DONNA WALKER TILESTON

What Every Teacher Should Know About Learning, Memory, and the Brain

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EDUCATION

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Learning With Mind, Heart, and Body

While the old academic model addressed primarily the intellectual aspects of learning, the prevailing model suggests that we learn with our mind, heart and body. This more holistic view underscores the importance of considering all of the learner's issues.

—Eric Jensen, *Completing the Puzzle*

It has been said that smart people are those who can store information quickly and can retrieve it from storage quickly (Sprenger, 2002). Underachievers are those who process information quickly and retrieve it from storage slowly; overachievers are those who process information slowly but retrieve it from storage quickly. How, then, can we help students to process information in a faster and more efficient way so that on the days when they need to use the information, they can retrieve it quickly? In this chapter and the chapters to follow,

we will look at ways to help students be more successful by using these activation and retrieval systems.

Incoming Information

While most of this book deals with the cognitive system of the brain, learning does not begin there. All learning seems to begin in the self-system of the brain. This is the system that decides whether or not to engage in the learning. "If the task is judged important, if the probability of success is high, and a positive affect is generated or associated with the task, the individual will be motivated to engage in the new task" (Marzano, Pickering, & Pollock, 2001). In order to make this decision, the brain examines the incoming information in regard to the following questions:

Is the incoming information important? It is necessary to note here that information can be important to the teacher and to the students, but unless the individual student believes the information is important, this system will not view it as important. As teachers, we must not only let our students know the importance of the learning, but how it will be important to them personally. Marzano et al. (2001) explain it this way:

> What an individual considers to be important is probably a function of the extent to which it meets one of two conditions: it is perceived as instrumental in satisfying a basic need, or it is perceived as instrumental in the attainment of a personal goal.

In working with students from poverty or from the inner city, this is an especially important aspect of the learning. Merely telling these students that the learning is important because they will need it for college is probably not going to provide motivation to learn. These students tend to live in the here and now, since that is all they have. How will the information help them

to survive, to keep from being cheated, or to be elevated in stature in front of their friends? In the PBS series *Good Morning, Miss Toliver,* this aspect of the self-system is handled very well. For example, when the teacher of these inner-city middle school students, Kay Toliver, is teaching fractions, she uses the example of pizza slices. Knowing fractional parts will help her students to judge which pizza slice is the best buy.

Have I had success in the past with this type of learning? One of the most important aspects of the self-system is self-efficacy. Self-efficacy is the belief that one can do something because of past success. This is somewhat different from self-esteem, which is the belief in oneself. Self-efficacy is based on concrete proof, not just "I think" and "I feel." For this reason it is important that we provide opportunities for students to experience success—even in incremental steps. The old adage "Success breeds success," is absolutely true. Marzano (2001) expands self-efficacy to say that it includes not only ability but also power and the necessary resources to be successful. Consistency in providing the necessary prerequisite skills and the necessary resources for success prior to an assignment helps to build self-efficacy in our students. How can we do this? Never give an assignment in which you will take a grade without providing the following:

- A matrix or rubric or other written form that tells students exactly what they must do to be successful. When we do this, there are no "gotchas" in the learning. Students don't need to guess our expectations, and they are more assured that there will be consistency in grading. In my book *What Every Teacher Should Know About Student Assessment,* I talk about how to build a matrix and a rubric. Form 1.1 is an example of a matrix for math homework. The information on the left-hand side contains the categories involved in the assignment. The checklist on the right contains the attributes that make the assignment a quality product.

Form 1.1 Homework Matrix

Components of the Assignment	*Point Value*	*Characteristics of Quality*
Problem solving		❑ Problem written correctly ❑ All work shown ❑ Work is neat and easy to read
Answers to problems		❑ Correctly answered ❑ Work has been checked for accuracy
Overall quality of work		❑ Work is handed in on time ❑ Work is legible ❑ Work shows evidence of thought

- Adequate time to practice the learning. Jensen (1997) says it is important for the brain to know that it knows the learning. We help the brain to know by providing information in various modalities (auditory, visual, and kinesthetic) and by practicing the learning sufficiently in terms of number of times practiced and time provided for the practice.

- Specific feedback. By specific feedback I mean feedback that not only tells students the strengths of their work but the weaknesses as well. Specific feedback provides dialogue on how the student is doing in regard to learner goals and classroom goals. Specific feedback offers suggestions and leads students to problem solve when things are not going well or when they reach an impasse in the learning. Avoid blanket statements like "Good job" because these statements do little to improve learning.

