Learning to Learn: Neurobiology and Cognitive Science as Bases of Autonomous Learning

by Amelia Barili, Lecturer, Spanish and Portuguese

Universities throughout the world are beginning to implement a shift from teaching-centered approaches to learning-centered ones that foster greater commitment on the part of the students and develop capacities of autonomous learning and life-long learning.

The need for autonomous learning comes from the fact that we are preparing students for a world of rapid change, and for a future filled with uncertainties. Students in this new millennium need to be able to think for themselves, and be self-initiating, self-modifying and self-directing. They will need skills that cannot be gained by learning content alone. A changing world demands changes in our instructional and curriculum practices, and highlights the need to think in social contexts.

The research I did as a BLC Fellow helps to show how these "new pedagogies" are supported by the recent findings of neurobiology and cognitive science that are making us re-think thinking and learning. The findings—which present new perspectives on how the brain works—emphasize the continuous dialogue between the brain and the heart, the importance of inner motivation, and of paying attention to intention for deep sustained learning. In this article I highlight relationships between these research findings and the principles of autonomous learning, as well as possible applications to intercultural studies and to the learning of a second language.

When I began my research I was looking for methodologies to empower students to learn in ways that would remain with them after they graduated. I had already implemented in my courses such pedagogies as service learning, collaborative learning, teaching from multiple perspectives and, this semester, I was looking for a way to teach Creative Thinking.

Reflecting on the classic works on creativity by May, Gardner, Csikeszentmihalyi, and others, I realized that to "teach creativity" was an oxymoron, and so I rephrased my research question to be: "What are the conditions that best foster creativity?" Inspired by Rollo May's definition that "creativity is not the superficial level of objectified intellectualization, but is an encounter with the world on a level that undercuts the subject-object split" and by the agreement among these authors that the two main characteristics of creativity are:

- Inner Motivation—which leads to great commitment and absorption in the task, and
- Inter-Intra Intelligence—which Gardner defines as the journey from the world to the self and back again,

I set out to find pedagogies that would nourish these characteristics.

This new orientation led me to a wealth of literature on student-centered approaches such as integrative learning, experiential learning, embodied learning, Socratic learning, team-based learning and mindful learning, among others. (See bibliography for websites that were particularly useful in this search.)

What these "new pedagogies" have in common is a switch of emphasis, from teaching to learning, from content-based instruction to student-centered learning processes. In other words, the emphasis is on helping students learn how to learn. Concomitantly, these pedagogies bring a change in the traditional classroom dynamics:

- The teacher is no longer the expert figure that imparts knowledge to students who passively take notes that they quickly forget after the exam. No longer the "sage on stage," the teacher becomes a mentor who models the tasks and engages in open dialogue with the students.
- The students take greater initiative for their own process of learning; they work in teams, learning with and from peers in progressively challenging tasks; they find opportunities to learn and apply the subject in other environments and contexts: in the local community, through service learning, etc.
- The content of the course does not come only from books, nor is strictly determined by the interests of the professor, but is open and flexible, accommodating students to do research according to their individual circumstances and encouraging them to express their voices.
- The goals of the course and the tools of assessment, such as rubrics, are discussed and developed at the beginning of the semester by teacher and students, providing an opportunity to reflect together on the process of learning.
- The emphasis is taken away from the letter grade to the real process of learning.
- As faculty we have often seen ourselves as teaching disciplinary content. Harvard psychologist, Ellen Langer, invites us to be more involved in assisting students on learning to learn or what she calls "Mindful Learning."

She recommends:

- Teaching conditionally: Make it clear that all knowledge has been constructed. There are no basic facts—they depend on the context, and the context is temporary since we are always adding to it or modifying it.
- Teaching relationally: Enable the student to take the new information, link it to prior knowledge, and then use it in some new way. Students can explain the new information in different terms, manipulate it to achieve different ends, and apply it to distinct, novel situations.

At the other end of the spectrum is rote memorization, what Langer identifies as "a strategy to take in material that has no personal meaning." We want to move from this impersonal and superficial way of learning to deep, sustained learning, a state where students learn to own the material.

