

SMARTfit's Multisensory Approach to Exercise and its Affect on Brain Plasticity and Learning

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By SMARTfit Inc



SMARTfit[™]
Seize The Now!

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SMARTfit's Multisensory Approach to Exercise, Promotes Brain Plasticity and Learning

Introduction

The scientific literature clearly shows that sitting for extended periods is a major risk factor for chronic disease yet the majority of our education and work environments are based on sitting. Sitting blocks a number of insulin-mediated systems, including muscular and cellular pathways that process blood sugar, triglycerides and cholesterol. Standing up — bearing your own body weight on your legs — activates all of these systems at the molecular level.¹

In addition to promoting physical health, exercise benefits brain health by:

- **Increasing brain derived neurotrophic factor (BDNF)**, which preserves existing brain cells¹ and promotes development of new neurons, effectively making your brain grow larger²
- **Decreasing bone-morphogenetic protein (BMP) and increasing noggin.** BMP reduces neurogenesis and Noggin is a BMP antagonist. By reducing the detrimental effects of BMP while boosting the more beneficial noggin, your brain is able to retain its agility^{3,4}
- **Reducing plaque formation:** By altering the way damaging proteins reside inside your brain, exercise may help slow the development of Alzheimer's disease⁵
- **Triggering genetic changes:** many of these to help protect against brain diseases such as Alzheimer's and Parkinson's¹
- **Triggering release of neurotransmitters:** endorphins, serotonin, dopamine, glutamate and GABA, some well-known for their role in mood control and have mood boosting effects¹
- **Activating PGC1 alpha:** This is the stimulus to increase mitochondrial biogenesis and increase the number and quality of these vital energy producing parts of cells.⁶



Science is also discovering that while all physical activity has a positive effect on the brain (“miracle-grow for the brain”¹²), exercise that combines the use of multiple senses with full body movement, including impact and resistance-based activities, challenges the brain at increased levels, requiring more complex cognitive function to make decisions and execute skills. The brain adapts, improving physical, sensory and neurological performance.

Interactive technology further enables this process in ways that traditional fitness can't, simultaneously prompting and providing feedback to participants' physical and cognitive actions, tracking results and setting benchmarks for improvement.

Hebbian Theory - Neurons that Fire Together Wire Together¹⁷

“Neuroplasticity, the brain's ability to re-wire itself in response to sensory experiences, is now accepted Science”¹⁸.



Research confirms that exercise is good for the brain because it releases essential hormones (BDNF) to stimulate growth of healthy neurons. SMARTfit programming goes further, embracing Hebbian Theory with technology and programming designed to simultaneously engage cognitive problem solving while requiring the whole body to deliver answers by triggering intelligent targets to earn game scores.

SMARTfit's Apple/Android driven system interface provides the tools to customize and tailor programming to any level while also supplying the data to measure and track progress. This play-based approach to physical exercise inspires the desire to improve which results in high retention as participants track their performance on their smart phones.

The theory is often summarized as "Cells that fire together, wire together."¹⁷

SMARTfit's Brain/Body Integrated Training Stimulates the Re-wiring Process

According to *Smart Moves* by neurologist Dr. Carla Hannaford in her book she states,

Research indicates that when both eyes, both ears, and both feet are being equally used, the corpus callosum (responsible for whole brain processing) orchestrating these processes between the right and left hemisphere becomes more fully developed – cognitive function is heightened and ease of learning increases.⁸

How?

In a Q & A session on Facebook, movement specialist M.A. Greenstein, Ph.D., wrote that exercise is "important for generating blood and oxygen flow. This results in neurotransmitter release (which) has been shown to boost strength of synaptic bonding, stimulating glial cell activity for information flow."



The faster the mind works, the more time seems to slow down, leaving more time to apply to conscious decision making as opposed to constant thoughtless reaction to stimuli. That is what athletes refer to as being in the “zone” or what sports psychologists call the “flow.” SMARTfit calls this “*Being in the now*”.

SMARTfit programs accomplish “*being in the now*” by encouraging right and left-brain intelligence and balance. They coax the player to perform movements that develop the corpus callosum, the super highway of connective motor and sensory axons that connects the two hemispheres of the brain.

Dr. Greenstein writes, “There is an important correlation between the use of spatial intelligence and long-term memory. Movement and cardiovascular exercise can help to grow the area of our brain that creates new memories: the hippocampus.” She notes the work of Harvard psychiatrist, John Ratey, who says that 20-30 minutes of cardiovascular exercise enables more “fruitful synaptic bonding.”⁶



In fact, movement is essential to the development of all four lobes of the brain. As activity in all lobes of both hemispheres increase with movement, more dendritic connections form, myelination increases, and those dendritic connections extend across the corpus callosum.

The better the connection between hemispheres, the more intelligently we are able to function. Maximum proficiency at critical thought, or skilled movement, requires peak activity of both hemispheres.

