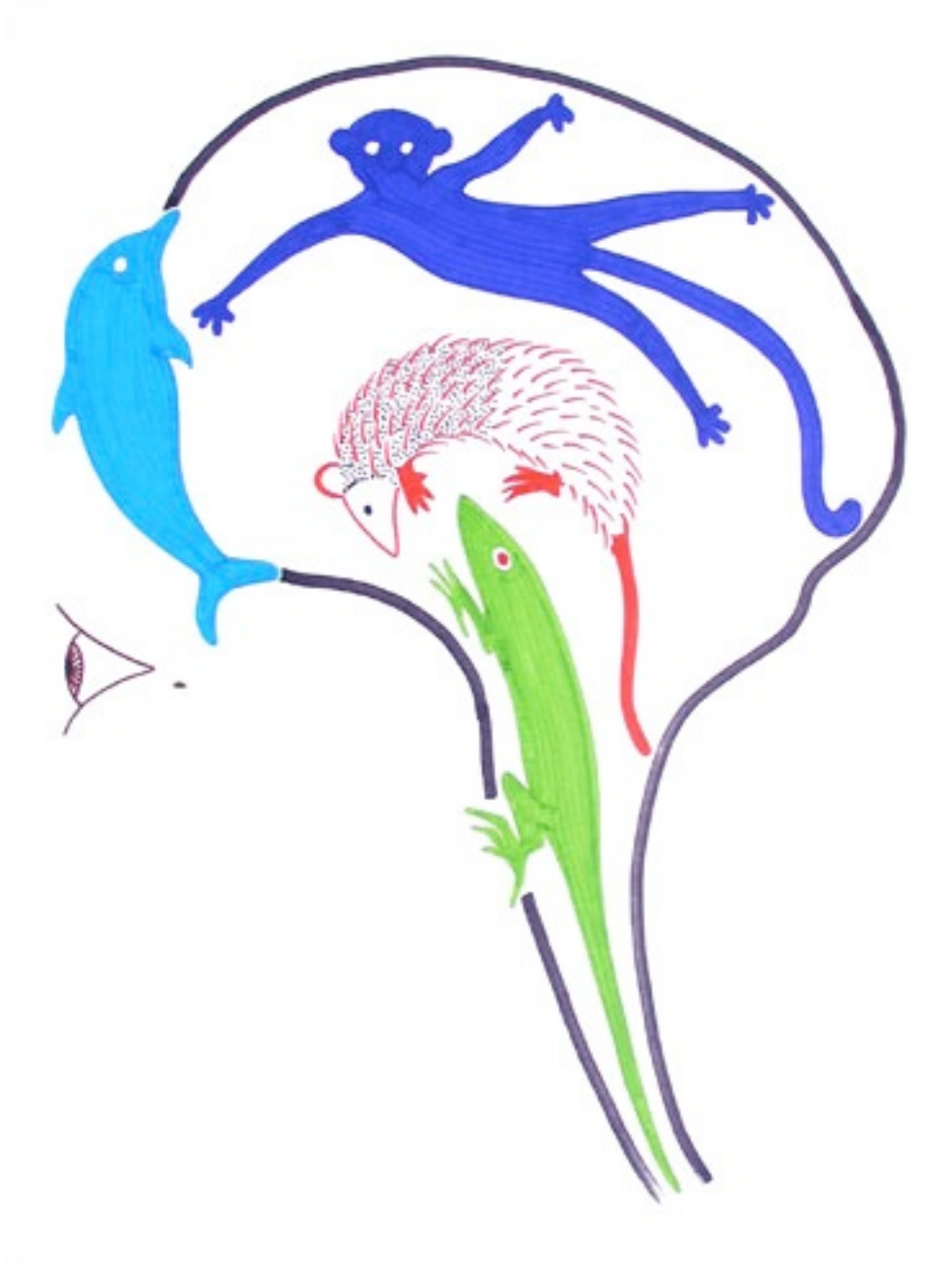


# Building Brains the Montessori Way



**A Workshop  
with Maren Schmidt, M. Ed.**

Building Brains the Montessori Way  
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Our human brain contains the foundations of vertebrate brain evolution: our reptilian brain (our Lizard Legacy) and our paleo-mammal brain (our Furry L'il Mammal). Evolved later is our human rational brain, the neocortex (our Monkey Mind), and highly developed in the human are the prefrontal cortex or frontal lobes (our Higher Porpoise; higher purpose).

From the website: [thegreatstory.org/charts/triune.html](http://thegreatstory.org/charts/triune.html)

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**Workshop Overview**

1. What are the important things for our children to learn?
2. What do children's brains need to maximize learning?
3. How do Montessori principles, methods and materials support brain development ?
4. What factors create effective skill building?

