



FINNISH NATIONAL  
BOARD OF EDUCATION

## PHYSICAL ACTIVITY AND LEARNING

**SUMMARY**

**STATUS REVIEW  
OCTOBER 2012**

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## Previously published status reviews from the Finnish National Board of Education:

**Kielten tarjonta ja kielivalintojen perusteet perusopetuksessa.** Tilannekatsaus joulukuu 2011. Muistiot 2011:3. ("Language Choices and the Basis of Language Selection in Basic Education. Status Review December 2011.")  
Authors: Teija Kangasvieri, Elisa Miettinen, Pirkko Kukkohovi & Marita Härmälä.

**Aivot, oppimisen valmiudet ja koulunkäynti. Neuro- ja kognitiotieteellinen näkökulma.** Tilannekatsaus tammikuu 2012. Muistiot 2012:1. ("The Brain, Learning Capacity and School. The Perspective of Neural and Cognitive Science. Status Review January 2012.") Edited by Teija Kujala, Christina M. Krause, Nina Sajaniemi, Maarit Silvén, Timo Jaakkola & Kari Nyssölä.

**Koulutuksen järjestäminen kohti 2020-lukua. Kuntarakenteen, oppilaitosverkoston ja ohjauksen nykytilanne sekä kehitysnäkymät.** Tilannekatsaus huhtikuu 2012. Muistiot 2012:2. ("Providing Education for the 2020s. Current situation and outlook of the municipal structure, network of educational institutions and steering. Review April 2012.")  
Authors: Riku Honkasalo & Kari Nyssölä.

**Muuttuva oppilaitosjohtaminen.** Tilannekatsaus toukokuu 2012. Muistiot 2012:3. (Changing School Management. Status Review May 2012.") Authors: Jukka Alava, Leena Halttunen & Mika Risku.

**Opetussuunnitelman käsittely opettajankoulutusten opetussuunnitelmissa.** Tilannekatsaus kesäkuu 2012. Muistiot 2012:4. ("Treatment of the Curriculum in the Curricula of Teacher Training Programmes. Status Review June 2012.")  
Authors: Erja Vitikka, Jaanet Salminen & Tiina Annevirta.

# Physical activity and learning

This review explores the association between physical activity and children's learning on the basis of recent research results. It is intended for teachers, teaching staff, directors of municipal educational and cultural services and others involved in making decisions on education. Its purpose is to highlight the complex significance of physical activity to children's growth and development, especially learning. The review also provides support and offers means to increase physical activity. It presents the latest research results, published between 2008 and 2011, on the effects of physical activity on children's learning and academic achievement, while also taking a stand on how to make use of the results.

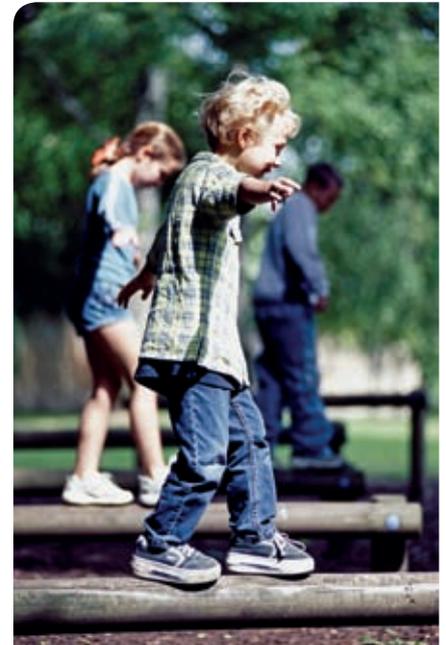
The review starts by describing the effects of physical activity on academic achievement, cognitive functions and schooling. It then goes on to examine the mechanisms that may possibly mediate the effects of physical activity on learning. In addition, it presents best practices to increase children's physical activity during the school day and analyses what the research results mean in terms of Finnish children and increasing physical activity at school.

