Brain-Friendly Techniques for Improving Memory

Teachers can use knowledge about how the brain remembers to help students retain concepts.

Jeanne King-Friedrichs

In Rhonda Fuglie's 4th grade classroom, six students lie side by side on the floor. Other students in the room clap and chant, "15 degrees north latitude, 30 degrees north latitude, 45 degrees north latitude," and so on as a classmate steps over each child, heading toward an imaginary north pole.

U.S. education. Staff members often meet in small study groups to explore the latest research and to discuss ways to enhance instruction.

Most of the 4th grade students are learning about latitude and longitude for the first time. Fuglie is a veteran member of the school's study group on brain-based learning, so she knows that she needs to implement five important strategies to ensure her students' retention of these new concepts (Squire & Kandel, 2000).

Connect to Prior Knowledge
New learning must be connected to what the students already know. They must be able to relate new concepts to information and experiences that they already have. Fuglie knows that these students have all experienced jet lag after traveling to and from their home countries, so she begins the study of longitude and latitude by encouraging students to talk about their common experience—waking up at 2:30 a.m. at their destination, hungry and full of energy because it is noon in the place that they have just left. Students laugh and groan as they talk in small groups about their experiences with jet lag.

Pulling in this emotional hook for the students provides an added benefit: When students are emotionally engaged with learning, certain neurotransmitters in the brain signal to the hippocampus, a vital brain structure involved with memory, to stamp this event with extra vividness (Cahill, 2000).

Develop Personal Relevance
A large map is the center of attention as students come up one by one to show where they went on their last vacation. The class counts time zones and discovers that each time zone is roughly equal to 15 degrees of longitude. The
students are involved, giving their full attention to this personally relevant topic. They see a reason for learning more about these imaginary lines and how to use this information about the world’s geography.

**Make Sense**

If the information is going to move from students’ short-term to long-term memory, it must make sense and have meaning (Sousa, 2001). Abstract lines on a map are difficult for a 4th grade mind to grasp, so Fuglie uses physical activities to help the concepts make sense.

For example, the students cut lines of latitude and longitude into pieces of fruit. The first crosswise cut in the middle is the equator. The first lengthwise cut is the prime meridian, from which all other longitudinal cuts are linked and measured in degrees. Fuglie asks the students to cut the line lengthwise all the way around the peel and then to spread the peel out, an exercise that helps them understand how the globe becomes distorted when it is turned into a flat map. As they excitedly discuss what they are doing, students begin to develop conceptual understandings, practicing the words and semantic cues that will later help tie their memories to this experience.

After this activity, students write in their journals, which challenges them to organize and articulate what they have just experienced. Can they place this sensory experience into a framework on which they can continue to build? Current research in neuroscience supports the idea that teachers should increase the “strength of connections between neurons that participate in the encoding experience” because these are the experiences that “have a high likelihood of being remembered subsequently” (Brandt, 2000).

Fuglie moves around the room, looking over students’ shoulders for insightful glimpses of their thoughts. She sees what the students understand and what she needs to reteach to correct misperceptions. This feedback, soon after the event, is essential to the learning process and should be consistent, specific, and timely (Jensen, 2000; Markowitz & Jensen, 1999). Reading the students’ journals helps her know where to start the next day.

**Elaborate on Key Concepts**

Neuroscientist Daniel Schacter points out, “Our recollections are largely at the mercy of our elaborations” (1996, p. 56). Classroom teachers face the challenge of making the encoding of the information and skills that we are attempting to teach students as elaborate and deep as possible. Fuglie develops a variety of learning experiences to help students deepen their understanding of latitude and longitude.

- Students use their bodies to simulate the lines of longitude and latitude. After rhythmically clapping as a student steps over students representing lines of latitude, the students stand up, hold their arms wide, and say, “Lines of latitude are utiltide!” Then they stretch one arm high and one arm low and say, “Longitude lines are loooool.” When Fuglie says, “Show me latitude,” or “Show me longitude,” the students respond by stretching their arms in the right directions. Through these activities, students receive immediate feedback and practice correct responses; such practice makes their learning of the new concepts more permanent (Wolfe, 1999).

