

# Nutrition, Health and Safety

## Teachers Doing Brain Surgery From the Inside Out: A Look at Applications of Brain Science for Early Childhood Educators and Parents

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In early childhood education, “everything is 0 to 3”, as the experts say. Clearly, those who know about and care about young children recognize the importance of early education and cognitive stimulation as the best way to grow physically, mentally, and socially healthy children. But do parents and teachers have a broad and confident understanding of the exciting research that underpins the “0 to 3” movement? Do they understand that “a three-year-old child has twice as many (neural) connections as an adult, and that the number of connections could easily go up or down by 25 percent or more, depending upon whether a child grows up in an enriched environment?” (Kotulak, 1996). This perspective on brain science is especially useful to those who would improve the prospects of youngsters from low- and moderate-income homes, those youngsters who would benefit most from a “brain friendly” school environment.

Recently, this author was called upon to provide a series of lectures to teachers around the country, about the impact of brain science on teaching. Following is the text of the address, with additional hand-outs for use in parent workshops.

### Teachers do brain surgery from the inside out

Let’s start this conversation with a paradigm shift. Professors love to write

and talk about paradigm shifts. They are cognitive earthquakes, beginning with an epicenter of research that sends shock waves of teaching and thinking energy around the intellectual network. Here’s the shift. I want you to stop thinking of yourselves as ordinary teachers and name yourselves as “brain surgeons”. Much more important sounding isn’t it? More than that: it is truth. Medical doctors may do surgery by cutting carefully from the outside, but we do operations just as delicate, and without a team or anesthesia to assist us, from the inside out. Our strategies, our words, our vocal inflections, our dispositions in the classroom become the finest or the most deadly scalpels as we manipulate and stimulate cognitive connections. How do we get inside without doing damage? First, we must make the brain accessible by applying research in cognitive science:

There are specific strategies for “Making the Brain Accessible” in such a way as to improve the impact of teaching and the quantity of learning. Brain research isn’t just for neuro-surgeons or cognitive scientists. Brain research is for those who do brain surgery every day, from the inside out: classroom teachers. So, let’s consider some ways to make the brain accessible in our classrooms and in our lives. Beginning with a quiz.

### A Brain Science Quiz for Teachers

Question One: Infants who do not receive intense nurturing and verbal reinforcement during the first six months of life may develop brains that are up to 30% smaller than average.

Question Two: It has been proven that physical exercise results in more and more healthy gray matter in the brain.

Question Three: Scents such as peppermint and spearmint may help students retrieve information from long-term memory.

Question Four: The use of colors such as blue and gray in the classroom may help dyslexic children to read and to lower anxiety.

Question Five: Toddlers who were given piano lessons and who were listening to classical music daily scored significantly higher than other youngsters on tests of spatial reasoning.

Question Six: Studies show that mothers who allow daughters to separate earlier in childhood produce more intelligent daughters, while the reverse is true for sons.

Question Seven: Research from NYU suggests that boys are 50% more likely to be held back in school than girls.

Question Eight: The corpus callosum, the area that divides the brain in half, is 14% larger in girls than in boys.

Question Nine: It takes boys longer to process auditory cues than it does girls.

In early childhood education, “everything is 0 to 3”, as the experts say. Clearly, those who know about and care about young children recognize the importance of early education and cognitive stimulation as the best way to grow physically, mentally, and socially healthy children. Do parents and teachers understand that “a three-year-old child has twice as many (neural) connections as an adult, and that the number of connections could easily go up or down by 25 percent or more, depending upon whether a child grows up in an enriched environment?” This perspective on brain science is especially useful to those who would improve the prospects of youngsters from low- and moderate-income homes, those who would benefit most from a “brain friendly” school environment.

Let's start this conversation with a paradigm shift. Professors love to write and talk about paradigm shifts. They are cognitive earthquakes, beginning with an epicenter of research that sends shock waves of teaching and thinking energy around the intellectual network. Here's the shift. I want you to stop thinking of yourselves as ordinary teachers and name yourselves as "brain surgeons". Much more important sounding isn't it? More than that: it is truth. Medical doctors may do surgery by cutting carefully from the outside, but we do operations just as delicate, and without a team or anesthesia to assist us, from the inside out. Our strategies, our words, our vocal inflections, our dispositions in the classroom become the finest or the most deadly scalpels as we manipulate and stimulate cognitive connections.

