**The Brain, Memory and Self-Concept**

*adapted from “Why Don’t Students Like School,” by Daniel T. Willingham*

**The Brain: A Survival Tool**

The most complex object yet discovered anywhere in the universe is the human brain. It only weighs three to four pounds, but the human brain contains over 11 billion specialized nerve cells, also called neurons. Neurons are capable of receiving, processing and relaying the electrochemical signals on which all our sensations, actions, thoughts and emotions depend.

How did our brains get to be this way? Most scientists agree that our brains evolved to help us survive in a changing environment. Just think about the traits that would have helped early humans survive their harsh environments—the ability to hunt, find safe food, avoid predators, and stay warm. Many of the abilities that human brains have developed, such as the ability to instantly take in a scene visually or to react quickly to danger, are traits that helped us survive and reproduce successfully hundreds of thousands of years ago.

**Memory: How It Helps Us Survive**

One of the most important survival mechanisms of the brain is memory. While it is helpful to be able to escape danger or fight off predators, brain power is an even better way to survive in a challenging environment. Most predators of early humans, such as lions and bears, were stronger and faster than their prey. Early humans could not out run their predators, but they could “out think” them. The brain’s ability to store important pieces of information gives us an enormous advantage when it comes to survival.

Imagine that you are an early human who must feed and protect his or her family. If you can remember the place where lions like to hunt, you can avoid that place and stay safe. A good memory won’t only help you avoid predators; it will also help you find food. If you can remember the place you found food growing last year, you will be able to return to that place, harvest the food, and increase yours and your family’s chances for survival. Similarly, if you can remember how you were able to catch an animal last time, you will be a more successful hunter, therefore increasing your chance to kill prey and eat. All kinds of useful information can be stored in memory and recalled when needed to help you hide from predators or fight them, obtain food, and protect yourself and your family.

Memory gives us another enormous advantage: language. With language, early humans could communicate with other about food sources, predators and survival skills. Over hundreds of thousands of years, humans have built an enormous store of knowledge that we have been able to pass on from generation to generation, through language and memory. As a species, our brains’ evolution has allowed us to develop art, music science, government, hobbies, humor and romance. We’ve also invented machines to do our work for us and take us places.

**Learning Involves Memory and Emotion**

This learning and remembering process also takes place in individuals. As children, we learn not only from our parents or guardians, who teach us about the world, but also through our own experiences. We burn our fingers on a hot stove, and cry. The next time we are near a hot stove, we remember the pain and what led to it, and we are careful not to touch the stove again. Or, an adult yells at us for trying to cross a busy street without looking both ways, and again we cry. The next time, we remember the bad feelings we had when we were yelled at, and we do not step into the street without looking again. On the other hand, if we are praised by our parents for cleaning our rooms or getting our homework done, we will continue to do those things so that we can repeat the pleasant experience of being praised.

We tend to think of learning as having to do with thinking, but the fact is that learning is also emotional. Just as early humans felt fear when they heard the roar of a lion, our brains still react to perceived dangers. In the modern world, danger probably won’t come from an animal predator, but we still feel emotional threats, such as when a teacher or parent yells at us or mocks us, and these perceived dangers affect our emotions and thus our ability to learn. It is difficult for a person to learn when he or she feels threatened by the learning environment, or stressed by events in their outside lives.

Learning is not only emotional, either—it is also chemical. There is a substance called *dopamine* which is released when we have rewarding experiences. Put simply, dopamine makes us feel good. When we have a rewarding experience, such as getting an answer right or solving a puzzle, a small amount of dopamine will be released in our brains. Over time, we come to associate experiences like success in school or in a certain subject with the good feeling we get from dopamine, and we come to seek out such experiences that are associated with it. If we are good at math and often experience success, we will come to seek it out. Our brains store memories of pleasant and unpleasant experiences, and the emotions and chemical changes that go with them. Over time, these memories build up and lead to the development of our *self-concept* as learners.

**Self-Concept and Past Experiences**

What is self-concept? Self-concept describes the way we see ourselves in the world. You might conceptualize yourself as a good softball player, a poor mathematician, a great artist or a loving mother. Similarly, in school, we come to develop a certain *self-concept* as learners. We may develop a positive self-concept when it comes to certain abilities, such as writing essays. We may develop a negative self-concept of ourselves as math problem solvers or readers.

Our self-concept is shaped by our past experiences. Some of our experiences, such as passing a difficult test or doing a problem correctly, raised our self-concept. Other experiences, such as trying, but failing, to understand a concept or failing to remember an important fact, may have lowered our self-concept. These experiences produced strong emotional reactions that the brain’s amygdala, its emotional center, encoded and stored along with the memory of what happened. These emotional cues are so strong that we often re-experience the original emotion each time we recall what happened.

