study. The review points out that standardized tests usually are designed to be administered less frequently (e.g., yearly) and are not sensitive to small changes in academic achievement (Watson, 2017). Therefore, applying a
progress monitoring tool would be important to consider for intervention studies like the current study in the future, if academic achievement is the outcome of interest.

Considering the importance of providing a full intervention description to allow reproduction by researchers and teachers (Norris, 2015), a thorough description of the intervention has been presented, explaining the MIT-approach and how the teachers were integrating PA in the academic lessons during the intervention. However, explaining the MIT-approach with full details would require a deeper elucidation with rich didactical and practical examples, which is not possible in the framework of a scientific paper.

It is important that teachers are more included in the development of future physically active lessons to ensure, that this kind of active teaching will have the support of teachers, and by that more likely will be introduced at curriculum level (Norris, 2015, Watson 2017). Based on the experiences from this study, future studies should already include the teachers in the early stages of the development of the study and intervention, both to qualify physical activities during lessons and to increase the teachers’ ownership of the project. At the same time, it is also important to involve the school’s principal or school leadership in the early stages of the planning of the intervention, ensuring ownership of the project and hopefully, together with the group of researchers, support the teachers during the project.

Conclusion

This study showed no effect on reading and math scores of a 12-week intervention of the MIT-approach in 13–15 years-old students. However, reading improvements in the intervention group was higher than in the control group, but due to differences in baseline scores a linear regression showed a ceiling effect.

The study showed that the physically active lessons engage and motivate more students, and they increase the students’ on-task behavior during lessons from the teachers’ perspective. The teachers also point out, that it creates new and different ways of learning for the students, and it contributes to positive social relations between the students. According to the teachers, integration of PA in the academic lessons is a challenge, because of the time pressure and strong curriculum demands in secondary school. It is also a challenge that the teachers feel a lack of competence in this field.
Regarding the special MIT-approach used in this project, the teachers see it as a more systematic way of using PA in the academic lessons in secondary school, and they experienced that this approach made the teaching more active, varied and versatile. Some of the five categories were easier to implement than others, and it also depended on the specific lessons and subjects.

The results of this study are all in all expected to provide schools and policy-makers with new insights into the potential of PA-integrated teaching in secondary school to improve academic achievement and students’ motivation in school. The MIT-approach can easily and inexpensively be scaled and disseminated across elementary and secondary schools in Scandinavia and other countries, to improve both educational quality and students school motivation.

References


