



This is the fourth article by Weiss in our series on brain-based learning. See July, September, and October.

Emotion and Learning

Have you ever been warned not to let your emotions rule your thoughts and actions? Throughout the history of Western civilization, there has been a conflict between emotion and thought. General wisdom of the ancients included, "Rule your feelings, lest your feelings rule you." But recent research conducted by neurologists and educators shows a strong link between emotion and reason, feelings and thoughts—thereby disproving the adage that emotion is the enemy of reason.

"I had been advised early in life that sound decisions came from a cool head, that emotions and reason did not mix any more than oil and water," says neurologist Antonio Damasio. He explains that he grew up thinking that reason and emotion were located in separate regions of the brain, each of which had a discrete neural system. He has since discovered that "reason may not be as pure as most of us think it is or wish it were, that emotions and feelings may not be intruders in the bastion of reason. They may be enmeshed in its networks, for worse *and* for better."

Damasio elaborates: "Emotions are inseparable from the ideas of reward and punishment, pleasure and pain, approach and withdrawal, personal advantage and disadvantage. In organisms equipped to sense emotions—that is, to have feelings—emotions have an effect on the mind, as they occur, in the here and now. Emotion is devoted to an organism's survival."

The more that neuroscientists explore how our brains process, store, and retrieve information, the more evident is the connection between emotion and reason. Scientists have discovered that the same areas of the brain that are involved in processing emotion are also involved in processing memory.

"Emotions and bodily sensations are intricately intertwined in a bi-directional network in which each can alter the other," says neurologist Candace Pert. "Usually, that process takes place at an unconscious level, but it can also surface to consciousness under certain conditions or be brought to consciousness by intention." Pert views the brain as a mechanism not only for filtering and storing sensory input, but also for associating that input with other events or stimuli occurring simultaneously at any synapse or receptor along the way.

By Ruth Palombo Weiss

Emotions imprint what we learn

and improve how we make decisions.

- Recent research conducted by neurologists and educators shows a strong link between emotion and reason, feelings and thoughts.
- Making daily decisions based on emotions is not an exception; it's the rule.
- The more emotionally engaged a learner is, the more likely he or she is to learn.

Says educator Eric Jensen: "The design of those feedback circuits, as well as emotion-sensitive structures such as the amygdala and nucleus basalis, ensures that what we are feeling at the time of learning will be coded with the content and context of our experience. It becomes the measured weight to all of our thoughts, biases, ideas, and arguments. It is, in fact, an emotional flavor that animates us, not a logical one."

Adds Damasio, "Making daily decisions based on emotions is not an exception; it's the rule. While extremes of emotion are usually harmful to our best thinking, a middle ground makes sense. Appropriate emotions speed up decision making enormously."

Says educator Robert Sylwester, "Emotion is an unconscious biological thermostat. It tells us that dangers or opportunities exist. It's important to remember that emotion has nothing to do with problem solving, except that it's the first important step in an extended (albeit often quickly traversed) cognitive path from awareness of a danger or an opportunity to solution and behavior."

If we look at what happens physiologically, everything we absorb is passed first through a kind of switchboard called the thalamus, located at the base of the brain. That information is then routed automatically to different sections of the brain. At first, the information goes through the brain's emotion-arousal systems for evaluation, to determine whether the information is perceived as benign or a threat. That evaluation involves a number of feedback loops originating in long-term memory. If we perceive the incoming information as threatening, we automatically engage in a series of reactions (which sometimes remain unconscious) to help us process the information.

In other words, our brains have to decide whether to keep or toss all incoming information. When unconscious emotional arousal reaches a certain point, it becomes a conscious feeling. That means there is some conscious control in subsequent related cognitive processes. Emotion thus activates attention, our focusing system, which locates the danger or opportunity and provides useful information about it.

For example, if we see a coiled snake

ready to strike, that information is processed through our thalamic pathways and sent to the amygdala, an almond-shaped structure in the brain that has 12 to 15 distinct emotive regions. The thalamic pathways to the amygdala do not differentiate among stimuli. Therefore, messages move quickly. So when information such as the sight of a coiled snake reaches the amygdala, the over-riding message is *Danger! Danger!* Immediately, the amygdala speeds biochemical signals to other regions of the brain. Nerves sending a message of fear reach every part of the body. A person's stomach tightens, heart races, blood pressure rises, feet and hands turn clammy, and mouth goes dry. A number of

rule, to back away slowly. My body registered the bear's growl. I saw it moving towards me, and my automatic systems took over. I spun around, and, even though I was carrying 15 pounds of equipment, I ran the fastest half-mile of my life. Then, the rest of my brain checked in and said, 'You don't have to outrun the bear, just your partner,'" says Schenck, laughing.

