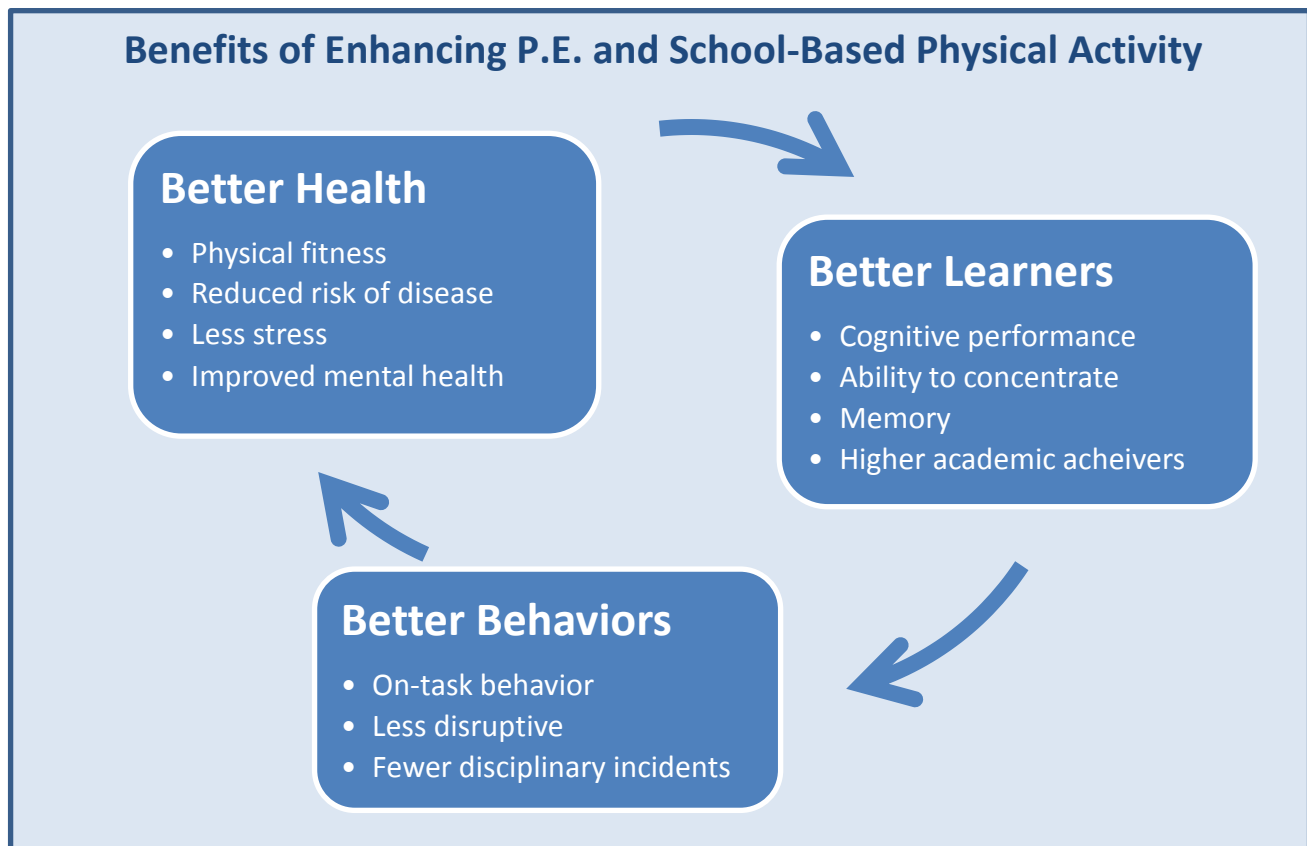


# Enhancing Physical Education in Illinois: How Investing in P.E. Yields Higher Achievers

Enhancing P.E. and physical activity during the school day lead to better learners, better behavior in the classroom, and better student health. Enhancing P.E. entails changing policies, practices, and curricula so that students spend more time in moderate to vigorous physical activity (MVPA) during each class.<sup>1</sup> Schools will see a return on investment on the dollars and time dedicated to P.E. and physical activity.



