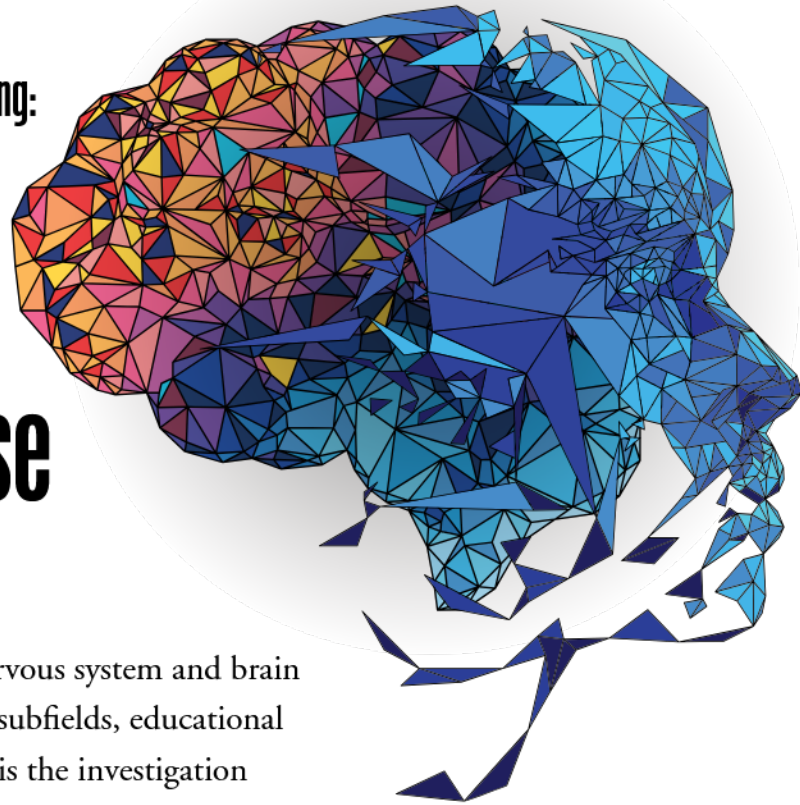


Using Neuroscience Research to Guide Your Parenting:

Finding the Signal and Ignoring the Noise

By Erin M. Miller, Ph.D., and Pamela R. Clinkenbeard, Ph.D.



The field of neuroscience, which is the study of nervous system and brain structure and function, is booming. Of its many subfields, educational neuroscience (aka “mind, brain, and education”) is the investigation of the educational applications of brain studies, including research on intelligence, creativity, and giftedness. But what does brain research really tell us about parenting and teaching gifted and talented students? Is there insight about how to be the right kind of parent for a gifted child?

This article will touch on what we know (and, just as important, what we don’t know) from research in educational neuroscience, and what that research means in practice for parenting gifted students. Along the way we will consider how gifted children’s brains may be different, what “brain-based” curriculum and programming means, how the concepts of neuroplasticity and appropriate challenge are critical for talent development, and what experts generally agree is needed for optimal brain development.

Are gifted children’s brains different than average?

Yes, by definition. The brain is the primary source of differences in cognitive ability, creativity, leadership, and all other areas of human endeavor. Those differences

result from a combination of genetics and experiences. Researchers have looked at differences in structure (for example, areas of the brain that seem to be associated with specific talent domains) and function (speed and efficiency of processing information) and often find small but significant differences between gifted students and average achievers. However, note that while the brain affects learning, learning also affects the brain. The experiences that children encounter can cause changes in both structure and function of the brain. But what kinds of experiences? What is wonderful and quite reassuring is that for the most part, parents simply need to respond to their children’s interests and support them in finding their passions.

What do we know (and not know) about the brain and gifted education?

New technologies and methodologies for peering into the “black box” of human cognition and emotion are proliferating rapidly. When an assertion or piece of advice is supported with claims of being “brain-based,” people often have greater trust in the advice. Publishers know that if they place a picture of a brain on a book cover, it will sell better. However, the over-application of brain research to education practice is a well-documented problem.¹ Much “brain-based” parenting and teaching advice is not actually based on neuroscience research. That doesn’t mean that it’s bad advice; in many cases, direct brain research confirms what experienced parents and teachers already know. But in

other cases, neuroscience has shown that commonly used strategies and practices actually don't work in the way that most people assume that they do.