**1. What are the important things for our children to learn?**

What are your greatest concerns for your children?

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Here is what Wayne Dyer found out from parents over 30 years ago.

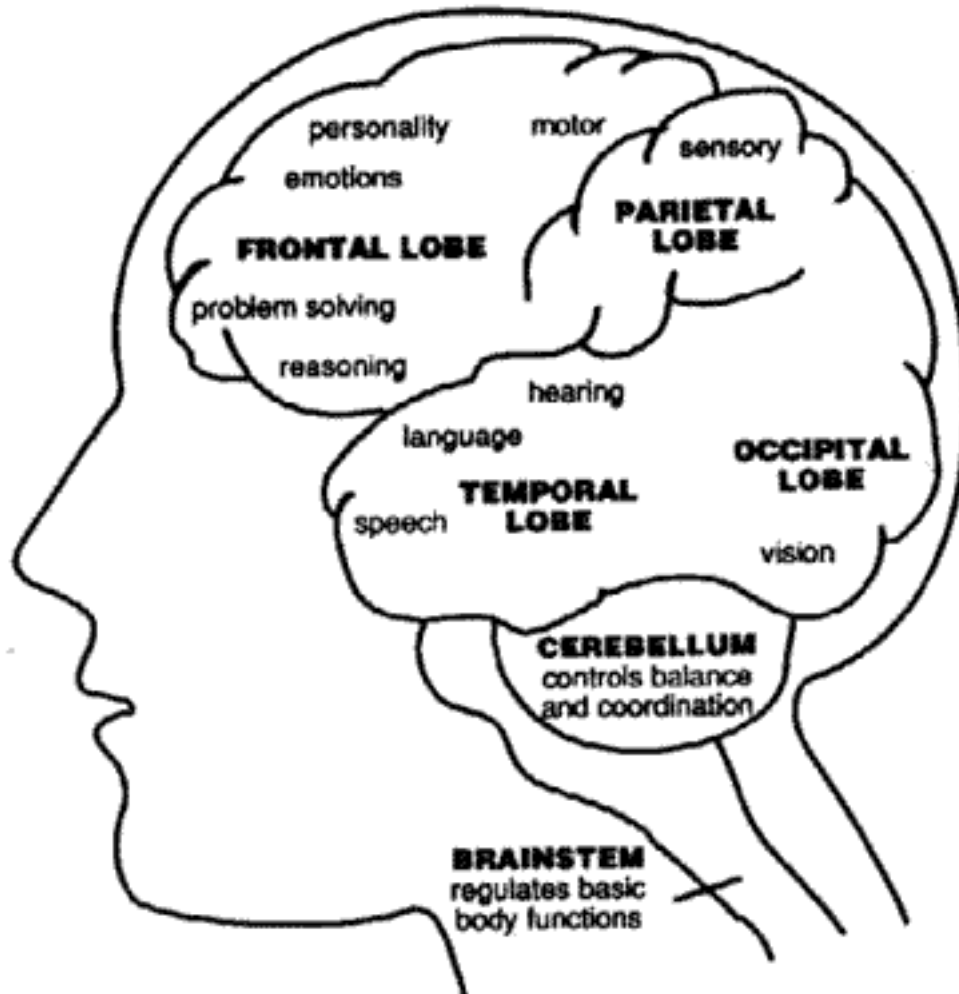
I want my children

- To have the ability to enjoy life;
- To value themselves;
- To be risk takers;
- To be self reliant;
- To be free from stress and anxiety;
- To have peaceful lives;
- To celebrate their present moments;
- To experience a lifetime of wellness;
- To be creative;
- To fulfill their higher needs and to feel a sense of purpose.

How are we going to create situations where our children can develop these qualities?

Let us look first at what current research says about what our children's brains need to maximize potential learning.

## 2. What do children's brains need to maximize learning?



Seven Golden Maximizers  
from Eric Jensen's, *Enriching the Brain*

- Physical activity
- Novel, challenging and meaningful learning
- Coherent complexity
- Managed stress levels
- Social support
- Good nutrition
- Sufficient time

### *#1. Physical Activity*

- True physical activity engages all the senses
- Activity helps the brain experience the new and to grow
- Exploration creates a curious intellect
- Mind and body crave multisensory, novel, challenging, and meaningful activities.
- Bilateral movements grow the corpus callosum connecting the left and right hemispheres of the brain
- The hand working with the mind is vital

Move—Explore—Discover—Grow

### *#2. Novel, Challenging, and Meaningful Learning*

A brain stimulating activity has three components:

- The child's creative manipulation, not the child watching the toy or activity passively
- The child's making of sounds, not passively listening
- The child has pieces to assemble, take apart, put together again, and the objects won't break

Meaningful learning requires time: time with people and time to interact with physical objects.

