

Physical Fitness and Physical Activity Can Help Academic Achievement and Increase Cognitive Development in Students

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Abstract

This article examines the connection between physical fitness and physical activity, emphasizing how both can enhance academic achievement and support cognitive development in students. It aims to analyze the effects of physical activity on academic performance, drawing on findings from previous research studies. Evidence indicates that physical activity can improve academic performance through both direct and indirect pathways. It enhances cognitive functions, such as attention, memory, and executive function, which can lead to better academic outcomes by fostering emotional intelligence, self-esteem, and overall physical health. The findings underscore the importance of integrating physical activity and fitness into educational and academic development.

1. Introduction

The physical health benefits of regular physical activity and maintaining physical fitness are widely established [1,2]. There has been growing interest in the benefits of physical activity for mental health, and a solid evidence base shows that regular activity and improved fitness increase psychological wellbeing [3,4]. Exercise can help people feel better about themselves and their lives, reduce anxiety, and improve mood. Evidence is also building to show that physical activity is associated with substantially reduced risks of mental illnesses and conditions such as depression, cognitive impairment, and dementia [5]. The benefits of physical activity in treating depression and improvement in select aspects of cognitive function in older adults are becoming increasingly well-established [6,7].

Recent estimates indicate that 25% of children in the US are overweight, and 11% are obese [8]. Metabolic syndrome has been estimated to be at 5% in elementary school children, and this percentage increases to 12% and 20% in minority and overweight children, respectively [9]. Decreased physical activity is likely a significant factor in the drastic increase in obesity rates, and one-third of male and female adolescents fail to meet recommended

standards for cardiorespiratory fitness [10]. Both fitness and fatness appear to be associated with cognitive function and academic achievement (Datar et al., 2004; Shore et al., 2008) in children [11-13].

Health-related physical fitness enhances cognitive functioning and academic achievement by improving blood flow and synaptic plasticity [14]. It also increases levels of brain-derived neurotrophic factor (BDNF), which supports the survival and growth of neurons [15]. Additionally, skill-related physical fitness may further optimize cognitive functioning and academic success by strengthening the motor-cognition network [16]. This network includes neural regions such as the dorsolateral prefrontal cortex and the neo-cerebellum, both of which are activated during motor tasks and are associated with various cognitive operations [16].

Student's physical fitness has been an essential moderator in the relationship between physical activity and cognitive functioning [17]. Physical fitness status and several other variables contribute to the inconsistent findings concerning the relationship between children's physical activity and cognitive outcomes. Thus, despite numerous studies documenting the positive relationship between

physical activity and children's cognitive functioning, there remains a lack of consensus on whether physical activity significantly affects children's cognition [18,19].

Physical activity is a fascinating research subject that impacts both physical and psychological wellbeing, including the development of a positive body image, alleviation of depression, and enhanced life satisfaction [20,21]. In addition, there is evidence that physical activity promotes intelligence and brain development. Intelligence is "the aggregate or global capacity of the individual to act purposefully, reason, and deal effectively with his environment. Intelligence has been examined in numerous studies and various research areas. One of the earliest studies on intelligence was conducted by Alfred Binet. He is considered the first researcher to attempt to measure and score intelligence using a standardized scale, known as the Binet-Simon Scale [22]. Academic achievement might be a direct indicator of intelligence in school education. Identifying the relationship between physical activity and academic achievement would inform the development of more effective practice education policies and teaching methods. Additionally, the importance of physical education in schools may be increased [23].

2. Physical Fitness and Physical Activity and Academic Performance

Children and youth benefit significantly from regular physical activity, which enhances their fitness, cardiovascular health, metabolic function, and bone health [2]. Experts have identified schools as a key setting for promoting physical activity among children [24]. One of the primary goals of physical education programs is to help students achieve and maintain an adequate level of aerobic fitness, as indicated by the National Health and Nutrition Examination Survey [6]. Additionally, regular participation in physical activity is recognized as a national learning standard for physical education, aimed at encouraging lifelong engagement in physical activity (NASPE, 2004).

Research indicates that children perform cognitive tasks more quickly and accurately after engaging in physical activity [25-29]. A single session of moderate-intensity physical activity has been shown to enhance neural and behavioral processes related to attention during specific cognitive tasks [27]. In one study, children who participated in 30 minutes of aerobic physical activity outperformed those who watched television for the same duration in cognitive tasks. Conversely, another study involving 69 overweight and inactive children found no differences in cognitive performance between those who walked on a treadmill and those who sat [30].

