

Benefiting the Brain and Language Learning Through Physical Exercise, Part 1

by Patrick T. Randolph

This is the first part in a two-part series on how exercise can help the brain and motivate language learners to excel at impressive rates.

I. Introduction—Learning from Our Ancestors



“The point of exercise is to build and condition the brain.”

—John J. Ratey, MD

Human beings did not evolve by sitting down in front of computers for prolonged periods of time. Quite the opposite. We have evolved because of being physically active, because “we are born movers” (Ratey, 2009, p.3). Movement, and plenty of it, is the essential ingredient that has boosted our brainpower and elevated our intellects, allowing us to do everything from creatively capturing a unique moment in life through poetry to curing destructive diseases like polio and tuberculosis.

It was movement or physical activity that helped our ancestors survive and develop both physically and mentally. “Learning and memory evolved in concert with the motor functions that allowed our ancestors to track down food, so as far as our brains are concerned, if we’re not moving, there’s no real need to learn anything” (Ratey, 2009, p. 53). In fact, we moved so much, the phenomenon seems to have become a part of our DNA. Richard Wrangham, a biological anthropologist at Harvard University, claims our male ancestors walked about 12 miles a day and the women logged in about 6 miles per day (Medina, 2009). It’s safe to say that our brains developed as we moved: searching, hunting, gathering, surviving, and planning the next place to set up camp.

Yet, despite this long, involved history of physical activity as a source of growth and development, and despite over 5,000 papers being published on exercise-related proteins (Ratey, 2009), and despite current research on how sitting is considered a very bad habit (Biswas, et al., 2015), our students spend most of their day sitting down while being required to

learn and retain information. And what is worse, I have noticed a growing number of instructors sitting down in front of the class while they teach their lessons. With so much research being done on our complex mirror neuron system (Iacoboni, 2009), and how that system in our students' brains mirrors their instructors' moods and actions, (Jensen, 2008; McPherron & Randolph, 2014), this is an added element of concern.

Logic and a basic physiology course will tell us that a great deal of sitting creates a serious set of problems related to attention and learning (Jensen, 2008). When the students sit down for a class, their bodies relax and their lungs provide less oxygen consumption for the brain. This, in itself, is a critical problem, because oxygen is one of the brain's key sources of fuel. In order to function at its optimal level, the brain needs a healthy dose of oxygen. But, if our students are confined to sitting, then they will be less likely to absorb the material in the lesson, and they will also lack that spark needed to become emotionally engaged in the content. According to the research done by Jensen (2008), we need to encourage our students to move around about every 20 minutes to keep their brains working at a healthy level.

II. The General Benefits of Exercise



“Only ideas won by walking have any value.”

—Friedrich Nietzsche

To be sure, there will be a number of skeptics out there, wondering just how exercise benefits the body, brain, heart, and soul. “After all,” they will argue, “look at what happened to the likes of Jim Fixx.” Or, as David B. Agus, MD, has noted, it was not all that long ago when “doctors believed running would stress the heart too much. People over forty were even encouraged to move from a two-story to a one-story house to reduce their exertion” (2011, p.215).

On the other hand, people have known for centuries about the medicinal value of exercise. Take, for example, Hippocrates. In his work, *Regimen*, dating back to 380 BCE, he writes:

Eating alone will not keep a man well; he must also take exercise. For food and exercise, while possessing opposite qualities, yet work together to produce health. (380 BCE/1931, p.229)

Even the skeptic has to admit that during and/or after a leisurely stroll or a healthy, heart-palpating workout, exercise just makes you feel good. In addition to the clinically proven fact that exercise nurtures healthy self-esteem, reduces anxiety and stress, promotes weight control, increases circulation, and helps feed oxygen to a hungry human brain, it is also “the only proven fountain of youth” (Agus, 2011, p.215).