This brings us to “neuromyths” (See pages 22-23). There are a number of popularly accepted facts about the brain that are simply not true, and some of these beliefs can interfere with practices that support appropriate learning challenge and motivation for gifted children. In some respects, everything is brain-based; there are very few behaviors that do not have their root cause in the brain. However,

if someone tells you that their approach is better than a tried-and-true approach because it is brain-based, it is best to treat that assertion with educated skepticism. We know less about the practical applications from neuroimaging studies than you might think, although researchers are learning more every day.

What do we know to help parents right now?

This is not to say that neuroscience research has nothing to offer parents of gifted children. One of the most relevant

findings is the ability of the cerebral cortex to change due to experience. Neuroscientists call this “brain plasticity.” What this means is that with every experience, the cerebral cortex changes both chemically and structurally. One influential study examined what happened in the brain when people learn to juggle. Scientists know the basic layout of the cerebral cortex and which areas are generally involved with what major functions. When people learned to juggle, the area of the brain that is involved with manual dexterity and visual perception became denser. As stated earlier, the brain affects learning, but learning also affects the brain.

There are implications of this work for talent development perspectives of giftedness and equity. The work of neuropsychologists shows clear evidence of the malleability of young children's thinking skills—the ability of the brain to adapt and improve. We know from both laboratory and school research that executive function skills can be improved with training. *(Executive functions, such as the ability to focus on relevant information and ignore the irrelevant, can transfer to a wide variety of outcomes that are important for school success.)* Students who are bright but disorganized can improve their organizational skills and perform better.² There are also important implications of neuroplasticity research for equitable gifted programming. One strategy might be to offer high-level, open-ended thinking skill programming and activities to all children at an early age, watching for and developing talents in children who are underrepresented in advanced programming, rather than just trying to identify children who already have skills that are advanced for their age.



COMPLICATED WORLD OF GENETICS VS. ENVIRONMENT

Differences in cognitive ability, like virtually all human characteristics, have a hereditary component and an environmental component. Although researchers can answer questions about trends in large groups of people, it is difficult to answer questions about the relative role of heredity and the environment for any one individual. If a parent and a child are both good at reading, is the child's ability due to genetics or environment? Most likely both. A parent who is good at reading probably enjoys it and, as much as possible, creates a reading-rich environment for the child.

The Necessity of Appropriate Challenge

There is a huge caveat to the concept of neuroplasticity: it requires appropriate challenge. In study after study it has been found that new neural connections are not formed unless the material encountered is

difficult enough to require some work and struggle on the part of the learner. Areas of the brain grow denser only when the task at hand is challenging.³ A weight training analogy is applicable here. Your muscles do not get stronger if you just keep lifting weights that you can already lift easily; you must continuously lift heavier weights to challenge yourself.

It is hard to overstate the importance of appropriate challenge for growth, yet it is the main stumbling block for parents who are begging schools and teachers to make sure that their gifted children actually learn something new. Parent groups and others who advocate for gifted education might want to add this to their talking points for school administrators and legislators.

Optimizing Your Child's Brain Development

There is considerable research agreement on a number of factors related to optimal brain development in children, especially with regard to the foundation that should be built to support that development. The Aspen Institute lists five physiological “preconditions” for optimal brain development and learning: quality sleep, adequate nutrition (and low exposure to toxins), physical activity and exercise, emotional and social well-being and safety, and cultural well-being and “belongingness.”⁴ For learning tasks, there’s nothing wrong with brain games and “brain training” programs, but neuroscience research indicates that they don’t really transfer to other skills. Playing a lot of Sudoku makes you better at Sudoku, but it doesn’t make you generally smarter.

Some of the strongest evidence for broad functional improvements in cognitive tasks is actually found in research on physical training. Among research studies presented at recent educational neuroscience conferences, aerobic exercise had some of the largest effects on general cognitive functioning in both children and adults. Anything that increases oxygen to

(Continues on p. 27)

BRAIN TERMINOLOGY: DEFINITIONS AND CONCEPTS

BRAIN—Central nervous system component consisting of the cerebrum, cerebellum, and brain stem.

CEREBRAL CORTEX—Outermost layer of tissue of the cerebrum.

CEREBRUM—Major component of the brain and central nervous system including the cerebral cortex, and structures such as the hippocampus, basal ganglia, and olfactory bulb.