The review examines physical activity from the perspectives of school physical education classes, other physical activity during the school day, leisure-time physical activity, overall physical activity and physical fitness. Learning, in turn, is considered from the perspectives of school grades, cognitive functions (attention, perception, memory and problem-solving), behaviour and schooling.



## Concepts:

- **Learning** is a core process of human growth and development. It is a key enabler of change in human behaviour. Learning results in changes in behaviour and the knowledge, skills and emotional reactions underlying behaviour. Through learning, we can adapt to changes in our environment and also actively influence our environment and our own behaviour as part of it. Learning is always an active and interactive process which takes place in a cultural and social context. Experiences obtained from the growth environment both cause and regulate learning.
- **Physical activity** is an important medium of learning offered by the growth environment. Although physical activity can be defined in the context of energy expenditure as any bodily movement that substantially increases energy expenditure over the resting level, it can be seen as a biocultural behaviour: energy is expended in active behaviours that occur in different forms and cultural contexts. Through physical activity, people learn to move, learn about themselves and about physical activity. **Exercise** is a subcategory of physical activity and can be defined as planned, structured and repetitive physical activity.
- **Cognitive functions** are related to reception, storage, processing and use of information, including attention, perception, memory and thinking. The term 'executive functions' is an established concept used in psychology to refer to co-ordination and control of information processing. **Executive functions** regulate other cognitive functions essential to human activity, such as memory, attention and thinking. Executive functions are responsible for setting goals, planning operating methods, selecting and controlling the cognitive functions required to achieve the goals, as well as for voluntary control of an individual's own actions, flexibility of actions as well as evaluation of actions. Such functions are essential in terms of making decisions, solving problems and learning.



**Physical activity is an important medium of learning offered by the growth environment.**

# The significance of physical activity to learning

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**Studies have linked physical activity integrated into classes, the amount of physical activity and good aerobic fitness with good school grades.**

**Increasing physical activity improved test results, in particular in tasks requiring executive functions and memory.**

## 1. Physical activity and academic achievement

Over recent years, research into the association between physical activity and academic achievement has increased considerably. The latest studies have shown a link between physical activity integrated into classes, the amount of physical activity and aerobic fitness, on the one hand, and school grades and standardised test results in individual subjects, on the other. The positive effects of physical activity on academic achievement have been detected in mathematical subjects in particular. Participation in training as a member of sports and exercise clubs has been linked to good performance at school. Furthermore, it should be noted that studies that involved increasing the time spent in physical education classes and breaks and, correspondingly, decreasing the amount of time spent in academic classes did not show any deterioration in pupils' academic learning outcomes.

## 2. Physical activity and cognitive functions

Physical activity has been found to have a positive effect on children's cognitive functions, such as memory, attention and general information processing and problem-solving skills. The latest studies indicated that increasing physical activity improved test results, in particular in tasks requiring executive functions and memory. However, there is still very little research on the direct effects of physical activity on cognitive functions and the results are somewhat inconsistent. Research has also shown that good aerobic fitness has a positive correlation with memory and executive functions. Conversely, muscular fitness does

not appear to have any link to cognitive functions. The connections between physical activity and cognitive functions may contribute to explaining the link between physical activity and academic achievement.

### 3. Physical activity and schooling

In addition to academic achievement and cognitive skills, physical activity also appears to promote other aspects that are important in terms of learning, such as classroom behaviour, concentration on assignments and participation in classwork – and, subsequently, learning itself. Physically active pupils also have higher goals for further studies after comprehensive school. Moreover, physically fit pupils are absent from school less frequently than their less fit peers.

The passages above condensed research results published between 2008 and 2011. In summary, it is fair to say that physical activity has positive effects on learning. However, results vary between studies and some have not found any link whatsoever between activity and learning. This calls for further high-quality research into this subject. The table on the following page is a compilation of examples of studies used in this summary.