Cognitive Effects of Exercise on Couch Potatoes

More important, Dr. Medina found that when exercise is introduced to so-called couch potatoes, a whole host of cognitive abilities return within twelve weeks. The gold standard appeared to be 30 minutes of aerobic exercise two to three times a week. Adding 20 minutes of strength exercise resulted in even more cognitive benefit.

At UCLA, Dr. Antronette Yancey heads the Center to Eliminate Health Disparities.⁹ One of her goals is physical fitness for children from diverse backgrounds because studies have shown that the results are more focused and less fidgeting. She states:

- "Exercise improves children. Physically fit children identify visual stimuli faster than sedentary ones. They appear to concentrate better. Brain-activation studies show that children and adolescents who are fit allocate more cognitive resources to a task and do so for a longer period of time."
- "Kids pay better attention to their subjects when they have been active."
- "Kids are less likely to be disruptive in terms of their classroom behavior when they are active."
- "Kids feel better about themselves, have higher self-esteem, less depression and less anxiety. All of those things can impair academic performance and attentiveness."

Yancey points to a recent study where elementary school kids were divided into three groups. The groups that exercised every day, she says, also performed best in the classroom.

They took time away from academic subjects for physical education in this case, and they found that, across the board, that did not hurt the kid's performance on the academic tests. And in fact, in the condition in which the trained teachers provided the physical education, the children actually did better on language, reading, and the basic battery of tests.



The Link Between Movement and Learning

Brain research strongly supports the link between movement and learning. The brain and the body's movement and learning systems are interdependent and interactive. For example, motor development provides the framework that the brain uses for academic concepts.

Children who have developed fine motor skills through daily exploration and manipulation of a wide variety of objects also possess the cognitive foundations necessary to build academic success.⁷ Neuroimaging techniques are revealing that certain motor tasks activate both motor and cognitive areas of a child's brain.³

The body's vestibular system controls balance and spatial awareness which facilitates the student's ability to place words and letters on a page. Tracking specific patterns, letters and numbers while engaging the whole body (using a foam noodle, ball, or hands in some of the games) promotes the brain's ability to encode symbols. In response to these findings, the new SMARTfit targets have the ability to display letters, numbers, words or symbols and encourage appropriate recognition and use of these images. According to neurokinesiologist Jean Blaydes Madigan:

About eighty-five percent of school age children are predominately kinesthetic learners. Using movement in the learning process helps many children retain and retrieve information more efficiently. Physical activity prepares the brain for learning by providing a healthier body/brain that works more effectively. All things being equal, healthy active students can learn better.¹⁰

Brain Derived Neurotrophic Factor (BDNF): "Miracle-Gro for the Brain"¹³

"At the molecular level, early studies indicate that exercise also stimulates one of the brain's most powerful growth factors, BDNF, which aids in the development of healthy tissue. BDNF exerts a fertilizer-like growth effect on certain neurons in the brain. The protein keeps existing neurons young and healthy, rendering them much more willing to connect with one another. It also encourages neurogenesis, the formation of new cells in the brain. The cells most sensitive to this are in the hippocampus, inside the very regions deeply involved in human cognition. Exercise increases the level of usable BDNF inside those cells. The more you exercise, the more fertilizer you create."¹³

Harvard psychiatrist, John Ratey refers to BDNF as "Miracle-Gro for the brain".¹³ He calls BDNF "a crucial biological link between thought, emotions, and movement." How do individuals get more BDNF?

Daily aerobic exercise is effective but including intervals of sprints is even better. In a recent German study volunteers who did two 3-minute sprints (separated by 2 minutes of lower intensity) during the course of a forty-minute treadmill session demonstrated higher increases in BDNF than non-sprinters. Not only that, the sprinters learned vocabulary words 20 percent faster than non-sprinting exercisers. It seems even a small amount of high-intensity exertion can have a profound effect on the brain.¹⁴

The Importance of Increasing Physical Activity at School

According to Dr. John Medina, "Because of the increased reliance on test scores for school survival, many districts across the nation are getting rid of physical education and recess. Given the powerful cognitive effects of physical activity, this makes no sense. Cutting off physical exercise - the very activity most likely to promote cognitive performance - to do better on a test score is like trying to gain weight by starving yourself."¹⁰

Engagement Rather than Preaching to the Converted – The SMARTfit Solution

The solution to engaging the rapidly growing inactive population has evaded us because we are now dealing with a population that has been conditioned to have everything delivered to them on a device with a screen. Exercise for most falls in the “have to basket”, something to be avoided. SMARTfit’s solution to the problem is to deliver exercise, fitness and learning into the “want to” basket by packaging its programming in the form of engaging full body activity games, loaded with alternating targets, pictures, sound effects and scoring built around timed games via computer technology and packaged exactly as we have been conditioned to receive entertainment.

