

## The Global Aspects of Brain-Based Learning

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*by J. Diane Connell*

Howard Gardner's seminal book *Frames of Mind: The Theory of Multiple Intelligences* (1983) taught educators around the globe to understand the actual connections that the brain has with learning. Beginning in the late 1980s and the early 1990s, thousands of American teachers became intensely interested in learning about the brain-based multiple intelligences and finding multiple ways to reach their increasing numbers of diverse learners.

The special significance of Howard Gardner's theory of multiple intelligences is his claim that all seven of his original intelligences, as well as his eighth, have physiological locations in the brain (Gardner 1983). Drawing upon research in neuropsychology, Gardner described how different functions of the brain can be related to particular brain-injury locations and stated: "The consequences of such brain injury may well constitute the single most instructive line of evidence regarding those distinctive abilities or computations that lie at the core of a human intelligence" (p. 63). He noted that some intelligences are "relatively independent of one another" and that "they can be fashioned and combined in a multiplicity of adaptive ways by individuals and cultures" (pp. 8–9). Gardner added that although intelligences "typically work in harmony," when "the appropriate observational lenses are donned, the peculiar nature of each intelligence emerges with sufficient (and often surprising) clarity" (p. 9).

*The enormous interest in the brain-based multiple intelligences helped to bring about the new field of Brain-Based Learning (BBL). Current research in the field of BBL is gleaned from the combined work of neurologists, biologists, psychologists, educators, and physicians. Professionals strive to extrapolate the most current research data on the brain and apply this information to teaching and learning in pre-K–16+ schools. Results gleaned from BBL provide*

a theoretical foundation for helping students learn and for helping teachers reach diverse learners in America and around the world.

### **Defining Brain-Based Learning**

Brain-Based Learning can be viewed as techniques gleaned from research in neurology and cognitive science used to enhance teacher instruction. These strategies can also be used to enhance students' ability to learn using ways in which they feel most comfortable, neurologically speaking. Jensen (1995/2000) defines BBL as "learning in accordance with the way the brain is naturally designed to learn" (p. 6). Perhaps the most important aspect of BBL is that it encompasses and combines specific types of research-based academic interventions as well as applied aspects of emotional learning.

A basic component of brain-based learning is that our *emotions influence our ability to learn*. Our brains are constantly striving to make connections between intellect and emotions. Jensen (1995/2000) explains that the "brain attaches emotion to each event and thought, forming patterns of meaning . . ." (p. 9). Generally speaking, teachers have paid little attention to the emotional content of lessons. Chapman and King (2003) quote Robert Sylwester as explaining in an interview with Marcia D'Arcangelo: "[O]ur emotional system drives our attentional system, which drives learning and memory and everything else that we do. It is biologically impossible to learn and remember anything to which we don't pay attention" (p. 141). The emotional system tells us whether something is important—whether we ought to put energy or effort into it. In other words, teachers are most likely to gain, and keep, the attention of students when they engage students' brain-based emotional systems in a challenging yet non-intrusive manner.

### **Twelve Principles of BBL**

Since the 1990s, educators and psychologists such as Armstrong (2009); Caine, Caine, and Crowell (1999) and Caine et al. (2009); Goleman (1994); Jensen (1995/2000, 2005); and Sousa (2006) have been forerunners in the BBL movement. These authors have helped with disseminating neurological research into research-based academic best practices.

For the past fifteen years, many regular education and special education teachers in the United States have embraced BBL techniques to reach an increasingly diverse school population. Interestingly, other countries around the globe, including Turkey, Chile, England, and Thailand, are also using BBL techniques in their schools. The sidebar provides a brief synopsis of Geoffrey and

