New discoveries in neuroscience are challenging what we think we know about the teenage brain—and sending some scientists back to the drawing board.

The Teenage Brain: Think Silly Putty, Not Stone

By Joanne M. Lozar Glenn

A certain law professor, known for her excellent and generous mentoring of female law students at a prestigious university, once said she wished she'd been a kindergarten teacher. Why? "You have so much more influence at that age," she replied. "Older kids are set in their ways."

Is she right? Is it too late to have a significant impact on high school and post-secondary students? Not necessarily. Recent advances in neuroscience suggest teenagers' brains are still developing, and new technologies have even allowed the observation of physical changes in brain structures.

Here's a look at five discoveries and what they might mean for teaching and learning.

What's New

Ask scientists what is most important when it comes to understanding the development of the teenage brain, and one word pops up more frequently than any other: neuroplasticity (the ability of the brain to change itself in response to experiences). Neuroplasticity, and four related concepts, are described below.

1. Teenage brains are incredibly plastic. Perhaps because the brain attains 95% of its adult size by age six, scientists used to think that characteristics like personality and mental capacity were set in stone early in life. New advances in neuroscience, such as functional magnetic resonance imaging (fMRI) and diffusion tensor imaging, say this isn't so.

"The most surprising thing [about the teen brain] has been how much it is changing," said Jay Giedd, a neuroscientist at the National Institute of Mental Health, in an interview on the PBS series *Frontline*. "The exuberant growth during the prepuberty years gives the brain enormous potential. The capacity to be skilled in many different areas is building up during those times."

The adolescent brain experiences three developmental processes: (1) growth spurts, (2) pruning, and (3) myelination. These stages are even more pronounced and active in teenagers than they are in young children. During this second growth spurt, which happens roughly between the ages of 10 and 19, children overproduce dendrites and synaptic connections, "just as they did in preschool," says Sheryl Feinstein, associate professor of education at Augustana College in Sioux Falls, South Dakota. The areas of the brain used for logic, problem-solving, and decision-making begin to develop. Gray matter continues to thicken, peaking in girls at age 11 and boys at age 12.

Overproduction is followed by a pruning of unneeded linkages as the brain organizes its neural pathways, and the grey matter thins. Then myelin—a fatty insulation made up of lipids and lipoproteins—wraps the remaining axons and nerve fibers that send signals, enabling them to travel faster. As a result, Feinstein says, "teens are learning faster and more efficiently than adults or young children."

And the brain continues to develop well into the mid- to late-twenties before reaching full maturity.

2. Teen brains differ from adult brains. Much of this growth and pruning occurs in the frontal lobes, which include the pre-frontal cortex, thought to be the seat of executive function (reasoning, judgment, planning, decision making, error correction, etc.).

Learning-Related Brain Studies

First Evidence of Brain Rewiring in Children (2009)

Investigators: Marcel Just and Timothy Keller
Institution/Affiliation: Carnegie Mellon University
Description: Third- and fifth-graders with reading difficulties received 100 hours of intensive reading instruction.
Purpose/protocol: To determine if instruction changes the brain. Researchers used diffusion tensor imaging to detect changes in water flow among white matter pathways before and after instruction.
Results: Water flow patterns changed, meaning that the brain had rewired itself and created new white matter that improved communication within the brain. The amount of change was directly related to the amount of improvement in decoding ability.
Significance: "We're not at the mercy of our biology." —*Marcel Just*
Sources: Personal interview; Roth (2009).

Executive-Level Reasoning: Middle School Brain Years Project (2009-)

Investigators: Sandra Chapman and Jacque Gamino
Institution/affiliation: Center for BrainHealth, University of Texas (UT) Dallas
Description: Funded by a $6 million appropriation from the Texas legislature, this research involves delivering a strategy-based program to train students in critical thinking.
Purpose/protocol: To measure strategic reasoning skills in Texas students and determine if training enhances those skills and promotes frontal lobe development, and if benefits generalize to the classroom.
Results: Preliminary results (pilot testing) indicate that training improves students' critical thinking abilities. Brain scans will determine if the cognitive gains correspond with actual brain changes.
Significance: "Teach a child a fact and he can pass a test. Teach a child to reason and he can build a life."—*Sandra Chapman*
Sources: Personal interview; BrainHealth (2009).