- Later during the week, the students paint and label large, flat maps, making the lines of longitude black and the lines of latitude red. Students work together to place stars on places that they are studying or that are important to them personally, writing the correct latitude and longitude coordinates beside each star.

- Students use raw and cooked spaghetti noodles to understand how flat maps depict the round shape of the earth. First, they place uncooked spaghetti noodles on the lines of longitude of a flat Mercator map. They discuss how the lines of longitude are parallel on a flat map, never touching. Fuglie points out that this map is not a realistic view of the earth; its flatness simply makes it easier to look at the world all at one time. Students then lay cooked spaghetti noodles on the lines of longitude on small plastic globes,
noting that the lines of longitude meet at the poles. This hands-on activity helps the students grasp the abstract visualization that flat maps make of the natural curvature of the earth.

- During center time, students play a learning game called Hemisphere Hunt or work on a computer program that reinforces the concepts of longitude and latitude.
- A pilot visits the class to speak about how he uses computerized maps to navigate.
- Students take a trip to a nearby air base. This “being there” experience (Kovalik, 1997) immerses all the students’ senses in an environment that builds on their understanding of longitude and latitude.

The culminating activity involves the whole class in an exciting simulation of navigating planes across a large continent. Working in teams, students use the lines of latitude and longitude to plot a daily course as they race to the finish. Energy is high as teams make their way through the challenges presented to them on cards that they draw each day. They must reevaluate their routes along new coordinates of latitude and longitude to cope with such problems as low fuel or unexpected storms. Their daily journal entries are filled with strong feelings—their despair when they have technical difficulties with their plane and must spend a day on the ground or their excitement as they close in on their destinations. Again, emotions add the adrenaline that will mark these memories as important and worth saving.

Rehearse Retrieval Cues
Rehearsal is important to learning (Squire & Kandel, 2000). Replicated studies have demonstrated that “cells that fire together, wire together” (Robertson, 2000, p. 13). Neuronal circuits that are continually activated together become stronger; they require less energy to activate as remembering becomes more automatic. Teachers must build into the learning context retrieval cues that will likely be present when students need to recall the concept (Squire & Kandel, 2000).

Throughout this lesson, Fuglie has provided her students with many mental and physical cues that they can later use to recall what they have learned. These retrieval cues can be visual, such as the painted map; kinesthetic, such as stretching arms to depict longitude and latitude; musical or rhythmic, such as clapping to count coordinates; verbal, such as “looongg for longitude”; or written, such as mnemonic codes to aid memory. Rehearsing the cue in the context in which it will need to be recalled is crucial.

When students have experienced such a rich assortment of learning experiences, does the teacher still need to use handouts? Fuglie’s answer is yes. Standardized tests may require that the students show an understanding in a paper-and-pencil format, so Fuglie uses handouts that simulate test questions. She also assigns a special activity for students and parents to work on together: mapping their routes home for the summer. The assignment asks students to label the latitude and longitude lines on the map, draw dotted lines to show their summer travel routes, and then explain the map to classmates, including geographic details about the time zones crossed and cities visited.

Assessment
The teachers at Asir Academy use various assessment procedures to report student achievement and progress to parents and other stakeholders. They redesigned report cards to include indications of developmental progress in reading, writing, and math. They also use portfolios to stimulate students’ reflections on their own learning.

This geography unit allows multiple ways to assess each student. Fuglie’s observations during the fruit slicing and rhythmic/kinesthetic activities help her assess students’ understanding of the material so that she can tailor future lessons to meet their needs. Writing activities, art projects, simulations, and learning games allow for a variety of assessment formats. Some include detailed rubrics, whereas others use traditional grading procedures. Clearly, however, the great variety of the lesson’s activities allows students to use their preferred styles of learning to make better sense of these new concepts.

How Brain Research Helps Teachers
More than half of the current research in the neurosciences is about learning or memory (Merritt, 2000), which suggests that brain research has enormous potential to help educators in their work. Educators do not need to be biologists, however, to understand good pedagogy.
We can never find out how to be good teachers by simply understanding the structure of the brain. On the other hand, knowledge about brain functioning, when we combine it with other knowledge that we already have, can be very useful. (Brandt, 2000)

Learning must be connected to what the students already know.

References

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