### Principles of Brain-Based Learning

- 1. The brain is a parallel processor:** The brain performs many tasks simultaneously, including thinking and feeling.
- 2. Learning engages the entire physiology:** The brain and the body are engaged in learning.
- 3. The search for meaning is innate:** “[T]he brain’s/mind’s search for meaning is very personal. The greater the extent to which what we learn is tied to personal, meaningful experiences, the greater and deeper our learning will be” (Caine and Caine 1994, 96).
- 4. The search for meaning occurs through patterning:** “The brain is designed to perceive and generate patterns, and it resists having meaningless patterns imposed on it” (Caine and Caine 1994, 88).
- 5. Emotions are critical to patterning:** Our emotions are brain based; they play an important role in making decisions. In the groundbreaking *The Emotional Brain*, Joseph LeDoux (1996) clearly explains how the emotional neural passageways (which originate in our amygdala) influence the neural passageways needed for academic and scholarly work.
- 6. The brain processes parts and wholes simultaneously:** The left and the right hemisphere have different functions, but they are designed to work together.
- 7. Learning involves both focused attention and peripheral perception:** People hold general perceptions of the environment and pay selective attention to various parts of it.
- 8. Learning always involves conscious and unconscious processes:** There is interplay between our conscious and our unconscious. “One primary task of educators is to help students take charge of their conscious and unconscious processing” (Caine and Caine 1994, 157).
- 9. We have at least two different types of memory: spatial (autobiographical) and rote learning (taxon memory).** The taxon or rote memory systems consist of “facts and skills that are stored by practice and rehearsal” (Caine and Caine 1994, 169). Spatial, or autobiographical, memory “builds relationships among facts, events, and experiences” (Caine and Caine 1994, 170).
- 10. Learning is developmental:** Children, and their brains, benefit from enriched home and school environments.
- 11. Learning is enhanced by challenge and inhibited by threat:** Students optimally benefit when their assignments are challenging and the classroom environment feels safe and supportive. Daniel Goleman (1994) expands upon the importance of eliminating threat from the classroom in the influential *Emotional Intelligence: Why It Can Matter More Than IQ*. *Each brain is uniquely organized*. When teaching, we need to consider how each student learns most effectively; each student has his or her own unique set of brain strengths and weaknesses.

Renate Caine's (1994; Caine, Caine, and Crowell 1999; Caine et al. 2009) principles of brain-based learning.

Clearly these principles can be used in pre-kindergarten through secondary classrooms and in college courses as well. They enable and encourage teachers to teach successfully to the diversity of learners found in American classrooms.

### **Application of Brain-Based Learning in the United States: Serving Diverse Learners**

The multitude of diverse learners in today's American public school classrooms has created formidable challenges for teachers and administrators. Analysis of recent census trends indicates that K-12 school populations will become yet more diverse in the foreseeable future. In addition to regular education students, most American classrooms include gifted students and an influx of English Language Learners and refugees, as well as students with a variety of specific special needs (e.g., high- and low-functioning autism, Aspergers, ADHD, emotional and behavioral disorders, specific learning disabilities).

Brain-Based Learning research affirms that although all students can learn, each brain is unique and each student has his or her own preferred learning style (Armstrong 2009; Connell 2005; Jensen 1995/2000, 2005). BBL also establishes that learning is greatly enhanced when students are taught using research-based learning strategies. Researchers have demonstrated the effectiveness of using BBL in an inclusion classroom to teach regular education students as well as ELL students and students with special needs (Green 1999; Lombardi 2008; Marzano 2003). This research confirms that inclusion teachers can reach students by incorporating aspects of BBL, such as multiple intelligences, learning styles, and emotional intelligences, into their classroom and homework assignments.

### **Now Is the Time: Let's Put BBL into the Teacher Education Curriculum**

Sadly, approximately twenty years after the "birth" of BBL, few undergraduate and graduate teacher education programs in the United States offer a specific course on BBL (Gunzelmann 2009). Especially regrettable is that most regular education teachers are responsible for teaching diverse learners as well as students with special needs. The biological basis of BBL is clearly applicable to all regular education and special needs students. BBL has a dual focus: (1) it encourages teachers to modify their teaching methods

to reach all students, and (2) it seeks to create a safe yet challenging emotional climate in the classroom.

Although a growing number of colleges do include BBL classes in their curricula, that focus needs to expand to all graduate and undergraduate programs that train teachers. Such a class would combine neuroscience research with research-based learning and teaching strategies. Examples of applicable course titles include: (1) “The Biology of BBL: Applications for Inclusion Classrooms” or (2) “Teaching Methods for Elementary or Secondary Education with a Focus on BBL.” It is interesting to note that Pickering and Howard-Jones (2007) of the University of Bristol, England, also recommend including neuroscience and psychology in initial teacher-training courses in England.

A number of books on BBL best practices could be used as supplemental textbooks. *Brain-Based Strategies to Reach Every Learner* (Connell 2005), used as a supplemental textbook in the author’s graduate and undergraduate teacher-training classes, provides examples of BBL strategies that work with both regular and special education students, as well as with culturally diverse learners. Other recommended books include *Teaching with the Brain in Mind* (Jensen 1995/2005) and *Becoming a “Wiz” at Brain-Based Teaching* (Sprenger 2003).

### Global Aspects of Brain-Based Learning

Interest in brain-based learning strategies and educational strategies is beginning to spread around the globe (Dwyer 2002). Pickering and Howard-Jones (2007) find that “responses from the educators based in the United Kingdom and other locations around the world have indicated enthusiasm for a role of neuroscience in education” (p. 111).