Schenck uses that personal incident to illustrate that even though someone has been well trained, it doesn't mean that he or she will process the information correctly in a real situation, unless practiced under real circumstances. That's why training for soldiers and firefighters are simulated reality situations. When Schenck actually came face-to-face with a grizzly bear, his body went into an automatic response; it took much longer for him to consciously override his flight response.

When we have an extreme emotional reaction, it doesn't go away rapidly. The emotional response may be with us for days, or even weeks. Despite that the danger is no longer imminent, the brain's chemicals continue to pump.

"Emotions have their own rules," says psychologist John Mayer. "Charles Darwin hypothesized that emotions are universal. In other words, the rules apply to dogs, primates, and humans. Furthermore, there is a direct link between emotions and motion. For example, when mammals are happy, they approach; in anger, they attack; when frightened, they escape; and when sad, they disengage."

Memory and problem-solving processes that develop a solution are activated when we attend to danger or opportunity. Thus, emotion drives attention, which drives learning, memory, and problem-solving behavior. Simply stated, learning doesn't take place when there's no emotional arousal. However, as we all know, emotional arousal doesn't necessarily result in learning.

Sylwester advises that we accept emotions for what they are and not think of them in negative terms. Anger and fear mechanisms, for example, evolved in humans so we could respond to an important need: keeping us from harm. Our primary emotions are surprise, happi-

More on the Subject

• *Theories of Mind and Cognition: A Learner's Guidebook* (2003), edited by Gerald Gray

• *Descartes's Error: Emotion, Reason, and the Human Brain* (G. L. Patenaud & Scott, 1996) and *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (Antonio Damasio & Damasio, 1999), by Antonio Damasio

• *Feeling: A History of the Body in Mind* (1998), by E. Schuman

• *The Emotional Brain* (Simon & Schuster, 1997), by Joseph LeDoux

• *Milestones of Emotion* (1997), by Gerald Gray

• *A Celebration of Nerves: An Introduction to the Human Brain* (1995), by Robert Sylwester

hormone-releasing glands are activated, the body goes into action, and the person runs away from the snake.

To give another example of that phenomenon, educator Jeb Schenck, who has trained thousands of people in wilderness skills, including what to do when you encounter a bear, tells what happened the first time he actually came face-to-face with a bear: Several years ago, he and a friend were climbing in the mountains when they met a bear. They stopped and looked, which was their first mistake. Schenck had taught many people to avoid eye contact. When he looked directly at the bear, it growled and made a false charge.

"I didn't even think about the second

ness, fear, anger, disgust, and sadness.

"Almost all of those emotions relate to negative situations, so emotions aren't necessarily about happy things. The issue isn't whether they're good or bad but when to use them appropriately—and to realize that they are, initially, unconscious systems that we control only when they become a conscious feeling," says Sylwester.

Emotion impels what we attend to, and attention drives learning. So, one of the important things we have to do is to ensure that learners become emotionally involved in whatever we're teaching them. If they don't get emotionally hooked on some level, they don't pay attention; if they don't pay attention, they don't learn. In fact, the more emotionally engaged a learner is, the more likely he or she is to learn. The big question for learners and teachers is how do they do that?

Gerald Clore, a research scientist at the University of Virginia, conducted a series of experiments in which he induced mild emotional states or moods in subjects by having them view a short emotional film, listen to music, or describe a happy or sad event on paper. He then asked them to make evaluations—such as, rate their life satisfaction or whether they liked a certain product or political candidate. That proved to be useful for studying how feelings work and influence our behavior. In general, he found that feelings aroused in one situation often carry over into a new situation.

"From our point of view, it's the information value of feelings that has an effect," says Clore. "In fact, the basic information value of emotional feelings is that something is good or bad in some way. The whole point of emotion is as an experiential representation of value, of goodness or badness. Cognition is about the presence or absence of things, whereas emotion is about whether it's good or bad for me."

