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ON LAYERS, LOOPS, AND LEARNING

Over the past decade we have made huge strides in understanding the wonders of brain development. If there are a hundred billion neurons and every neuron has the possibility of one to 10,000 synaptic connections to other neurons, the complexities, intricacies, and infinite opportunities for the brain's performance are incredible. In each layer and every neural loop within the brain, there is the embedded jewel of learning. In other words, each neuron is an import and export station for signals it receives, reorganizes, and relays to other neurons.

Educational experiences and exposures, when stimulating enough, generate new dendrites on the neuron's cell body, thus enriching the brain structure. Although the brain must smartly prune unused connections to stay efficient, impoverished brains will lose far more synaptic connections than they gain. Brain scans, therefore, show either a densely connected network or a sparse one, but it is always ever changing. We now know how the brain registers, retains, and releases learning (neural pathways) to function optimally.

Neurobiologist Gerald Edelman says, "The nervous system behavior is to some extent self-generated in loops. Brain activity leads to movement, which leads to further sensation and perception and still further movement. The layers and loops between them are the most intricate of any object we know, and they are dynamic. They continually change." As educators, we know we are important change agents. How we can translate this new understanding of educational neuroscience into the classroom, however, still remains a topic that needs clarity and emphasis. Let's look more closely at the "brainy" basis for active and collaborative learning that will boost student effort.

Intentional submersion. *Connect learning with students' lives and experiential background.*

- The brain is innately programmed to search for patterns and meaning through categorizing and organizing. This means that educators must submerge students in actual experiences where they can manipulate their knowledge, discover patterns, and organize them into relevant and meaningful categories.
- Providing choices empowers students. So, wherever and whenever feasible, include students in the decision-making process. For example, ask them which day of the week they want assignment submissions.

Bodily Activation. *Connect learning to movement.*

- All the parts and areas of the brain are interconnected and, consequently, body movement can precipitate brain function and connectivity. The whole body participates in any thinking process. A supportive environment produces the neurotransmitter "dopamine," which improves episodic memory, working memory, verbal functioning, flexible thinking, creative problem solving, decision making, and social interactions. According to David Sousa, "Lecture continues to be the most prevalent model in secondary and higher education but produces the lowest degree of retention."
- Mingle music and movement into theories, equations, or formulas that must be understood and memorized. It's a fun and effective technique for forming lasting neural pathways in the brain that lead to long-term memory.

Flexible individualization. *Connect learning to learning styles and multiple intelligences.*

- Every brain is unique. The development of the right brain and the left brain may be balanced or one side may be dominant. An educator's goal is to develop both sides of the brain through stimulating activities.
- Change things up to create excitement and interest for you and your students!
- Use music. Patterns within rhythms soothe and de-stress while stimulating learning by regulating energy and preparing neural pathways for content matter to be learned.
- It is best if educators use diverse forms of assessment, such as portfolios. Portfolios tell and respect the unique developmental story of each student and measure ability in a myriad of ways, rather than unilaterally.

Participatory processing. *Connect learning with others.*

- The brain is social and works best in conjunction

with other brains. Relevance reigns supreme when it comes to learning and memory. New neural pathways that are originally dirt roads may either disappear (if less relevant) or turn into highways (when very relevant). Long-term memories have feedback loops that are inscribed forever and thus easily retrieved. True learning involves feeling. So let's raise the emotional stakes and get some buy-in to our subject matter.

- Dialogue instead of monologue should be the motto of educators. Ask students to share their thoughts and comments during your presentations.
- Pair and share after a new concept has been taught. True learning is reinforced when students teach each other.
- Democratic settings are more conducive to learning than authoritarian ones. Decide upfront which decisions can be offered to students to empower them. Participatory management of the class creates buy-in and increases inner drive.

Jensen says, "The brain is what we have. The mind is how we use it." Let's use strategies that brain research indicates will promote optimal learning. Active and collaborative learning is not an ornamental addition; it is embedded methodology for effective impact. Yes, some of these techniques bring us out of our comfort zones. But comfort zones can soon become beds of stagnation if we don't embrace the future and adapt. The only thing that is constant in this world is change.

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