Brain Activity During Rest and Sleep (2010)

Investigators: Lila Davachi and Arielle Tambini
Institution/Affiliation: New York University
Description: Sixteen individuals were (1) scanned with functional magnetic resonance imaging (fMRI) while at rest, (2) asked to view a series of paired images, (3) told to rest, (4) scanned, (4) asked to view another set of paired images, (5) told to rest, (6) scanned, then (7) quizzed on what they had seen.
Purpose/protocol: To compare relative levels of spontaneous neural activity in two key brain regions involved in memory during rest, before and after visual recognition tasks.
Results: Brain activity in the memory-related regions was more closely correlated several minutes after people had viewed the images than before they started the experiment, suggesting that the brain was conducting memory-consolidating activity. The more closely correlated the brain activity during the rest period, the higher the individual's quiz score.
Significance: "Taking a rest may actually contribute to your success at work or school."—*Lila Davachi*
Source: Hamilton, 2010.

"These lobes are different in teens and adults," says Carol Glod, professor at Bouve College of Nursing, Northeastern University (Boston, MA). "Compared to adults, that part of the brain is less developed." This may explain why teens seem so emotionally labile, as she notes, "The emotional part of the brain is [often] stronger in teens, and their executive functions haven't developed enough to modulate the emotions."

Glod admits that some of this science is new and the conclusions preliminary and controversial. Boston Children's Hospital neurologist Frances E. Jenson, for example, writes that science has not actually researched the teenage brain. Instead, research has focused on the baby brain, translating information into new treatments for brain injury or early childhood education. Or it has focused on the adult brain, translating knowledge into treatments for dementia (Jensen, n.d.).

But, Glod says, the information we do have seems to suggest that teen brains don't just develop in one area and then stop—they develop over time. "Not everything is hardwired. Key points in development are also influenced by culture, environment, and life experience," she notes. "So we can try to understand where teens are coming from and that they may not be thinking things through as well as educators might expect."

3. Brains need stimulation and exercise to reach and maintain their potential. This is what some scientists like to call the "use it or lose it" principle. Just as the body will atrophy without exercise and proper nourishment, so will the brain's cognitive abilities if not used over a period of time.

"The brain develops only when and if the person is doing something to construct its physical elements (dendrites and neural networks) for learning the knowledge and skills specific to that part of the brain," says Rita Smilkstein, invited faculty at Western Washington University (Bellingham). "For example, teenagers need opportunities to learn how to make responsible decisions and behave in mature ways. Then their pre-

frontal cortex can grow."

As evidence she cites the development of the cerebellum, located in the hindbrain and responsible for automatic responses, movement, and balance. The cerebellum is usually fully formed by the age of two, Smilkstein explains, "because kids have done what they've needed to do to grow the appropriate dendrites and neural networks for learning how to walk and maintain their balance."

Noting that the frontal lobes are one of the last places to be insulated by myelin, which "seals and lubricates" neural connections, Feinstein endorses the theory that how teens spend their time determines the connections their brains make. "It's a window of opportunity as far as learning goes," she says. "You cannot get your brain too full."

4. Brains can be rewired. In December 2009, researchers Marcel Just and Timothy Keller at Carnegie Mellon University published the first study showing that education can affect brain circuitry (see sidebar, "Learning-Related Brain Studies"). Students who had reading problems received intensive reading instruction and, as a result, the neural pathways in the white matter of the brain changed.