- How do I feel about the learning (classroom, teacher, other students, and subject matter)? If you have ever been in a classroom in which the emotional climate was one of tension or fear, you already know why this aspect of learning is so important. Our species has survived because our brain attends to information by priority. If we are under threat, whether physical, emotional, or otherwise, our brain pays attention to the threat over all other incoming stimuli. As Jensen (1997) says,

> The brain stem is the part of the brain that directs your behavior under negative stress; and is the most responsive to any threat. When threat is perceived, excessive cortisol is released into the body causing higher-order thinking to take a backseat to automatic functions that may help you survive.

Jensen (1997) places threats into categories that assist in our understanding of how threat affects the classroom (our brain likes information in categories or other patterns). The following categories are presented with an analysis (by me) of how they might affect our classrooms.

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Long-Term Memory Pathways

According to Sousa (1995),

> Long-term memory refers to the process of storing and retrieving information. Long-term storage refers to where in the brain the memories are kept. Think of the long-term storage sites as a library and of long-term memory as a librarian who retrieves information and returns it to its proper storage places.

For the purposes of this chapter, we will look at the storage system itself and at ways to retrieve information with greater efficiency.

Memory Pathways

Most researchers include three memory pathways through which information is stored in long-term memory. While most

learning in the classroom is directed toward the semantic pathway, educators should strive to incorporate all three pathways to make the learning more powerful and to help students do a better job of retrieving information.

The Semantic Memory System

This is the memory system most often used in education. It is the area that stores words and facts—and it is the least brain-compatible of the three memory systems. That is one of the reasons our students cannot remember the learning. When facts and words are taught in isolation, without any context or connection, they are lost unless rehearsed, reviewed, or relearned. Teaching English language learners using this memory system is unproductive since these students lack the language skills to be able to make meaning of the learning. The same is true of students from poverty. Most of their learning outside of school and prior to entering school has been contextual and has involved semantic memory in a very limited way. Jensen (1997) says,

> The exact location of the semantic memory function has not been pinpointed, though we know it operates out of the cerebral cortex. The brain is poorly designed for remembering print and text copy. Information embedded in content is usually learned, or attempted to be learned, through rote tactics and by following list-like formats. Semantic memory is the type of list-oriented, sometimes rote, memory which requires rehearsal; it is resistant to change, is isolated from context, has strict limits, lacks meaning and is linked to extrinsic motivation.

In other words, if students are to learn facts and words, they must have something with which to connect that information, otherwise it is useless to the brain and discarded. Some techniques that help students to remember facts or words include mnemonics (Please Excuse My Dear Aunt

Sally, for operations in math), rhymes (remember how you learned the alphabet with a song?), peg words or past learning with similar content (Last week we learned . . . this week we will add to that by learning . . .). As Jensen says, "This type of learning is typified by seated classroom work and homework, e.g., 'Study for Friday's test by reading chapter six.'"

The capacity of semantic memory is restricted. We have difficulty dealing with large amounts of semantic facts at one time. That may account for the reason so many of our students say, "When are we ever going to use this?" Their brains are in overload, and if they are not going to use the information, why tack it onto the frustration they are already feeling? One way that we can add more information into semantic memory is by chunking the information into some type of category system. For example, instead of giving my students a long list of why people immigrate, I give them categories of reasons such as religious reasons, political reasons, economic reasons, social reasons, and so on. By doing this, I am helping them to put the information into a format that is more brain friendly and that will allow us to cover more reasons. The average adult can handle about seven to ten chunks of new information at one time. A three-year-old child can handle about one chunk of information at a time. That is one of the reasons we give small children only one direction at a time: "Pick up your blocks." If we said, "Pick up your blocks and take them to your room. Put them in your toy box and close the lid," the chances are the child would only get through the first direction. The amount of chunks of information that we can process at one time is age dependent and is fixed. (We cannot change the number of chunks, although we can change how much we put into a chunk.) Form 4.1 is based on several pieces of research from Sousa, Jensen, and others. It shows the number of chunks of information that we can handle at a given age.

What does this mean for the learner? It means that if I give my high school students 20 unrelated items to learn, they will have difficulty with the processing because their brains are