**Physically active pupils also have higher goals for further studies after comprehensive school.**

Authors	What was done?	Results
<b>Donnelly et al. (2009)</b>	The study involved adding 90 minutes of moderate-to-vigorous physical activity to the school week by organising ten-minute physical activity sessions for second- and third-year pupils in between classes.	Subject-specific test results in reading, spelling, mathematics and composite improved over a period of three years.
<b>Reed et al. (2010)</b>	In the study, a total of 30 minutes of in-class physical activity was organised for third-year pupils during the course of one school day, repeated on three school days per week over a period of four months.	Pupils in the test group performed better than the control group in standardised tests in the humanities and social subjects. Added physical activity also had a positive correlation with fluid intelligence, which illustrates the ability to reason quickly and abstractly.
<b>Castelli et al. (2011)</b>	In the study, 9-year-old children participated in an afterschool physical activity program every day for a period of nine months. The program lasted a couple of hours, involving about 40 minutes of moderate-to-vigorous physical activity.	Children accumulating more moderate-to-vigorous physical activity during the physical activity programme performed better than their peers in the most demanding tasks requiring executive functions.
<b>Davis et al. (2011)</b>	In the 13-week study, children aged 7 to 11 were divided into a control group and two different exercise groups, which only differed in terms of the amount of moderate-to-vigorous physical activity (low-dose group: 20 minutes per day, high-dose group: 40 minutes per day). The children participated in exercise groups at the end of every school day.	<p>The research results indicate a correlation between increasing the amount of daily aerobic exercise by 40 minutes and better scores in a mathematics test, but not in a mother tongue test.</p> <p>The children who participated in exercise program significantly improved their scores in assignments requiring executive functions when compared with children in the control group. Furthermore, the children in high-dose exercise group achieved significantly better scores than children in low-dose exercise group.</p>
<b>Kamijo et al. (2011)</b>	In the 9-month study, children aged 7 to 11 participated in a two-hour afterschool physical activity program following each school day. The programme focused on aerobic exercise, but it also included a muscle fitness session twice per week. Children accumulated at least 70 minutes of moderate-to-vigorous physical activity on a daily basis.	Response accuracy in a memory test improved among children who had participated in physical activity, whereas there were no changes in accuracy among children in the control group. Furthermore, the benefits of physical activity were the more pronounced, the more demanding the memory tasks were.

# Factors mediating links between physical activity and learning

Based on research, physical activity does not necessarily have a direct effect on learning outcomes; instead, the effect is mediated through several other factors.

It would appear that the anatomical and physiological effects of physical activity do not only extend to the whole body but also to the brain. Physical activity increases brain volume and activity, in particular in regions associated with memory and executive functions. The changes brought about by physical activity in brain structures and functions create additional possibilities for learning. Furthermore, motor and cognitive skills would appear to develop hand in hand, because the same mechanisms of the central nervous system are responsible for controlling both motor and cognitive skills in parallel. Physical activity also offers opportunities to meet and solve challenges in the living environment, which will further develop not only cognitive, but also social skills.

Engaging in physical activities offers opportunities for social interaction, which may explain the link between physical activity and learning. Participation in organized physical activities develops children's and young people's ability to listen to and follow instructions, wait for their own turn and choose ways of action appropriate for the situation. Furthermore, physical activity provides them with opportunities to vent and process their feelings. At its best, engaging in physical activities develops teamwork skills, self-direction and the ability to co-operate with different people. These aspects may contribute to explaining physically active children's good learning outcomes. It has also been observed that the positive effects of physical activity are mediated through self-esteem and school satisfaction. Moreover, obesity may have negative effects on children's cognitive functions and learning.



**Physical activity increases brain volume and activity, in particular in regions associated with memory and executive functions.**

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# The significance of physical activity to health

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Over the last thirty years, Finnish children's and young people's aerobic fitness has deteriorated and obesity has increased. Overweight girls and boys account for about one fifth of the 12-year-olds' age group. Childhood and adolescent obesity often continues on to adulthood. There are many underlying factors behind obesity, but the single most important reason is excessive energy intake relative to expenditure.

Finnish physical activity recommendations encourage children younger than school age to take at least two hours brisk physical activity every day, and school-aged children to be physically active for at least 1 to 2 hours daily, in a variety of ways suitable for each age. Based on physical activity measurements, about one half of Finnish primary school pupils and only one sixth of lower secondary school pupils fulfil the minimum recommendation for physical activity. Follow-up studies show that a high level of physical activity in childhood and adolescence also predicts a physically active lifestyle in adulthood.