COGNITION—The actions and processes related to acquiring knowledge, evaluating this knowledge, and adapting to the environment and overcoming obstacles by engaging in reasoning.

EDUCATIONAL NEUROSCIENCE—The field that brings together the multiple components of neuroscience to address issues related to education. Also called neuroeducation or “Mind, Brain, and Education.”

NEURONS—The cells of the nervous system, including the brain, that are specialized to carry electrochemical messages. Neurons consist of cell bodies (gray matter), axons (white matter), and dendrites. Messages travel along axons and jump to the dendrite of the next neuron.

NEUROPLASTICITY—The understanding that the brain changes throughout life, and that environmental factors can affect both the structure and the function of the brain.

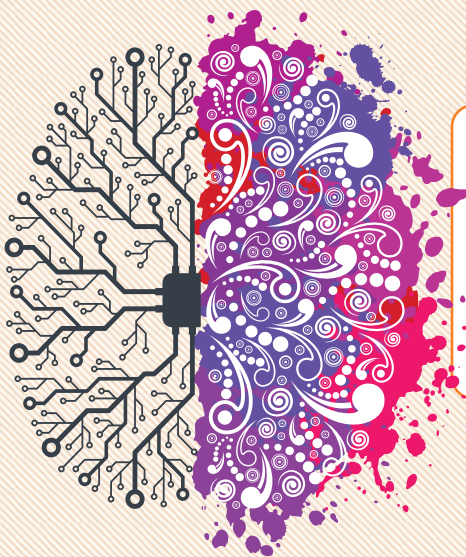
NEUROSCIENCE—Study of the central and peripheral nervous system (including the brain). Domains of study include biological areas like anatomy and physiology, chemical processes, and psychological areas such as development, sensory/perception, and cognition.

NEUROMYTHS

One area of research in educational neuroscience is people’s beliefs about the brain; widespread incorrect beliefs are known as “neuromyths.” Neuromyths tend to be quite persistent in society, including among teachers, and some can interfere with educational practices that support appropriate learning challenge and motivation for gifted students.

MYTH 1: You only use 10% of your brain.

Everyone uses all areas of their brain.¹ One common metaphor is to think about it like your home. You might not use every room every day, but over the course of a month, you probably have used all areas of your house.



MYTH 2: Right and left brained.

A healthy human being is not left or right brained. Different areas of the brain are specialized for different cognitive tasks. However, regardless if one has an affinity for creative or analytical thinking, both sides of the brain are used equally. Individuals do not favor one side or the other, and most tasks use at least some areas on both sides of the brain.²

MYTH 3: The brain does not change after puberty.

The brain continues to change through neural plasticity until death.³ There are periods of development in which learning is easier, but the brain is malleable throughout one’s lifetime.





MYTH 4: Brain training in adulthood increases IQ.

Although one can improve at certain cognitive tasks through practice, the improvement does not appear to transfer to other cognitive abilities.⁴ It is difficult to train the brain past its potential. However, one can certainly underachieve by not seeking to be a lifelong learner.

MYTH 5: The Mozart Effect.

Listening to a specific type of music does not have an effect on intelligence.⁵ However, training in music does change the brain as one develops new skills.

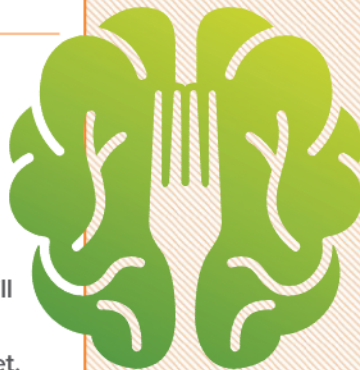


MYTH 6: Learning styles.

According to neuroscience research, students do not do better if instruction is matched only to a single mode of learning (i.e., verbal, auditory, kinesthetic). Instead, while many students have a preferred mode of learning, they learn best when information is presented in many different modalities and using multiple areas of the brain.⁶

MYTH 7: Nutritional supplements can increase intelligence.

There are certainly situations in which malnutrition can inhibit intellectual development. But there is no evidence to suggest that a particular diet will result in greater intelligence.⁷ No amount of nutritional supplementation will enhance development; all that is required is a basically healthy diet.



Endnotes

- ¹ Centre for Educational Neuroscience. (n.d.). Neuro-hit or neuro-miss? Retrieved from <http://www.educationalneuroscience.org.uk/resources/neuromyth-or-neurofact/>
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