NOW YOU SEE IT, NOW YOU DON'T

LESSON PLAN

Title: Now You See It, Now You Don't
Setting: In Classroom
Subject: Biology - Neuroscience
Grade Level: 6-8
Time Frame: 35 Minutes
Paired Dana Foundation Fact Sheets: 6th-8th Grade How Does the Brain Work?
Next Generation Science Standards: Meets MS-LS1-8

STUDENT OBJECTIVES

- Understand the different stages of memory storage.
- Learn about the brain regions that are involved in memory formation.
- Practice our short-term memory with a fun memory test for the entire class.

BACKGROUND

Memory is the process by which information about the world around us is encoded, stored, and recalled. While some animals do display evidence that they too have memories, humans are unique in that our memories help create complex language and self-awareness.

In this lesson, students first learn about the different stages of memory formation and the brain areas that sub-serve this ability. Then the entire class participates in an interactive and fun test of their short-term memory.

MATERIALS

- Printed copies of 6th-8th grade Dana Foundation fact sheet, "How Does the Brain Work?" **Downloadable here:** www.dana.org/factsheets
- Audio and visual capacities for a PowerPoint presentation.
- Pen and paper for every student in the class.

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TEACHER BACKGROUND INFO

WHAT TO KNOW BEFORE YOU TEACH

* Note: This content is primarily for the instructor's reference; the accompanying PowerPoint presentation will be for the students.

Three Stages of Memory Storage:

Encoding → Storage → Retrieval

Encoding: The process by which our brain receives sensory information to be put into memory. The different types of encoding are semantic encoding, visual encoding, and acoustic encoding. Semantic encoding is the encoding of words and their definitions and seems to be the most effective way for humans to memorize verbal information. Visual encoding is the encoding of images, and this happens as you read over words that conjure pictures in your mind. For example, as you read a list of words including, "dog, squirrel, honesty, compensation," you will have an easier time recalling the two animals because these are high-imagery words while honesty and compensation are more abstract. Acoustic encoding is the encoding of sounds and the ability for you to remember lyrics to songs for years to come. This is one of the reasons we teach young kids through song and rhyme.

Storage: Storage is the retention of what your brain has encoded, and it is also known as your "long-term memory." Before information gets stored permanently, it must go through three distinct phases: sensory memory, short-term memory (STM), and long-term memory (LTM). Sensory memory is just as it sounds - memory of things that we see, hear, and taste; it is very brief, lasting only a couple of seconds. Most of the sensory information we process is unimportant; for instance, you don't "need" to remember the color of your colleague's shirt during a meeting. If we view something as important (for example, what the colleague is saying!), that information will move into STM. STM lasts for about 20 seconds, and during this short duration, your brain might take the sensory memory and link it to an existing LTM. Research has actually shown that most people can retain about 7 items in their STM.

LTM is the permanent storage of memories, and can be distinguished by two types: implicit and explicit. Implicit memories are those that are not part of our consciousness, are created from repetitive behaviors, and can be divided into procedural and emotional memories. Procedural memory is just as it sounds—memories on how to perform procedures such as riding a bike. Explicit memories are those involving facts and experiences and as such are categorized as semantic (facts) and episodic (events).

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A third type of memory is called, "working memory," and it fits somewhere in between STM and LTM. It is a more dynamic form of STM, and involves an integration of sensory information such as visual and auditory input to remember a complex piece of information. An example would be watching a cooking program on TV and attempting to follow the instructions while cooking. It is the repeated use of our working memory that creates new brain pathways and commits items to our LTM.

Retrieval: The act of getting your LTM out of storage and back into conscious awareness is called retrieval. We must retrieve memories all of the time during the day, such as the procedural implicit memory of how to tie our shoes or the episodic explicit memory of the conversations we had with friends the day before. There are three ways that memories can be retrieved: recall, recognition, and relearning. Recall is the act of accessing information without cues. Recognition involves a type of comparison between what you have already learned and what you are newly encountering. Relearning is when you learn the same information a second time, and retrieval is a lot faster than when you learn it just once.

Brain Regions Involved in Memory

While many brain regions are involved in memory, it is generally accepted that specific parts of the brain are more important than others. These include the hippocampus, the amygdala, the cerebellum, and the pre-frontal cortex.

Hippocampus: This small structure (looks like and is named after a seahorse) in the brain's temporal lobe is important for the storage of explicit LTMs, and especially information regarding spatial navigation. Alzheimer's disease and other types of dementia affect the hippocampus first and are characterized by profound short-term memory loss and the inability to form new memories.

