Learning Potential

Rethinking

How Instruction on Brain Plasticity, Intelligence, and Metacognition Boosts Academic Outcomes

BY DONNA WILSON, MARCUS CONYERS, AND KELLY ROSE

The mission statements of many schools echo a common theme: All students *can* learn, and we will help them succeed. However, few schools are delivering specific instruction consistently about brain plasticity, malleable intelligence, and the application of metacognitive and cognitive skills that would help children achieve more of their academic potential.

In this vacuum, widely held but often unacknowledged misconceptions about the nature of learning capacity persist. In particular, a mistaken notion of innate intelligence as destiny runs through our culture. Americans are inclined to associate accomplishment with genetically endowed capabilities and to label people in the top tiers of their fields as naturally gifted, implying that their successes are out of reach for the rest of us.

ILLUSTRATION BY MARK ALLEN MILLER

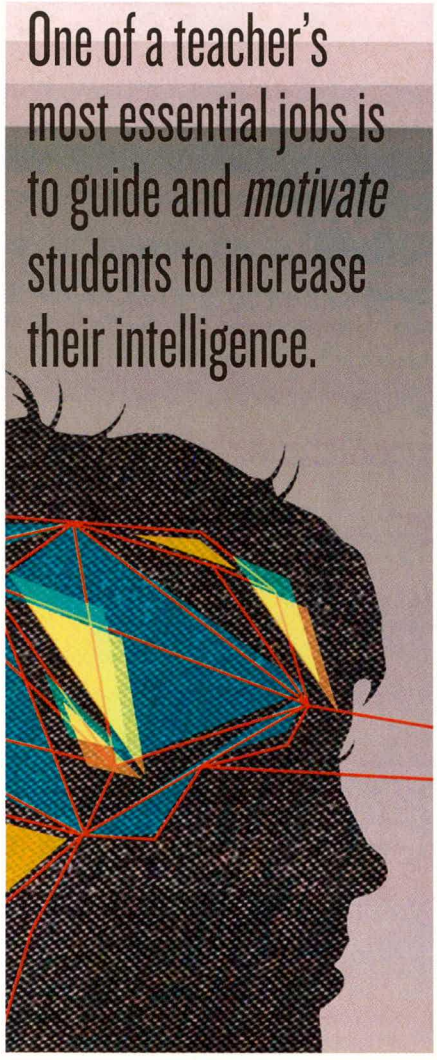
Applying these assumptions to education leads to a view of students' potential for academic achievement as determined primarily by their inherited intellectual predisposition: Some children possess high levels of natural talent and intelligence, while the learning capacity of others is limited by a more meager legacy. Following that logic, even when students with supposedly limited learning potential are doing their best, they can't learn to achieve at the levels of their supposedly more intellectually favored peers. As a result, schools often give them less demanding work, which puts them further behind their peers. With an underlying view that students' innate ability has a more significant impact on academic outcomes than the quality of the educational experiences they receive and the amount of effort they put into learning, it's not surprising that some teachers dismiss the idea that all students have the potential to succeed as well-meaning but unattainable.

This is how we sort kids. This is how we fall short in meeting our missions.

There's a better way.

REDEFINING POTENTIAL

Over the past 15 years, researchers from the diverse but interconnected fields of neuroscience, psychology, and education have contributed to the emerging "science of learning," expanding our understanding of how the brain learns and how educators can teach students to make the most of their lifelong capacity for learning. These findings support our definition of *potential* as the neurocognitive capacity to acquire the knowledge and skills to achieve to a higher level of performance.[1] Teachers — with support from school leaders — need to truly understand and embrace this definition of potential. Then they can begin to transform their teaching practices. The goal is for teachers to nurture students' potential by guiding them to metaphorically rewire their minds with new attitudes, knowledge, and abilities.



The foundations of students' learning potential are built permanently into the brain's readiness for learning from infancy throughout life and in the mind's ability to continually adapt to new challenges. Perhaps the most relevant neuroscientific concept for schools and communities is *experience-dependent synaptogenesis*, which explains and clarifies how neuronal connections, or synapses, are forged by learning experiences. In essence, it tells us that the brain is changeable, or "plastic." This property has been demonstrated by brain scans showing the results of intensive practice and study by groups of learners as diverse as violinists, cab drivers, and medical students.

