



The Myth of Left- vs Right-Brain Learning

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It has been more than a decade since researchers began calling for caution over certain brain-learning strategies supposedly based on neuroscience. Nonetheless, misconceptions still persist. This paper explores the myth of hemispheric dominance in learning, and provides advice to educators, parents, and others in the field. It has long been a popular view that some people favour one hemisphere over the other and that such cognitive preferences have implications for learning. Scientific research into the structures and functions of normal brains, both as they develop and on into adulthood, has demonstrated the fallacy of this belief. As such, interventions and products that target left- or right-brain learning should be treated with caution. It is unlikely that these interventions successfully target one hemisphere over the other, or that they improve learning outcomes in ways that depend on such perceived differences. Educators, parents, and others in the field are urged to inform themselves about the fundamental features of neuroscience, and to look for significant independent research that supports specific learning programs. While many school-based programs in mainstream settings are supported by research, school leaders, teachers and parents should take into consideration the quality of evidence available, the purpose of the intervention and how the intervention or program may fit the needs of the students and context.

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Introduction

Neuroscientists have long known that brains are ‘plastic’: If they were not, learning would occur neither during development nor maturation (Blakemore & Cooper, 1970; Ismail, Fatemi, & Johnston, 2017; Kolb, 2018; Munte, et al., 2002). As such, many educators have, for some time, looked to neuroscience to help inform their practices. Despite that recognition, and as Howard-Jones (2009) points out, “Decades without formal interdisciplinary communication have allowed many unscientific ‘brain-based’ ideas to become established in the classroom” (p. 550). While some of those ‘ideas’ have been developed by well-intentioned, classroom-based teachers and school leaders, an industry that offers products and learning programs that claim neuroscientific authenticity has also grown.

Discriminating between ideas and programs that have scientific merit and those that don’t can be difficult. As a consequence, researchers have urged that so-called ‘brain-based’ learning strategies be approached with caution (Goswami, 2006; Howard-Jones, 2009; Dekker, et al. 2012). The challenge in that approach is, of course, that myths still prevail, as do the so-called learning strategies based on those myths. The aims of this paper are (i) to highlight the myth of brain-dominance in learning, and (ii) to provide advice to educators, parents, and others on how best to avoid programs and interventions based on this myth.

Hemispheric Asymmetry

Brains are among the most complex structures in the known universe. One hundred billion neurons are distributed across the two hemispheres of the brain, with the hemispheres being located on either side of our bilateral mid-line. Joining the two hemispheres is a massive bundle of fibres called the corpus collosum. While the hemispheres are symmetrically distributed within the brain, one on each side, they are morphologically asymmetrical, and develop asymmetrically (Levin, 2005; Zaidel, 2001).

Perhaps unsurprisingly, in that context, the two hemispheres function asymmetrically as well. That is, each hemisphere has functions that are not similarly represented in the other. Almost



all brain processes are undertaken by specialised groups of neurons in identifiable and predictable locations. Certainly, all clusters of neurons are massively interconnected with other parts of the brain, but specific areas are “tuned” for specific tasks and functions. Those areas develop at specific times during maturation, and damage to an area can lead to a deficit in whatever task it is that the neurons in that area do.

While some areas are bilaterally represented – the same place in each hemisphere exhibits the same types of functions - the tuning of neurons in each hemisphere typically is not. For example, visual processing occurs at the back of the brain, in the occipital lobes (put your hands *behind* your head and your palms are resting above the occipital pole of each hemisphere). Both the left and right occipital lobes process visual information, but the left hemisphere processes information from the right visual field, and the right hemisphere processes information from the left. That same pattern is seen for other functions too – the left frontal lobe controls the right side of the body, and so on.

In addition to those processing asymmetries, more specific hemispheric specialisations, or ‘performance dominances’ occur. That is, there are examples of brain processes that occur predominantly in one hemisphere, and much less so, or not at all, in the other. The most salient example is language. In 1865, Paul Broca first noted that lesions in the left hemisphere affected language ability in stroke patients. A hundred and fifty years later, functional magnetic resonance imaging studies have unpacked the complex nature of language specialisation. In 95% of right-handed people, language is processed predominantly in the left hemisphere. For the other 5%, language processing seems to be distributed bilaterally between the hemispheres. In left-handers, the left-hemisphere performance dominance in language processing is reduced to around 75%, while language is processed bilaterally in 14% (Pujol, Deus, Losilla, & Capdevila, 1999), and a weak right-hemisphere predominance is found in the remaining 11%.