Question Ten: The teacher's voice should be considered a musical instrument in instruction, and may affect students' ability to learn material.

Have you tallied your responses? Would many of you be surprised to learn that all of the answers are True? All of this material, and much more is included, along with specific teaching suggestions, in my books, More Than Pink and Blue: How Gender Shapes Your Curriculum (1998) and Beyond Hands-On: Techniques for Using Color, Scent, Taste, Touch and Music to Enhance Learning (1996).

#### An Amazing Quote about the Brain's Capacity

How great is the capacity of the human brain? According to Dr. Gerald Edelman: "If you were to count the synapses in the human brain, at the rate of 1 per second, you would finish 32 million years later" (1992). Amazing. That's some brain, with an almost unlimited potential to create, solve problems, learn, and do. But how do we make that brain power accessible? I'm interested in that question, not just from the expected perspective of teaching, but also from the perspective of the teacher. You have to believe in this stuff and use it and breathe it yourself before you will have the energy and creativity and desire to bring it into the lives of children. How much attention do you give your brain on a daily basis? Is it well fed? Carefully tended? Gently stimulated? Rested? Exercised? Pampered with scent and music? Or is it like your body? Tired? Stressed? Living on junk food? I invite you to consider these

suggestions for making the brain accessible as a personal quest for growth, rest, and renewal as much as a professional one. From a purely selfish position, I am here to tell you that what I have found out about brains has been as good for me as it has for any of my students.

### **Practical Suggestions**

Here are some practical, simple suggestions for making your brain more efficient, your thinking more effective, and hopefully, your students more creative and flexible in their thinking and learning.

### **Recognize the power of early learning to make students smarter**

Much of the powerful research on brain science comes from the study of infants and young children. We now know, for better or for worse, depending on whether you teach four-year-olds or fourteen-year-olds...that earlier is better. For example, breast-fed babies seem to have an advantage of 5 or more points on IQ tests than their formula-fed friends (Anderson, 1999). This may be because breast milk contains perfect brain-feeding proteins and amino acids that cannot be replicated by human hands. This is critical for those who write grants, teach in child-development programs, or who interact with young mothers, and who may be in a position to influence young mothers to consider the importance of breast feeding. Unfortunately, the mothers who are least likely to nurse their infants (low-income

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mothers) are the same ones whose babies would benefit the most.

The impact of early experiences extend beyond nutrition after birth to experiences prior to birth. Increasingly, teachers deal with educational problems that began in gestation, when young brains were influenced by toxins, alcohol, and even medications.

To fully understand the journey of the young brain, teachers should read: "Fertile Minds" (1997), "Your Child's Brain" (1996) and a newer piece:

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"Fragile Brains", (2001). These articles help to channel a cacophony of voices competing for our attention and give a nice graphic organizer to this vast array of new research. Eric Jensen's discussion of the 3 types of dysfunctional brains: the depressed brain, the oppositional brain, and the sluggish brain sheds light on the day to day challenges of trying to teach youngsters whose brains have been subtly, yet critically impaired by stress, mental illness, early exposure to toxins and substance abuse, and poor parenting.

### Learn to Feed Brains

A book that changed my life is called Eat Smart, Think Smart (1996). It seems that foods and vitamins make the brain work smarter, not harder. Have you considered a choline cocktail before a major project or test? Now I'm not talking about hard liquor here, but about juices and vitamins whirled up in a blender to make your brain sing. Have you considered passing out cups of high protein snack mix before and during standardized tests? There's a recipe in my book to help you.

And if you simply want a healthier brain for yourself or your students...what food choices are you making? Here are some familiar foods that students and teachers might not be getting enough of:

- \* Oranges and apples provide rich doses of vitamin C, a powerful antioxidant that keeps the brain from aging prematurely. Plus, we know that the taste and scent of oranges or apples may encourage creative thinking.

- \* Almonds, sunflower seeds, and walnuts are vitamin E rich foods that the brain seems to crave and absorb in increasing amounts as our brains age.

- \* Carrots, broccoli, and greens contain a power punch of Beta-Carotene, which seem to help the brain neutralize oxygen-depleting pollutants and smoke that cross the blood-brain barrier and slow down thinking.

