FAB 9 Study Sheet #6 – Movement & Stress

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Topic 6: You gotta move it, move it

Most findings in neuroscience just bolster theories from other fields and intuitions we already have. There are two exceptions. One is sleep. Yes, we knew students need sleep, but until neuroscience told us how absolutely important it is for learning, we put it in the same category as brushing your teeth or eating salad. We thought not getting enough sleep was just a matter of just toughing it out.

The other exception is exercise, another activity we tend to associate with general health rather than brain function. Again, neuroscience is telling us it is critical for the latter, and mainly because of blood flow.

As Read Montague puts it, our brains evolved on legs, and this makes all the difference (2006). Our ancestors walked from 10-20 kilometers a day, so our brains evolved with far more blood flow than we get in our modern sedentary lifestyle (Medina, 2008). The human brain burns up blood-supplied glucose at ten times the rate that other body parts do, and glutamate is the most common neurotransmitter. As the messenger rather than just modulator, glutamate gets released every time a synapse fires and eventually builds up to a toxic level, causing neural erosion. As long as our blood keeps pumping through (and we get sleep), these neuron busters get carried away in the oxygen, but if not, they accumulate (Ratey, 2008). Cognitive function deteriorates and we age prematurely. Think about how you feel after a long meeting. Your mind feels dull, you have a hard time talking, and your normally sharp cognitive skills turn muddy. This is what happens when your brain is active for a couple hours but your body is not. Unfortunately, that is what happens in most schools, but for even longer periods.

In addition to clearing out toxins, exercise does other things as well. It causes the release of mood-shaping neurotransmitters like dopamine, norepiniphrine, and serotonin (Ratey, 2008). Even just a little exercise gives learners better focus, higher motivation, more confidence, and less impulsiveness; in other words, ideal classroom behavior. The release of neurotropins, like BDNF (Brain Derived Neurotrophic Factor), occurs too, at two or three times the normal level. Harvard's John Ratey calls BDNF "Miracle Gro" (a lawn fertilizer) for neurons.

Unfortunately, many of us still cling to the notion that more regular class time is what learners need to pass tests and that physical education classes are an "extra." And yet, a study with 5000 children over a three-year period found that 30 minutes of exercise, twice a day, led to greater achievement across the board, especially with girls. The largest increase was …now get ready for this… in math, an area of study that requires intense executive processing (Medina, 2008, pp. 24-25).

It is important for us to make teachers aware that to optimize brain function, they need to get their students out of their seats every half hour or so (See Helgesen's chapter, page xxx). That does not mean you have to conduct physical exercises in class, but a few simple changes can make a huge difference: a) have students come to the front to get the quizzes and handouts, instead of passing them out; b) when handing papers in, have them bring them to you instead of passing them forward; c) instead of just raising hands to answer questions have students all stand up and those who do not know the answer sit down; and d) have them do

pair work standing up. A little moving benefits student energy, mood, and cognitive ability. It improves learning.[1] So why don't you put this book down and go out for a walk?

Topic 7: Stress as a teaching tool

If you google "stress and learning," you will come up with article after article about how stress is bad for you – the mantra of our age – and how even a small amount is bad for learning. On the other hand, I often hear teachers say, "A little stress is good for learning," a notion that comes from animal studies; rats dropped in cold water learned the exit routes faster. Obviously, these teachers do not mean debilitating long-term stress, a disease; they mean those little single instance stresses we use all the time. Calling on students to answer, having them play games, giving them a cautionary look – our favorite tools – all cause a stress response.

Leaving long-term stress aside, which is it? Does a little one-time stress aid or hinder learning? Actually, neuroscience has found something amazing. It does both, and at the same time. When information comes in that the pre-frontal cortex and insula identify as a stressor, which is heavily dependent on the psychological disposition of the recipient, the hypothalamus is signaled and two key structures in the nervous system are activated (Joëls et al, 2006). The faster is the autonomic nervous system (ANS), which controls overall bodily response. It activates the flight-flight response, which is characterized by an increase in heart rate, harder breathing, loss of hunger, release of glucose from energy stores, and the flow of blood into skeletal muscles. It also causes the release of noradrenaline which helps orient the organism towards dealing with threats.

While the autonomic nervous system just shapes an immediate response, the second system, the hypothalamic pituitary adrenocortical axis (HPA) shapes a longer-lasting response. It causes the release of stress-related hormones such as cortisol that both sharpen attention and shield neurons. In a kind of two-stage rocket, information related to the stressor is deeply learned, but learning from before the stress, or up to an hour after, is lost (Koolhaas et al, 2011). This makes sense. An organism needs to learn that something that might be dangerous or vital, and that learning needs to be shielded from other learning that might overwrite it. This probably explains why students playing intense computer games, pleasurable because of the stress, show lower retention in study done just before or after.

The place in the brain targeted by stress is important too. For some classroom stresses, such as a student being scolded about improper use of the past tense, the emotional part (the insula) is activated, not the part of the brain that deals with verbs. The scolded student is likely to remember the scolding for a long time, and maybe even the particular mistake that led to it, but unlikely to remember much else about verb tenses, or anything taught in the next hour.

Medina, J. (2008). *Brain rules: 12 principles for surviving and thriving at work, home, and school*. Pear Press.

Montague, R. (2006). *Why choose this book?: How we make decisions*. EP Dutton.

Ratey, J. (2008). Spark: *The revolutionary new science of exercise and the brain.* New York: Little Brown.

[1] In fact, our motor areas involved in all kinds of processing so any movement might aid learning. For example, numerous studies have found that chewing sugarless gum increases retention, the best known being Scholey's 2002 study that showed it increased word retention up to 35% (Laskaris, 2006). The exact reason why, though, is still not clear.