Does Exercise Make You Smarter?

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Introduction

Recent research in neuroscience has suggested that exercise can benefit both the body and the brain. Some claim that exercise can make you smarter. If that were true, then quality Physical Education programs in schools would give every student an advantage to learn. But is it too big of a leap to claim that exercise can improve academic performance or increase cognitive function? If so what kind of exercise is needed and how much? Does playing a game of tag or cricket produce the same results? What does a quality Physical Education program contribute to the education of the child?

As educators in general and physical educators in particular, we should have an understanding of how learning takes place and what we can do as educators to enhance the learning of each child, giving every child every advantage to learn. The emerging field of cognitive neuroscience has bridged the gap between science and education by providing educators with the knowledge of how the brain learns and how we can facilitate and support young Australians to become successful and confident learners as stated as the central aim in the Melbourne Declaration on Educational Goals for Young Australians in December 2008.

As we explore recent neuroscience findings, many questions arise.

• Can exercise make you smarter?
• What does the research say?
• Can Physical Education increase learning?
• Can you build a better brain?
• How does the research translate into classroom practice?

Definitions of movement, physical activity and exercise

As we look into the literature we must clarify terms in relation to human development.

Humans are made to move. Our brains are designed to move to enable us to navigate our environment. Our genetic code dictates that we cover 20 kilometres a day on foot combining walking and running. Therefore, movement, physical activity and exercise are essential to human development.

What is the difference between movement, physical activity and exercise?

Movement is the umbrella term that covers all motion; simply stated movement is not being still.

Physical Activity is movement that expends more energy. For example, walking to the door is movement. Skipping to the door is physical activity.

Exercise elevates the heart rate into the target heart rate zone and sustaining that elevation for a period of time, optimally for 150 minutes over a 7-day period (Medina, 2012). New research states that the exercise period doesn’t have to be consecutive minutes but can be spread out throughout the day, another good argument for maintaining purposeful recess and lunch play times in our schools.

Physical Fitness is a dynamic state of physiological balance that enables one to survive in a physical crisis. For example, running down several flights of stairs to escape a burning building.

Physical Activity vs. Physical Education

What is the difference between physical activity and physical education?

Someone can be physically active without being physically educated. For example, I can take a brisk walk and be physically active. But if I’m physically educated, I have been taught how to recognise and have a good understanding of the benefits and the purpose of walking to increase my healthy state, Physical activity is the “what”. Physical education is the “why”, the “how”, the “when”, the “how long” and the “how much”. Physical education is teaching lifelong healthy active living so that an 8 year old will someday be 80 years old and be able to carry 2 sacks of groceries up 2 flights of stairs.
We need to be physically active, physically educated people. Physical education that is taught by a professional can have lifelong benefits for health and learning.

A history of the link of movement to learning in Australia

Is this idea that exercise may increase student performance a new concept in Australia?

In Australia in 1977, the Hindmarsh Primary School experiment found that “a student’s general learning potential is increased or decreased in accordance with the increase or decrease of physical fitness.”

In the 1978 R-12 Physical Education Bulletin of the Education Department of South Australia, Brain Nettleton of the University of Melbourne wrote:

“There is much evidence to link an increase in physical fitness with an increase in scholastic attainment.”

In 1979 R-12 Physical Education Bulletin published a selection of reports from teachers at Pimpala, Ingle Farm West, Magill, and McRitchie Primary Schools describing the improvements in the health behavior and academic outcomes for the schools as a result of increased commitments to quality physical education programs.

The SHAPE schools project in association with the Division of Human Nutrition C.S.I.R.O. involved 500 students in 8 schools in a 14-week intervention. The results confirmed that a strong relationship between the health, behavioral and academic performance where movement was utilized more in the education process of the students.

New Evidence

With the use of very sophisticated modern brain imaging technology, neuroscientists can view the effects of exercise using brain scans, which measure the activity of the brain in real time. In the past 5 years, many compelling studies have directly linked exercise to the growth of new brain cells (neurogenesis), a concept that was foreign until the advent of brain imaging technology. Scientist can now measure the effects of exercise on cognitive function. Because of this emerging science, numerous studies have shown what has been reported for the last 40 years, that movement facilitates cognition (Sylwester, 1999); that physical activity anchors learning (Hannaford, 2008) and that exercise boosts brain function (Medina, 2008).

Can you speak neuroscience?

Can you justify your physical education program to a group of decision-makers using the latest research from the cognitive neuroscience?

Do you know how we process new information?

Can you explain muscle memory?

Do you know where in the brain we pay attention?

Do you know what role our muscles play in learning?

The answers to these questions are embedded in brain science. As educators we should be familiar with these and other concepts about how we learn.