Since *Brain-Based Strategies to Reach Every Learner* (Connell 2005) was printed, the author has received e-mails and telephone calls from educators in countries worldwide, including Chile, Thailand, Canada, England, and Russia. The *South China Morning Post* published a comprehensive article (Sharma 2007) regarding neuroscience and current BBL activities in Germany, Holland, and Finland.

In 2008, Caine and Caine's *Making Connections* was translated into Turkish. In addition, Muhammet Ozden and Mehmet Gultekin (2008), faculty members at Anadolu University in Eskisele, Turkey, published "The Effects of Brain-Based Learning on Academic Achievement and Retention of Knowledge in Science Courses." They write, "The learning and teaching process in science courses should be based on exploration and inquiry" (p. 4). Two other recent publications from Turkey focus on making connections between BBL and the constructivist learning model: Gulpinar (2005) and Kahveci and Selahatdin (2008).

In September 2007, the University of Chile in Santiago hosted an international conference titled "Early Education and Human Brain Development." In attendance were scientists from Chile, France, Germany, Holland, Spain, the U.K., and the U.S. (Hirsh-Pasek and Bruer 2007). The author has had the privilege of presenting several two-day workshops in Chile: in Santiago (January 2008) and in Vina del Mar (January 2009). Audiences in both cities consisted of pre-K-16 teachers eager to apply BBL techniques in Chilean schools and colleges. They were receptive to both the academic interventions and the focus on the emotional climate of a classroom.

Many teachers and researchers in the U.K. are investing time and interest in BBL. Howard-Jones (2008) writes, "In a recent survey of teachers, almost 90 percent thought that knowledge of the brain was important, or very important, in the design of educational programmes" (p. 6). Pickering and Howard-Jones (2007) discuss how many educators already use education initiatives linked to the brain. Those include teaching and learning approaches, learning styles, emotion and learning, educational kinesiology, and ideas based on research in cognition and neuroscience.

Clearly, the door is now open: educators and neuroscientists from around the world need to continue working together to bring education the findings from neuroscience that are most relevant and applicable to teachers.

The remainder of this article explains the idea of building a "Learning and the Brain Community." This type of "community" is based upon two principles: (1) creating a learning atmosphere that

intentionally welcomes and accepts all learners and (2) using effective, research-based academic BBL strategies to enhance student learning. Teachers and principals around the globe could implement such a learning community.

### **Building a “Learning and the Brain Community”**

The big idea is to strive *intentionally* toward creating a cohesive “community of learners.” In either a classroom or a school of that nature, *everyone* must be convinced of the importance of “buying into” the learning community. In such a place, all students and all adults are respected and cultural differences are valued (Berger 2003; Dwyer 2002). Goals and expected outcomes should focus on both the academic and the emotional aspects of learning. Wolfe and Brandt (1998) have stated that for academic learning to take place, students need to feel safe and challenged in a classroom with an emotional climate based upon respect. This notion is supported in the neurological research: Goleman (1994, 2006); LeDoux (1996, 2002); and Zull (2002) explain the neurological phenomena that take place inside students’ brains when they feel unsafe in a classroom (like someone in the wilderness). If the amygdala, located inside our limbic system, perceives the learning environment as “unsafe,” it will essentially shift the blood and oxygen in the brain into a “flight or fight” mode, making it impossible for a student to learn content.

Ideally, all members of a school community, including administrators, teachers, specialists, paraprofessionals, bus drivers, lunch aides, and custodians, participate in a learning community. Building a Learning and the Brain Community is a year-long commitment. During the academic year, a continual focus should be kept on the goals and objectives created together by the community members. Monthly or bimonthly meetings are needed to build and maintain this type of learning community (Berger 2003).

Agenda items for the first few meetings could include (1) sharing a vision of the learning community and (2) reading and discussing books such as *An Ethic of Excellence* (Berger 2003); *Spirit Whisperers* (Moorman 2001); and *Teaching with the Brain in Mind* (Jensen 1995/2005). Professional participants will also benefit from taking workshops or university classes that focus on the application of research-based BBL strategies.

Once adults understand the big BBL community concepts, they can begin to design and implement specific BBL strategies. The remaining monthly learning community meetings can be devoted to teachers sharing the results of their academic and emotional work in their classrooms. Teachers need scheduled time to plan and

develop their new BBL lessons. I recommend that teachers share BBL lessons with one another. In an ideal Learning and the Brain Community, teachers strive to support each other's efforts and provide constructive feedback on each other's BBL lesson plans: collaboration is the key to schoolwide success (Berger 2003). Students who witness cooperation and support between the teachers in their building are more likely to imitate such behaviors with their classmates.