Almost as impersonal as rote memorization is the "Follow the Instructions Procedure." Langer's argument is that if we encourage or simply present a step-by-step method of problem solving, we are fostering memorization, or "an essentially mindless type of success." It is better for the brain to figure out the meaning of the information in different contexts and to discover how to read the information in novel ways.

Langer has done many experiments that show the success of this method in various disciplines. In our field, she did an experiment where she had three groups read short stories. The first group just read, the second read looking for specific details, and the third was told to read the stories from different perspectives and/or imagine different endings. The results showed that the third group enjoyed the process much more and remembered significantly more details about the stories. This is one of many possible ways of putting into practice Langer's advice to "study like a detective always connecting new knowledge to previous knowledge."

Her advice strongly resonated in me at this point of my research. I was delighted to discover the connections between Langer's work and that of UCLA neuroscientist Daniel Siegel, whose work I had studied in the context of his collaboration with the Dalai Lama concerning the research scientists and advanced meditators are doing at the Mind Life Institute. Suddenly my research of techniques to teach creative thinking to my students at Berkeley touched a central nerve of my life outside academia: my conversations and work with my dear friend, physicist and systems analyst, Fritjof Capra, about the convergences of East and West (and arts and science), and my interest in cognitive science, embodied learning, contemplative practices, and neurobiology.

It was at that point, when Rick Kern suggested that I demonstrate how neurobiology and cognitive science support "new pedagogies," that I went from learning about autonomous learners to actually experiencing once again becoming one. When I realized how my two lives were converging, I couldn't stop reading, thinking and reflecting on what I was discovering. I wanted to see from different perspectives how all these pieces of the puzzle fit together and to find ways to express that which is deeply meaningful and relevant to me. The result of this combined research is a rich framework of which, perforce, I can only give highlights within the limits of this report

Some of the principles from cognitive science (according to Maturana, Varela, Damasio, Lakoff and especially Capra) that I find most relevant to re-thinking the process of learning are the following:

1. The mind/body split is artificial. Descartes was wrong. Body and mind are not two separate things. Mind is not a thing but an embodied process. Mind is the process of cognition involved in the process of life.
2. Life and cognition are inseparably connected. Cognition involves the entire process of life—including perception, emotion and behavior. The interactions of a living organism with its environment are cognitive interactions.
3. Cognition is not the representation of an independently existing world, but rather a continual bringing forth of a world through the process of living. "To live is to know."
4. Communication is not a transmission of information, but a coordination of behavior between living organisms. Learning is a self-reflecting experience. Both the teacher and the student are cognitive organisms in process.

These cognitive principles, combined, give us the cognitive basis for the shift of paradigms from teaching to learning. They explain why a deep cognitive process requires teachers to shift from a role as an authority figure who imparts the knowledge about a fixed world out there, to one who models and assists in creating environments for learning.

Those findings of cognitive science coincide with these latest findings of neurobiology which are also leading us to re-think thinking and learning.

1. Neuroplasticity: Experience changes the function of the brain itself. The connections among the 100 billion neurons in the brain are continually carving out new pathways that can support ongoing learning and can enrich our mental health well into our nineties. How we think/feel affects our brain and our capacity for further thinking/feeling. It is clearly important to actively shape the nature of our experiences in ways that keep the mind or cognitive process thriving and foster habits of life-long learning.
2. Reflective Coherence: Neuroplasticity requires internal attunement. In practice this means attuning our attention to our intention. Optimal learning happens when the brain and the heart are attuned. This is not just an alignment of desire and reason. There is an embodied process, an actual physical resonance between heart and brain that recent neurobiological findings have demonstrated and which is partly facilitated by the fact that the heart has neurons and glia (neurotransmitters) like the brain has. These dynamic interactions between brain and heart, feeding into one another in resonant patterning, shape our perceptions and our capacity to understand and learn. The inherent learning that happens when the heart is involved, as shown by these neurobiological findings, was apparently known to ancient cultures such as the Chinese, whose ideograms for thinking, studying, learning, and recalling all include the radical for "heart." [See the accompanying piece on the "heart" radical.]
3. Awareness of Self and Other. The internal attunement that fosters neuroplasticity is mediated by the social resonance circuits of the brain, including the mirror-neuron system and related areas of the pre-frontal cortex that map the self as observed and observing self. In other words, learners learn best when heart and brain are not at odds but resonating together, and when they can meaningfully connect their intra- and interpersonal selves. Learning is indeed an embodied and social experience. When we consider the power of reflective coherence to alter not only the power of our brain function, but our deep sense of self and our perceptions of the world around us, we realize the need to take this dimension into account in our pedagogies.

