Brain-Based Learning: A Reality Check

Neuroscience has much to offer our understanding of teaching and learning. But we must be cautious about taking research out of the laboratory and into the classroom.

We’ve been hearing a lot about connections between the brain and classroom strategies. But what do we actually know? Educators who explore the link between brain science and teaching and learning must be cautious and prudent in how they interpret, and ultimately use, research.

Those of us in education who study basic neuroscience research try to match it with data from applied psychology or cognitive science. When we find multiple studies, with good samples and clear evidence, we point them out to other educators. We don’t say, “Brain research proves…” because it does not prove anything about educational practice. It may, however, suggest a particular pathway.

Complaints About Brain-Based Learning

My positions on the basic complaints about brain-based learning follow.

Some people often misrepresent the findings. This criticism is genuine. Many well-meaning educators believe that hearsay or a single study justifies a certain classroom strategy, even without evidence that it does so. Educators who use or quote research should know what makes a good study; who is funding it; what the reputation of the researcher is; how the study is designed; and what the implications of, and the constraints on, the findings are. A little information can be dangerous. To be accepted as professionals, educators must know their stuff.

No body of brain-based research justifies every strategy of good teaching. In fact, most of what passes for good teaching is a collection of basic psychology and common sense refined by trial and error. New findings, however, can steer all of us in more productive directions.

Educators should say this: “These studies suggest that XYZ may be true about the brain. Given that insight, it probably makes sense for us, under these conditions, to use the following strategies in schools.” This approach, which is cautionary and not causal, sticks with the truth. Valuable, new studies offer insights suggesting that certain actions seem to make good sense. It’s a bad idea to base a school on brain research alone. Schools must also consider budgets, goals, resources, community interests, local culture, and standards. However, schools that ignore brain research are being equally reckless.

There is nothing new in this approach. When people say that good teachers have been doing this for years, they either are very young or have short memories; only 35 years ago, good teaching was defined by all-lecture, content-laden classes and quiet students sitting still at their desks. It’s true that through the centuries, teachers have been using brain-compatible strategies, but not because they knew much about the brain. They were probably using collected, refined wisdom. But it’s also true that if educators don’t know why they do what they do, their actions are less purposeful and professional. And some of these notions have led to bad teaching.

Here’s a list highlighting research that we can apply in the classroom and topics that have important implications for learning, memory, schools, and staff development:

- The social brain: how interactions and social status affect hormone levels
- The musical brain: how musical training influences the brain and behavior
- The hormonal brain: how hormones can and do affect cognition
- The moving brain: how movement influences learning
- The plastic brain: how to enrich the brain and what seems to rewire it
- The spatial brain: how space, relational learning, and recall work
- The attentional brain: how the prefrontal cortex drives attention and deficits
- The emotional brain: how threats affect memory, cells, and genes
- The adaptive brain: how distress, cortisol, and allostatic states influence learning
- The patient brain: how time has a role in the learning process
- The computational brain: how feedback plays a role in forming neural networks
The artful brain: how the arts affect the brain and behavior
The connected brain: how bits of brain information circulate throughout the body
The developing brain: how to optimize the value of early years by knowing what to do and when to do it
The hungry brain: how nutrition has a role in learning and what foods are best
The remembering brain: how our memories are encoded and retrieved

Basic neuroscience research, which is usually done at the molecular, genetic, or cellular level, may soon have potential applications in school. For example, the discovery that the brain can and does grow new cells (Eriksson et al., 1998) supports not giving up on children with damaged brains. The study showing that these new cells become highly functional is just as important (Markakis & Gage, 1999).

Can we help a student with a disability make more connections or grow new cells? Two studies suggest there’s hope: One shows that educational challenge seems to grow more dendrites (Jacobs, Schall, & Scheibel, 1993); the other shows that running grows new cells (van Praag, Kempermann, & Gage, 1999). Does this information mean that schools should mandate challenging academics and physical education programs? These studies are insufficient by themselves, but when we combine them with other studies on social, emotional, or cognitive benefits, we can make a strong case. Because of the complex variables involved, it’s irresponsible to say that “brain research proves” that a better learner will result.