## How to Maximize the Benefits of P.E.

- Students spend at least 50% of P.E. class in MVPA by participating in small-sided games, reduced wait-time and time spent taking attendance or giving instruction, and other approaches that minimize inactivity
- Administrators schedule P.E. before challenging academic subjects to maximize the residual cognitive benefits of activity on learning and academic achievement
- Teachers emphasize health-related fitness and achievement of each student's personal best, modifying instruction to accommodate varying levels of physical ability
- Teachers emphasize teamwork and cooperation
- Schools periodically evaluate P.E. curriculum and instruction against state and national standards
- P.E. includes a broader wellness approach focused on developing life-long skills for physical activity and nutrition

For more information on the fundamentals of Enhanced P.E., consult this basic [fact sheet](#).

# BETTER LEARNERS

## What does the research say?

There is substantial evidence of a relationship between both physical activity and fitness and improved cognitive and executive functioning. These brain functions play a significant role in goal-directed behavior and the ability to concentrate. Improved executive functioning allows students to organize and prioritize tasks and information.<sup>2,3,4</sup> Regular physical activity, even short bouts, enhances various aspects of brain activity that affect academic performance, including learning, memory, concentration, and mood.<sup>5</sup>

## How does it work?

A growing body of evidence suggests a relationship between moderate to vigorous physical activity and the structure and function of the student brain. Active children show greater attention, have faster cognitive processing speed, and perform better on standardized academic tests than children who are less active.<sup>6</sup>

Cardiorespiratory fitness, a measure of how well the body can transport oxygen to its muscles during exercise, is also related to optimizing task performance across one's lifespan as well as increasing academic achievement and test performance. Studies demonstrate that higher fit children display higher levels of cognitive control, better task performance, faster reaction times, enhanced working memory, and attention.<sup>7,8</sup>

## Return on Investment:

### Fit students perform better academically

Studies have shown time and again that there is a positive association between fitness and academic achievement, as measured by standardized tests and improved grades. This relationship has been observed in China, Illinois, Massachusetts, California, and Texas.<sup>9,10</sup>

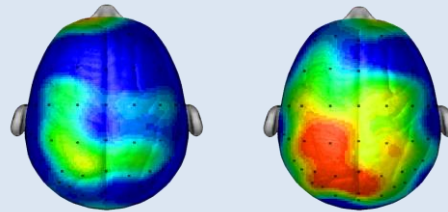
For more in-depth information about the neuroscience related to physical education, consult [‘Summary of Neuroscience Research: Exploring the Link between Physical Activity and Cognitive Function’](#).

## Cognitive Effects of Exercise On Preadolescent Children

Average composite of 20 students' brains taking the same test after 20 minutes of:

Sitting Quietly

Walking



Scan compliments of Dr. Charles Hillman University of Illinois

<sup>11, 12, 13, 14</sup> Higher fit children have been found to have enhanced math and reading abilities.<sup>15</sup>

Preliminary results from a 2010 study suggest that students in the Fitnessgram® “Healthy Fitness Zone” (HFZ) for cardiorespiratory fitness were two to four times more likely to meet or exceed the Illinois Standardized Achievement Test (ISAT) reading and math test requirements than students who were not.<sup>16</sup> As fitness level increases, so does academic achievement.<sup>17</sup>

### PE can improve performance in other academic classes

The residual cognitive benefits of exercise have been found to last from 30 minutes to about 1 hour.<sup>18, 19, 20</sup> Physical education classes should be held before challenging academic subjects to take advantage of the residual effects of exercise on students' abilities to focus, elevated concentration and improved cognitive skills resulting in higher academic scores.<sup>21</sup> Research has found that longer doses (40 min) of exercise are more beneficial than shorter doses (20 min.).<sup>22</sup>