In his book *Neurobiology of Affect in Language*, linguist John H. Schumann refers to this heart-brain dialogue as affect—the movement towards or away from learning a language according to the inner motivation of the student. His research shows that students' life experiences and needs determine their inner motivation. Based on the fact that the neural circuitry that gets stimulated in animals looking for the right patch to graze on is the same circuitry that gets stimulated in humans when learning a second language, he calls this motivation for

learning "mental foraging." Claire Kramsch calls it "desire." Based on neurobiological findings about the function of these neural circuitries, Schumann makes a thought provoking side remark when he compares students with cows and sheep, and teachers with herders who provide what the students graze on. He remarks that in fulfilling this function we, as teachers, can either satisfy their desire for the particular nourishment they intuitively know they need or, when that desire is not met, move them to change pastures or to give up their natural sense of what is nourishing and what is not.

What these findings show us is that if we focus on attuning our own minds and those of our students, we will be harnessing perceptual skills, and strengthening neural circuits that will enable more robust intra- and inter-attunements for the classroom and beyond.

These connections between new pedagogies and the findings of cognitive science and neurobiology provide the scientific basis for a paradigm shift in education. This new paradigm, in keeping with the demands of a rapidly changing world, emphasizes autonomous learning. Active reflection on our perceptions of self and other, as well as fostering inner motivation are key elements in the change from a teaching-centered system to a learning-centered one that is spreading throughout the world at the university level. In Europe, for example, the Sorbonne and Bologna Declarations established a mandate to create a Higher Education Quality system based on intercultural competence and autonomous learning. In our field, globalization is closely linked to the phenomena of multiculturalism, multilingualism, and transnationalism. Assisting our students in developing greater awareness of self and other, and on reflecting about their learning processes is necessary to promote not only their professional mobility but also more effective social interaction and greater social cohesion in our fast-changing world.

For the purpose of reflection on these issues I leave the reader with some guiding questions...

- How can we develop habits of life-long learning?
- What skills and knowledge will stand the test of time, given the dynamic nature of knowledge and information?
- What would change in our approach to teaching if we become aware of scientific findings that show that how a person reflects internally will shape that person's capacity for deep sustained learning and will deeply affect also how she/he treats both herself/himself and others?
- How can we foster autonomous learning in our culture and language courses?

Suggested Readings

On Creativity and Creative Thinking

The Courage to Create. Rollo May. New York: W.W. Norton & Company, 1975.

Frames of Mind: The Theory of Multiple Intelligences. Howard Gardner. New York: Basic Books, 1983.

Creating Minds. An Anatomy of Creativity Seeing Through the Lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi. Howard Gardner. New York: Basic Books, 1993.

Creativity. Flow and the Psychology of Discovery and Invention. Mihaly Csikszentmihalyi. New York: Harper Collins, 1996.

On Learning-Centered Teaching

Learner-Centered Teaching: Five Key Changes to Practice. Maryellen Weimar. San Francisco: Jossey-Bass, 2002.

Creating Significant Learning Experiences. An Integrated Approach to Designing College Courses. L. Dee Fink. San Francisco: Jossey-Bass, 2003.

Team-Based Learning: A Transformative Use of Small Groups for Large and Small Classes. Larry K. Michaelsen, Arletta Bauman Knight, and L. Dee Fink. Westport, CT: Praeger Press, 2002.

Introduction to Rubrics. Danielle D. Stevens and Antonia J. Levi. Sterling, VA: Stylus, 2005.

