

# Memory Lane Is a Two-Way Street

**By exploring all five memory lanes, teachers can help students retain information and perform better on different types of assessments.**



*It is fifth-hour English class. We have just graded one of the grammar assignments. I count the number of possible answers and decide how many points each is worth. I instruct the students to take one and one-half points off for each incorrect answer, to subtract from 100, and to put the grade on the top of the paper.*

*Initially, silence prevails. Suddenly, I hear a wave of conversation. I look up from my plan book and watch my students struggle to figure out how to multiply fractions. "You have studied fractions, haven't you?" I ask. Some students shake their heads, some shrug their shoulders, and some look at me as though they haven't a clue.*

*I become angry with the math teacher. At lunch, after I have calmed down (I collected the papers and figured the grades myself), I ask her whether the 7th graders have covered fractions yet this year. Her answer is, "Of course. They did very well, and we continue to study them in our daily review." I am confused. I cannot decide whether I believe her.*

**T**his scenario happened in 1971 when I first began teaching, and similar things still happen in classrooms today. At first, I struggled to find reasons for this phenomenon and came up with answers as varied as "We have poor math teachers," "Kids today just have no math brain cells," and "It must be a problem with transference."

In 1987, I decided to find out just what was going on inside my students' heads. Potentially scary territory—but because I planned to spend so much time dealing with children, I needed more information. My research began slowly because finding material in those days was difficult. But by the early 1990s, new information about brain research captivated me.

After spending a summer training with Eric Jensen, I found another reason for living: I became a "brain junkie." For the past several years, I have focused on memory because memory is the only way to verify learning. In addition to being a classroom teacher, I teach graduate classes on brain research and

brain-compatible teaching strategies. In workshops with teachers throughout Illinois, I have translated some of that research into classroom use.

### Five Memory Lanes

When I discovered that brain cell connections were pruned away with disuse (Diamond & Hopson, 1998), I thought we were all in big trouble. After continuing my study, I found the good news: Our memories are not necessarily "bad"; we simply store them in different areas of the brain.

I call the separate pathways to these memories *lanes* and have identified five separate memory lanes: semantic, episodic, procedural, automatic, and emotional. By understanding these lanes, I discovered why my students could not do fractions in English class.

The structure in the brain called the hippocampus controls the semantic memory. The hippocampus does not store the memories themselves, but it catalogs them (Sylwester, 1995).

Semantic memory, because it deals with words, is the lane most relevant to education. It is also the most difficult memory lane to use. If you use semantic memory to retain information, you must process it repeatedly for long-term effects.

The hippocampus is like a filing cabinet with two drawers, one semantic and the other episodic. Because it identifies sensory memories worth saving, it controls access to the episodic memory lane (Sylwester, 1995). Episodic memory is location-driven; remembering where you were when you learned something can help trigger the memory. Where were you the night Princess Diana was killed? That location will lead you to remember details about the event.

The procedural memory lane is found in a brain structure called the cerebellum. This formation deals with posture, balance, and some memory. Procedural memory is your "how-to" memory. Riding a bicycle, driving a car, and tying your shoe are examples of using your procedural memory.

Also in the cerebellum, the automatic memory lane is sometimes called

reflexive or stimulus-response memory. Automatic memory is triggered by such things as flash cards, music, and other repetitive devices that are not necessarily physical. Some examples of information stored in automatic memory are the alphabet, the multiplication tables, and song lyrics.

The final lane is the emotional memory. The amygdala, a structure in the forebrain, is in charge of all our emotional memories. Whenever information is received by the brain, the amygdala filters it for emotional content. If the perception has some emotional content, then the amygdala processes that memory. Like the hippocampus, the amygdala does not

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A traditional paper-and-pencil test can assess memory from different lanes.

store all memories; it simply catalogs them. Because the amygdala is such an important brain structure, emotional memory will always be more powerful than other memories (LeDoux, 1996).

### The Two-Way Street

Each of these memory lanes is a two-way street. We can store information in any of the lanes, which is the *receiving* part of the process. We can also retrieve information *from* the memory lanes, which is the *retrieving* part. We can teach in ways that help students store information in most memory lanes, and we can assess students in ways that help them better retrieve information.

Let's begin with the semantic lane, often used in educational settings. Semantic information is what we expect our students to learn from textbooks, lectures, and handouts. We must "chunk" information into small segments because our short-term memory is brief, lasting only seconds unless we repeat the material often. Therefore, the more the students work with and talk about the information, the more likely they are to remember it

(Jensen, 1998). Mnemonic devices can aid in retaining some of these memories. Peg systems, acrostics, and acronyms are strategies that work for some students. Mind mapping, time lines, graphic organizers, and outlines are other successful methods.