A recent study was conducted over a 13-year period. The final result was inspiring: It was concluded that for every minute a person walks, he or she adds one to two minutes to his or her life (Cool, 2012). And, an even more recent study has shown that even just a good, brisk walk of 150 minutes per week yields an amazing “1-to-7 return: seven extra minutes of life gained for each minute spent exercising” (Goldberg, 2013, para.7). Perhaps now, even our skeptics are on their way to the nearest *Famous Footwear* or *Payless Shoes*.

Other studies (Eagleman, 2011) have shown that “Many people are found to have the neural ravages of Alzheimer’s disease upon autopsy—but they never showed the symptoms while they were alive” (p.128). The reason why they were able to keep the disease at bay was their active mental and physical lives.

III. The Benefits for the Brain



“Physical activity is cognitive candy.”

—John Medina

In her 2012 article, “How Exercise Could Lead to a Better Brain,” Gretchen Reynolds asserts that “Exercise, the latest neuroscience suggests, does more to bolster thinking than thinking does” (para.1). She bases her claim on a very enlightening study done at the University of Illinois under the direction of Justin S. Rhodes. The project looked at four different living environments for mice and concluded that unless there was significant exercise in their daily routine, their cognitive skills did not increase. That is, the mice that exercised on the running wheels did better on the cognitive tests than the mice that only had mentally stimulating environments. According to Rhodes, “Only one thing had mattered . . . that’s whether they had a running wheel” (as cited in Reynolds, 2012, para.6).

Although the above study was conducted on mice, plenty of research has demonstrated that exercise has also boosted human brainpower and potential. One of the many and most important things that exercise has been found to do is supply our brains with the needed oxygen it requires for attention and learning (Jensen, 2008; Medina, 2009; Sousa, 2011).

A second crucial benefit of exercise is that it causes “nerve cells to bind together” (Ratey, 2009, p. 53). This process is pivotal in acquiring new information in the learning process. Another very inspiring phenomenon that exercise promotes is the development of new neurons in the hippocampus—a process known as *neurogenesis*. This is particularly important because

the hippocampus is one of the most important centers for memory formation and learning. In short, exercise helps create new “baby neurons” in your brain—no matter how old you are!

Although it seems that the benefits of exercise for the brain are endless, and they are, I would like to conclude this section with a brief look at the impact that exercise has on helping to produce and release valuable neurotransmitters. These are essential *neurochemicals* that help regulate everything from our emotional states to our cognitive performances and the way we make sense of the world.

Some of the main neurotransmitters that exercise helps elicit are *acetylcholine* (involved with attention and memory); *dopamine* (involved with the rewards of learning, is a key factor in balancing moods, facilitates learning, emotional responses, and it is also important in developing our working memory (Knecht et al., 2004)); *epinephrine* or *adrenaline* (involved with our attention systems); and *serotonin* (involved in regulating our moods and it also helps in facilitating the learning process). From the above, we can easily see that exercise is the great promoter of all things essential for a healthy, happy, and effectively functioning brain.

IV. The Benefits for Learners

“To improve your thinking skills, move.”
—John Medina



According to Sousa (2011), “Studies confirm that higher concentration of oxygen in the blood significantly enhance cognitive performance in healthy young adults” (p.238). Dr. Antonette Yancey robustly confirms these findings with her own research.

Kids pay better attention to their subjects when they’ve been active . . . Kids are less likely to be disruptive in terms of their classroom behavior when they’re active. Kids feel better about themselves, have higher self-esteem, less depression, less anxiety. All of those things can impair academic performance and attentiveness. (as cited in Medina, 2009, p.18)

Perhaps one of the most revolutionary programs that has tapped into the notion that *education means exercise* is taking place at Naperville Central High School in Naperville, Illinois. The educators and administrators there have set up a “Zero Hour Physical Education (PE) Class.” This class is designed to help their underperforming students bolster their reading skills, and it has done just that. The class starts one hour before their regularly scheduled classes and focuses on intense fitness. The research shows that the students who took that class when it was first offered increased their reading and comprehension scores by 17 percent, and the students who declined from taking the class only improved by 10.7 percent (Ratey, 2009). Needless to say, the school has continued with this program in full force.