While various other functions have, over time, been cited as being specific to the left or the right hemisphere, there is little evidence that any normal cognitive functioning occurs in only one hemisphere or the other. The corpus collosum provides a connection that ensures massive data-exchanges between the two hemispheres. Activation of neurons in any one location in one



hemisphere will lead to activity in many other regions of both hemispheres as well. While diseased or damaged brains may function differently, in well-functioning brains, the notion that one hemisphere can work independently of the other is false.

So... people really aren't right-brain or left-brain thinkers?

While a simple model of hemispheric specialisation for learning is attractive as a heuristic, the notion is a fallacy. There is currently no substantial empirical evidence to suggest that people use their left or right brain more for thinking (Lindell & Kidd, 2011). It is certainly true that some people tend to be stronger in analytical types of thinking, others are stronger in creative thinking, and some are strong across multiple domains. But, there are no good grounds at all to associate these traits with the predominance of one hemisphere over the other (Nielsen, Zielinski, Ferguson, Lainhart, & Anderson, 2013).

That means that despite tuning asymmetries and despite hemispheric specialisations, there is no research to date that has demonstrated that individuals are left- or right-brained learners. In fact, the idea of right- or left-brain learning is possibly one of the oldest and most pervasive neuromyths circulating today.

Origins of the left-brain/ right-brain learning myth

The origin of the myth of left/right-brain learning is unclear, but it may have emerged from the scientific literature on *split-brain* patients. Split-brain surgery was initially developed in the 1940s as a treatment for seizures. The procedure involved severing the corpus callosum, the massive neuron pathway connecting the right and left hemispheres, and offered one of the first opportunities to study interactions between the hemispheres.

The procedure which is now replaced by more refined protocols allowed researchers at that time to study a small population of split-brain patients (Gazzaniga, Bogen, & Sperry, 1962; Sperry, 1961; Sperry, 1968). Gazzaniga (2008) has noted that split-brain surgery was successful in decreasing seizure activity and, happily, produced no instances of 'split personalities'. He also noted that while cutting the corpus callosum produced little or no change



in cognitive activity in the ‘dominant’ left hemisphere of most patients, the right hemisphere in split brain patients often showed a significant decrease in activity.

Of course, cutting the corpus collosum prevents language processes accessing the right hemisphere, which among other things, specialises in making perceptual distinctions, and processing and managing emotions (Gazzaniga, 2008). In other words, being able to articulate ideas *looks* like a function of the left hemisphere, and handling perceptions and emotions *looks* like a function of the right hemisphere. In normal, healthy individuals, that distinction is obviously incorrect and based on gross simplifications of complex interactions between the hemispheres. Nonetheless, it may be one source of the myth of left-brain/right-brain learning styles.

Another source of the left/right brain learning myth may relate to misconceptions surrounding hemispheric dominance. As explained above, hemispheric dominance relates to the sites of origin of specific processes within the brain. The same term has colloquially become associated with other functions; left or right handedness or what side of your body you choose to sleep on, for example. In reality, it is difficult-to-impossible to identify by observation any types of hemispheric dominance, and that is likely because of the vast amounts of information being exchanged between the hemispheres at any one moment and all cognitive processes depend on the coordination of complex interhemispheric processing (Doron, Bassett, & Gazzaniga, 2012).

Brain-based Education Based on Evidence

While it has been 70 years since the first split brain surgery and despite the almost exponential growth in brain research and neuroimaging studies, there is a considerable time lag between findings generated by ‘pure’ research and the implementation of that research into teaching practice. That situation is not unique to education. The estimated lag in health research, which is the time from initial research to practical healthcare solutions, is 17 years. In the case of education, we can expect the lag to be much greater (Balas & Bohen, 2000).



One reason for that is there are a number of steps required to convert brain science into impactful teaching strategies. Brain imaging or functioning needs to be linked, unambiguously, to observable and teachable behaviours and skills. Those behaviours and skills need to be linked to valuable learning outcomes, and then those learning outcomes need to be implemented into curriculum. Each step requires professional expertise, and without someone explicitly and systematically undertaking each of those steps, and supporting each transition with scientifically meaningful evidence, myths arise and mistakes can occur (Donoghue & Horvath, 2016; Horvath & Donoghue, 2016). For busy school staff, gaining the technical and scientific expertise to translate the most up-to-date neuro-jargon into useful practices and knowledge in the classroom can be difficult even if they do have the time to work through the process. As consequence, teachers and other educators can, despite good intentions, mistake misconceptions and outdated theories for scientifically-based innovations.