Once the adults are ready, *students become the real focus of their work*. Students need to understand that their roles as members are essential to the success of the learning community. Students must be shown how to invest emotionally in becoming a part of a pluralistic environment free of sarcasm, ridicule, and prejudice. Students need to be taught to be proud and supportive of others' accomplishments. Moorman (2001) explains that classrooms must be places where students with diverse backgrounds and interests can be proud of others' talents and accomplishments.

Students are expected to produce their best work. Students' self-esteem increases when they can see their accomplishments and understand the value of producing their highest-quality work. Caine and Caine (1994) emphasize that the brain's search for meaning is deep and personal: human brains are constantly seeking depth and meaning. In a learning community, Berger (2003) describes an atmosphere in which everyone is expected to value genuine effort and quality work. Student work is always on display, both at the school and in the community at large.

Students are taught to respect their teachers and one another. Moorman (2001) points out the importance of teaching students responsibility for their own actions. In his chapter the "Principle of Personal Responsibility," he discusses ways to help students think through their actions and choices. Students are held accountable for their role in the learning process regarding behavior and academic work; they are led to become successful thinkers and learners.

In essence, students learn to become members of a society that expects hard work and collaboration and that values the opinions of every member. An entire school that embraces these concepts will be able to help make the world a better place. Students who receive the same messages year after year will internalize them. When those students transition from school, they will take their values with them into the world at large.

The next section provides a research-based BBL strategy that teachers around the world can implement with diverse learners in pre-K–16 settings.

## Use of Multiple Intelligences in Designing Lessons and Delivering Content for Pre-K–16 Students

The theory of multiple intelligences provides a framework that teachers can use to create lessons that will reach all learners. The eight MI's include verbal-linguistic (word smart); logical-mathematical (math smart); spatial (picture smart); bodily-kinesthetic (body smart); musical (music smart); naturalistic (nature smart); interpersonal (people smart); and intrapersonal (self smart). There is a likelihood of an existential intelligence as well (Gardner 1998). Gardner contends that although all people have each MI in their brains (they are, after all, brain based), each person's compilation of MI strengths is different. Most people have a range of strong, moderate, and less-developed multiple intelligences. (Readers unfamiliar with the multiple intelligences are referred to a recent book by Thomas Armstrong [2009].)

Surveys and observations have found that most teachers typically utilize only *some* of the nine MI's in their classrooms—and the ones that they use the most often usually constitute their strongest multiple intelligences (Connell 2005). Such teachers are most likely to connect with students whose learning styles resemble their teaching styles, but not with those whose learning styles vary greatly from theirs. For example, teachers with strong visual, spatial, and bodily-kinesthetic brain-based MI's are likely to provide students with wonderful hands-on activities; however, they most likely do not provide students enough verbal explanations to meet the needs of students whose strength is verbal-linguistic. Accordingly, teachers who include all the MI's in their lessons during the day will be able to connect with the diversity of learners found today in classrooms around the world.

Simply put, teachers can begin to use brain-based learning techniques by making sure that they use all nine multiple intelligences during their instruction and assignments each day. Gardner (1983) notes that it is not necessary to use all nine MI's in each lesson; however, a good global goal for teachers is to plan to use all MI's during the course of the day.

Connecting MI's with our Learning and the Brain Communities, teachers will benefit greatly during the monthly meetings by sharing ideas and findings from their use of the various multiple intelligences. Other research-based BBL strategies that can be implemented in the global communities include: *differentiated instruction* (Tomlinson 1999); *multisensory* approaches to reading, writing, and math (Fast ForWord; Orton-Gillingham; Wilson Reading System); *learning style* approaches (Connell 2005; Frender 1994); and *left brain, right brain*

strategies (Connell 2005; Gunzelmann and Connell 2006; Springer and Deutsch 2001). Interested readers are encouraged to read those books to facilitate their understanding of more-effective BBL strategies.

## Conclusion

During the past twenty years the field of brain-based learning has grown tremendously. It is reasonable to expect that its research and applications to teaching and learning will continue to expand in the United States and in many countries around the world. The newest MI brain research has threefold advantages: first, it provides educators access to brain research to make academic brain-based connections to teaching and learning. Second, it allows educators to design classroom and school environments that accommodate a growing diverse group of student learners. Finally, it is becoming clear that BBL research and strategies provide a solid foundation for educators around the world to create successful Learning and the Brain Communities.

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