This is Your Brain on Art

Neuro-ed researchers say creativity can set kids' minds on fire.

by Deborah Rudacille

"It's gonna be a really tough project. You're gonna have to use your head, your brain, and your mind too," substitute teacher Ned Schneebly (a.k.a. slacker Dewey Finn) warns his students in the TBS classic School of Rock. Like just about every film ever made about an inspirational teacher, the sweetly subversive Rock trades on the truism that emotional engagement fires the synapses, leading students to previously undreamed-of accomplishments. In many of those films—Dead Poet's Society, Mona Lisa Smile, Mr. Holland's Opus—art is the core of the great teacher's pedagogy, the liberator of minds and hearts.

Mariale Hardiman and her colleagues at the Neuro-Education Initiative at the Johns Hopkins School of Education would like to test that hypothesis. An early advocate of developing a pedagogy based on cognitive neuroscience ("neuro-ed" for short), Hardiman developed an "arts-integrated" curriculum—using the arts as a teaching methodology—at Roland Park Elementary/Middle School while serving as the school's principal from 1993 to 2006. Other educators and theorists have promoted the use of arts in the classroom, as in the Waldorf and Reggio Emilia schools, but Hardiman says that her "brain-targeted" teaching model provides an instructional model that can be used in any school.

Like most educational experiments, however, arts integration has never been systematically tested. Based on her previous research and her experience at Roland Park, "I would guess that the kids who have done the work in an integrated way would have that knowledge more embedded in their memory," Hardiman says. "But believe it or not, there are no controlled studies on that."

And that, she and her colleagues say, is the problem with almost the whole of educational theory. "When you read about the medical practices of one hundred years ago, you think it's crazy what people used to do," says Charles Limb, scientific director of the Neuro-Ed Initiative. "And one day we may feel the same about how we used to teach children."

An auditory researcher best known by the lay public for his "this is your brain on jazz" studies (see "The Creationist," March '10 Urbanite), Limb says the time is right for education to become more of an applied science like medicine. Not only are educators hungry for data on the effectiveness of teaching methodologies, but neuroscientists also now have the tools, and therefore the motivation, to measure complex human behaviors that were once beyond the scope of science—like how learning to play a musical instrument or painting a landscape or writing a short story reshapes the brain and therefore the person.

Using functional magnetic resonance imaging—which tracks blood flow in the brain while a subject is engaged in a task—Limb has charted which areas of the brain are most active when jazz musicians improvise. "I image their brains when they are generating music on the spot, really high-level sophisticated music," he says. "And we are seeing patterns of brain activity during those creative behaviors that are unlike anything seen during a scripted memorized behavior." The pre-frontal cortex—the central brain structure involved in creative thinking, and the part of the brain that is, Limb says, "most human"—really lights up when subjects are creatively engaged.

It's just that kind of creative lightning storm that that Hardiman and her colleague Susan Magsamen, founders of the Neuro-Education Initiative, would like to encourage in schoolchildren by pairing the arts with more traditional teaching methods to facilitate learning across the curriculum.

At Roland Park, Hardiman created an approach in which students were enrolled in music, theater, visual arts, and dance programs—and encouraged to incorporate those arts into their core classes to reinforce the learning of key concepts. Faculty involve the arts in their lessons as well. Fractions might be taught using rhythm and beat to illustrate the concept of 3/4 time, the rotation of the planets around the sun via dance. While studying the novel Hatchet, students at Roland Park created a tableau to depict through their bodies what it would be like to be stranded alone in the wilderness, the theme of the book.

It may sound a little hippy-dippy, but arts evoke emotion, Hardiman points out, and the role that emotions play in laying down long-term memory (and thus learning) is well-established. Our brains take in enormous amounts of information each day and prioritize data to be stored in both short- and long-term memory. First priority is information related to survival, such as perceived threats. Second priority is emotionally-tinged data. Most new information is lost within twenty-four hours—unless the brain has a strong motive for converting it to long-term memory and rehearses or repeats the data to effect an actual change in the physical structure of neurons, a process called long-term potentiation. Arts integration, with its emphasis on repetition of information through both cognitive and emotional brain circuitry, theoretically helps facilitate that process.

Trained as a learning disabilities specialist, Hardiman has been mapping the connections between neuroscience and education for more than thirty years. "The very first definitions of learning disability came right out of neurology," she points out. "It was really the neuroscientists studying brain injury that led to psychologists picking it up and then educators. And now, years later, it has been proven that yes, there are differences in how children with learning disabilities process information."

Meanwhile, as a teacher and later as an administrator, she saw various "flavor of the month" educational initiatives come and go and was bothered by the field's lack of scientific rigor. "It's always a new initiative: Throw out the old and start something new. It's why education never really changes, because we don't have a model that incorporates all the best practices and is informed by research."