We learn using many processes at once: cognitive, physical, emotional, social and spiritual/moral (“Who am I and what is my purpose here?”). In other words, we teach the whole child. Human development encompasses cognitive, behavioral and health components, all being necessary to put the brain and body into balance to create healthy, successful, confident learners.

Recent studies show a direct link between movement, physical activity and exercise to improved cognition and increased student performance.

In May 2012, Dr. Ingegerd Ericsson of Sweden conducted one of the few studies directly linking Physical Education to improved academic performance. The study showed that more Physical Education in schools led to better grades. It also stated that more physical education sharpened the students’ ability to learn, especially in boys.

A study conducted by Dr. Henrietta Van Praag in May 2012 concludes that “physical activity improves learning”. The focus of the study was how exercise impacts neurogenesis in the hippocampus, the learning and memory center of the brain. It seems that when large muscle movement taxes the muscle, it releases a compound that initiates the growth of new neurons in the hippocampus. More brain cells do not make you smarter but gives you more capacity to learn. This research would seem to justify daily quality physical education that provides for developmentally appropriate movement throughout the school day.

A February 2012 study conducted by Dr. Michael Hopkins of Dartmouth University is entitled “Exercise Makes you Smarter”! The study focused on the role of BDNF sometimes referred to as the fertilizer for the brain. BDNF is an acronym for brain derived neurotropic factor or growth factor. Dr. Hopkins shows that exercise floods the brain with BDNF to aid the brain's mental sharpness and ability to memorize, thus increasing learning. The study also proposes that exercise could alleviate some symptoms of ADHD.

Dr. John Medina, author of Brain Rules at the June 2012 Brain Symposium Conference in Honolulu, explained that the amount of BDNF in each person differs according to heredity. Some people naturally have more than others. He said that one role of BDNF is to act as a buffer against stress which is why exercise seems to buffer the ill effects of depression acting as a natural medication. He stated a study in which people using an antidepressant were weaned off the medication at the same time they were prescribed a vigorous exercise regimen. After one year they showed 80% improvement (a better % than when on drugs) and were drug free with no side effects from the medication.
Specific studies like these give credence to movement, physical activity and exercise in a number of ways and a variety of modalities throughout the school day to ensure that the student is prepared to learn, eager and energized to learn and more able to anchor that learning.

If you still doubt the quantity, quality or rigor of the studies that support movement, physical activity and exercise in the learning process, check out the over 38000 references found in Medline, the medical profession’s reference journal of research. Also, check out my collection of research article at www.actionbasedlearning.com.

**Does exercise make you smarter?**

Dr. Michael Hopkins thinks so in his Dartmouth study of BDNF entitled “Exercise makes you Smarter!” So let’s look at the physiology of exercise to find out what is happening.

**Why exercise?**

We exercise for our brain! Exercise benefits the brain first. Why? Because the brain does not produce its own fuel nor does it store its own fuel. The brain depends on the body to get the blood to the brain to deliver brain fuel like glucose and oxygen.

Exercise changes the brain at a molecular level. It changes the brain immediately to the positive.

- Exercise delivers fuel like glucose and oxygen to the brain.
- Exercise balances neurotransmitters, our brain chemicals to regulate body and mind functions as well as our behaviors.
- Exercise increases memory by strengthening secondary dendritic branching responsible for memory retention and retrieval.
- Exercise initiates neurogenesis, the growth of new brain cells.
- Exercise creates, activates and stores BDNF to help the brain grow and protect itself.
- Exercise increases attention levels through the development of the cerebellum.

**Benefits of exercise**

The single greatest predictor of aging well or not is the presence or absence of a sedentary life. Our society is into a lot of ‘sitness’ and not a lot of fitness. A study by the American Cancer Society showed that sitting for long periods of time could cause neuronal death.

Dunstan et al. (2010) in Television Viewing and Mortality. The AusDiab Study Circulation 121: 384-391 found that:

- Compared to those watching less than 2hrs/day of television, those who watch more than 4hrs/day of television had a:
  - 46% increased risk of death from all causes
  - 80% increased risk of death from CVD

The researchers noted that these associations remain even in people who exercise and in people with healthy weight!

Another study followed elementary students who were sedentary and overweight. They participated in an aerobic exercise program for 3 months. They showed improvement in their fitness levels and BMI. Then they stopped exercising for 30 days and their fitness levels returned to unsatisfactory and their weight was the same as before (Medina, 2012).

Exercise creates the best environment for neural plasticity, the ability of the brain to change (Ratey, 2008). We can influence the change with exercise, intentional movement, diet, sleep and meditation.