When physical activity is incorporated as a break from academic learning, it has been linked to improved attention, increased on-task behavior, and enhanced academic performance [20,31-33]. A comparison of 1st-grade students in classrooms with stand-sit desks—allowing children to stand at their discretion—versus those in traditional seated classrooms revealed that the former group stood more often and expended significantly more energy [34].

Teachers can effectively integrate physical activity breaks into the curriculum or use them to refocus students' attention during lessons [35]. With minimal training, educators can efficiently manage students' energy expenditure during these activities. Furthermore, after-school physical activity programs have demonstrated improvements in cardiovascular endurance, which can positively affect academic performance [36].

Classrooms are dynamic environments where children must distinguish important information amid various distractions. Students are required to listen to the teacher, adhere to classroom procedures, concentrate on specific tasks, retain information, and connect new knowledge to their prior experiences [27]. Research suggests that even a single session of moderate-intensity walking can lead to significant improvements in tasks that require attentional inhibition.

The benefits of physical activity on academic performance can be both immediate and long-term. Shortly after engaging in physical activity, children often show improved concentration on classroom tasks, enhancing their learning experiences. Over time, consistent, developmentally appropriate physical activity contributes to improved physical fitness, which may positively influence academic performance in subjects such as mathematics, reading, and writing. Evidence suggests that physical activity affects brain function and can lead to these beneficial outcomes.

- A research project conducted with 24 elementary schools, known as Physical Activity Across the Curriculum (PAAC), demonstrated that incorporating physical activity sessions into the school curriculum could have long-term benefits, including improved academic performance. When comparing improvement in standardized test scores over three years, schools were stratified and randomly assigned to receive either physically active lessons or a control group.
- A recent review of 39 studies on the mental and intellectual benefits associated with school-based physical activity programs found that the most significant effects were observed when children engaged in aerobic physical activity, such as jogging in place, rather than resistance activities like push-ups and sit-ups [37]. The same review showed that children who were physically active in small groups (10 to 39 children) showed greater improvements than those in large groups (30 or more children) or tiny groups (1 to 2 children). This finding is important when developing policy focused on class size.
- Eleven- and 12-year-old students participating in physical education lessons, including fitness stations and team games at varied intensities, were compared with students who sat for the same amount of time [28]. Children who participated in the physical education lessons demonstrated a greater recall of a percentage of vocabulary words on a memory task before and after class discussions than the sedentary students. These findings suggest that participating in physical activity during physical education lessons may facilitate immediate and delayed memory.
- A study of 115 adolescents found that active lessons requiring more coordination (such as balancing, reacting, adjusting, and

differentiating) were associated with better concentration on academic tasks compared to traditional physical education lessons focused on team sports [26].

- Among 5,316 students in grades K through 5, the frequency and duration of physical education class were positively associated with standardized test performance among girls but not boys. This relationship may be attributed to a lower baseline level of fitness among female students, suggesting that the girls may have had more to gain from participating in physical education [38].
- Brain processes such as directing one's attention, switching attention between tasks, and transferring information from short-term to long-term memory are essential actions for learning. Recently, scientists have been investigating the underlying brain functions that may explain some of the immediate and long-term academic benefits of physical activity. After walking on a treadmill for 20 minutes at a moderate pace, children responded to test questions in the content areas of reading, spelling, and arithmetic with greater accuracy. They exhibited more intense brain responses than children who had been sitting. Further, children who walked for 20 minutes performed better on reading comprehension than those who sat for a similar length of time. Following this, children also completed learning tasks more quickly and accurately, and were more likely to read above their grade level [26].
- Physically fit children have larger hippocampal volume and basal ganglia [39,40]. Both of these brain structures have been associated with learning in children.

3. Conclusion

Physical education provides all children with the opportunity to engage in physical activity and improve their aerobic fitness. Regular participation in physical activity and higher levels of fitness has been linked to enhanced academic performance and cognitive functions, such as attention and memory—key components of effective learning. Long-term studies have shown that increased physical activity, often resulting from more time spent in physical education classes, correlates with improved academic outcomes. Even a single session of physical activity can lead to improved scores on academic tests, greater concentration, and a more efficient transfer of information from short-term to long-term memory. Active children tend to stay focused and on task in the classroom, which enhances their learning experience. It is essential to note that while numerous studies emphasize the benefits of physical activity and fitness on children's academic achievement, it is reasonable to recommend increased physical activity in schools as an evidence-based strategy to enhance performance [41-42].

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