Physical activity has a beneficial effect on children's physical and mental health. Physical activity reduces the risk of contracting cardiovascular diseases, prevents excessive weight gain and maintains or improves physical fitness, while also having a positive effect on children's mental health. A sufficient level of physical activity is vital for normal growth and development. At its best, physical activity supports children's physical, cognitive, motor, social and ethical growth and development in many ways.

A physically active lifestyle has a significant bearing on overall health at all stages of the life cycle. However, the foundations for good health in adulthood and prevention of obesity and osteoporosis are already laid during childhood. The sooner we pay attention to physical activity and inactivity, the more lasting the results that we can achieve.



**School-age children are encouraged to be physically active for at least one to two hours daily, in a variety of ways suitable for each age group.**

**The foundations for good health in adulthood and prevention of obesity and osteoporosis are already laid during childhood.**

# Ideas to increase children's daily physical activity

Increasing children's physical activity and promoting a physically active lifestyle call for engaging children, their parents, teaching staff and decision-makers. Parents' support, example and attitudes are of particular importance, because a physically active lifestyle is adopted at a very early stage. Regular leisure-time physical activity plays a significant role in increasing children's overall physical activity, regardless of whether this takes place at sports clubs or with family and friends.

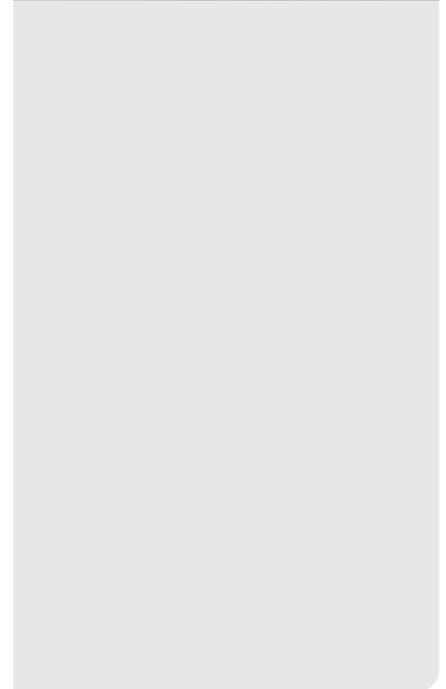
Schools also play an important role in encouraging children to be physically active.

*Physical education at school aims to have a positive effect on children's and young people's physical, mental and social functioning and well-being.*

## Physical education at school

- reaches all pupils, in particular physically inactive children;
- provides skills, knowledge and experiences based on which it is possible to adopt a physically active lifestyle;
- offers an opportunity to reflect on right and wrong, selfishness and following the rules and to go through different feelings;
- supports pupils' well-being and growth towards independence and collaboration as well as self-motivated physical activity.

→ Increasing physical education at school and developing its contents are important means of promoting children's exercise.



### **There are diverse options available to increase physical activity at school:**

- increasing physical education
- different types of physically active breaks
- sporty events
- physical activity during school breaks and when commuting between home and school.

These activities complement physical activity taken during the school day and help pupils adopt a physically active lifestyle. They also add some pep and spice to the school day that are important for learning. During the pilot phase of the national Finnish Schools on the Move programme in 2010–2012, several schools have developed and experimented with various actions to increase physical activity during the school day. Some examples have also been collected in the table on the next page.



## Examples of increasing physical activity during the school day:

Break-time physical activity	
<b>Longer physically active breaks</b>	A longer physically active break can be organised by combining morning lessons or arranging for a longer break as part of school lunch. The longer morning lessons are interrupted with a couple of minutes of exercise to maintain concentration on learning.
<b>Break-time peer activators</b>	Some pupils are trained to become break-time activators - physical activity instructors during breaks. These 'break activators' plan and organise break-time physical activity for their peers and brainstorm purchases of exercise equipment, for example.
<b>Break-time marathon</b>	Break-time marathon means that pupils walk or run along a route marked out in the schoolyard, accumulating kilometres equivalent to the marathon distance. As they are walking, pupils collect points for their own class and when a class has achieved a certain score, they get a reward, such as an indoor exercise break in the school gym.

