***A Neurologist Makes the Case for Teaching Teachers About the Brain***

"Neuroscience should be required for all students [of education] . . . to familiarize them with the orienting concepts [of] the field, the culture of scientific inquiry, and the special demands of what qualifies as scientifically based education research." - Eisenhart & DeHaan, 2005

Do you recall some of your college professors who knew their subject matter but had zero teaching skills? Staying awake in their one-way-directed lecture classes required Herculean strength (or lots of coffee). They were never trained to develop the skillset of engagement strategies.

Even though I was a physician with a strong science background, when I decided to become a classroom teacher (and thought I'd teach science), I did not want to make that career change without the benefit of instruction and guided student teaching. The year I spent in my graduate school of education program was invaluable in my transition to becoming a professional educator.

Curriculum in schools of education has changed in response to changes in society, pedagogy and technology. As computer technology became an asset in classrooms, schools of education appropriately included that instruction in the curriculum. Many states made similar education program curriculum adaptations in response to multiculturism, increases in English language learners, and the use of the concrete-connect-abstract progression in math instruction.

Now that the neuroscience research implications for teaching are also an invaluable classroom asset, it is time for instruction in the neuroscience of learning to be included as well in professional teacher education.

Neuroscience Knowledge Strengthens the Lifeline

For today's students, educators are the lifeline they need to climb for access to the playing fields of 21st century opportunity, open only to those who acquire the necessary skillsets. Teachers who are prepared with knowledge of the workings of the brain will have the optimism, incentive and motivation to follow the ongoing research, and to apply their findings to the classroom. These teachers can help all children build their brain potential -- regardless of past performance -- bridge the achievement gap, and reach their highest 21st century potential starting now.

One example is the research about the brain's neuroplasticity and the opportunities we have as educators to help students literally change their brains -- and intelligence. To become a teacher without understanding the implications of brain-changing neuroplasticity is a great loss to teachers and their future students.

Beyond understanding the brain's neuroplastic response to stimulation -- how activation and use of memory networks makes them stronger -- future teachers need to recognize how stress inhibits neuroplasticity. It is only when information is processed in the brain's reflective, cognitive prefrontal cortex that new learning can be incorporated into networks of long-term, conceptual memory.

Seeing neuroimaging scans of students during stress states, such as those that build up with sustained or frequent boredom (information already mastered; no evident relevance) or frustration (repeated past failures in subject), offer powerful insights into the importance of classroom climate and differentiation of instruction. These scans reveal the increased metabolic state that blocks processing in the highest brain (prefrontal cortex; PFC) when this boredom or frustration alienates students from instruction. The amygdala is the switching station that, when hyperactive in response to high stress, switches input and output away from the PFC and down to the control of the lower, reactive brain. Behavior reactive responses from the lower brain are the involuntary survival responses of fight/flight/freeze (act out/zone out).

What Triggers Student Behavior

As students' stressors build, loss of information access to the PFC for memory construction means new learning is not retained. The lost communication from the PFC emotional control networks to the lower brain means the lower brain's reactive behaviors are in control. These students and uninformed teachers come to believe that nothing better can be expected. Students develop the fixed mindset in which the brain's primitive survival networks restrict effort toward goals that, by experience, are not expected to be reached.

Teachers who understand this neurological consequence of the brain’s programmed response to stress can change the educational and life outcomes for students who have been blamed and punished for unintentional acting out or zoning out. When teachers know about the brain's reactions to the stressors that promote the low brain control state of involuntary, reactive behavior, they become more aware of how much they can influence students' successful brain processing. When they understand that the brain responses in the high-stress state are neither voluntary student choices nor reflective of a student’s academic potential, knowledgeable teachers recognize that their interventions can reduce stress, return students' voluntary control of their behavior, and promote successful memory construction and cognitive processing in the PFC.

When new teachers understand how they have the capacity to reduce the stress of frustration or boredom by providing all students with opportunities to learn at their appropriate level of achievable challenge, their motivation will increase with the expectation of success. As we know, it does take dedication, motivation and lots of time to achieve the often onerous task of differentiation for all students. The background knowledge of neuroscience provides that extra motivation.

Bringing Neuroscience into Education

There are no more critical life supports than passionate, informed teachers who can resuscitate students' joyful learning. When educators learn about how the brain appears to process, recognize, remember and transfer information at the level of neural circuits, synapses and neurotransmitters, and when they share that knowledge with students, they share empowerment with their students. Informed teachers help students understand their ability to change their brains and experience success and renewed confidence. Students thrive in classrooms where teachers have the added tools from their neuroscience understanding. The result is nothing less than reigniting the joys of learning, even when they have been extinguished for years.

The most valuable assets for improving education won't be developed in a neuroimaging laboratory. It will be educators, with the foundational knowledge about the science of learning, who will be prepared to evaluate the validity and potential educational correlations from neuroscience research. These teachers will be the front line professionals who will recognize potential applications of laboratory research and develop the strategies that bring the benefits of this research to their students.

Frontloading is More Critical Than Ever

If you've read this far, you have probably developed your foundation of the neuroscience of learning knowledge through professional development, reading or professional learning communities in your schools. Sadly, those opportunities are increasingly limited for new teachers.

With decreased funds for substitute coverage, professional development conferences, consultants and prep time, it is becoming more difficult for teachers to access new topics of expertise after leaving schools of education. There is also the problem of integrating new learning into the classroom without guidance and feedback. The time for future teachers to build the foundations of neuroscience knowledge is during their studies and supervised teaching experiences while they are in schools of education.

The future developments in neuroscience, 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 into what is happening in the brain in response to those conditions. Through this collaboration, their observations about what works for their students will feed neuroscience research. As the data is analyzed, replicated, applied and adapted, and as 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?