Morris, Wooding, and Grant (2011) note that the time between initial research and useful practice does have the benefit of providing an opportunity to ensure the efficacy of any new programs or approaches. But for that time to be an advantage, parents, schools, interested others, and skilled, reputable researchers have to undertake some due-diligence. That is, they need to carefully explore or conduct research investigating the claims made by *brain training* programs or interventions (see, for example, Shipstead, Hicks, & Engle, 2012; Stong, Togerson, Togerson, & Hulme, 2010). Educators should find opportunities to partner with researchers to explore the efficacy of new programs and approaches. Parents and schools interested in exploring the efficacy of new programs or approaches should carefully eschew marketing brochures and websites to explore more carefully the claims of brain-based training programs. An easy way to start is to look at how recent the science is behind the program. If little time has passed, it is likely there have been little corroborating science, and certainly little chance that the proposed programs have been rigorously tested.



What else do teachers and parents need to know?

Many mainstream educational programs are of a high standard and there are a number supported by sound research. Nonetheless, parents and educational professionals should be wary of educational programs that lack independent empirical evidence or that rely on the use of personal stories and testimonials (Bowen & Snow, 2017). Some programs and products muddy the waters with assertions like “neuroscience proves that our program grows your brain” or “this program makes your child’s brain light up”. Whether, or not, such claims are true, they are something of a distraction from a couple of important questions: The most important question we can ask of any program that is supposed to improve student learning is “Does this program improve student learning?” And the next question must be “Where is the science to show it is so?” Those questions may sound obvious, and they are, but they often get lost in irrelevant claims about supposed neural mechanisms. In the end, it matters little whether brains get bigger or smaller; it matters little whether whole brains are more, or less active. What matters is the impact of the learning mechanisms – do learners learn more? Or do they learn more effectively? Is their retention better? And do they enjoy the learning process (a critical step in becoming lifelong learners)? And, if they do, show us the evidence for that. Not someone’s claim, but real, and valid data.

There are many excellent, expert researchers working to discover strategies that help make learning more effective. A few minutes on Google Scholar, for instance, will reveal how much formal work has been done to study or validate strategies, as well as the outcomes of that work. A key message here is that if you type in the name of a commercially available program and find nothing, then it is wise to be cautious about accepting its promises or effectiveness (Bowen & Snow, 2017).

Useful guidelines are available for parents and educators in this area, especially for those raising or working with children with learning difficulties or developmental delays (Bowen & Snow, 2017; Stephenson, Wheldall, & Carter, 2017). Parents and schools need to do their own homework to determine whether the broad claims made in a program’s promotional materials



are indeed true. They should ensure that interventions and strategies fit with their unique needs and context, and suit the purpose at which they are aimed at.

How to Start?

Parents should be aware that early childhood is a time of rapid cognitive development and growth. Brains are born with a full complement of undifferentiated neurons, and require normal experiences to drive the development of processes and pathways.

The good news is that parents can drive development simply by providing rich and stimulating environments and experiences. Those experiences do not need to be complex or expensive. Parents can give their children a solid foundation for future learning by helping their children build positive and supportive relationships with caregivers (including teachers); giving them opportunities to play, socialise, read books, and listen to nursery rhymes; exposing them to languages and music; giving them opportunities to learn social and emotional competencies; providing a healthy diet; and keeping kids physically active (Allen, Kern, Vella-Brodrick, Waters, & Hattie, 2018; Allen, Vella-Brodrick, & Waters, 2017; Barreto, de Miguel, Ibarluzea, Andiarena, & Arranz, 2017; Grove, Reupert, & Maybery, 2015; Riebschleger, Grove, Cavanaugh, & Costello, 2017).

Once kids reach formal learning settings, even as early as preschool, qualified teachers and educators provide children with age- and stage-appropriate opportunities to develop into functioning adults. Children who are able to embark on a safe and healthy developmental trajectory, void of neglect, trauma or abuse, and surrounded by caring, trusting and nurturing relationships are in a good position for healthy brain development to naturally occur.

Conclusions

Despite its fallacy, the myth of left- or right-brain dominance is problematically enduring. Parents and educators should be extremely cautious when approaching educational programs, interventions, phone apps, or books that claim to stimulate one hemisphere in preference to the other (e.g., right-brain approaches).



Similarly, the claim that a program or resource is “whole-brain” or “brain-based” in its approach should be a red flag for educators and parents, especially in the absence of rigorous scientific research. This is because *all* learning environments and experiences drive the “whole-brain” since it is the brain that learns.

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