### *#3. Coherent Complexity*

- Speak clearly
- Name things one at a time
- Whenever possible hand the child the object being named
- Speak using real words—no goo-goo-duckie-poo baby talk
- Read aloud for at least ten to fifteen minutes per day
- Speak in whole sentences, slowly, kindly and respectfully, for example, "Orange. This is an orange."

*The Pink Tower is a perfect example of "coherent complexity."*

#### *#4. Managed Stress Levels*

- A newborn's brain creates neurons at a rate of over a quarter a million per minute.
- The young brain grows and absorbs information without evaluating, filtering or giving priority to the information. The brain receives each event with the same import as every other experience.
- The young brain hasn't learned how to filter critical information for survival, as true or false, real or fantasy, or good or bad. The brain receives violence, disrespect, hurtful language and physical abuse with the same sense of reality as calmness, kindness, positivity and gentleness.
- Loud noises, harsh lighting, disruptions, irregular schedules, though, are among the activities that create stress in the young child and communicates to the brain and body to be on danger alert.
- The brain seeks to control stress in the young child and begins to create a brain structure based on acceptance or avoidance of the stimuli in the child's environment.

#### *#5. Social Support*

Children's brains learn best with adult guidance.

Children need people who will

- Promote their interests and dreams
- Practice with them
- Point out important things
- Protect them from physical and psychological harm
- Enjoy the adventure of life with them.

#### *#6. Good nutrition*

High blood sugar levels affect the hippocampus, the part of the brain that helps organize memory.

Good nutrition includes:

- Complex carbohydrates
- Fresh fruit and vegetables
- Water
- Protein

Children from one to three years need about 1300 calories per day with 16 grams of protein.

Four to six year olds need about 1800 calories with 24 grams of protein.

Seven to ten year old need around 2000 calories with 28 grams of protein.

Protein rich foods include milk, soy milk, eggs, cheese, yoghurt, peanut butter, lean meats, fish, poultry, beans, tofu, lentils, grains nuts and seeds.

Oxygenate the blood and brain with proper breathing and drinking water.

*#7. Sufficient time*

- Children need time to simply sit, rest, observe, quietly explore and be.
- Children need time to choose meaningful activities. With time to choose learning becomes personal and powerful.
- Children need time to be involved in activities that are not evaluated, judged or prioritized by adults.

**With these seven brain maximizers what kind of learning environment would you create? What qualities would this environment have?**

### **3. How do Montessori principles, methods and materials support brain development ?**

Properly prepared Montessori schools share three main characteristics:

1. Adults professionally trained in Montessori philosophy, methods and materials for the group they are teaching.
2. Prepared environment based on three-year groupings
3. Children's free choice of activity within a three-hour work cycle

#### *Montessori teaching principles:*

Respect for the child  
Awareness of sensitive periods  
Use of human tendencies  
Use of the prepared environment  
Limitation of materials  
Teacher as link to the child and the environment  
Freedom of choice  
Development of responsibility  
Understanding of the self-construction of the child  
Going from the whole to the parts  
Going from the concrete to the abstract  
The work of the hand and the mind  
work of the hand and the mind  
Observing the child at work  
Non-interference of spontaneous activity  
Repetition through variety  
Indirect preparation  
Techniques that lead to mental and physical independence  
Three-hour work cycle  
Three-year age span  
Development of the whole child—intellectually, physically, socially and emotionally

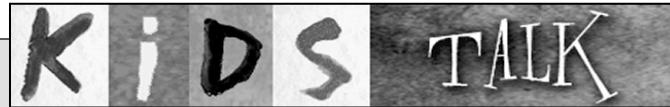
#### *Teaching techniques*

Inviting the child  
Waiting for the teachable moment  
Indirect preparation  
Observing the child  
Non-verbal teaching techniques  
Experience before language  
Point of interest  
Accessibility to materials  
Control of error in activities  
Understanding the importance of repetition



Show. Don't tell.  
Clear and precise presentations  
Practiced presentations  
Teaching to the periphery  
Say thank you  
Teach. Don't correct.  
Not every child needs every lesson  
Relight the candle  
Go from the known to the unknown  
Be friendly with error  
Assure success

For more on Montessori principles and techniques see Chapter 3 in *Understanding Montessori: A Guide For Parents*, by Maren Schmidt. Available at [MarenSchmidt.com](http://MarenSchmidt.com) or [Amazon.com](http://Amazon.com).