Educators need to combine the findings of the brain-mind field with those of other fields to diversify and strengthen the applications. Neuroscience is not the only source for research; it’s an important part of a larger puzzle. When we synthesize findings in neuroscience with those in sociology, chemistry, anthropology, environmental studies, psychiatry, psychology, education, and therapy, we get powerful applications. The brain is what we have; the mind is how we use it.

We now know enough about the brain to justify specific strategies that only a few years ago were just good ideas without scientific basis. Here’s an example. We have powerful evidence that embedding intense emotions—such as those that occur with celebration, competition, or drama—in an activity may stimulate the release of adrenaline, which may more strongly encode the memory of the learning.

More Criticisms
Brain research changes too rapidly to be of value. Every dynamic field, such as medicine, technology, genetics, and communications, is changing fast. The computer bought five years ago is considered old today. But it worked when needed. A new computer may be faster, but it doesn’t invalidate the old one. The same attitude is helpful in brain research.

Let’s say that a district influenced by the Mozart effect—listening to Mozart’s music enhances learning—is deciding whether an early music program should be optional or mandatory. The district will have to find out about the impact on emotions, memory, cognition, and social skills as well as costs and results from school studies.

In light of critics’ efforts to debunk
the theory, the background story is worth telling. The studies by the original researchers, Shaw and Rauscher, showed only a slight enhancement of spatial-temporal reasoning (Rauscher, Shaw, & Ky, 1993). They believed that music might have other effects (and it does), but never claimed that listening to a few minutes of Mozart would turn someone into an Einstein. The studies that could not or did not replicate this effect were missing the real gems.

In all the hoopla about the Mozart effect, people often miss the lesser-known studies that demonstrate that music training enhances memory (Chan, Ho, & Cheung, 1998) and that music can physically change the brain (Schlaug, Jancke, & Pratt, 1995; Schlaug, Jancke, Huang, Staiger, & Steinmetz, 1995; Monaghan, Metcalfe, & Ruxton, 1998; Pantev, Oostenveld, Ross, Roberts, & Hoke, 1998). Early, long-term music instruction does have a positive impact on learning, memory, and intelligence (Rauscher, et al., 1997). Educators should focus on those studies, not on the 10-minute magic-bullet miracles.

Consultants are trying to capitalize on the brain-based learning movement. Most consultants and staff developers in this field try to stay abreast of developments. They qualify their statements and stick to the truth.

Unfortunately, some teachers and consultants stretch the truth, avoid doing the research, mislead teachers, and make false claims about what brain research says and does not say. The peer-review process should make these presenters aware of what they’re doing and encourage them to upgrade the quality of their talk—or find another profession.

We all share the same mission. We want to make positive, significant contributions to learners everywhere. And because each learner is unique, we need many shapes, sizes, formats, and packages to successfully appeal to each one. So far, we’ve found no magic bullet for learning.

One Last Complaint

Brain-based learning is confusing; one person says one thing, and another says the opposite. We need better sharing so that we are all reading from the same page. Many ill-informed educators are still confused about some learning basics.

Myth: Early childhood experiences cause our synaptic count to multiply rapidly. Enriched classrooms, therefore, nistic to the brain.

Reality: The brain strengthens learning through repetition. Repetition is bad only when it becomes boring. A good teacher knows many creative and fun ways to review.

Myth: School environments primarily determine learner success.

Reality: Many factors influence learner success, including parents, peers, genes, trauma, nutrition, and environment. Although we have no way to estimate the singular impact of an individual variable, we can safely say that school environments are important.

Myth: Most learners use only 5 to 10 percent of their brain.

Reality: We have no objective evidence that this is true. We probably use most areas of our brain daily. Increases in creativity or productivity can come from doing the right thing rather than from simply doing more.

Myth: Emotions and intelligence are separate.

Reality: Although emotions and intelligence may originate in separate places in the brain, their paths usually cross in the orbitofrontal cortex. So, in a sense, they are inseparable.

