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Health and Learning**How to Teach Students About the Brain***Judy Willis*

Teachers should guide students in how best to use their most powerful tool.

If we want to empower students, we must show them how they can control their own cognitive and emotional health and their own learning. Teaching students how the brain operates is a huge step. Even young students can learn strategies for priming their brains to learn more efficiently; I know, because I've taught both 5th graders and 7th graders about how their brains learn.

I was a practicing neurologist before I became a teacher. Once I entered the classroom and observed how my students learned, the connections between my two professions became clear. I began to write about brain-based teaching strategies. It took a few years, though, before I realized that my students could also understand how their brains learn.

When I began incorporating basic instruction about the brain into my classes and teaching simple activities to improve brain processing, students not only became more engaged and confident, but they also began changing their study practices in ways that paid off in higher achievement. Consider these typical comments from my 7th graders:

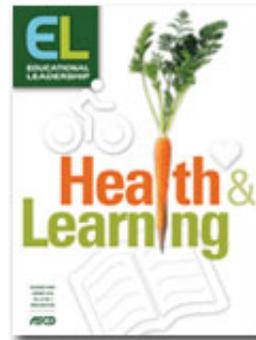
I imagine neurons making connections in my brain when I study. I feel like I'm changing my brain when I learn something, understand it, and review it.

If I use my prefrontal cortex to mentally manipulate what I learn, my dendrites and synapses grow, and I will own that learning for a long, long time. I won't have to learn fractions all over again each year.

Explaining how the brain works is especially important for students who believe that they are "not smart" and that nothing they do can change that. Many children, and even some parents and teachers, think that intelligence is determined at birth and that even intense effort will not budge their academic abilities. The realization that they can literally change their brains by improving how they approach learning and how they study is liberating.

Brain Filters: Let the Right Stuff In

I have taught both upper elementary and middle school students about filters in the brain that determine what information reaches their prefrontal cortex, which I call their thinking brains. We discuss three key elements of this filtering system: the reticular activating system, the limbic system, and dopamine.



December 2009

Students realize that their physical health, their emotions, and how well they focus their attention affects whether new information even reaches their thinking brains or gets filtered out because of negative emotions.

I guide students in activities that help them focus and achieve positive moods to prime themselves for learning. We practice techniques to increase mindfulness. For example, students learn to do visualizations, deliberately recalling in detail a place where they felt happy, calm, and safe. The more learners practice visualizing their particular calming place, the stronger the neural network holding that memory becomes; eventually, the students can easily return to that memory whenever they feel stressed. Returning to that safe place enables learners to let new information that someone is presenting flow into their thinking brain rather than being filtered out.

Students discover that when I guide them to visualize historic events, to picture vocabulary words with images that depict their meaning, or to see math procedures acted out in their mind's eye with "dancing numbers," they can better recall history, vocabulary, or math lessons.

I have students do relaxation breathing before we begin a test or challenging lesson. Students report that they feel calmer, more alert, and more focused—and they do understand and remember more.

To help students realize that brains and intelligence can change, I discuss *neuroplasticity*—the fact that the brain can grow new connections between neurons as we learn something by having new experiences. We can then strengthen these connections by remembering, practicing, visualizing, or using the new information. I show them brain scans, and we make diagrams and clay models of connections forming between neurons through cellular projections called dendrites. More dendrites grow when a person learns something new and then gets adequate sleep, I explain.

I send home photos of growing dendrites taken through an electron microscope and assign students to explain to family members the neuroanatomy behind these photos. (See the [Neuroscience for Kids Web site](#) for sample photographs).

Students' Most Powerful Tool

The more students practice, the sharper their brain—already their most powerful tool—becomes. Students know that the more they practice a basketball shot or rehearse a ballet performance, the more their skills improve. In my class, they learn that brains respond the same way. When a learner goes over multiplication facts or rereads confusing parts of a book, the brain gets better at processing this information because, with such repetition, more neurons grow and connect to other neurons, and neurons get more efficient at sending one another signals.

I talk directly with students about *why* strategies like taking scheduled short breaks or connecting learning to something pleasurable enhance brain function because of the role of dopamine and the emotion-monitoring amygdala. Students hypothesize about what strategies (such as taking too-frequent snack breaks and interrupting their focus with texting versus creating a homework schedule or turning off the television) will help—or hinder—their learning. They experiment with studying under different conditions (with and without music, working in bed or at a desk, and so on), collect their own data about what works best, and compare data. Students also chart the relationship between their level of effort and the achievement of their goals.

When my students started telling other teachers about how they had learned to "make my brain work the way I want it to," colleagues began asking me for my brain lessons. I have shared with fellow teachers a brief overview of what I think students should know about their brains. In the interest of helping more teachers gain and share this information, I present that overview here as a downloadable pdf document. I

invite readers to use this document ("[What You Should Know About Your Brain](#)") with students as they wish.

During the first four weeks of school, I present about three 15-minute sessions focused on this material each week. Each time, I explain a section of the material in my own words and demonstrate on models, with sketches, or with actual images of brain structures. Questions prompt discussion that deepens students' understanding of brain function. For example, asking, "Why don't neurons (nerve cells in the brain) replace themselves like skin and blood cells do?" reinforces the fact that neurons store memories; if brains continually replaced neurons, learned information would be lost.

As we learn about brain function, students write about how this new information influences their attitude toward school, their study habits, and their ability to change their own intelligence. Throughout the year, I incorporate reminders about brain function into my instructional strategies. For example, I explain how growing more dendrites connects new information that a person learns into neural networks, solidifying the knowledge. Rehearsing newly learned material stimulates dendrites. After we discuss a new concept, I have students write summaries of the new information in their own words in their learning journals; we call these summaries *dend-writes*.

Students Take Charge

I have seen direct discussions of brain functioning yield wonderful results in terms of students taking charge of their own learning. One 10-year-old student told me,

Now I know about growing dendrites when I study and get a good night's sleep. Now when I'm deciding whether to watch TV or review my notes, I tell myself that I have the power to grow brain cells if I review. I'd still rather watch TV, but I do the review because I want my brain to grow smarter. It's already working and feels really good.

Having seen how interested my students are in learning about their brains and how they respond to that learning with increased motivation and better study habits, I've come to believe that instruction about how the brain processes information should be included in the curriculum. Whether as part of health class or in a separate course, students should receive direct instruction in how best to use their most powerful tool.

Teaching students the mechanism behind how the brain operates and teaching them approaches they can use to work that mechanism more effectively helps students believe they can create a more intelligent, creative, and powerful brain. It also shows them that striving for emotional awareness and physical health is part of keeping an optimally functioning brain. Thus, instruction in brain function will lead to healthier learners as well as wiser ones.

Judy Willis, MD, practiced neurology for 20 years; she currently teaches at Santa Barbara Middle School in California and conducts professional development workshops. She is the author of *Teaching the Brain to Read: Strategies for Improving Fluency, Vocabulary, and Comprehension* (ASCD, 2008); www.RADTeach.com; jwillisneuro@aol.com.