Neil Duncan, a physical education teacher at Naperville states, “Basically, we’re getting them to that state of heightened awareness and then sending them off to class” (as cited in Ratey, 2009, p.11). From what I discussed above, we can see that Duncan’s comment is supported by the recent discoveries in neuroscience. And, given our brief survey of

neurotransmitters, we can be sure that those neurochemicals are helping the students to improve their academic skills and helping them to encode and learn the new material.

V. The Benefits of Exercise for Language Learners

In addition to all the amazing neurotransmitters that are released during exercise, there is also one extremely significant protein that is produced called *brain-derived neurotrophic factor* (BDNF). BDNF is an overwhelmingly powerful neurotrophin because it helps in the process of neurogenesis (as above, the creation of new neurons) in the hippocampus, and it strengthens the existing connections and neural-communication between the neurons—making cell communication all the more potent and helpful in learning and memory (Ratey, 2009).

I mention BDNF because it was also found to be a significant factor in a 2007 German study that analyzed vocabulary acquisition and exercise. The study looked at 27 participants and had them exercise and study vocabulary. The study concluded that “vocabulary learning was 20 percent faster after intense physical exercise... This condition also elicited the strongest increases in BDNF and catecholamine levels” (Winter et al., 2007, p.597). Thus, it was suggested that both BDNF and physical exercise improve language learning.

Schmidt-Kassow et al. (2013) conducted a similar study in Germany six years later that investigated how young females encode vocabulary while exercising. This study looked at 81 healthy, young German females learning Polish. The participants were divided into three groups of 27. One group studied the new vocabulary after just sitting for a 30-minute period; the second group rode stationary bicycles and then studied the vocabulary list; and the third group rode the bicycles at a moderate pace and studied the list simultaneously for 30 minutes. The upshot? The third group had the best results when tested two days after the initial encoding of the lexical items.

Concluding Remarks

The *Nebline*, an educational newsletter published in Lincoln, Nebraska, recently came out with an article titled, “Sitting is the New Smoking” (Henneman, 2015). The crux of the article looks at our sitting culture and offers multiple ways to combat our new bad habit. My recommendation to all educators—whether they be ESL instructors or philosophy professors—is to get their students involved in some kind of physical activity before and during class. In addition, I think instructors should promote exercise and encourage students to do more of it on their own. John Medina calls physical exercise “cognitive candy” (2009, p.22). I believe if we all look at exercise that way, our bodies, minds, and souls will benefit from this physically fit and mentally healthy version of a *dolce vita*.

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PATRICK T. RANDOLPH was recently awarded the “Best of the TESOL Affiliates” for his presentation on vocabulary pedagogy. He teaches in PIESL at the University of Nebraska-Lincoln and specializes in vocabulary acquisition, creative and academic writing, speech, and debate. He has created a number of brain-based learning activities for the language skills that he teaches, and he continues to research

current topics in neuroscience, especially studies related to exercise and learning, memory, and mirror neurons. Randolph has also been involved as a volunteer with brain-imaging experiments at the University of Wisconsin-Madison. He lives with his wife, Gamze; daughter, Aylene; and cat, Gable, in Lincoln, NE.

Randolph and McPherron's book, *Cat Got Your Tongue?: Recent research and classroom practices for teaching idioms to English learners around the world* is available on Amazon:

http://www.amazon.com/Tongue-Teaching-Idioms-English-Learners/dp/1942223226/ref=sr_1_fkmr0_2?s=books&ie=UTF8&qid=1449810804&sr=1-2-fkmr0&keywords=cat+got+your+tongue%3F

and at TESOL Press: <https://www.tesol.org/BookLanding?productID=196>

*Chapter Eight of this book offers 13 lesson plans for teaching vocabulary and idioms, many of these activities are movement-oriented and very effective.

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