For instance, let’s suppose your 7th grade math teacher, Mr. McCarthy, tended to yell at students who didn’t get the answers to questions right. Mr. McCarthy was big and red-faced, and could easily embarrass you in front of the class. When you entered 7th grade, you had to start learning algebra. You had success in other subjects but not math. Making mistakes in Mr. McCarthy’s class scared you, and you tried to “fade into the woodwork.” You started to feel anxious each time you went to Mr. McCarthy’s class, with a sick feeling in your stomach. When you failed three tests even though you had studied, you came to the conclusion that you just weren’t good at math.

**New Learning—Deciding What to Accept and Reject**

In order to help us survive in a complex world, our brains take in more information from our environment in a single day than the largest computer does in a year. All of this information is potentially important in our survival. It is important, for instance, that we hear the loud sound of a bus that is coming toward us and can run us over, or the hiss of a live wire that could electrocute us. But paying attention to all of it would cause our brains to “short-circuit”—therefore we have a filtering system. Just as a water filter can be used to filter the dirt out of our drinking water, our brain’s filtering systems “screen out” the information that we don’t need to pay attention to.

We use memory as a guide to decide whether new information coming through our senses into the brain is important to us. If a person is in a new learning situation and memory tells us that this kind of situation has been successful and pleasurable in the past, then the information is likely to pass along into our awareness and we are open to the learning. The learner now consciously recognizes that there were successes with this information and focuses on it for further processing. For instance, someone who was a very successful student in mathematics will remember how the success boosted their self-concept. As a result, that person now feels confident when faced with basic mathematic problems. On the other hand, for someone who was a poor mathematics student, lack of success would lower his or her self-concept. Such a person will avoid dealing with math problems whenever possible, a condition known as *math anxiety*.

If past experiences produced failure, then the brain is likely to block the incoming data, just as venetian blinds are closed to block light. The learner resists becoming part of the unwanted learning experience and resorts to some other activity to avoid the situation—day-dreaming, making jokes, or just “tuning out.” In effect, the learner’s self-concept has closed off the receptivity to the new information.

Have you ever noticed yourself in a class that you don’t like, or that makes you anxious? You hate this subject! You know that you aren’t going to understand what the teacher is saying and you feel like tuning out any way that you can. Maybe you will make a very detailed drawing in your notebook. You may start to feel kind of giddy, like you want to start laughing for no reason or you can’t stop making jokes. In effect, you are resisting the new learning experience, which you anticipate will be unpleasant.

Students who experience self-concept shutdown in the classroom often give signs of their withdrawal—folding their arms, losing themselves in other work, or causing distraction. Learning is not just about thinking. Too often, teachers deal with this withdrawal by re-teaching the material, usually slower and louder. But they are attacking the problem from the wrong angle. It is the equivalent of putting a brighter light outside the closed venetian blinds, hoping the light will penetrate. If the blinds are fully closed and effective, no light will get through, no matter how bright it may be.

**Overcoming Negative Self-Concept**

As we’ve seen, learning is not just about thinking. It is also emotional. Research has shown that our emotions are powerful motivators. In fact, when a new idea struggles with an emotion, the emotion almost always wins. If we have a bad feeling about a particular teacher or about a particular subject, like math or writing, for instance, it is very difficult for our thoughts to override our emotions. We may know that we need to pass this math test, but still be unable to make ourselves pay attention or be open to the new learning.

We all know how difficult it is to struggle with our emotions. On the other hand, we all know that we can control our emotions when we have to. When someone steps on our toes on the subway or screams an insult at us, we may *want* to use violence but we rarely do. Humans are able to control their emotions and do what makes sense in a situation, rather than just reacting. This is true in learning situations, too.

If we can recognize that a negative emotion, such as math anxiety, is blocking our learning, we are on the path to overcoming that block. Once we acknowledge that we are afraid, we can talk to ourselves sensibly about that fear. We can tell ourselves that just because we failed before does not mean that we *cannot* succeed. Just because you don’t feel strong in math doesn’t mean that you aren’t a “math person.” It simply means that you have to keep trying.

Working with your emotions in this way can help you overcome your resistance to new learning. Earlier we used the metaphor of Venetian blinds that must be open for new learning to come in. The best intervention for math anxiety, for instance, is to open yourself to new learning, and have faith in your ability to solve problems when you keep trying. Once you have a few successes, you will start to gain confidence. You will realize that it is not about being a “math person”, but about your ability to keep working at it. If you keep working, you will be able to *change* your negative self-concept as a math learner. This is one of the most important steps you can take for success and confidence in yourself as a learner.