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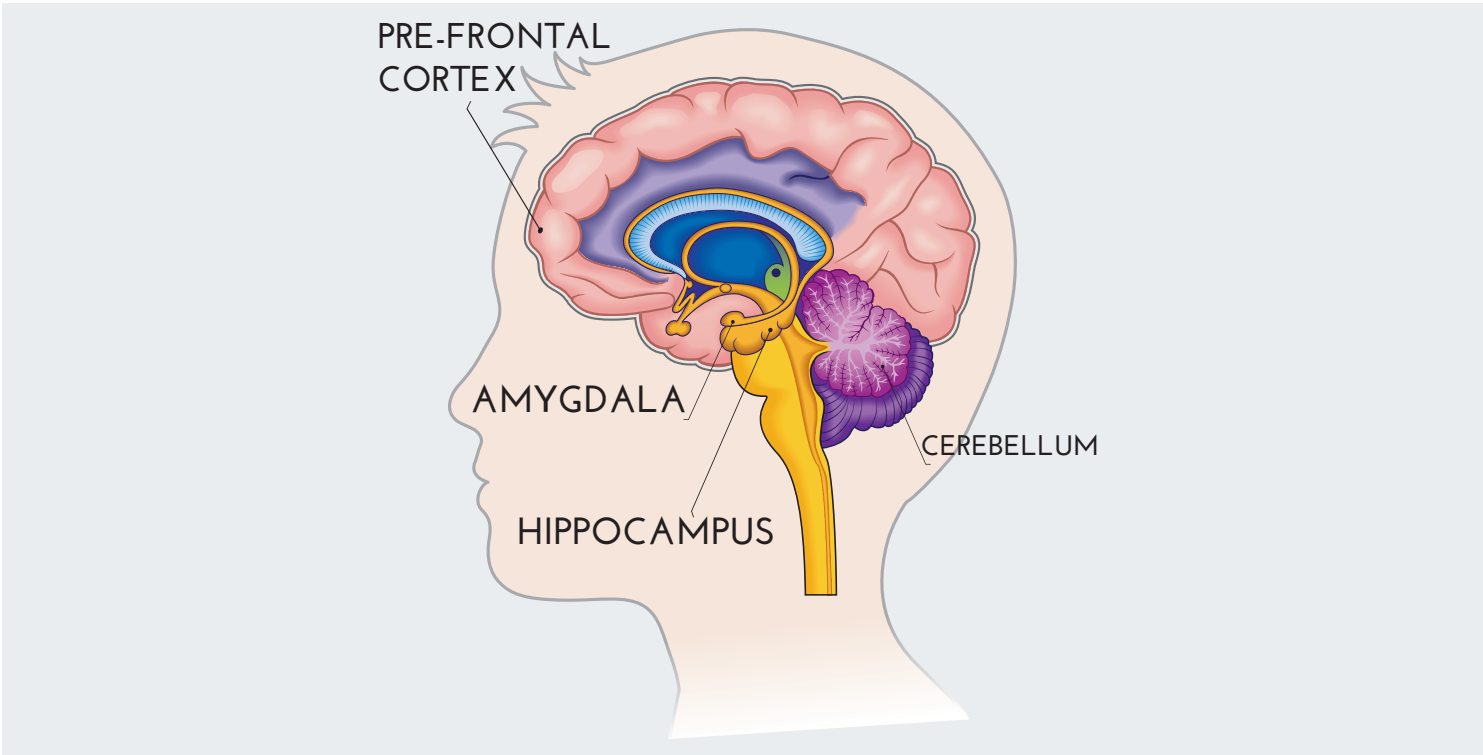
Brain Regions Involved in Memory

Amygdala: An almond-shaped nuclei in the brain's temporal lobe that is important for assigning emotional value and significance to otherwise non-threatening memories. For instance, when kids associate a doctor's office with the pain and fear of getting a shot.

Cerebellum: Located at the base of your brain, the cerebellum is typically associated with fine motor movement; however, this area is also involved in creating implicit procedural memories such as how to ice skate.

Pre-frontal Cortex: This portion of your frontal lobe is important for working memory as it is where memories are temporarily stored and also the part of your brain that talks to other areas to keep specific memories on hold while they wait to be discarded or stored in LTM.



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PROCEDURE

[1] Each student reads 6th-8th grade Dana Foundation fact sheet, "How Does the Brain Work?" **(5 minutes).**

[2] Briefly introduce the exercise and give a short PowerPoint presentation on memory **(15 minutes).**

[3] The last slide of the PowerPoint will have pictures of 20 or so items. The instructions for this activity will be displayed on the second to last slide. Give these directions to the class **(15 minutes):**

a. Get a paper and pen ready.

b. When I click to the last slide with the pictures, look at the images for 60 seconds and remember what you see.

c. When 60 seconds are up, write down as many of the objects as you can remember.

d. Add up how many you remembered correctly, and obtain a class average for how many items you can store in your "short-term memory."

ADDITIONAL RESOURCES

- A collection of neuroscience puzzles and fact sheets for kids in grades K-12 that are available for download (PDF): **www.dana.org/educators**

* The "Now You See it, Now You Don't" activity was originally developed by Eric H. Chudler, Ph.D., University of Washington, and was adapted by Elizabeth Weaver, M.S. and Linda Qi Beach, Ph.D. for the Dana Foundation.