Episodic memory is powerful enough to keep my English students from performing math skills easily in my room. If you learn something in one location, being in that location will often trigger the memory. Have you ever given a test and watched your students look at the blank chalkboard or the bulletin board as though they were seeing answers? They were! Your room is full of concealed information. By visualizing what was on the boards, students are triggering their memories. *You* are also covered with invisible information. Your presence during testing aids your students' memories. They can look at you and remember the concepts you shared with them.

Enhancing episodic memory can be as simple as using your bulletin boards to post important information. You can also change the seating charts and the room arrangement for each unit. Sitting in the same place throughout the year can cause confusion; students may jumble the information because the location has been contaminated with many different ideas. Making the room as unique as possible will add to learning. Wearing costumes or hats helps this memory as well.

Procedural memories are sometimes called "muscle memories" because they refer to physical movements. You can address this type of memory by incorporating special procedures into your lessons. Some topics are more conducive to this than others, but you can invent procedures for most topics. For example, many textbooks and curriculums have physical movements attached to their strategies for learning a topic. Have you ever tried to tell someone how to tie a shoe without using your hands? Even having students get up and move while they are learning will have an impact on your lesson.

Music is a great way to contact automatic memory lanes. My students learn

their helping verbs with songs that they create. Students can get together in small groups and invent lyrics about helping verbs to the tunes of simple, well-known melodies. Flash cards, quiz shows, and sentence completion tasks also assist in this memory.

Because specific chemicals are released in our brains after emotional experiences, these memories are stronger than others (LeDoux, 1996). Create emotional memories in your classroom with music, role play, debate, and your own enthusiasm. Whenever you can connect new learning to old memories in your students' brains, you may also be making an emotional connection. Neuroscientists have discovered that emotional memories are permanent; all they need is the right trigger (Davis, 1997).

I enjoy using music in the classroom for both automatic *and* emotional memories. "Moon River" brings back memories of my first boyfriend; I remember Steve from the original Beatles and Wally from the Supremes. Some of my students can remember *The Outsiders* from Elvis, *The Giver* from the theme from *2001: A Space Odyssey*, and the Civil War from "Mission: Impossible."

### Changing Lanes for Assessments

I had one of my greatest disappointments with my Greek mythology unit a few years ago. I had been gathering material and ideas for this unit since the 1970s. Teams of students created puppet shows, newspapers, skits, and posters. We laughed and compared the gods and goddesses with soap opera characters. I believed that the students were really learning. But when I gave the final test, the grades suggested the opposite. I was angry with my students for underperforming. What happened? I finally realized that I had taught the unit by using emotional, automatic, and episodic memory lanes, but I had assessed it in my traditional forced-choice format. I had used the semantic lane for assessment.

Could I have given my students this traditional test and received better results? Yes, if I had prepared them to

change lanes. Practice tests or quizzes would have helped. I also could have formatted my test to aid their memory process.

A traditional paper-and-pencil test can assess memory from different lanes. Students can stimulate their automatic memory through sentence completion, matching words, or writing down whatever they can remember. For instance, if students learn a song to remember a formula, have them write it on the back of the test before they begin answering the questions. You can use it for extra credit or as part of their grade.

You can assess procedural memory by using questions that suggest steps in a procedure. Use such clues as "After

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we added the sodium, we then mixed x." Let students work through the procedure and then answer questions about it.

By being in the right place, students can trigger their episodic memories. I made the mistake of rearranging the room and changing my seating chart in the middle of a unit. The students acted as if they had never before seen the material, which I had to spend three days reteaching. Remember, too, that *you* are part of the invisible information. Don't have substitute teachers give exams.

If students have strong feelings about a topic, then they are sure to have emotional memories. Contact those memories on an assessment by using feeling words. Ask how a character, a famous person, or even the student feels about what happened. If you used music to access emotions, play that music before or during the test. Triggering those emotions will also activate other memory lanes.

The semantic memory lane is triggered through traditional assessment. However, if you used mnemonic devices to help students remember, let them use the devices on the test. For instance, when my students "mind map" a particular story or a chapter and use the map to study, I have them recreate the map on the back of the test. Then, they can use the map to find answers to the questions on the front. This triggers their memories and reinforces the mnemonic benefit.

### Divergent Pathways

Some proponents of brain-compatible classrooms will insist that we use only authentic assessment with our students. I strongly believe in portfolios and assessment options for my students; I have many students who uncover their memories and their knowledge through role play, skits, radio shows, and oral presentations. Realistically, however, we do not always have time for pure authentic assessment. Parents also are used to and expect traditional assessment. Some students, too, excel on traditional tests and prefer them.

To meet the needs of all my students, I provide a variety of teaching styles and assessments. Understanding and assessing memory lanes give me tools to help students remember and learn—in as many ways as possible. ■

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**Marilee Sprenger** is a teacher at Lindbergh Middle School in Peoria, Illinois, and an adjunct professor at Aurora University. She may be reached at 5820 Briarwood La., Peoria, IL 61614 (e-mail: msprenger@aol.com).

