**Topic Ten: How to retain information in long-term memory**

***Learning Objectives:***At the end of this reading you will be able to:
1. Describe the process of sustaining focused attention
2. Explain the concept of brain plasticity
3. Give an example of how to transfer learning from short-term to long-term memory  ***Conceptual Framework***: **Organizing the brain for learning**
In order for learning to be retained there are specific actions, within each learners, that can be utilized to facilitate the process. The first step is to focus attention of what you want to remember. This means involving your five senses in the moment. Memory is triggered by how engaged one is in the experience of the moment of exposure to learning. The more our five senses are stimulated during the learning process, the greater the chance of transferring the information from short-term to long-tern memory.

Sleep has a major role in the learning process. When the human brain is asleep, memory of information learned while awake is processed. This process can enhance the potential for consolidating memory in the pre-frontal cortex for later retrieval. Adequate rest/sleep optimizes the brains ability to consolidate previously acquired learning. There is a direct relationship between the learning experience and the timing of sleep that can be used to strengthen the memory of a learning experience. A learning experience can be processed with greater clarity both qualitatively and quantitatively during rapid-eye movement (REM) sleep. REM sleep triggers the processing of information/learning that is remembered during the entire sleeping period. The brain needs adequate rest/sleep to adequately process a persons learning exposure for later retrieval. Learning cannot be optimized without adequate sleep/rest. For example, even taking a 20-minute “power nap” will enhance learning retention.

It is important to understand that “cramming” does not facilitate learning. Expending time in an intensive “study” of material is not facilitative for long-term memory. The strategic spacing between “study” periods actually supports recall of learning. Short study sessions that consist of reviewing information strengthen understanding of the material to be learned. This process facilitates reflection about study material that provides connections between prior knowledge and newer pieces of information. Written reflection of information to be learned promotes long-term recall of that information.

Visual depiction of information to be learned enhances the memory of that information. Using visual images to represent ideas strengthens memory. Visual images reinforce learning for later retrieval of information. Visual images enhance understanding of information.

Making emotional connections between one’s prior knowledge and material to be learned strengthens later recall of new information. Emotional arousal stimulates the brain to consolidate learning for retention. Emotionally charged memories of information will increase likelihood of remembering the information.

Doyle, T. (2011). Learner-centered teaching. Sterling, VA: Stylus Publishing.
 ***Example***Multi-sensory stimulation can enhance the learning process. An example of this can be found in audio-visual and tactile-kinesthetic engagement of any material to be learned. When I was in medical school, I would read my medical books pacing back and forth across the room while recording my voice on a recorder. I would, then, play my voice recording all night, while I was sleeping, with the recorder set on rewind and replay.

 ***Positive support for learners***When a student gets stuck academically and seems “unable” to learn it is import to provide active supports for that student. The brain wants to make sense out of "chaos" that it is experiencing. Providing supports for learning is vital to not stifle the drive for discovery learning. Providing the learner a safety net during the learning process to reawaken intrinsic motivation can strengthen the learners resolve to accept personal responsibility for making sense out of problems to be solved and enjoying the learning process.
 ***Self-Assessment***1. When you were a child, what supports for learning would have helped you feel more empowered about academic learning?
2. As a child, when learning supports were not provided what did you do next?
3. As an adult, when you feel overwhelmed by a task, what do you do to keep from giving-up?

**Topic Eleven: How can I engage in active learning?**

***Learning Objectives:***At the end of this reading you will be able to:
1. Describe the process of active learning
2. Explain how learning is enhanced by physical activity
3. Give an example of how physical activity can enhance learning ***Conceptual Framework***: **Integrating movement in the learning experience**
The first nerve cells evolved 500,000,000 years ago to facilitate movement of organisms to coordinate more efficient self-feeding. The human brain evolved to work more efficiently when the body is physically active. Physical activity stimulates the learning process. A molecule referred to as a brain-derived neurotrophic factor (BDNF), stimulates nerve cells (neurons) in the brain to grow and proliferate. There is a direct relationship between body movement and learning. Learning is nurtured by physical exercise. Physical exercise stimulates the plasticity of neurons for taking in information. Physical activity makes learning of information more accessible. For example, aerobic exercise can optimize both performance and the thinking process that facilitates performance.

There are three brain functions that stimulate cognitive capacity. First, physical activity stimulates the production of BDNF. Secondly, BDNF stimulates neurogenesis. This protein stimulates the growth of nerve cells. Thirdly, BDNF facilitates the stimulation of neurons and connections between neurons that facilitates the potential for learning and memory of that learning. Exercise, in isolation, does not spark learning. Rather, exercise helps the brain to be more receptive to learning potential. Even the simple act of walking can enhance cognitive functioning. However, aerobic exercise facilitates the learning of new information more efficiently.

The basis for learning and remembering that learning is contingent on the plasticity of the synaptic junctions between neurons facilitated by BDNF. How does this happen? Exercise enhances the production of the neurotransmitters: serotonin, dopamine, and norepinephrine. These neurotransmitters impact our ability to sustain focused attention, stay alert to what we are experiencing, and our motivation to learn. These abilities nurture the abilities to be patient with the learning process, exercise self-discipline and self-control, as well as have a positive attitude toward life-long learning. In the entire brain, the neurons in the hippocampus have the greatest impact on learning and memory. BDNF appears to be most active in the hippocampus. What becomes most fascinating is that the hippocampus is, also, the part of the brain that is most responsive to emotions. That is the reason why emotional arousal tied with physical activity is such a powerful combination for nurturing the learning process.

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 ***Example***Physical exercise enhances the learning process. An example of this is my multi-sensory engagement with may studies during medical school. Not only did I read my medical books pacing back and forth across the room while recording my voice on a recorder while recording my voice to play back on the recorder all night while I was sleeping. I would also transcribe each chapter and create concept maps for each chapter that I would review while I was eating at each meal. This would activate my taste buds and sense of smell to reinforce my remembering concepts through the pleasure of eating food and smelling the aromas of the meal.

 ***Positive support for learning***When learning a concept seems too difficult, we need to get physical. The brain wants to make sense of the material. So, committing to 20-30 minutes of aerobic exercise, at least three times a day will prime the brain for greater retention of material studied after the exercise period. Exercise awakens the brains intrinsic motivation to make sense out of information that seems confusing prior to the aerobic exercise and stimulates energy to confront the learning process with a more positive focus.
 ***Self-Assessment and reflection***1. Have you ever tried to memorize something that was just not sticking? Did you give up or push yourself to complete the memorization process?
2. Are you willing to commit to starting and continuing a commitment to exercise on a regular basis? Set a date and start a calendar to record your progress.

3. Develop a written plan to help you stay committed to your exercise regime. Write a series of positive affirmations that you can use to support your commitment.

**Topic Twelve: How to embrace learning and make a commitment to positive change**

***Learning Objectives:***At the end of this reading you will be able to:
1. Describe why accepting responsibility for one’s learning needs to be an intrinsic motivation
2. Explain how neuroscience research supports active learning
3. Explain the meaning of the sentence: *The one who sustains focus on learning a skill will eventually learn* it. ***Conceptual Framework***: **Having a self-directed commitment to life-long learning**
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