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Brain Research and Education: Fad or Foundation?

1. Experience shapes the brain.

The brain is the only organ in the body that sculpts itself from outside experience. In a sense our experience becomes biology. We used to think that the brain you were born with was the brain you were stuck with, but we now know that learning experiences change and reorganize the brain's structure and physiology. Several studies have shown actual structural changes in various parts of the brain depending on the way in which these structures were used. The changes can be observed in behavior as well as structure. It should be fairly obvious that this finding has strong implications for education. We now know that learning is a matter of making connections between brain cells and that the experiences our students have shape their brains. Obviously we do learn from reading and hearing, but the strongest connections are often made through concrete experience. Which do you think would make the most lasting changes in the brain, reading about an experiment someone conducted, or performing the experiment yourself?

2. Memory is not stored in a single location in the brain.

When an experience enters the brain, it is "deconstructed" and distributed all over the cortex. The affect (or the emotional content) is stored in the amygdala, visual images in the occipital lobes, source memory in the frontal lobes and where you were during the experience is stored in the parietal lobes. When you recall information, you have to reconstruct it. Since memories are reconstructed, the more ways students have the information represented in the brain (through seeing, hearing, being involved with, etc.) The more pathways they have for reconstructing, the richer the memory. Multimodal instruction makes a lot of sense.

3. Memory is not static.

It would be nice if memory were a matter of experiencing something once and then retrieving it at a later date in exactly the same form as it was originally stored. But memory doesn't work that way; it is dynamic. It decays naturally over time as new experiences infiltrate older ones. Fortunately, this natural decay can be minimized by using elaborative rehearsal strategies. Visualizing, writing, symbolizing, singing, semantic mapping, simulating and devising mnemonics are strategies that can be used to reinforce and increase the likelihood of recall. They often have the added benefit of enhancing students' understanding of concepts as well as retention.

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4. Memory is not unitary.

There are two distinct types of memory each of which involves different brain structures. Declarative Memory is our everyday memory, the conscious ability to recall what you ate for breakfast yesterday, the names of your favorite musicians and the formula for finding the area of a rectangle. It is information that you can declare. Procedural Memory refers to skills and habits that you engage in without conscious recall such as driving a car, decoding words, touch typing and playing the piano. Procedural learning requires many repetitions over a period of time; in fact there is no other way to learn them. Repetition, however, generally is not an efficient way to learn or retain declarative information. Understanding the differences between these two types of memory is essential in designing classroom instruction and practice. Rote rehearsal is essential for procedural memory while elaborative rehearsal strategies are much more effective for declarative. In discussing declarative memory, Harvard psychologist Daniel Schacter writes, "For better or for worse, our recollections are largely at the mercy of our elaborations; only those aspects of experience that are targets of elaborative encoding processes have a high likelihood of being remembered subsequently."

5. Emotion is a primary catalyst in the learning process.

Some of the most important findings from neuroscience have been in the area of the role of emotion in learning and memory. Two small but powerful structures deep within in each hemisphere called the amygdala regulate our emotional responses. These emotional responses have the ability to either impede or enhance learning. On the one hand, for survival purposes, our brains are hard-wired to pay attention to and remember those experiences with an emotional component, whether it is the Challenger explosion or a particularly vivid simulation in which you took part in the 8th grade. However, emotional responses can have the opposite effect if situations contain elements that a person perceives to be threatening. In these situations, the amygdala starts a chain of physiological responses (commonly called the fight or flight response) to ready the body for action. Under these conditions, emotion is dominant over cognition and the rational/thinking part of the brain is less efficient. The environment must be physically and psychologically safe for learning to occur.