## It's like Miracle-Gro® for the Brain! - Dr. John Ratey

Brain-derived neurotrophic factor (BDNF) helps the brain grow, and can improve learning. Exercise has been proven to cause BDNF secretion in mice. Physical activity causes the human brain to produce:

Adrenaline - provides energy

Noradrenaline - enhances focus

Dopamine - thinking, working memory

Cortisol energy - memory

Serotonin - attention, mood

Glucose-energy - memory formation



## BETTER BEHAVIOR

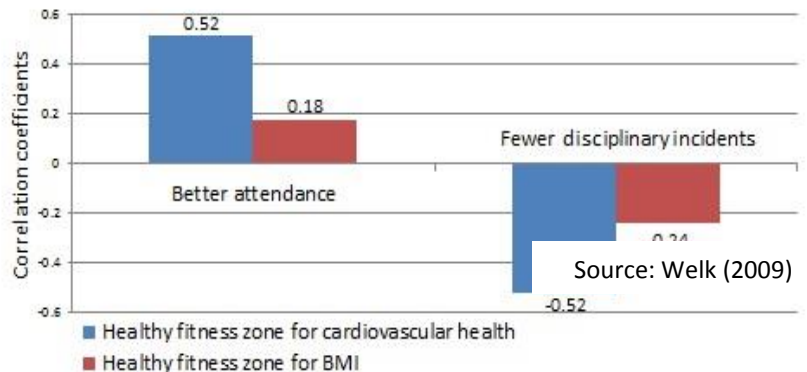
### What does the research say?

**Physical education is related to better academic behaviors:** Studies have found positive associations between P.E. and attention/concentration, self-concept, impulse control, perception of academic or intellectual competence, and other cognitive skills and attitudes.<sup>23</sup>

**Simple in-class activities can boost performance** Studies suggest that children who participate in short bouts of physical activity within the classroom have more on-task behavior, with the best improvement seen in students who are least on-task initially.<sup>24</sup>

**Benefits for children with ADHD:** When children with ADHD participated in physical activity, parents and teachers reported improved behavior scores, including social and attentional problems and less anxiety.<sup>25</sup>

### Student Fitness and BMI Levels Correlate with Attendance and Disciplinary Incidents



### Return on Investment:

**Fewer suspensions means more kids in class** Researchers analyzed FITNESSGRAM® test results from more than 2.4 million Texas students in grades 3 to 12 during the 2007–08 school year and found higher physical fitness achievement was associated with better school attendance rates and fewer disciplinary incidents.<sup>26</sup>

## BETTER HEALTH

### What does the research say?

Physical inactivity may be one of biggest public health problems of the 21<sup>st</sup> century.<sup>27</sup> Being physically active and fit can reduce the risk of chronic diseases like type 2 diabetes, heart disease, and some cancers – even in the presence of higher body mass index (BMI). When compared with BMI, body composition (% body fat) and weight status, research shows that physical fitness has a stronger association with good health.<sup>28</sup>

### Addressing the state’s public health problem:

Nearly 1 in 3 Illinois children are either obese or overweight. The impact of enhancing P.E. will not only help reverse this trend, but also stands to positively impact children over the course their entire lives. Helping children become fitter and establish behavioral patterns that encourage lifelong fitness will help in the prevention of diseases such as obesity, hypertension, and cardiovascular disease.<sup>29, 30</sup>

### Return on Investment: The Big Picture

**Children sleep better:** Poor sleeping patterns are linked to poor school performance and an increased risk of being overweight or obese. For every sedentary hour, a child needs 3 extra minutes to fall asleep. Children who are more physically active fall asleep an average 15 minutes sooner – and better - than their sedentary peers.<sup>31</sup>

**The many benefits of exercise on mental health:** Exercise has been shown to elevate mood, positively influence depression and anxiety, reduce psychosocial stress and enhance various aspects of self-esteem.<sup>32</sup>

**Overall wellness for all:** In addition to physical activity, a quality P.E. curriculum may also support good nutrition, which is essential to overall health and well-being. Establishing healthy nutritional habits early in life, reduces kids’ risks of developing diabetes, stroke, cancers, and heart disease later in life.<sup>33</sup>