On Multiculturalism, Intercultural Studies, and Ecology of Languages

Pedagogy of the Oppressed. Paulo Freire. New York: The Continuum, 1970.

Borderlands/La Frontera. Gloria Anzaldúa. San Francisco: Aunt Lute Books, 1987.

Language Acquisition and Language Socialization. Ecological Perspectives. Claire Kramsch (ed.). London-New York: Continuum, 2002.

Critical Citizens for an Intercultural World: Foreign Language Education as Cultural Politics. Manuela Guilherme. Clevedon: Multilingual Matters, 2002.

Intercultural Competence for Professional Mobility. Evelyne Glaser, Manuela Guilherme, María del Carmen Méndez García, and Terry Mughan. Graz: Council of Europe, 2007.

On Mindfulness in Teaching and Learning, Re-thinking Thinking and Intelligence

Frames of Mind: The Theory of Multiple Intelligences. Howard Gardner. New York: Basic Books, 1983.

The Power of Mindful Learning. Ellen J. Langer. Cambridge, MA: Perseus Publishing, 1997.

The Feeling of What Happens. Antonio Damasio. New York-London: Harcourt Inc., 1999.

The Developing Mind. Daniel J. Siegel. New York-London: The Guilford Press. 1999.

On Neurobiology and Language Learning

The Neurobiology of Affect in Language. John H. Schumann. Malden, MA: Blackwell Publishers, 1997.

The Mindful Brain. Daniel J. Siegel. New York: W.W. Norton & Company, 2007.

On Cognitive Science

Philosophy in the Flesh. George Lakoff and Mark Johnson. New York: Basic Books, 1999.

Gentle Bridges. Conversations with the Dalai Lama on the Sciences of Mind. Jeremy W. Hayward and Francisco Varela. Boston-London: Shambala, 2001.

Mind and Consciousness in Hidden Connections. Fritjof Capra. New York-London: Doubleday, 2002.

Useful websites:

http://www.podnetwork.org/search.htm#faculty

http://ctl.stanford.edu/Tomprof/postings.html

TeacherTube.com (see Did You Know? 2.0)

http://rubistar.4teachers.org/index.php

The "Heart" Character

by Liu Li, Lecturer in Chinese, East Asian Languages and Cultures

心 is the "heart" character. It is also a radical of many Chinese characters. It is written just like this (心) when a character has top-bottom structure; however it is written differently, like this, 忄, when a character has left-right structure.

想 think; suppose; reckon; consider; want to; would like to; feel like (doing something); remember with longing; miss.

思 think; consider, think of; long for.

念 think of; miss; read aloud; study; attend school.

思想 thought; thinking; idea; ideology.

想念 remember with longing; long to see again; miss.

慧 intelligent; bright.

愛 love; affection; like; be fond of; be keen on; cherish; treasure; hold dear; take good care of; be apt to; be in the habit of.

慮 consider; ponder; think over; concern; anxiety; worry.

恕 forgive; pardon; excuse; <polite> excuse me; beg your pardon; forbearance (as advocated by Confucius).

聽 listen; hear; heed; obey.

憶 recall; recollects.

悔 regret; repent.

懺 repent.

怕 fear; dread; be afraid of; I'm afraid; I suppose; perhaps.

恨 hate; regret.

憐 pity; sympathize with.

憫 commiserate; pity; <formal> sorrow.

懼 fear; dread.

悅 happy; pleased; delighted; please; delight.

惱 angry; irritated; annoyed; unhappy; worried.

慕 admire; yearn for.

Phrases with 心

心神 mind; state of mind.

心無二用 one cannot keep one's mind on two things at the same time; one should concentrate on one's work.

心願 cherished desire; aspiration; wish; dream.

心意 regard; kindly feelings; intention; purpose.

意志 will.

心機 thinking; scheming.

心計 calculation; scheming; planning.

心不在焉 absent-minded; inattentive; preoccupied (with something else).

用心 diligently; attentively; with concentrated attention; motive; intention.

專心 concentrate one's attention; be absorbed.

專心學習 concentrate one's attention to study / learn /emulate.