### **The Pink Tower**

“When will my son stop playing with the blocks in the classroom and start to do some real work?” This is a question I’ve heard many times from concerned parents. Parents are anxious to see some tangible results of their child’s time in the classroom. I can think of no better learning pastime than “playing” with the blocks in a Montessori classroom. Let me show you the Pink Tower.

In the Montessori primary class (for three- to six-year-olds), we introduce the Pink Tower to the three-year-old as part of the sensorial work to help develop visual discrimination. The Pink Tower stands prominently in the classroom, ten pink-colored cubes, the largest, the ten cube, being ten centimeters on each side and the smallest, the one cube, being a one-centimeter cube. Dr. Montessori took the butcher’s wooden weighing blocks and painted them pink to make a tower enticing to the child.

With the Pink Tower, the child works on a rug and carries one block at a time with both hands. It takes ten trips over and ten trips back to get all the blocks to the rug, so this activity builds concentration and memory.

The work with the Pink Tower also is a lesson in physics with the child’s inner teacher asking some of these questions: What combinations of blocks can I stack and the tower will continue to stand? What other building combinations can I make besides a tower? What relationships does the Pink Tower have with other materials in the classroom? The physics of the work is the child’s exploration.

The Montessori teacher doesn’t pose these questions to the child. It is the child’s mind that poses the questions, consciously or unconsciously, as the child explores and discovers the answers on his or her own by manipulation of the materials over a period of time in the primary classroom.

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As the child works with the Pink Tower, the child's body and mind are absorbing information that will help in future math work. At the simplest level, the Pink Tower is a set of pink building blocks. As the child explores the other materials of the Montessori classroom, the child will begin to see relationships within this material and among other materials.

For example, the child will discover that the ten-cube is much heavier than the one-cube. Perhaps in counting the Thousand Chain, a Montessori material of beads grouped by tens, or working with the Golden Bead Material used to build numbers concretely up to 9,999, the child will make the connection that the ten-cube is one thousand times heavier than the one-cube; that its numerical value is one thousand times greater than the one-cube; and that its volume is one thousand times greater.

Numerical value is not an abstract concept in the primary Montessori classroom. Working with the Pink Tower helps the child know by sight and feel the difference between one and a thousand.

Many children enjoy drawing the Pink Tower. The Pink Tower lends itself to artwork and challenges the child to figure out how to draw a cube, how to maintain the proportion of the tower, how to shade, and more.

For the six or seven-year-old elementary student, we "borrow" the Pink Tower from primary to make the initial presentation for the Cubing Material, a set of cubes and prisms that allows children to explore algebra in a hands on manner. We introduce the idea that each cube of the Pink Tower has a mathematical name and numerical value. The smallest cube is represented by  $1^3$  and the ten cube is written  $10^3$ .

With the Cubing Material, the elementary student uses the algebraic binomial,  $(a+b)^3$ , and trinomial,  $(a+b+c)^3$ , formulas in a concrete way. With the Cubing Material children can transform the cube of one number to another cube by adding prisms and smaller cubes. The children's explorations lead them to analyze and name the parts of the new cube and derive the algebraic formula for the cube built with two values,  $a+b$ . The eight pieces of this binomial cube,  $(a+b)^3$ , can be given a mathematical name. This can also be done with the twenty-seven parts of the trinomial cube,  $(a+b+c)^3$ .

*Binomial Formula:*

$$(a+b)^3 = a^3+3(a^2b)+3(ab^2)+b^3$$

*Trinomial Formula:*

$$(a+b+c)^3=a^3+3(a^2b)+3(a^2c)+b^3+3(ab^2)+3(b^2c)+c^3+3(ac^2)+3(bc^2)+6(abc)$$

We allow children to use their imagination (usually in their sixth elementary year *if* they are interested) to use these keys and derive the quadrinomial formula,  $(a+b+c+d)^3$ , on their own.

For the older child who has a desire for more mathematics, we will revisit the Pink Tower in the form of the Cubing Material to derive the cube root of numbers to ten million.

For geometry work in the elementary, the child can derive the formulas for volume and surface area from the cubes of the Pink Tower. Geometric progression is an inherent concept within the Pink Tower. With primary and elementary students, we can further explore the Pink Tower by rolling and moving the cubes through a tub of sand or flour, thus creating a footprint of a solid moving through space and a concrete, hands-on experience with ideas from calculus.

The beauty of the Pink Tower, and all the other Montessori materials, is that there are multiple physical concepts embedded in the materials, whether we are cognizant of them or not. Children and adults, and amazingly even Montessori teachers, do not need to be aware of the concepts of numerical value, weight, geometry, art, engineering, or calculus to enjoy working with and learning from the materials.