- \* Brown rice, dried beans, and salmon are rich in Thiamin or Vitamin B1. These foods help the brain turn glucose and oxygen into energy...thus making the brain go in high gear...or not.

\* Fish, salmon, tuna, and sunflower seeds are a dose of Niacin or Vitamin B3, which helps the brain produce the neurotransmitters it needs to do its work. Fish in Omega-3 oil also seems to lubricate cognitive functioning and may play a role in curbing brain dysfunction. In another amazing book, Your Miracle Brain (2000), one reads about an Italian medical doctor who claims to have eliminated her son's attention problems by switching his lunch sandwich filling to a daily dose of tuna!

\* Soybeans, eggs, lentils, corn, and whole grains contain pantothenic acid, which provides the brain's source of intercellular energy, moving information from cell to cell.

\* Bananas, rice, wheat germ and even avocados give your brain pyridoxine that is necessary to break down glycogen, which is the primary brain food.

One cannot underestimate the importance of nutrition, especially in the formative early years. The long-term effects of poverty and malnutrition on the developing brain may include permanent damage to the brain's hard-wiring (Brown & Pollitt, 1996). In developing nations, it is easy to see this food-brain connection, but in the U.S., under-nutrition rather than starvation may be the culprit.

### **Set up a Sensory-Rich Environment**

Scents are powerful and easy to use in teaching and learning. In fact, it seems that the Olfactory Bulb in the brain plays a role in memory. It makes sense to use scents in teaching young children.

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\*Cinnamon for creativity. Cinnamon or ginger can be swirled into finger paint.

\*Rose for reflection. Again, candles, sprays, and fresh flowers can make your classroom more relaxed and inviting. New research about floral scents suggest that some may function in a similar role as the mints, actually improving accuracy in problem solving.

\*Vanilla or sandalwood in a scent pot or candle can encourage creative thinking.

\*Bold scents such as eucalyptus, orange, or mint boost attention.

\*Classical music in the classroom encourages brain function. The tones and patterns impact the left side of the brain, where spatial reasoning and mathematical intelligence are stored. Known as the Mozart Effect (2000), music seems to offer a powerful teaching and learning strategy that has not been fully explored.

\*Stimulate the brain with frequent, yet unexpected rewards. Amazing studies

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by Dr. Wolfram Shultz and a team at the University of Cambridge suggest that one learns best “when the outcome is surprising”, when the brain has to anticipate and when the brain is given unexpected information (2002). In teaching situations where the brain is challenged, dopamine fires at such a rapid rate that the pleasurable response is equated to that of taking cocaine. Imagine: your teaching could be so powerful it could really get students “high on learning”. It sounds suspiciously like posters some of us used to make back in the 1970’s!!!

### **Give the Brain a Break**

Some of the most exciting new research in cognitive science has to do with the importance of sleep. In the past year, researchers have noted that there is almost always a relationship between sleep apnea and ADD (2002). Children who snore, who have sleep disorders, often display the symptoms of an attention problem. At this point, nobody can say whether the sleep disorder causes the attention disorder or visa

versa. However, it is clear that a lack of sleep interferes with learning and memory. We do know for sure that the hippocampus, which is the hot spot for storing and retrieving memories, does its best work during deep cycle sleep, at least 6 hours of it. So, it would follow that youngsters who seldom spend quality time in deep cycle sleep may not process information that was introduced in school. It is like learning in a sieve. All the good “juice” flows out during sleep instead of being captured by the hippocampus. A sleep connection might explain more readily how Ritalin and other Dexedrine derivatives really work in youngsters who have attention problems. According to Dr. Lawrence Diller, the author of Running on Ritalin (1998), there is a myth surrounding the effect of Ritalin. It does not have an “opposite effect” on kids who have ADD, calming them down. It probably stimulates these kids to stay awake and focus because they never got adequate rest, due to their sleep apneas and breathing problems. This is some of the most compelling research percolating out there today.

### **Be sensitive to gender differences in teaching and learning**

(Adapted from More Than Pink and Blue: How Gender Shapes Your Curriculum)

Boys and girls brains seem to process stimuli in different ways, using different parts of the brain with interesting results that can impact teaching. Here are some ideas to consider.

\*Keep boys at work tables, not at desks. Boys tend to be spatial and visual in

their learning. They are messy learners for the most part and need room for their "stuff".