So while still at Roland Park, she published a book, Connecting Brain Research with Effective Teaching: The Brain-Targeted Teaching Model, that drew together the emerging themes of her own research. The first, and perhaps most controversial in terms of conventional educational practice, is the vital role that emotions play in learning. "Traditionally our culture teaches us that the intellectual side, our cognitive system, is totally separate from our emotional system," she says. "Teachers are certainly not taught to take into account a child's emotional presence in the classroom. Just the opposite. It's 'Sit down and do your work.'"

Another factor in the model is the need to present big concepts rather than just discrete facts. "The analogy is that if we look at a puzzle but never see the big picture, just the little pieces, then the little pieces don't make sense," she says. The brain, Hardiman points out, "really does like to look at big pictures. It's always trying to make sense of information."

All of this has profound implications for educational policy, Hardiman says. If one takes it as a given that the purpose of education is not merely the regurgitation of facts, but also the acquisition of higher-level skills like problem-solving and innovation, then we as a nation are on the wrong track with the current "teach to the test" approach. "Kids are getting better and better at being test-takers," she says. But they are not necessarily getting better at learning the content or exhibiting application of knowledge. "So we believe that neuro-education and learning about how children think and learn can really change what happens in classrooms and change the policies that focus on such a narrow view of what education is."

Both Hardiman and Limb are quick to say that they are not advocating a wholesale abandonment of traditional teaching methods. Worksheets are not going to disappear anytime soon. At Roland Park, for example, "we were always very focused on our test scores because we had to be," Hardiman says, with scores on standardized tests tied to school funding. But within that traditional model, there is still room for innovation, she says.

Teachers themselves agree, up to a point. "If it's done right, arts integration helps," says Amy Begg-Marino, a seventh-grade art teacher at Mt. Royal Elementary/Middle School, one of six Baltimore City schools now experimenting with the model, "because it gives students more avenues to explore a subject and different ways to produce something proving they understand the concept being taught."

Not only does arts integration help students grasp concepts, but it can also be a tremendous aid in classroom management. "Generally some of the kids who are the worst kids in other classes are angels in mine because they like doing something they are good at," Begg-Marino says. "You have sixth-graders who read on a fourth-grade level, and if you give them sixth-grade work they are automatically going to act out because they get frustrated. But you don't have to draw the perfect picture for it to look fabulous."

But practical considerations limit the method's effectiveness. "There is not really enough planning time built into the schedule to do good arts integration right now," Begg-Marino says. "I get one hour of planning for every five hours of teaching." There is just no time in the schedule, she says, to help a math or science or English or social studies instructor plan a lesson that integrates arts concepts. "So practically it's very hard."

She also recognizes downsides to the methodology. Say students are reading The Scarlet Letter, and multiple options are offered to assess their understanding of the book's themes. Some students may choose to write a paper on the book; some may write an alternate chapter for the book; others may draw a new cover or illustrate a scene. But when it comes time for testing, she points out, the child who chose the art project may not be prepared for the kind of convergent thinking—coming up with the one right answer—required by tests.

And with the Obama administration's new Race to the Top initiative linking teachers' professional advancement—salary and promotions—to their students' test scores, many may resist using precious planning time to put together lessons that may enrich students' understanding of the subject but don't necessarily translate into higher scores.

The folks involved in the Neuro-Ed Initiative understand that reality but insist that by sharing information, neuroscientists and educators may, in the long run, help shape policy and classroom practice. "Neuroscientists study the brain, and educators want to train and educate the brain," Limb says. "So in the end we are looking at the same organ from different sides. There really ought to be a dialogue."

Limb and his colleagues have already taken steps to create that conversation, sponsoring seminars like the 2009 "Learning, Arts, and the Brain" conference at the American Visionary Art Museum. Scientists presented their research, and teachers quizzed them on how the work might apply to classroom instruction. Begg-Marino attended the conference and liked what she heard. But, as she pointed out, "a study is one thing and to prove it would be great. But implementation is a whole other thing."

Limb acknowledges the challenges. "To me it seems a given that one day we'll have a better working understanding of how the mind works, and that will be the main basis for how we try to instill new knowledge. But how to get there is like science fiction.

"We have to start somewhere," he adds. "Being practical, we think the first step is to measure whether an arts-integrated approach to teaching children is more effective."

Though Hardiman doesn't yet have enough data to prove the effectiveness of her model, test scores did rise at Roland Park after her arts-integrated curriculum was launched. Still, she says, that wasn't the main goal. "The test scores did continue to go up. However, the driving force for arts integration was to foster deeper thinking."

—Deborah Rudacille attended Catholic schools for sixteen years, from elementary through college, and later taught writing for five years in the Johns Hopkins Center for Talented Youth Distance Education program. An excerpt from her latest book, Roots of Steel: Boom and Bust in an American Mill Town, was published in the May Urbanite.