Exercise prepares the brain for learning by putting the brain in a more optimal learning state (Jensen, 2009).

Exercise increases the capacity of the executive function area of the brain: the part of the brain that pays attention, makes decisions, problem solves, plans and controls impulsivity. A study conducted by Medina (2012) showed that the executive function was improved by 102% after 4 months of aerobic exercise of 150 minutes over a 7-day period.

The positive benefits of exercise last 60-120 minutes depending on the person. Dopamine levels increase to improve learning for about 2 ½ hours. After that serotonin levels elevate to create an “afterglow of exercise” that regulates our mood and behavior.

Exercise was also shown to assist memory function in another study (Medina, 2012). However, the change came after 3 years, which suggests that exercise needs to be a lifelong commitment.

Exercise reduces cognitive pathologies like depression, Alzheimer’s and dementia (Medina, 2012).

The simple answer to the question is that exercise is beneficial to the brain and body and there is evidence to show that exercise may help us learn. Smarter is an ambiguous term that is defined in many ways. So to say exercise makes us smarter may be too big a leap. Let’s just say we know it helps us in many ways to prepare our brains for learning and keep our brains and bodies in balance.

**Can PE raise test scores and/or improve academic achievement?**

The simple answer is “yes” and “no”. Much of the research is being done on exercise and not Physical Education. Exercise can be measured whereas Physical Education programs vary greatly from school to school, district to district and state to state. Most studies are done in a laboratory and few are done in a school setting. However, some convincing studies have been released around the
world using school age students as the subjects. Let’s look at a few of those.

In Australia ACHPER (SA’s) eat well be active – Primary School Project is providing anecdotal evidence showing improved engagement and learning outcomes for students.

A 2012 study conducted by the Medical University in Charleston, South Carolina showed significant improvement in student performance after incorporating specific physical movement programs, and more PE along with movement and physical activity in the classroom at Mitchell Elementary School. The program studied was the Action Based Learning LAB for R-year 2 and the Body Brain Adventure for year 3-5. Both programs blend intentional movement while reinforcing academics. The study was presented at an international pediatric conference by researchers from the Netherlands.

The Hillman Castelli study of 2009 tested 2000 fourth graders from the Netherlands. The study was presented at an international pediatric conference by researchers from the Netherlands.

The data showing increased academic achievement through movement, physical activity and exercise has convinced the Indianapolis Public Schools to open an elementary school in 2013-2014 called the SUPER School with Action Based Learning as its focus. Indianapolis Public Schools believe that healthy, active students make better learners.

The Cooper Aerobic Institute under the direction of Dr. Kenneth Cooper released a study in 2009 called the Texas Youth Fitness Study. The study correlated the Fitnessgram Fitness scores of over 2 million students with their Texas Standardized test scores. The results showed that the higher the fitness levels the higher the academic scores. The study also showed that the students with the higher fitness levels had fewer behavior issues and higher attendance.

Put your brain into action

Putting learning into action

Educational research tells us that many of our students prefer to process information kinesthetically using their senses (Hannaford, 2008) as well as an innate desire for exploration (Medina, 2008). Movement facilitates cognition (Sylwester, 1999). Intentional movement anchors learning (Kovalik, 2007).

These concepts can be applied in the gymnasium and the classroom. Quality Physical Education curriculum and methodology helps to prepare the brain for learning and has been shown to increase student performance (Zientarski, 2012). Teachers have reported that when students return from a quality PE class they are more alert, focused and ready to process. Teachers who use Action Based Learning movement with intention in their classrooms find the students more energized and more engaged in the learning.
To ignore or discount the growing body of cognitive neuroscience research is missing the opportunity to elevate the field of physical education into the 21st century learning community. There are many skeptics in our field who view the neuroscience research as not rigorous enough or not tested fully. Because the science is so new we do need more studies, which provide a unique opportunity for our universities to undertake evidence-based studies that show the link of physical education to improved learning. We now have neuroscientists supporting the need for more Physical Education in our schools based on their findings. We should join forces to advocate for quality Physical Education programs.

I am proud to be a physical educator! I believe that our Physical Education curriculum is central to a child's learning. And that what we do lays the framework for all learning and now we have the research on our side that supports our passion. For me it's all about the health and the learning of every child every day. Let's change the world one little heart and one little brain at a time!

References


Other Resources

Blaydes Madigan, J. 2000, Thinking On Your Feet, Murphy, TX: Action Based Learning.


About the Author

Jean Blaydes is an internationally known educational consultant, speaker and author on the subject of how brain research supports the link of movement to enhanced learning. Visit the Action Based Learning website at http://ablab.com/ or email her at actionbasedlearning@gmail.com.

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