Related to these findings is the conclusion that intelligence is not fixed at birth. Over the past two decades, in the nurture versus nature debate, research has amassed on the side of nurture, indicating that experiential and environmental factors contribute greatly to the development of intelligence. While genetics do play a role, "a significant part of students' intelligence is attributable to environmental influences," note psychologists Robert Sternberg and Wendy Williams.[2]

A related line of inquiry into the nature of intellectual capacity, focusing on the development of expertise, suggests that instead of relying on innate intelligence, accomplished performers in academics, arts, sports, and other fields achieve their aims through persistent hard work and deliberate practice. After extensive research in this area, psychology professor K. Anders Ericsson determined that committing to 5,000 to 10,000 hours of practice is the true secret of success. Applying that dynamic to education, students who are motivated to commit to the sometimes hard work required for learning and who receive effective instructional support and opportunities for practice are more likely to excel than their peers who (1) rely on innate "gifts" or (2) give up because they don't believe they have the intellectual wherewithal to learn. Cognitive assets — we call them *assets* rather than *skills* to convey the idea that they are valuable and can be enhanced over time — are mental processes to carry out tasks, such as focusing attention on key elements in problem solving or employing memory strategies to enhance recall. These cognitive assets can be taught to and learned by students of all ages, supporting the view of intelligence as dynamic and malleable.

One of a teacher's most essential jobs is to guide and *motivate* students to increase their intelligence. Understanding how brain plasticity facilitates malleable intelligence and believing that students can get smarter make a big difference in the instructional strategies teachers use and the positive learning environments they create in their classrooms. As a teacher told us after learning about potential and plasticity, "I now teach all students

as if they are gifted — because they each have a gift and can learn to do anything."

Having these dispositions can also help inspire teachers to employ explicit instruction with strategies supporting students' development of cognitive assets and capacity to become smarter across a range of intellectual abilities. Sternberg and colleagues created a model designed to help teachers recognize and nurture complementary forms of intelligence. The WICS model — for Wisdom, Intelligence, and Creativity, Synthesized — builds on and expands traditional instructional models that emphasize memory and analytical abilities. It encompasses a broader range of thinking skills that self-directed learners need to thrive in 21st-century classrooms and later in the knowledge-based working world.

POWERING POTENTIAL THROUGH METACOGNITION

Hand in hand with the motivating message that students can become functionally smarter is the matter of equipping them with the means to do so by teaching them to "think about their thinking." In other words, they need to know how to employ metacognition to take charge of their learning.

In a recent article in *Scientific American Mind,* cognitive neuroscientist Stephen Fleming suggests "insight into our own thoughts, or metacognition, is key to high achievement in all domains."[3] Teaching for metacognition entails instruction integrated into and alongside core subject matter on why and how students can monitor their thinking as they engage in learning tasks and wield cognitive assets to improve learning. Educational research has determined that the development and use of metacognitive skills accounts for some 40 percent of the variance in learning outcomes across a variety of tasks.[4]

In our book *Five Big Ideas for Effective Teaching: Connecting Mind, Brain, and Education Research to Classroom Practice,* we set out a practical approach to teach students to employ a metacognitive approach to learning. The process begins with establishing clear intent about what students want to achieve; planning and executing action steps; and assessing, monitoring, and adjusting their thoughts and actions to make steady progress. This model emphasizes translating thinking into action so students recognize that they are responsible for maintaining their focus on learning, for identifying when they need to employ specific cognitive assets, and for evaluating how well they are learning and how they might do better now and in the future.[5]

All in all, this model conveys to students the understanding that learning is an ongoing process grounded in a variety of thinking skills that they can learn to wield and improve over time. This is what Stanford University's Carol Dweck means when she encourages educators to encourage students to embrace a growth mindset.

PRACTICAL BRAIN-BASED TEACHING STRATEGIES

Here are four brain-based teaching strategies all educators should employ:

1 Teach students about their brains' amazing neuroplasticity.

Incorporating into everyday lessons the message that "learning changes their brains" empowers students to realize more of their academic potential. In particular, students must be explicitly taught how to use cognitive assets so they can take charge of their learning. These essential tools support learners as they gather information, process their learning, and then apply their experiences in the world. With support, students recognize why and how to steer their learning based on an understanding that they are growing their brains.

From kindergarten through high school, educators and their students experience the benefits of building lessons about the brain into core content. Kara Morrissette, who now teaches fourth-graders at Tybee Island Maritime Academy in Georgia, has taught the concept of brain plasticity to kindergartners with the message that each of her students has an amazingly brilliant brain that changes every time he or she learns something. Her students demonstrate their excitement about learning by "kissing their brains" — kissing their fingertips and then touching their heads. They've learned this through "the magic of imitation," as their teacher regularly shares her excitement about learning and growing *her* brain.

Older students benefit from learning the practical aspects of brain plasticity as well. By the time high school students make it to Jeremy Green's Advanced Placement psychology and U.S. history classes at Franklin County High School in Georgia, some seem convinced that their academic shortcomings are innate and permanent. They are resigned to struggling with reading high-level texts, the most common problem Green encounters among his students. With the goal of dispelling the misconception that they are stuck where they are, Green begins the school year by sharing with students a presentation titled "Your Brain Is Amazing." He reinforces that message throughout the school year by teaching cognitive assets alongside core content, such as explicit instruction on the organizational skills that students will need to complete a research project.