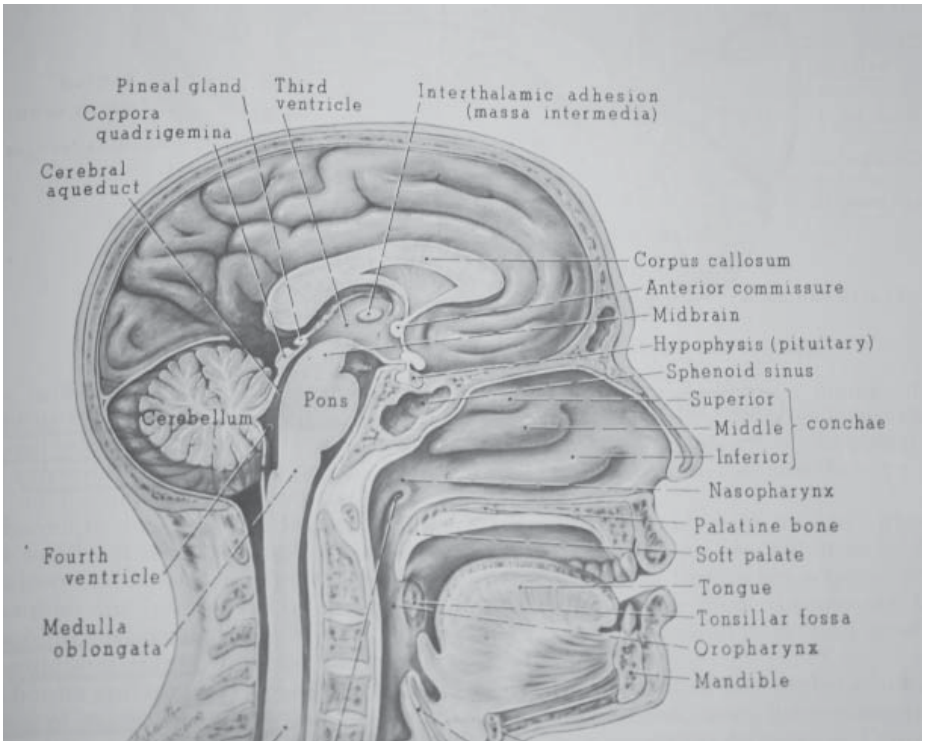
"The white matter is just a fiber bundle. It doesn't do any thinking," Just says. "But the experiment showed changes in how information in the brain was coordinated. What this says is that learning complex skills involves the coordination of different information and processes. No matter how trivial the task, at least 10 to 20 areas of the brain are activated."

What this also says is that neuroscience has a role to play in education. "But we are still at the very early stages of understanding what types of instruction would best benefit student learning," Keller says.

5. Brain cells called mirror neurons may explain why some teens have better emotional intelligence than others. First discovered in monkeys and only recently in humans, mirror neurons "fire" when an individual performs an action. When an observer watches the individual perform that action, the same neurons fire in the observer's brain, even though she or he is only watching, not performing, the action. Feinstein likens it to what happens when we watch football: "We're throwing the pass with Peyton Manning."

The discovery of mirror neurons may have implications for learning through observation, mentoring, and demonstration. As for emotional intelligence, research about mirror neurons seems to support the idea that humans learn about others through feeling rather than through reasoning. Scientists, among them Marco Iacoboni (Gunn, 2008), believe that mirror neurons hold the key to how humans learn empathy and why they either "get" or "don't get" emotion. Humans vary in the number of mirror neurons in their brains; people with autism, Iacoboni discovered, have very few mirror neurons. "So it's no surprise that they have trouble with social skills," Feinstein says.

Figure 1. Brain Basics



The large, rounded, cauliflower-like structure we commonly picture when we think of the brain is called the cerebrum. For more information and illustrations, please see http://bungelab.berkeley.edu/KidsCorner/kidscorner/glossary.html.

Caution: All That Glitters…

As Keller suggested, a lot remains unknown, with significant uncertainty regarding some claims that are being made about the teen brain. The popular idea that teen turmoil is caused by an immature brain, for instance, is one that Robert Epstein, noted researcher, former editor-in-chief of *Psychology Today,* and author of *Teen 2.0: Saving Our Children and Families from the Torment of Adolescence,* does not support.