Myth: Mozart wrote the best music for enhancing learning.

Reality: Recent studies show that many kinds of music enhance learning. But the impact of music depends on whether we want an arousal effect or long-term cortical changes, enhanced memory or spatio-temporal reasoning.

Myth: Learning styles and multiple intelligences are brain-based theories.

Reality: These theories make good sense on the basis of what we know about the brain. But they address the uniqueness of the brain. But they were developed before recent discoveries in neurology and have stronger roots in psychology and social science.

Myth: Getting the right answer quickly is best.

Reality: Given the value of trial-and-error learning, we believe that learners who are neither the quickest nor the slowest are more likely to be better, more reflective thinkers.
Myth: An enriched environment contains posters, mobiles, manipulatives, and music.

Reality: Enrichment comes more from the process than from the structure. Challenge, feedback, novelty, coherence, and time are crucial ingredients for rewiring the brain. Given a choice between a pretty classroom and a good teacher, a parent should take the good teacher. Ideally, though, a student should have both.

Myth: Covering more content in each hour is better.

Reality: Students need time to digest, think about, and act on their learning; connections need time to strengthen. Therefore, adding more content makes little sense. Each learner probably has an ideal number of ideas that he or she can learn in an hour. This number is based on the subject matter’s complexity and novelty and on the learner’s background, motivation, and learning skills. Only language acquisition is helped by exposure to more content in an hour.

Myth: We now know how best to assess learning.

Reality: We still don’t know how to assess much of what we learn, and we don’t know a great deal about the roles of volition, subject affinity, and mental models in learning.

Myth: More synapses mean greater intelligence.

Reality: We have no evidence that this statement is true. The research on this topic is sparse and, at times, conflicting.

Myth: Everyone can learn and can meet high standards.

Reality: The first half of this sentence is true. The second half is fraught with problems. If we count all the students with some kind of brain dysfunction (depression, brain insults, attention deficit disorder, drug use, dyslexia, obsessive-compulsive disorder, distress, alcohol, trauma, and so on), we’ll have from 20 to 60 percent of a school’s population. Learners with healthy brains can reach high standards. Many students have learning problems. With sufficient resources, we can reach some of them; others may never achieve their potential.

Myth: The right brain is creative; the left brain is logical.

Reality: The right brain processes spatial information and works randomly and with wholes (the gestalt). None of these attributes guarantees creativity. The left hemisphere is better with sequencing, language, parts, and creating internal dialogues (interpreting events). Any logic produced is not a result of a structure-function relationship. The left brain and the right brain have clear anatomical and functional differences. But whether this knowledge has much applicable value is questionable.

The Future of Brain-Based Learning

Brain-based learning is neither a panacea nor a magic bullet that will solve education’s problems. It is not yet a program, a model, or a package for schools to follow. One critic of brain-based learning said that it will be at least 25 years before the benefits of brain research reach the classroom. I’ll cite one example to show why I disagree. Neuroscientists Michael Merzenich and Paula Tallal developed FastForWord, a reading-improvement product that applies discoveries in neural plasticity to change the brain’s ability to read the printed word. The benefits are already helping many students.

Educators should not run schools solely on the basis of the biology of the brain. However, to ignore what we do know about the brain would be irresponsible. Brain-based learning offers some direction for educators who want more purposeful, informed teaching. It offers the possibility of less hit-or-miss instruction in the classroom. We have learned about the impact of the environment on learning, the roles of trauma, and the effects of distress and threat. With additional clarity from research, brain-based approaches may suggest better options for anyone who struggles with learning.

We are in the infancy of brain research. But dismissing it as faddish, premature, or opportunistic is not only shortsighted, but also dangerous to our learners. Of course brain research seems hazy, confusing, and contradictory. It’s new! At this early stage, rejecting brain research would be like calling the Wright brothers’ first flight at Kitty Hawk a failure because the plane flew only a few hundred yards.

The future belongs to those with vision who not just grasp the trends, but who also understand their importance. We are at the beginning of the field of brain research. Integrating brain research with our everyday lives is something that we must try to do.
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References

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