\*Give boys more wait time for verbal tasks and girls more wait time for mathematical tasks. Research suggests that many of the differences that we see on test results between boys and girls are really differences in timing, not talent. Boys' language development trails girls during the first three grades in school, and girls' need time to "talk about" math in their brains and to others. I was observing at a district level "Math Computation Bee". As usual, my daughter Audrey Jayne, who is both musically and mathematically gifted, was the only girl on her team and one of the few girls represented. I watched all day and every team and I saw a pattern that affirmed the research. As each question was read, the girls used their little note pads to jot down facts and numbers. The boys scrambled for the buzzer before the problems were even read out. Buzz Buzz...the boys want to be first, and the girls want to get the right answer.

\*Make science connect to real life tasks for girls. In science, girls seem to need a reason for knowing their science. How does it work in the real world? How does chemistry work in cooking or in my body a girl wants to know?

\*Make social studies connect to real life tasks for boys. Boys do better at reading maps and globes, but fall down on the more language-intense knowledge of cultural geography and the social science. It is not enough to know where the Mediterranean Sea is if you don't

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know how its location impacted trade and religion in the countries that border it. Geography isn't just places, it is people too.

\*Use technology to help boys develop verbal and writing skills. With boys who have strong visual and spatial skills,



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technology is the tool to making them more polished writers. A publishing center can give boys the tools they need to develop research and writing abilities and girls the opportunity to improve their leadership skills by working in such a center.

\*Give girls a language for mathematics and a chance to solve problems in groups. Single gender groups that is. Though more recent AAUW studies conflict with earlier research on the issue (because of fear of segregating girls I think), my own work with grants and girls suggest that girls-only math classes with female instructors may help to overcome the biological and social constraints that girls have in mathematics (AAUW, 1998).

\*Understand that hormones may play a

more critical role in learning than we once knew. It seems that the release of estrogen impedes mathematical reasoning in women...and this occurs right around the time that our math curriculum becomes more abstract and challenging. Is it any surprise that girls might flounder and lose ground at this point? Likewise, it seems that testosterone encourages mathematical reasoning and sharpens it. See a connection?

\*In an interesting note, we also see that girls who have no brothers, or who are only children, do not experience that same level of math anxiety or science slump, if they have a father in the home. In laymen's terms, it seems that the dads treat these girls like the sons they never had. I see this in my two daughters. My husband is an engineer, and my daughters can measure metric, read a meter, or handle tools with amazing skill.

### **Be Advocates for Movement and Sports**

Feeding the brain is critical, but so is exercise. Have you heard about the "fat rats"? In studies, 3 groups of rats were placed in different environments. The fat couch potato rats ate with gusto and received little exercise. The moderately moving rats walked the maze on occasion, but the lean, mean rats worked out daily on the little wheel and jogged the maze. As in most rat studies, their lives ended prematurely when they were killed so that their little rat brains could be studied. Guess what? The lean, energetic rats had significantly more gray matter (2002). So why do we cut

physical education first in our schools? Soccer balls and jump ropes could be just as important in brain gain as computers and textbooks. More research suggests that daily exercise increases the brain's creative ability, giving writers and artists a cognitive and artistic boost. If you want to become brain advocates, you might have to get off your collective behinds and move into action!

### **Finally, Know thy Brain**

In conclusion, learn all you can about the pieces and parts of the human brain. At 3 pounds of mostly water and tissue, the brain is delicate and powerful at the same time.

First, though a male brain is up to 10% larger than a female's, this does not mean that the male is more intelligent! It does appear, however, that females use their smaller brains more efficiently. The corpus callosum, the area dividing the brain in half is up to 14 times larger in females. Experts believe that this enables females to use both sides of the brain simultaneously, accomplishing several tasks at the same time!

Another brain structure that teachers and future teachers need to understand is called the Amygdala, a walnut-sized structure deep in the brain that scans the environment for emotional stimuli. The brain, it seems, sends out radar for danger and then warns the neuro-cortex to shut down if danger is present. In very young children, we think, the more often and more intensely the amygdala is circuited, the longer the brain stays shut down in danger mode. If a child lives in a highly stressed, abusive situation, for

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example, he or she may miss critical learning periods because the higher order thinking centers are shut down to prepare the body for fight or flight.