- <sup>1</sup> Guide to Community Preventive Services. Behavioral and social approaches to increase physical activity: enhanced school-based physical education [www.thecommunityguide.org/pa/behavioral-social/schoolbased-pe.html](http://www.thecommunityguide.org/pa/behavioral-social/schoolbased-pe.html).
- <sup>2</sup> Best, J.R. (2010). Effects of physical activity on children's executive function: Contributions of experimental research on aerobic exercise. *Developmental Review*, 30(4), 331-351.
- <sup>3</sup> Hillman, C.H., Pontifex, M.B., Raine, L.B., Castelli, D.M., Hall, E.E., Kramer, A.F. (2009). The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience*. 159(3):1044-54. doi: 10.1016/j.neuroscience.2009.01.057
- <sup>4</sup> Segen, J.C. (1999). *The Dictionary of modern medicine*. Highstown, McGraw Hill.
- <sup>5</sup> Sattelmair, J., Ratey, J. (2009). Physically active play and cognition: An academic matter? *American Journal of Play*, Retrieved June 4, 2013 from <http://johnratey.typepad.com/SattelRatey.pdf>.
- <sup>6</sup> IOM (Institute of Medicine). 2013. *Educating the student body: Taking physical activity and physical education to school*. Washington, DC: The National Academies Press.
- <sup>7</sup> Hillman, C.H., Castelli, D.M., Buck, S.M. (2005) Aerobic fitness and neurocognitive function in healthy preadolescent children. *Medicine and Science in Sports and Exercise* 37(11), 1967-1974
- <sup>8</sup> Kamijo, K., Pontifex, M.B., O'Leary, K.C., Scudder, M.R. Chien-Ting, W., Castelli, D.M., Hillman, C.H. (2011). The effects of an afterschool physical activity program on working memory in preadolescent children. *Developmental Science*, 14(5):1046-1058. doi: 10.1111/j.1467-7687.2011.01054.x
- <sup>9</sup> Castelli, D.M., et al. (2007).
- <sup>10</sup> Chih, C.H., Chen, J.F. (2011). The relationship between physical education performance, fitness tests, and academic achievement in elementary school. *International Journal of Sport & Society*, 2(1), 65-75.
- <sup>11</sup> Chomitz, V.R., Slining, M.M., McGowan, R.J., Mitchell, S.E., Dawson, G.F., & Hacker, K.A. (2009). Is there a relationship between physical fitness and academic achievement? Positive results from public school children in the northeastern United States. *Journal of School Health*, 79(1), 30-37. doi:10.1111/j.1746-1561.2008.00371.x
- <sup>12</sup> London, R.A., & Castrechini, S. (2011). A longitudinal examination of the link between youth physical fitness and academic achievement. *Journal of School Health*, 81(7), 400-408. doi: 10.1111/j.1746-1561.2011.00608.x
- <sup>13</sup> Roberts, C.K., Freed, B., McCarthy, W.J. (2010). Low aerobic fitness and obesity are associated with lower standardized test scores in children. *The Journal of Pediatrics*, 156(5), 711-718. doi: 10.1016/j.jpeds.2009.11.039
- <sup>14</sup> Van Dusen, D.P., Kelder, S.H., Kohl, H.W. III, Ranjit, N., Perry, C.L. (2011). Associations of physical fitness and academic performance among school children. *The Journal of School Health*, 81(12):733-740. doi: 10.1111/j.1746-1561.2011.00652.x
- <sup>15</sup> Castelli, D.M., Hillman, C.H., Buck, S.E., & Erwin, H.E. (2007). Physical fitness and academic achievement in 3rd and 5th grade students. *Journal of Sport & Exercise Psychology*, 29(2), 239-252.
- <sup>16</sup> Bass, R.W., Brown, D. D., Laurson, K.R., and Coleman, M.M. (2013). Physical fitness and academic performance in middle school students. *Acta Paediatrica Nurturing the Child*. Advance online publication. doi: 10.1111/apa.12278.