When we have positive, affective feelings while doing a task, it's likely that we will feel that we did the task well. The same is true about negative feelings: We'll feel there's a problem.

"Dewey and Piaget say that you learn only when you encounter difficulties," Clore continues. "In other words, we develop new knowledge when the old knowledge doesn't work. The net effect is that when we're in a positive state, we

tend to use whatever knowledge, information, inclinations, or strategies are already present. We use what we know. However, if we encounter difficulty in doing a task, we take in new information from the environment."

Clore notes that the best learning situations empower us to use what we know, while forcing us to extend that knowledge and build on it. That happens when a task provides both positive and negative feedback, when it's neither too easy nor discouragingly difficult. The ultimate challenge is how teachers and trainers can use emotion as a teaching aid.

Linking emotion and learning

In order to establish direct biochemical links between emotion and memory, it's crucial to engage people's curiosity, says Renate Nummela Caine, in her writings *Making Connections: Teaching and the*

So, one of the important things we have to do is to ensure that learners become emotionally involved in whatever we're teaching them.

Human Brain and Education on the Edge of Possibility. She suggests that we create a sense of surprise and mystery in teaching and use humor. Those techniques foster emotional connections that make a direct biochemical link with memory.

Caine says, "Engage learners' confidence. Begin with what they already know because if they are in any way threatened or have a sense of helplessness, their brains will not register a maximum level of input. Furthermore, they won't go beyond what you ask of them. Include meaning by helping learners see how new information connects with what they already know."

When people do perceive a learning situation as threatening, they may be able to learn a fragment of information with practice and rehearsal, but they aren't likely to make broader connections. An

example would be training someone to put together a carburetor. If the learning situation is fraught with intimidation (the instructor shouts, belittles, or threatens), the person could probably assemble the carburetor but wouldn't likely figure out how the carburetor makes the engine work, a more complex connection. For such interconnections and creative thinking to occur, people need to be in charge of their own learning.

"It really has to do with power and control," says Caine. "People [who have a tyrannical instructor] tend to learn only what they think will please the instructor. They'll do what they can get away with but are unlikely to [be creative]. It isn't just psychological; it's physiological. If you're in a state of vigilance, what kind of learning can you access? The less power and control are over them, the more people can access their creativity."

Emotions, once aroused, can't be turned off automatically. If someone has an emotional encounter—for example, was chewed out—he or she might not express it outwardly, but the feeling can last for hours or days. In that situation, the person isn't likely to be able to override his or her feelings and be receptive to learning.

On a positive note, adults are usually emotionally involved in their education and have a great desire to learn, either because it will advance them professionally or they're required to learn a new skill or new information for their jobs. And adults are often aware of the strengths and weaknesses of their learning styles.

A challenge for instructors of adults is to coach them into accepting new teaching approaches. For instance, many older learners are comfortable with the lecture mode. The array of technologically enhanced teaching tools that let learners choose their own paths rather than rely on a linear didactic model is a far cry from the authoritarian figure at the head of a classroom imparting information. It's up to training professionals to ease learners into new approaches and to lessen their anxiety.

Schenck points out that even how an instructor arranges the learning environment can be crucial. Rather than set up rows of chairs with the instructor standing at the front of the room, you can place the chairs or desks in a semi-

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circle, a giant U shape, or a big open rectangle with the instructor sitting at eye level with learners. Almost instantly, you've made the atmosphere less threatening, more balanced, and set an emotional tone that is friendly rather than confrontational.

Another suggestion is to hold learning sessions in other than traditional settings. Think about how welcoming the typical elementary or kindergarten class looks with colorful pictures and toys, and compare that to a high school or college classroom. The higher we go educationally, the more sterile the environment can be.

Says Schenck, "After all, you're teaching to the brain, not just teaching verbal or math skills. You're teaching to the entire body and all of its senses and multiple ways of processing." He further suggests using the Socratic dialogue

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method of teaching rather than a lecture format. "Try [speaking with] a personal voice rather than a teacher's voice."

Our emotions are unconscious and visceral. We can teach how to bring them to consciousness and how to use them profitably in a learning situation. As a learner, if you want to understand emotions and use them to benefit your learning, you have to recognize when you're having emotions and what you are feeling. As an instructor, it's crucial that you set up the learning situation in a manner that arouses learners' feelings of security, well-being, and self-confidence. It's equally important to challenge them without threats, intimidation, or pressure. □

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