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Brains and Schools: A Mismatch

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How do you improve learning if you never really talk about how learning happens?

Since the fall of 1957, when the Soviet Union launched Sputnik, people have talked about school reform, proposing pretty much the same solutions for more than half a century: more math and science, higher standards, more money, better teachers, more accountability, longer school days and years. Lots of educators have done lots of work; lots of money has been funneled into the effort; and the tide of mediocrity continues to rise. That could finally change—if we invite a new voice into the conversation.

Clearly, children need good teachers. Teachers need good training. Standards and accountability matter. But it would help the larger reform conversation if everyone spent more time looking at research into learning and the brain and less time rehashing the same tired issues: falling test scores, not enough science and math, clichés about 21st-century skills, left- and right-brain myths, the national obsession with being No. 1. The central issue is the mismatch between the way brains learn and the misconceptions about learning on which schools are built. The issue is the incompatibility between learning and schooling.

Over the past 20 years, psychologists, neuroscientists, and other researchers have offered valuable insights into how people learn. Researchers such as **Kurt Fischer of the Harvard Graduate School of Education** suggest that learning involves building new neural networks. Understanding the Vietnam War or quadratic equations means "wiring" the brain, growing a network for the war or the equations. Subsequent use of these circuits (in discussions or on tests, for example) relies less on recalling the facts and more on skills for rebuilding the relevant neural network when the concept is needed.

This process of building and rebuilding neural networks—this process of learning—requires considerable effort from the learner. Teachers can teach or tell a student anything they want, but only the learner can learn it. The essence of learning isn't memory and recitation; meaningful learning (the sort of learning educators hope to foster) results from an active effort to understand, an effort that promotes the growth of increasingly efficient webs of neural connections among different regions of the brain.


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As it is built, the network (for the skill, the understanding) constantly falls apart or regresses. We seem to be getting it, and then we lose it—as, for example, the idea or skill becomes more complex; or as the conditions supporting the learner's effort (the presence of a helpful teacher, a quiet room) become less supportive (a noisy home without anyone who can answer questions). In the changed conditions (from classroom to home), the ability and understanding collapse and the learner needs to rebuild. Little wonder that kids may seem to "get it" during the lesson yet bring in homework that reflects no understanding. One can almost hear the teachers' lounge comments: "It's as though they had never seen this stuff before."

The cycle of building-regression-rebuilding is the brain's process of learning. Each time we rebuild the neural network, the skill or concept becomes more stable and automatic. The highest level of skill or understanding results from repeatedly experiencing this building-rebuilding cycle over time (years), moving through a sequence of increasingly complex levels. That movement is not linear and steady; it is dynamic and messy. Flaws or omissions in building the structure of the skill or understanding can weaken the result and restrict progress to higher levels of ability. Look at what happens to algebra learning in children who never build a solid understanding of fractions.

Teachers can tell and talk, but only learners can learn. Teachers may have taught fractions last week; students may not have learned them, even if they remember that the teacher taught them. This failure of students to learn is not news to teachers. What is news is the reason for the failure to learn. It isn't that Sally won't listen or isn't intelligent or won't try harder to memorize what she has been told; it's that she hasn't engaged in the hard work of constructing and reconstructing neural pathways to understanding. And one reason for the lack of engagement may well be that Sally doesn't care.

Neuroscientists also continue to establish the links between emotion, thinking, and learning. These are inextricably connected. The notion that emotion impedes good thinking and good decisionmaking is a myth. In fact, patients with damage to the part of the brain that plays an important role in integrating emotion and cognition (the ventromedial prefrontal cortex) have impaired thinking in several ways. Although these patients can have very high IQs, logic, problem-solving, planning, and decisionmaking all suffer. And, although they retain knowledge that they developed prior to their injury, they cannot use this knowledge to manage their daily life. Just as you cannot separate hydrogen from oxygen and still have water, you cannot separate emotion from cognitive function and still have thinking—or learning.

Antonio Damasio of the University of Southern California has written that **"emotion is the rudder for thought,"** and his colleague Mary Helen Immordino-Yang has developed the idea further, stating: "We think in the service of emotional goals." In other words, we think about things connected to goals that matter deeply to us. Passionate science teachers think a great deal about science

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learning."

(it matters to them), and, while some of them succeed in sparking the interest of a few students, educators know that most students remain apathetic. Fortunately, what matters to some of these students are good grades, so they study enough to pass the tests, which teachers tend to interpret as evidence of meaningful learning. Students who are genuinely, deeply interested in science, and teachers whose lessons support this kind of purposeful intellectual exploration, are rare.

These insights into brain function and learning—theprocess of building and rebuilding neural networks and the connection between emotion and thinking—are just two of many that suggest a need to rethink the traditional assumptions about learning that have shaped our schools. Learning is a much more complex process than most people imagine.

Parents, teachers, administrators, even kids, know that something happens to a child's innate curiosity and interest in learning about the world. We don't need researchers to tell us that the brain is a meaning-making organ. People make sense of the world in order to survive and thrive in it. Children are natural learners, alive with questions.

And then school happens.

But it doesn't have to happen as it does. Thousands of good teachers, drawing on years of experience in many different sorts of classrooms, have discovered these same insights into learning that research now supports. What these teachers deserve and what all students need are schools (an educational system) that supports learning.

The time is right for educators and researchers to become partners. The time is right to look at school reform through the lens of the biology and psychology of learning instead of bickering about testing and standards and more of the same old failed practices. Waving sticks and carrots at our kids will not produce the sort of deep, meaningful learning that everyone claims to want. Neither will blaming teachers, parents, or kids.

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