Events	
<b>Theme days</b>	A theme day may involve activities such as inviting local sports clubs to present their activities with the aid of local 'sports heroes'. Pupils can prepare posters in visual arts lessons to present their own sports interests.
<b>Television formats</b>	By way of example, at a 'Dancing with the Teens' event, pupils challenge adults to participate in a social evening to dance together based on the Strictly Come Dancing (also known as Dancing with the Stars) TV format.

## Physically active commuting between home and school

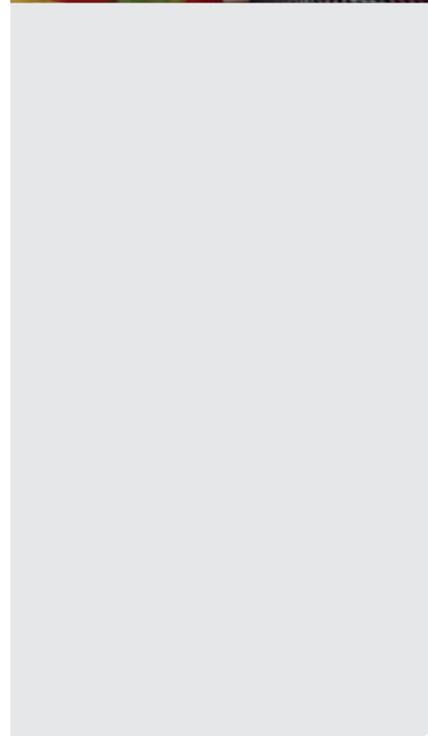
<b>Home to school campaign</b>	In the home to school campaign, pupils set their own goals, such as walking or cycling to school at least three days per week. Achievement of the goal is monitored and successes are rewarded. Pupils mark the days when they travelled to school in a physically active manner on a poster on the classroom wall and add up the days. The class with the highest number of active days is rewarded with reflectors, a trip or in some other way.
<b>School transport</b>	In order to promote physical activity among pupils entitled to school transport, it is possible to make use of waiting times by organising exercise-oriented club activities. Transport can also be organised such that pupils can walk some distance either when leaving home or when arriving at school.

The above-mentioned examples describe different ways of promoting physical activity at school. However, it is also advisable to bear in mind the role of parents in their children's physical activity habits. It is important for children's parents to learn about the positive effects of physical activity and to get involved in promoting children's physical activity. Adopting a physically active lifestyle already starts in an individual's childhood family and school.

## Conclusion

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Physical activity promotes children's and young people's health and well-being in many ways. It has also been noted to have a positive effect on learning and cognitive functions, such as memory and executive functions and, as a result, possibly on academic achievement. On the whole, the arguments for promoting children's physically active lifestyle are convincing. Schools offer good opportunities to increase children's physical activity and also to support their learning. However, increasing physical activity during the school day calls for creativity and flexibility as well as commitment from different parties, such as teachers, children's parents and decision-makers. Researchers recommend adding diverse physical activities appropriate for pupils' age and developmental levels to school days. Such physical activity supports children's physical, psychological and social growth and development, while also promoting health, well-being and learning.





This summary is based on a Finnish-language publication of the Finnish National Board of Education entitled *Liikunta ja oppiminen. Tilannekatsaus lokakuu 2012. Muistiot 2012:5*. Authors: Heidi Syväoja, Marko Kantomaa, Kaarlo Laine, Timo Jaakkola, Kirsi Pyhälto and Tuija Tammelin.

The Finnish National Board of Education publishes status reviews about contemporary themes in education policy. By nature, status reviews are concise literature reviews compiling research, statistics and indicators relating to the theme in question. They aim to consolidate a knowledge-based approach in monitoring and development of education and in decision-making processes.

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