"The newest studies suggest that danger-seeking teens actually have more *mature* brains than their passive counterparts," Epstein says. An article he wrote for *Scientific American* noted that a brain-imaging study found that in risk-taking teens, the brain's white matter looks like that of an adult.

Epstein believes that a "tumultuous" adolescence is a recent phenomenon, one that began when the "factory model" of education replaced the one-room schoolhouse and began trapping teens

in what he calls "the frivolous world of peer culture." Research conducted with a colleague at the California School of Professional Psychology showed "a positive correlation between the extent to which teens are infantilized and the extent to which they display signs of psychopathology" (Epstein, 2007). In more than 100 cultures around the world, Epstein notes, teen turmoil is completely absent and teens work side by side with adults with no conflict.

"There is no teen suicide, depression, or drug abuse in these cultures, and nothing inherent that makes teens have the problems we see in our culture," he says.

Epstein believes that treating teens as overgrown children and excusing their behavior on underdeveloped brains is dangerously close to cultural stereotypes prevalent in the early 1900s. "Scientists were claiming that blacks and women were inferior and blaming it on their brains," he says. "And that racial psychology was very powerful."

Granting that we know much more than what early 20th-century scientists thought they knew about the brain, Epstein believes that "brain science is still very new, very primitive, and overhyped." He recommends treating adolescents with more respect and keeping behavioral and academic standards high, arguing that when teens almost immediately rise to the challenge when they are treated like adults.

Potential Implications for Teaching and Learning

Giving caution its due, there is still much excitement among neuroscientists and educators about what brain science could mean for education. So dream a little, the experts were asked: If classrooms were brain-based and focused on harnessing that enormous potential, what would they look like? Here's a peek.

1. Students would be challenged to literally "grow their brains." Teachers would "take a lesson from a baby and gear the whole curriculum around seven magic words: 'See if you can figure this out,'" Smilkstein says. Her research and experience teaching middle school through graduate school led her to write *We're Born to Learn: Using the Brain's Natural Learning Processes to Create Today's Curriculum* (Corwin Press, 2002) to explain how that might be done.

"Evidence shows that when kids get problems to figure out and projects to do, they're naturally engaged and motivated," she says. "The brain says, 'This is what I was born to do.'"

Smilkstein believes students need to know they are natural-born learners. So she starts the first day of any class by having students reflect on how they learned to be good at something. They make notes, get into groups, discuss, and share.

So far, she's done this exercise with more than 9,000 people. "Every single group without exception self-identified four to six stages, including (1) trying it, (2) practice, (3) more practice, (4) beginning to get skillful, (5) refinement, and (6) mastery," she says. The exercise hooks students into being conscious of their own learning process. As students work through lessons or projects, Smilkstein asks them where they are in the stages and provides activities to help them move from one stage to the next. "Students actually have said to me, 'Give me something to learn so I can grow my brain.'"

Asked if building a curriculum around the brain's natural learning processes means changing public education's test-based culture, she doesn't miss a beat. "Here's what the research has shown," she says. "Take two groups of teachers. One group prepares students only to take the test. The other group has students do critical thinking activities, and spends just a small amount of time on test preparation. The second group does better [on the test]."

2. Every lesson would be constructed to maximize individual "achievable challenge." Teens' reward impulses, that is, their levels of dopamine, are erratic, according to Judy Willis, a California-based neurologist turned classroom teacher. When students experience the positive feeling of doing something well, their dopamine levels rise and they feel good; when they make a mistake, dopamine levels lower and, she says, the changes can alter neural wiring through neuroplasticity.

"If a teacher plans lessons so students' efforts at their individual levels of achievable challenge are reinforced by success, they will be motivated to persevere in further challenge," she says. Games, individualized computer learning, appropriate competition, and even having kids conduct their own experiments about which learning strategies work best for them are approaches that, in the hands of a savvy educator, can create optimal learning challenges.