- <sup>17</sup> Grissom JB. Physical Fitness And Academic Achievement. *JEP online* 2005;8(1):11-25
- <sup>18</sup> Joyce, J., Graydon, J., McMorris, T., Davranche, K. (2009). The time course effect of moderate intensity exercise on response execution and response inhibition. *Brain and Cognition*. 71(1)14-19. doi: 10.1016/j.bandc.2009.03.004
- <sup>19</sup> Hillman, C.H., Pontifex, M.B., Raine, L.B., Castelli, D.M., Hall, E.E., Kramer, A.F. (2009). The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience*. 159(3):1044-54. doi:10.1016/j.neuroscience.2009.01.057
- <sup>20</sup> Pontifex, M.B., Saliba, B.J., Raine, L.B., Picchiotti, D.L., Hillman, C.H. (in press). Exercise improves behavioral, neurocognitive, and scholastic performance in children with attention-deficit/hyperactivity disorder. *The Journal of Pediatrics*.
- <sup>21</sup> Kubesch, S., Walk, L., Spritzer, M., Kammer, T., Lainburg, A., Heim, R. (2009). A 30- minute physical education program proves students' executive attention. *Mind, Brain, and Education*. 3(4) 235-242
- <sup>22</sup> Davis, C.L., Tomporowski, P.D., Boyle, C.A., Waller, J.L., Miller, P.H., Naglieri, J.A., Gregoski, M. (2007). Effects of aerobic exercise on overweight children's cognitive functioning: A randomized controlled trial. *Research Quarterly for Exercise and Sport* 78 (5): 510-19.
- <sup>23</sup> Centers for Disease Control and Prevention. *The association between school based physical activity, including physical education, and academic performance*. Atlanta, GA: U.S. Department of Health and Human Services; 2010.
- <sup>24</sup> Mahar, Murphy, Rowe, Golden, Sheilds, Raedeke (2006). Effects of a classroom-based program on physical activity and on-task behavior. *Medicine & Science in Sports and Exercise* (38), 12 2086-2094
- <sup>25</sup> Verret, C., Guay, M., Berthiaume, C., Gardiner, P., Beliveau, L. (2012). A physical activity program improves behavior and cognitive functions in children with ADHD- an exploratory study. *Journal of Attention Disorders* (16), 1, 71-80.
- <sup>26</sup> Welk, G. (2009). *Cardiovascular Fitness and Body Mass Index are Associated with Academic Achievement in Schools*. Dallas, Texas: Cooper Institute.
- <sup>27</sup> Blair SN. (2009) Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med*. 43:1-2.
- <sup>28</sup> Hainer, V., Toplak, H. and Stieh, V. (2009) Fat or Fit: What Is More Important? *Diabetes Care*. 32(suppl 2):S392-S397.
- <sup>29</sup> Ratey, J.J., Loehr, J.E. (2011). The positive impact of physical activity on cognition during adulthood: a review of underlying mechanisms, evidence and recommendations. *Reviews in the Neurosciences*, 22(2), 171-185. doi: 10.1515/RNS.2011.017
- <sup>30</sup> Sattelmair, et al. (2009).
- <sup>31</sup> Nixon, G.M., Thompson, J.D., Han, D.Y., Becroft, D.O., Clark, P.M, Robinson, E....Mitchell, E.A (2009). Fall asleep: the determinants of sleep latency. *Archives of Disease in Childhood*, 94(9), 686-689
- <sup>32</sup> Scully, D., Kremer, J., Meade, M.M., Graham, R., Dudgeon, K. (1998). Physical exercise and psychological well being: a critical review. *British Journal of Sports Medicine*, (32), 111-120.
- <sup>33</sup> Flegal, K.M., Kit, B.K., Orpana, H., Graubard, B.I. (2013). Association of all-cause mortality with overweight and obesity using standard body mass index categories. A systematic review and meta-analysis. *Journal of the American Medical Association* (309)1, 71-82

