Getting inside students' heads

Why know the neuroscience of learning?

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Neuroscience research about how we learn is advancing at increasing speed. Neuroimaging research is opening windows allowing us to watch the brain process, recognise, remember, and transfer information at the level of synapses and neural circuits.

The most valuable assets for improving education won't be developed in a neuroimaging lab. Neuroscientists will not become classroom teachers and they are unable to translate lab analysis into classroom strategies. It will be educators with the foundational knowledge of the science of learning, who will evaluate the validity and potential educational correlations from neuroscience research and bring its benefits to their students.

Teachers with foundational knowledge of the neuroscience of learning will be able to use the research to:

- Bust the neuromyths that arise when research is misinterpreted, making sure precious educational funds are spent on evidence-based practices shown to be effective in improving learner outcomes
- Create increasingly supportive and engaging learning environments, curriculum, and instructional strategies to ignite student motivation, promote growth mindsets, engagement, perseverance, and educational success for all learners
- Become teachers-scientists, with increased skills of observation using the scientific method and data-analysis tools to develop and evaluate the outcomes of learning interventions. It is these educators who will be the innovators.

WHAT SORT OF KNOWLEDGE IS USEFUL FOR TEACHERS?

An understanding of how information is routed in the brain and how new neural connections are made and strengthened are important to understanding how we learn. Some key examples of neuroscience research with direct implication for teaching strategies include an understanding of the attention filter (the Reticular Activation System), the emotional filter (the Amygdala deep in the limbic system), and the limitless potential of neuroplasticity (the processes involved in creating new connections, connecting new information to old) – or as we like to call it: learning.

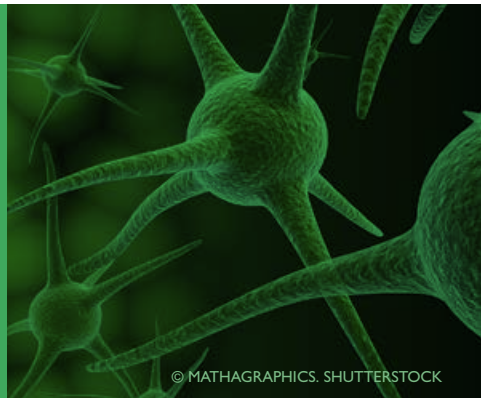
Information enters our brain through the senses.

Only then is it processed by the pre-frontal cortex, where we can hold onto information and do something with it.

With reflection and practice, information is consolidated into long term memory.

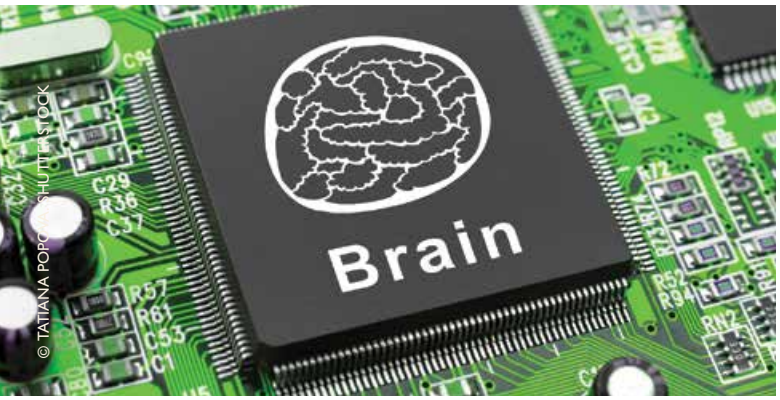
Information is first filtered through our emotions to minimise danger, maximise reward.

"NEUROPLASTICITY: THE PROCESSES INVOLVED IN CREATING NEW CONNECTIONS, CONNECTING NEW INFORMATION TO OLD – OR AS WE LIKE TO CALL IT: LEARNING."



We know for instance, that when information enters the brain it is routed to one of two areas: (1) the pre-frontal cortex, what we might call the thinking brain, which can consciously process and reflect on information and (2) the lower, automatic brain, which we might call the reactive brain, which reacts to information instinctively rather than through thinking. When a student is anxious, sad, frustrated or bored, their brain filters conduct sensory information from the world into his reactive brain where the response is to either ignore it, fight against it as a negative experience, or avoid it (e.g. switch off and daydream). It is unlikely that information will be processed thoughtfully or remembered.

When one's stress levels are down and interest is high, the most valuable information tends to pass into the thinking brain. When students are focussed and in positive or controlled emotional states, their executive functions can more successfully organise newly coded memories into long term knowledge. Every time they review or use that knowledge, activity along the connections between nerve cells increases. Repeated stimulations makes the network stronger – practice makes permanent.



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So how can teachers create environments where anxiety is low while providing enough challenge and novelty for suitable brain stimulation?

1. MAKE IT RELEVANT

When stress in the classroom is getting high, it is often because a lesson is overly abstract or seems irrelevant to students. Teachers can reduce this type of stress by making the lesson more personally interesting and motivating. Ideally, students should be able to answer the question, "Why are we learning about this?" at any point in a lesson.

2. GIVE THEM A BREAK

Teachers can give students a three-minute vacation to reduce stress. Any pleasurable activity used as a brief break can give the amygdala a chance to cool down and the neurotransmitters time to rebuild.

3. CREATE POSITIVE ASSOCIATIONS

Eliminating all stress from students' lives is impossible. However, by avoiding stressful practices like calling on students who have not raised their hands, and giving students opportunities to set personal goals and recognise and savour their successes, teachers can dampen the stress association.

4. PRIORITISE INFORMATION

What facts are worthy of writing down and reviewing when studying? Helping students learn how to reduce the amount of information they need to deal with is a valuable stress-buster.

5. ALLOW INDEPENDENT DISCOVERY LEARNING

Thanks to dopamine release and the consolidation of relational memories, students are more likely to remember and understand what they learn if they find it compelling or have a part in figuring it out for themselves. In addition, when students have some choices in the way they will study or report on something, their motivation will increase and stress will diminish. They will be more accepting of their errors, motivated to try again, and less self-conscious about asking questions.

6. A SAFE HAVEN

Classrooms can be the safe haven where academic practices and classroom strategies provide students with emotional comfort and pleasure as well as knowledge. Brain-imaging studies show that when teachers use strategies to reduce stress and build a positive emotional environment, students gain emotional resilience, learn more efficiently and at higher levels of cognition.

Future neuroscience outcomes with the most extensive and useful classroom applications will likely arise from input that educators provide to scientists. When experience reveals particular strategies as repeatedly successful, classroom to research lab channels will be open for teachers to suggest investigations to see what is happening in the brain in response to those conditions. Through this collaboration, the observations of neuroscience-savvy classroom teachers, about what works for their students, will become neuroscience research investigations. As the data is analyzed, replicated, applied, adapted, and strategies become even more effective, what started as a teacher's observations will be disseminated to benefit students worldwide. After all, isn't sharing what we teachers do so well?

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Dr. Judy Willis, a board-certified neurologist in Santa Barbara, California, has combined her 15 years as a practicing adult and child neurologist with her subsequent teacher education training and experience. After ten years teaching elementary and middle school, and writing six books for educators, Dr. Willis left the classroom and dedicated herself full-time to teaching educators. Dr. Willis travels nationally and internationally giving presentations, workshops, and consulting while continuing to write books and staff blogs for NBC News Education Nation, Edutopia, and Psychology Today.
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