3. Feedback would be provided as instantaneously as humanly possible. The brain's creation of neural networks in response to every new piece of knowledge it takes in "should act as a real motivator to provide swift feedback to students," Feinstein says. If a student gives a wrong answer and that response is not quickly corrected, then an incorrect neural connection forms—which is hard to undo.

On the other hand, "if a teacher is there with quick, corrective feedback," Willis says, "the brain will rewire the network so that the predictive pattern is reinforced and the network strengthened."

In her classroom, Willis builds in opportunities for students to practice and to check their work immediately. For example, she may give students magic slates, have them do a math calculation, and then hold up the slates so she can see if they need more or different instruction to get it right. At a practical level, this ensures that students "learn as they go," and as Feinstein points out, the more you know about a topic, the easier learning more becomes.

4. R & R would be scheduled into every school day and every class period. Seasoned educators know that pacing, i.e., giving students time to process learning, is an important part of delivering a lesson. Brain imaging studies now show why. Resting—or napping—after learning something

new allows the brain to consolidate memories (see sidebar, "Learning-Related Brain Studies"). Unfortunately, Feinstein says, "In our rush-rush society, this [processing time] is what we give up."

No wonder kindergarteners soak up knowledge like a sponge—naps are built into the curriculum. Will we ever see recess reinstated in places where it's been eliminated (or introduced into higher education levels)? We can always hope.

5. Educators would celebrate rather than criticize students' quest for social status. Hawaii-based educator and motivational speaker Eric Jensen notes that recent cross-connections between brain research and sociology are suggesting new understandings about human behavior. The discovery of mirror neurons, for example, seems to support the notion that humans are largely wired for social interaction and bonding.

"When we're born we want a stable caretaker," Jensen says. "As we get older, if the brain is healthy, we're interested in affiliation. Once we begin to affiliate, we start a quest for status."

The class clown, teacher's pet, the techie who can fix an iPod®—even the ordinary Joe who talks to his neighbor without getting caught—are all seeking status among their peers? "It's not a discipline issue as commonly thought," Jensen says. "Though it doesn't solve the problem, neuroscience gives us another point of view about classroom behaviors."

Jensen thinks educators would do well to give kids with the biggest attitude problems high-status jobs with real-world names—for example, UPS driver, not class messenger—in the classroom. They could also invest in discovering the students' unique qualities and publicizing that expertise, calling on it when needed. "I would rather the kid feel good that he's got status than have him take it from me by being the wise guy," Jensen says. In this, he says, good teachers are like the aikido master—redirecting an attack rather than opposing it head-on, zig-zagging like a stream around any obstacles.

6. Educators would take the idea of being role models more seriously than ever before. The discovery of mirror neurons is another instance of new research explaining what we've long suspected is true—that teens learn best by example.

"If the business instructor is enthusiastic, the kids will feel excitement and joy," Feinstein says. "If they see unscrupulous behavior modeled in business, they will think that's OK—and that's why you have to have the discussion about what is ethical."

Teens' struggle with impulsivity is another incentive for teachers and other adults to remain calm when teens are acting out. "Gaining control over emotional expression is a matter of relearning the inhibition of [emotionally driven] deep structures within the brain," says Susan Smith Kuczmarski, professor in the Kellogg Business School at Northwestern University (Evanston, IL). "Remaining in control while the individual is acting out models emotional control and decreases the chance of inadvertently reinforcing the lack of inhibition."

7. Educators would become learning specialists—brain coaches, perhaps—not just subject matter experts. They would follow Willis' lead and teach students about how the brain learns. Willis discusses the brain's filtering system with her students, introduces them to mindfulness to improve their concentration, and emphasizes the brain's neuroplasticity.

"When I began incorporating basic instruction about the brain into my classes and teaching simple activities to improve brain processing, students not only became more engaged and confident. They also began changing their study practices in ways that paid off in higher achievement," she says. "Explaining how the brain works is especially important for students who believe that they are 'not smart' …. The realization that they can … change their brains by improving how they approach learning and how they study is empowering."