The interaction between emotions and cognitive function is under inspection. One interesting discussion is found in Daniel Goleman's Emotional Intelligence (1995). The phrase "EQ not IQ", has become associated with this book. EQ is emotional intelligence. However, Goleman talks about brain science, explaining that emotional

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circuits are developed early on, so early that that they may be considered a natural development, which in part, they are. Teachers can develop skills in teaching emotional intelligence, traits such as perseverance, tolerance, and patience if they understand how important and how cognitive these traits truly are.

In closing, consider one more critical fact about the brain, because it may shape your perspective on teaching and learning. The word glial, comes from the Greek word for "glue", and is a word used to describe the trillion glial cells that form a protective shield around synapses. Remember that if neural pathways or circuits are not used, the glial protection sheds away and the pathways become dormant. The brain is a use it or lose it organ, and we now

know that major brain potential begins to be lost around the age of 10! As teachers, perhaps nothing else you do is as important as preparing and guiding parents, care givers, and the public to understand that the glial does not last forever in a brain. It is not like rubber cement, immovable and impenetrable. It is more like that minty school paste, temporary and useful unless it dries up and flakes off.

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<http://www.dana.org/> (The Dana Foundation and Brain Awareness Week)  
<http://faculty.washington.edu/chudler/funhenews.html> (Neuroscience for Kids)  
<http://www.csuniv.edu/facultywebsites/lbone/lboneframe.html> (Dr. Bone's web page, containing a free Learning Styles Inventory).

<http://www.plsweb.com/> Free Learning Style Inventory for teachers and kids  
<http://www.brainconnection.com/gen?main=contact> (The Brain Connection)  
<http://www.ibro.org/> (International Brain Research Organization).

#### Ideas for a Brain 101 Parent Training Session

1. Create door prize baskets with "brain friendly" foods. We put cans of salmon and tuna, blueberry muffin mix, children's vitamins, spinach, black-eyed peas, brown rice, and green tea bags in a decorated basket.
2. Create a booklet of brain-feeding recipes such as the ones featured in the attached hand-out.
3. Design refrigerator magnets in the shape of a "brain" and put important foods on it.
4. Make hand-outs with the tips featured on the attached list or use them separately on newsletters.
5. Serve a meal prior to the workshop and include foods from the brain-food list or magnet.
6. Use scented candles or potpourri on the tables during the workshop to illustrate the "de-stressing" power of scent.

7. Organize a sample "homework center" table for parents to view. This will help them to visualize the importance of organization and schema in the brain.

## **Brain Building Family Recipes**

### **Salmon Patties**

**A good source of Omega-3 fats that the brain loves**

**2 small cans of boned, skinless salmon (flaked and drained)**

¼ cup skim milk  
1 beaten egg  
¾ cup bread crumbs  
salt and pepper

Mix all ingredients into a dough. Pat into thin patties for browning. Brown patties in olive oil until done.

### **No-Bake Blueberry Yogurt Pie**

#### **Blueberries are brain food!**

1. You will need an 8 inch graham cracker crust.
2. Mix 2 small cartons of blueberry low-fat yogurt, 1 regular sized container of fat-free whipped topping and 1 cup fresh blueberries (drained).
3. Fold the mixture into the crust and top with more berries. Chill at least 3 hours before serving.

### **Parent Tips for "Lighting Up" Your Child's Neural Pathways**

#### **(Suitable for a brochure or hand-out)**

1. Make sure that your child gets adequate sleep. Teenagers actually need more sleep than younger children. Minimum: 8 hours !
2. Physical exercise pumps glucose and oxygen to your child's brain. A physically active child has a cognitively active brain!
3. Choose brain-friendly foods that boost energy, neural activity, "brain cleansing", and natural enhancement.
4. Keep stress to a minimum so that cortisol, the stress hormone, cannot attack the brain.
5. Use music to help the left side of the brain work more effectively.
6. Learn your child's preferred "learning style" and use it to assist with homework and projects.
7. Use scents such as peppermint and spearmint to keep children alert while they study and take tests.
8. Use bold colored index cards and scented markers in your homework center to keep the brain alert.
9. Create a language-rich environment. Lots of books. Good conversation. Words literally help to grow brain connections.
10. Avoid television and video games. They over-stimulate the right side of the brain and can contribute to ADD and other disorders.