How physical activity can boost academic performance in primary school

by Anne de Bruin
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The importance of being physically active is well known. Active people are healthier, live longer, and have a lower risk of developing mental disorders. The foundation for a physically active lifestyle is laid in childhood. Unfortunately, we are seeing a decline in the number of children who engage in the recommended amount of physical activity each day (60 minutes of moderately or highly intense activity). Instead, children are sedentary much of the time, sitting in the classroom or in front of the television. This problematic development is reflected in a sharp rise in obesity levels among children.

As children spend a large number of their waking hours at school, schools provide the perfect environment for children to be physically active. However, many schools have cut back on opportunities for them to do so. This is not surprising; schools are under great pressure to improve academic achievement. As a result, many educators believe that academics (i.e. reading, spelling, and mathematics) should be given priority over physical education.

Physical activity and cognition

However, there is compelling evidence of the beneficial effects of physical activity on children’s cognitive development and brain health. Children who are more physically active generally do better in school, as reflected in their performance in mathematics, spelling, and reading. Increased physical activity is associated with improved academic achievement and stronger connections between brain regions, as well as with more efficient activation of regions involved in cognitive tasks.

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Interestingly, the relationship between the physical and cognitive domains seems to be strongest for executive functioning. Executive functioning is an umbrella term for a set of higher-order cognitive functions that guide and control behavior in order to reach specific goals. Executive functions allow an individual to retain information, concentrate on a specific task, and inhibit automatic responses. They are very important for performance in school.

Because physical activity is closely linked to executive functioning, and because executive functions are strong predictors of academic achievement, it seems only logical that the executive functions of children who are more physically active would be more highly developed. The results of one of my lab’s studies (forthcoming) suggest that this is indeed the case. We found that the executive functions of less physically fit students were less well developed. Consequently, their
How is physical activity linked to cognition?

These results raise the question of how physical activity is linked to cognition. Several mechanisms have been proposed to explain this relationship. One is physiological: Moderate to vigorous physical activity, such as brisk walking, produces general physiological changes in the body and specific changes in the brain. In the short term, a session of physical activity increases blood flow to the brain. In the long term, this results in structural and functional changes, for example an increase in brain volume or stronger connections between brain regions that are often activated together.

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A learning/developmental perspective emphasizes that physical activity can also be cognitively demanding – when it is characterized by difficult rules or complex movements, for example. This type of physical activity is believed to activate the same brain regions as those needed to perform cognitive tasks. These regions are shaped, or “trained,” to function more effectively, resulting in improved cognitive performance. According to this perspective, it is the qualitative aspects of physical activity (for example the types of activities involved) that determine how strong the effect on cognitive performance will be.

Results of recent studies suggest that the two mechanisms are additive. In other words, moderate to vigorous physical activity that also involves complex rules or movements will have the most beneficial effects on cognition.

Understanding underlying mechanisms

Unfortunately, there has been little research into the underlying mechanisms that determine the effect of physical activity on cognition. Consequently, we do not know whether different types of physical activity have different effects on cognition, nor the role played by physiological and learning/developmental mechanisms.

That is why my colleagues at the University of Groningen and I are currently conducting a project to investigate the effects of two types of physical activity on primary school students, and specifically on their physical fitness and motor skills, executive functioning, academic achievement, and brain structure and function.

One of our interventions focuses on aerobic physical activity at a moderate to vigorous level of intensity, in an effort to shed light on the physiological mechanisms described above. The other intervention seeks to be more cognitively engaging by including difficult rules and complex movements, so that we can learn more about learning/developmental mechanisms.

Last year, almost 900 primary school students from grades 3 and 4 took part in our project; half of them were involved in one of the intervention programs. Over a period of 14 weeks, these students participated in physical education classes four times a week. We are currently analyzing the data to determine whether this led to an improvement in cognition and academic achievement. We are also eager to find out whether such improvements are reflected in changes in brain structure and functioning.

Results of this study will add to our understanding of how physical activity relates to cognition and
academic achievement. They may also have more practical implications, as they shed light on ways to design physical education programs that are beneficial not only for children's physical health and development, but also for their cognitive health.

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