But there are some exceptions. "The only [type of] student this does not work with is … students who have very negative self-images," Smilkstein says. "They cannot let themselves succeed. Students like this are total heartbreakers."

Jensen adds a caveat: "Some kids in non-trusting homes will see some strategies as being manipulative," he says. So he suggests paying careful attention to when such information is shared with kids. "The appropriate time might be [when you're] debriefing at the end of a project."

Understanding the brain is helpful for students and for their teachers, he adds, "It gives me the key to the vault to making the world more sane for kids, [letting me] guide them and work with their needs instead of being an annoying obstacle in their life."

The View Forward

Marcel Just, who demonstrated that the brain can be rewired, is pursuing additional research using fMRI and other technologies to uncover "the architecture of human thought." This research not only demonstrates which areas of the brain are involved in certain cognitive processes but is beginning to reveal how the brain codes certain types of concepts. For example, Just conducted an experiment in 2008 that used brain activation patterns to correctly identify what subjects were thinking about.

"Now we can decode the hot spots [that light up during thinking]," Just says. "We can say 'this person is thinking about a piece of furniture and it's probably a sofa.'"

When Just talks, his voice conveys great confidence in the promise that neuroscience holds for changing instruction in the not-too-distant future. "It's conceivable that by 2015 we will have as targets of education particular brain states," Just says. "If, say, an instructor knows how an advanced concept is represented in the brains of experts in that area, she will be able to teach to the brain and not to the test."

The challenge now, according to Giedd, is to bridge the gap between neuroscience facts and practical advice for parents, teachers, and society. "What can we do to help teens optimize the develop-

ment of their own brains?" he asks.

Researcher-educators like Willis, Jensen, Smilkstein, and others are beginning to blaze that trail. Meanwhile, Giedd offers this perhaps anticlimactic observation: "The more technical and more advanced the science becomes, often the more it leads us back to some very basic tenets…The best advice we can give is things that our grandmother could have told us generations ago: to spend loving, quality time with our children."

We might also remember to engage in the critical thinking we are always expecting from our students, heeding Epstein's cautions to those who would change the way they teach based solely on theories about how the brain learns. "What you learn about theories can make you insensitive to actual individuals," he says.

Instead, he reminds educators that really effective education is directed to the individual. "Be sensitive to individual differences, especially the pace at which people need to learn, what information they bring [with them], and what constraints they have in their home," he says. "These are the keys to creating successful learning experiences."

Joanne Lozar Glenn is a professional writer and educator based in Alexandria, Virginia, specializing in education and healthcare. She can be reached via e-mail at jlg@joannelozarglenn.com or by phone at 703.721.2088.

Selected Resources

Assorted Media

Brain Health. (2009, Jan. 5). Minds in motion: Student results impress lawmakers. *University of Texas at Dallas News*. Retrieved Jan. 27, 2010, from www.utdallas.edu/news/2010/01/05-001.php

Choudhury, S., Charman, T., &Blakemore, S-J. (2008, Sept.) Development of the teenage brain. *Mind, Brain, and Education* 2(3), pp. 142-7. ERIC document # EJ835181.

Chudler, E. H. (2007). *Inside Your Brain* (for students ages 9–12). New York: Chelsea House Publishers.

Epstein, R. (2007, April/May). The myth of the teen brain. Scientific American Mind.Retrieved Feb. 1, 2010, from http://drrobertepstein.com/pdf/Epstein-THE_MYTH_OF_THE_TEEN_BRAIN-Scientific_American_Mind-4-07.pdf

Gunn, M. (2008, Jul. 21). Mirroring people: An interview with Dr. Marco Iacoboni. *Tech Nation* podcast. Retrieved Feb. 3, 2010, from http://itc.conversationsnetwork.org/shows/detail3750.html#

