

Teaching the Way People Learn

Module 2: Viewing the Teacher as a Brain Changer

This handout accompanies the video for Module 2. Use the handout to review information from the video and to record discussion.

Section 1

- Research suggests that knowledge of educational neuroscience is a powerful commodity that leads to higher student achievement, engagement, and motivation.
- Fundamental knowledge of how the brain works should be an important component of a teacher's pedagogical knowledge.
- A basic familiarity of brain structure and function will allow educators to become better consumers of scientific research.
- At the end of the module journey (a "celebration" of neurons), well may we exclaim with the psalmist, "I will praise you for I am fearfully and wonderfully made."

Stop & Jot 1: Name 5 facts about the brain with which you are familiar. Why might it be important for educators to understand brain structure and function?

Section 2

- The human brain weighs only about 3lbs. and makes up just 2% of the body weight but uses around 20% of the body's oxygen and blood.
- The brain is part of the human nervous system, a system that receives, processes, and stores information in order to coordinate actions.

- From the outside the brain's most distinguishing features are its convolutions or folds. The wrinkles are part of the cerebral cortex, the brain's outer covering.
- The brain consists of several hundred billion cells of two main types: neurons and glial cells.
- Neurons receive and transmit information to other cells through electrochemical signals. Each neuron connects with thousands of other neurons and as a result, the process of cellular communication can involve highly intricate neural pathways.
- The increasing strength of the connections between neurons that sustain memory derives from the repeated activations of those networks.
- Neural plasticity refers to the brain's continuous capacity to generate new neural networks in response to stimuli.
- The neuroplastic response also includes the thickening of the layers of insulation called myelin around existing connections. A greater number of connections among neurons in a circuit means faster and more durable communication.
- Through neuroplasticity the brain is molded by experience to reshape and reorganize itself.
- Not all activations of memory circuits stimulate the neuroplastic responses equally.
- Once encoded, short-term memory requires mental manipulations of the new information.
- Mirror neurons may help an individual to decode the intentions and predict the behavior of others.

Stop & Jot 2: How do brain cells communicate? Why is it important for educators to know how they do?

Section 3

- All learning begins with sensory information.
- The brain has a sensory intake filter called the reticular activating system in the brainstem. The RAS determines what the brain attends to and what information gets in.
- Though small in size, the cerebellum is central to the body's balance, posture, walking, and planning motor commands for the coordination of harmonious movements.

- Folded around the brainstem is the limbic system which is the brain’s principal regulator of emotions. It's powerful enough to override both rational thought and innate brainstem response patterns.
- Memories formed during a specific emotional state tend to be easily recalled during events that provoke similar emotional states.
- Sensory information extracted from the external environment arrives in the amygdala for emotional processing before it reaches the cortex, the part of the brain where rational thought takes place.
- Some examples of specific school-related stressors that can trigger the amygdala to send input away from the cortex are
 - Anxiety related to speaking in class, answering questions, or oral presentations
 - Fear of being wrong
 - Physical and language differences
 - Test-taking anxiety
 - Boredom as a result of prior mastery or absence of personal relevance
 - Frustration with material students believe exceeds their understanding
 - feeling overwhelmed by the demands of school assignments
 - Inability to effectively organize
 - Feelings of isolation or lack of acceptance by peers or teachers

Stop & Jot 3: “The amygdala receives stimuli 40 milliseconds before the cortex. This finding indicates that fearful responses precede any conscious, thoughtful responses to stimuli.” What might an implication of this knowledge be for educators?

Section 4

- The hippocampi are integrated structures that appear to convert important short-term experiences into long-term memories.
- Functionally, think of the hippocampus as the catalog for our library of memories.
- New memory construction takes place after new sensory information leaves the amygdala and enters the hippocampus. Memory is stored in separate hemispheres of the brain based on the sensory modality in which it is experienced.

- The brain develops stronger and extended memory circuits when new learning is connected to multiple circuits by recognizing the common threads among existing circuits or experiencing the learning through multiple sensory modalities such as vision, hearing, and movement.
- Storage of memory in neural networks is based primarily on patterns or relationships.
- Activating students' existing relevant prior knowledge guides the brain to recognize connections with existing memory networks in the hippocampus.
- To ensure that there is related to existing memory in the hippocampus to link with the new input, it is essential to help students become aware of their prior knowledge. Strategies that have been shown to ensure activation of prior knowledge include the use of pre assessments, advance organizers, essential questions, concept maps, graphic organizers, and hook activities.
- The cerebrum is the largest area of the brain accounting for more than 80% of the brain's weight. It is divided into halves referred to as cerebral hemispheres. Several major wrinkles and folds form a set of four lobes in each hemisphere. Each lobe tends to specialize for certain brain functions.
- At the front of the brain are the frontal lobes, and the part that lies just behind the forehead is called the prefrontal cortex, often called the executive control center.
- Trauma to the frontal lobe can cause dramatic and sometimes permanent behavior and personality changes.
- Because most of the working memory is located here, the prefrontal cortex is the area where focus occurs.
- The frontal lobes mature slowly. The capability of the frontal lobes to control the excesses of the emotional system is not fully operational during adolescence.

Stop & Jot 4: Why might research addressing the development of the frontal lobe be of particular interest to educators?

Section 5

- Above the ears rest the temporal lobes. These lobes are where auditory stimuli are initially processed.
- The parietal lobe is located at the top and side of each hemisphere and is responsible for processing sensory information such as pain, body position, temperature sense, limb position, and touch.

- Located at the back of the brain, the occipital lobe receives and processes visual stimuli and their properties including color and motion.
- Differences in information processing between the left and right hemispheres of the brain were established and popularized as a result of studies of so-called “split-brain” patients.
- More recently developed views of hemispheric specialization suggest that both hemispheres are involved in most tasks although their contributions may not be equal.
- As research evolves, popular notions of how the brain works also need to change to reflect the latest scientific thinking.
- With a basic understanding of brain structure and function, educators can avoid using mere popular notions of how the brain works.
- Neuroscience research likely supports strategies you’ve already found most successful in your experience as a teacher.

Go and Grow

Without referring back to the video or handout, what are **three** valuable points you take away from this module?

What are **two** things you would like to do “tomorrow” with the information you learned?

Assignment: What is **one** question you have and would like to research? For the next time you meet, prepare a brief summary of your findings to share with others who may have the same question.