"Our role as teachers and coaches is to sell them on the idea that they can get better," Green says. "If we improve, we win — period."

2 Use the brain's various learning pathways in classrooms and schools.

Teachers make learning memorable when students are more involved and motivated to participate. The thousands of hours of practice identified by Ericsson should never be a deluge of worksheets and test prep. We need to engage students, not herd them. For example, well-orchestrated collaborative learning gives students the chance to be socially engaged and to teach and learn from one another through supportive dialogue. Taking science classes outside — having students study and monitor local ponds and streams, grow food and learn about

soil management, examine air quality, inventory local bird populations, and even sample locally grown produce at lunchtime — connects students to their environment and puts their senses to work to make learning more fun, real, and memorable. It also requires the use of cross-disciplinary skills, such as math, reading, and writing.

Using metaphors in teaching metacognition is another way to engage multiple pathways. In keeping with the idea of driving their brains, students can learn when to step on the gas, when to hit the brakes, and when to steer in another direction.

3 Personalize classroom instruction. Each brain is as unique as a fingerprint, so it requires a certain level of individual instruction and guidance. In particular, the three C's — *caring*, *choice*, and *challenge* — facilitate individualized instruction. When students are in a caring environment in which they feel safe, secure, and encouraged to take intellectual risks and when they are provided with choices — in choosing books to read independently or choosing topics for research projects, for example — they can apply what they are learning to their personal interests. Giving students choices motivates and engages them. It reinforces the message that they are in charge of their learning. Students supported through these varied experiences are more likely to challenge their own thoughts and strive to achieve their full learning potential. Teachers need a variety of strategies to meet the needs of all learners. A unit that combines social learning, hands-on activities, and independent research, for example, provides a range of learning experiences so that each student can make his or her own meaning.

Applying aspects of the WICS model also helps personalize instruction by recognizing and building on each student's strengths. Some students have well-developed analytic and working memory abilities, while others are practical problem solvers, readily able to transfer learning to new situations. Still others may be quite creative, exploring and synthesizing information in novel ways. Emphasizing these varied forms of intelligence underscores that all students have the potential to become smarter and better learners and sends a motivating message about their ability to succeed.

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4 Guide students to become smarter by optimizing use of their cognitive assets. Explicit instruction on "practical optimism" — on taking positive action to increase the probability of successful outcomes — builds on educational research that reveals that when students believe they can succeed, they are more likely to succeed.

Developing selective attention is another cognitive asset that can and should be taught. The HEAR strategy offers four steps to sharpen attention on learning: *halt*, *engage*, *anticipate*, and *replay*. With this tool, learners devote their attention to a specific purpose, practice good listening skills, imagine what they might gain from listening, and then review what they learned from the experience.

Another cognitive asset that has wide applications both inside and outside of the classroom is systematic planning. It encourages students to think through the steps required for a learning project so that it can be completed on time, and then to assess how well the plan worked and whether planning and execution could be improved in the future.

This is just a partial list of changes in teaching practices and strategies that will help align teaching and learning with recent research in brain development. Essentially, what we want is for educators to imagine what schools can be like if they apply strategies aimed at setting aside misconceptions about innate talent and intelligence, focusing instead on guiding students to drive their brains to achieve their learning potential.

By teaching and modeling a metacognitive approach to learning, teachers can guide students to develop cognitive assets that will serve them well throughout their lives in school and career and wherever their personal pursuits may take them.

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Notes

1. Donna Wilson and Marcus Conyers. *Five Big Ideas for Effective Teaching: Connecting Mind, Brain, and Education Research to Classroom Practice*. New York: Teachers College Press, 2013, p. 53.
2. Robert J. Sternberg and Wendy M. Williams, *Educational Psychology* (2nd ed.). Upper Saddle River, NJ: Pearson, 2010, p. 138.
3. Stephen M. Fleming. "The Power of Reflection," *Scientific American Mind*, September/October 2014, p. 31.
4. Marcel V.J. Veenman, Rob D. Hesselink, Shannon Sleeuwaegen, Sophie I. E. Liem, and Marieke G. P. Van Haaren. "Assessing Development Differences in Metacognitive Skills with Computer Logfiles: Gender by Age Interactions." *Psychological Topics*, *23*(1), 2014, 99–113.
5. Donna Wilson and Marcus Conyers, "The Boss of My Brain," *Educational Leadership*, *72*(2), October 2014. Retrieved from *www.ascd.org/publications/educational-leadership/oct14/vol72/num02/%C2%A3The-Boss-of-My-Brain%C2%A3.aspx*.