Hamilton, A. (2010, Jan. 29). Studies: An idle brain may be ripe for learning. *Time.com*. Retrieved Feb. 12, 2010, from http://www.time.com/time/health/article/0,8599,1957114,00.html

Jensen, F.E., MD. (N.d.). Frances E. Jensen, MD, on the teen brain. Children's Hospital Boston: *For Patients and Families*. Retrieved Feb. 13, 2010, from http://www.childrenshospital.org/patientsfamilies/Site1393/mainpageS1393P316sublevel357.html

Roth, M. (2009, Dec. 10). Learning, adaptation can change brain connections, CMU researchers say. *Post-Gazette.com*. Retrieved Jan. 22, 2010, from www.post-gazette.com/pg/09344/1019898-115.stm

Zadina, J. (N.d.). Brain matters: Research on learning. *Taking Center Stage—Act II: A Portal for Middle Grade Educators*. California Department of Education. Retrieved Feb. 3, 2010, from http://pubs.cde.ca.gov/tcsii/prolearningtoolkit/zadina1takeaction.aspx

Websites

www.aleks.com
Web-based, customized, individualized assessment and instruction

http://faculty.washington.edu/chudler/neurok.html
Neuroscience for kids

www,hensenkearung,com
Eric Jensen's resources for "brain-based" learning

www.nature.com/neurosci/neuropod
Listen to how the brain works.

www.ninds.nih.gov/disorders/brain_basics/know_your_brain.htm
Diagram and text about brain structure and function

www.pbs.org/wgbh/pages/frontline/shows/teenbrain/view/
Video: Inside the teenage brain

www.RADTeach.com
Judy Willis, M.D., M.Ed., on the neurology of learning

BUSINESS SPOTLIGHT

The Garrison Institute: Bringing Mindfulness to Education

By Joanne M. Lozar Glenn

As early as 1979, mindfulness training was shown to produce positive changes in the brain and in the immune system. Since then, physicians, especially those who specialize in the science of the brain and mind, have been exploring the impact of mindfulness on stress reduction.

Now, mindfulness is being introduced in education, through the Garrison Institute's Cultivating Awareness and Resiliency in Education (CARE) professional development program for educators. Funded by a major grant from the U.S. Department of Education's Institute for Educational Sciences (IES),[1] the project involves partnering with Pennsylvania State University to complete and evaluate a mindfulness training program for educators.

Mindfulness Training: the Why and the What

Teaching is a stressful profession, yet stress reduction is rarely addressed in teacher training programs. When teachers lack the skills to manage their emotions around stressful events, they burn out and quit the profession, or they burn out and stay in the classroom. This, of course, can have detrimental effects on students and on the classroom environment.

"[Mindfulness training] can help teachers become more aware of their emotional state so they can respond more thoughtfully to emotionally provocative situations," says Patricia A. Jennings, director of the contemplation and education initiative at The Garrison Institute (Garrison, New York). Through training in contemplative (reflective) practices such as meditation, attention training and refinement, breath awareness, and other simple concentration techniques, educators become more skillful in monitoring their own emotions, dealing with stress, and enhancing their sense of well-being. The expected payoff? Teachers will be more effective in delivering content and in managing behavior, ultimately staying more committed to the profession. In addition, students will flourish.

The CARE Research Project

The CARE curriculum combines exercises for recognizing emotional patterns (one's own and others') with contemplative practices and has been piloted in school districts in Denver, San Francisco, and Pennsylvania. The IES grant, which began in May 2009, funds further development and evaluation of the program over a two-year period in rural and suburban elementary schools in central Pennsylvania.

In the first year of the project, the training will be bracketed by pre- and post-assessments of teacher well-being and burnout to collect preliminary evidence of the training's effectiveness. With a team of researchers, Jennings, the project's principal investigator, will administer questionnaires and surveys to teachers and to student teachers and their mentors and conduct a post-intervention focus group. The focus group's purpose is to identify what participants found most useful in the training and how they are applying the training in the classroom.

In the second year, researchers will conduct classroom observations before and after teachers have completed the CARE training to collect data on how the training affects classroom climate.