SMARTfit, shares with video games, the utilization of game play to engage participation. However, instead of simulating play, SMARTfit engages players in multisensory kinesthetic experience including dynamic, integrated, multi-planar athletic movement. This is in combination with tactile contact and resistance, using sporting, fitness, or PE equipment. The result is a powerful combination of cardio fitness, brain fitness, functional fitness, sports specific training and action-based learning in one system.

Success with SMARTfit is measured by the ability of participants to keep the game in play as a result of their physical and mental responses. SMARTfit delivers its programming in fun, short, full brain-body activities that engage cognitive decision making, motor control, and reaction skills.

Coaches and instructors can customize activities and lesson plans to achieve specific program outcomes which they can access from Apple or Android smart phones or tablets.

SMARTfit’s programming tailor’s activities to deliver movement and cognitive function to suit the ability level of the pupil/trainee/patient. Therefore, desired measurable outcomes are produced, such as learning, fitness, motor skills, mood improvement, social interaction, team building, and brain plasticity (aka neuroplasticity). Results are measured via electronically generated scores that precisely measure development, progress and





achievements, all of which can be downloaded electronically.

SMARTfit programs are specifically designed to stimulate the body and the brain concurrently. Our training provides this level of stimulation and enables individuals to merge the mental and the physical while continually encouraging higher levels of accomplishment, which in turn pushes demands on the neurological system to rewire itself more efficiently. Regular use will literally improve the level at which the mind and body function competently together.

SMARTfit requires players to forget multi-tasking and to apply 100% focus on the required task and to move as quickly and fluidly as possible from one task to the next, staying constantly *in the now*. As soon as one moves into anticipating the future or judging the past the focus *in the now* is lost, performance drops and mistakes are made. *In the now* training is very effective in sharpening the ability to pay attention. It provides practice in taking mental dominion over one's actions and remaining in the present for longer periods.

Our multisensory approach to simultaneously engage physical, cardio, motor, vestibular and cognitive decision making, draws on brain research, exercise science and sports science for its release of fitness and exercise solutions for everyone from at-risk populations to performance athletes.

References

Evidence in this document has been gathered from scientific research, interviews with medical and science professionals, as well as experienced observations by seasoned trainers who have worked with the SMARTfit products and programs in their facilities during the past seven years.

1. *Peak Fitness by Mercola: Take Control of Your Fitness, 2017 Update.*
<http://fitness.mercola.com/sites/fitness/archive/2017/08/11/fitness-plan-2017->

updates.aspx?utm_source=dnl&utm_medium=email&utm_content=mv1&utm_campaign=20170820Z1_UCM&et_cid=DM155542&et_rid=22239817

2. [PNAS February 15, 2011: 108\(7\)](#)
3. [PLoS One. 2009 Oct 20;4\(10\):e7506](#)
4. [New York Times July 7, 2010](#)
5. [The Journal of Neuroscience, 27 April 2005, 25\(17\): 4217-4221](#)
6. [Forbes Magazine October 13, 2013](#)
7. Shams, L., Kim, R. "Crossmodal influences on Visual Perception." *Physics of Life Reviews* 7:3, 269-284. September 2010.
8. Hannaford, C. *SMART Moves*. Great River Books. ISBN-13:978-0915556373. 2nd Edition. September 2007.
9. Lessen-Firestone, J. "Fine Motor Skills: A Key to Academic Success." *LearningCareGroup.com Learning Care Group*, 2133 Hagerty Road, Suite 300, MI 48375. April 25, 2011.
10. Blaydes Madigan, Jean "Thinking on Your Feet." *Actions Based Learning*. ASIN: B0006sc39m. 2000.
11. Khalsa, D., Stouth, C. *Brain Longevity: the Breakthrough Medical Program that Improves Your Mind and Memory*. Grand Central Publishing. ISBN-13: 978-0446673730. April 1999.
12. Tomlin, R. "Physical Activity Keeps Parkinson's at Bay." *Baylor College of Medicine* <http://www.bcm.edu/news/item.cfm?newsID=544>. January 2006.
13. Ratey, J. Spark. *The Revolutionary New Science of Exercise and the Brain*. Little, Brown and Company. ISBN: 0316113506. January 2008.
14. Gabriel, L. "BDNF—Miracle-Gro for the Brain." *Thought Medicine*. <http://www.thoughtmedicine.com>. April 2010.
15. Neighmond, Patti. "Exercise Helps Students in the Classroom." *NPR Interview* retrieved from www.npr.org/templates/story/story.php?storyId=5742152 . August 31, 2006
16. Medina, John J. *Brain Rules*. Pear Press. eISBN: 978-0-979-77778-3. c2008.
17. Donald Hebb, *Hebbian Theory*
18. Eric Kandel, *Nobel Prize Winner 2011*