They will measure overall disruptive behavior and student compliance, cooperation, communication, problem-solving, interest level, focus, and responsiveness.

"So far [the training] seems to help teachers slow down, take a breath, and think carefully about how to respond to stressful situations," Jennings says. "They are more responsive and less stressed out."

The two-year program design will allow the team to test its research protocol in order to write a grant for a larger project that would involve a randomized trial. The trial would directly measure individual student outcomes, including student classroom behavior. "The next level is [collecting data about] efficacy," Jennings says. "We want to show that the program is feasible, attractive, and effective."

Significance and Next Steps

Jennings says that her own practice is informed by the work of Maria Montessori, whose educational philosophy included creating contemplative learning environments characterized by a deep respect for students and a deeper connection with them than is typical in today's classrooms.

"There's been a growing movement toward integrating a more mindful approach into the educational setting," she says. "When we received funding, a program in North Carolina received funding for an educational intervention program that also has a mindfulness-based social-emotional approach." Even the highly rated but traditional-leaning journal *Review of Educational Research* published her paper (written with colleague Mark Greenberg) linking teacher social and emotional competence to academic learning outcomes. "The reviewers liked the fact that we had a solid theoretical model for change," she says, "and that we were approaching a problem that hadn't been dealt with [in any substantive way] previously." Getting clear about the practices and principles of contemplative education is the theme for the Institute's May meeting, when they'll attempt to create a theoretical framework for a larger mapping project. "We are interested in considering developmental issues related to contemplative education," Jennings says. "Some things that you can do with adults aren't appropriate with kids."

Jennings expects to release the mapping report within the next two years and to convene a symposium on the results in 2011. She expects a positive outcome. "These tools are particularly helpful in developing self-awareness and being able to self-regulate difficult emotions, which [helps navigate] social situations," she says. "A pretty strong feeling is out there that there must be alternative ways to approaching problems, and this is a chance to find ways to apply the wisdom of contemplative traditions to social issues [such as education]."

Fast Facts: The Garrison Institute

Founded: 2003.

Located in: Garrison, New York (on the Hudson River north of New York City).

Size: $3 million budget; 23 staff.

Mission: Apply the transformative power of contemplation to today's social and environmental concerns.

Initiatives: Contemplation and Education; Transformational Ecology; Transforming Trauma.

Business model: Not-for-profit, nonsectarian organization.

Governance: Board of Trustees, Advisory Council & Senior Fellows, Leadership Team.

Sustainability: Income derived from retreats, foundation gifts and grants, individual gifts, and fees and other program-related income.

Kudos: Successfully bringing together luminaries in the field such as Adele Diamond (neuroscience), Daniel Goleman (emotional intelligence), Peter Senge (learning organizations), and others.

Quote: *We ask a lot of teachers these days, and we have a lot riding on their ability to deliver. The award of federal funding shows growing recognition of the need to provide teachers the necessary tools to hand the enormous social and emotional demands of the job.*—Patricia Jennings, Director

Website: http://www.garrisoninstitute.org

Note

1. $932,424 to Pennsylvania State University with a subaward of $290,511 to the Garrison Institute.

Further Reading

Brunette, L. (2003, Feb. 6). Meditation produces positive changes in the brain. University of Wisconsin-Madison News. Retrieved Feb. 9, 2010, from http://www.news.wisc.edu/8238

Jennings, P.A., & Greenberg, M. T. (2009, Spring). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research 79*(1), 491–525.

University of Massachusetts Medical School. (N.d.). International scientific conference: Investigating and integrating mindfulness in medicine, health care, and society (April 7-11, 2010). Retrieved Feb. 9, 2010, from http://www.umassmed.edu/cfm/conference/index.aspx

Joanne Lozar Glenn is a professional writer and educator based in Alexandria, Virginia, specializing in education and healthcare. She can be reached via e-mail at jlg@joannelozarglenn.com or by phone at 703.721.2088.