As in the Zen proverb, "When the student is ready, the teacher will appear," the Montessori analog could be, "When the student is ready, the concept will appear."

When your child tells you he or she worked with the Pink Tower today, you can say with sincerity, "I'm glad to hear you are doing such important work."

#### 4. What factors create effective skill building?

Seven Factors for Effective Skill Building (from Eric Jensen)

- We have the ability to focus our attention on the task at hand.
- We have control over the choice of the task.
- The task is meaningful to us and we understand how to do it.
- We have adequate time to practice the task, which research shows to be 60 to 90 minutes per day.
- We control feedback, which is accurate and timely.
- We have the opportunity to repeat the task daily or many times per week.
- We have overnight rest between practice sessions.

Let's look over this list of factors for effective skill building in relation to the child's work with the Pink Tower. The work with the Pink Tower is representative of most of the child's free-choice activity within a Montessori classroom.

The work in a Montessori classroom utilizes all these seven factors for effective skill building.

#### Summary

As we consider what we really want for our children, the maximizers for brain growth, Montessori principles and teaching techniques, and the factors for effective skill building, we should see intricate interconnections among these components.

7 factors for maximizing brain development  
x 7 factors for effective skills  
x 20 Montessori principles (at the minimum!)  
x 20 Montessori teaching techniques (at least!)

**At least 19,600 connections support brain development in children or perhaps as many as (54! ) which is approximately  $2.3 \times 10^{71}$**

What should schools be for?

As Dr. Steven Hughes, a pediatric neuropsychologist, says "Schools should be about building better brains."

Nobody does it better than properly prepared Montessori schools.

Properly prepared Montessori schools share three main characteristics:

1. Adults professionally trained in Montessori philosophy, methods and materials for the group they are teaching.
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## About Maren Schmidt

Maren Schmidt currently writes a blog and an award-winning newspaper column on child development issues, Kids Talk. She is a certified Association Montessori Internationale (AMI) elementary practitioner. Ms. Schmidt founded a Montessori school in 1991 and has over twenty-five years experience working with children.

During those years Schmidt taught children, from ages two to fifteen years, acting as school administrator, curriculum coordinator, and parent education coordinator, as well as being a classroom teacher. She has worked as a parenting instructor using the *Active Parenting* curriculum for several years.

Schmidt holds a M.Ed. in Curriculum and Instruction from Loyola College in Baltimore Maryland. She attended the University of Arkansas at Little Rock, earning a degree in Interpersonal and Organizational Communications.

Schmidt resides in Kamuela, Hawaii with her husband, Mark. She is the mother of two adult daughters, Dana and Hannah.

At present, Schmidt divides her professional time between creating on-line workshops writing, speaking, and consulting on Montessori and child development topics. Visit [www.MarenSchmidt.com](http://www.MarenSchmidt.com) for more information.

Her book, *Understanding Montessori: A Guide for Parents* is available at [MarenSchmidt.com](http://MarenSchmidt.com), [Amazon.com](http://Amazon.com), [BarnesandNoble.com](http://BarnesandNoble.com) and other on-line booksellers.

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## **Building Brains the Montessori Way**

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## Triune Brain Theory

Triune Brain Theory, formulated by Dr. Paul MacLean, Chief of the Laboratory of Brain Evolution and Behavior at the National Institute of Mental Health postulates that there are three distinct areas of the brain.

These three areas are delineated biologically, electrically and chemically and are based on developmental patterns and evolved functioning.

1. Reptilian brain
2. Limbic or early mammalian brain
3. Neocortex or neo-mammalian brain.

The reptilian brain or brain stem develops between conception and the first fifteen months after birth. The job of this brain is self-preservation. The reptilian brain monitors the outer world through sensory input and then activates the body to ensure survival.

The reptilian brain includes the brain stem, the medulla oblongata, pons and cerebellum. All sensations go first through the brain stem and then are sent on from the switch-board (the pons) to the thalamus in the limbic brain and/or the neo-cortex for interpretation. Nerve nets are first developed in the reptilian brain.

As the reptilian brain forms we develop an estimated 100 trillion nerve nets that link all our senses and muscle movements.

Limbic system has links with the neocortex allowing for emotional and/cognitive processing. It also works in concert with the body to elicit the physical signs of emotions like the flush of embarrassment and the smile of joy. Limbic system emotions also determine the release of neurotransmitters that either strengthen or weaken our immune system.

The limbic system consists of five major structures in the brain: the thalamus, hypothalamus, basal ganglia, amygdala, and hippocampus.

The thalamus acts as a relay station for all incoming senses, except smell. It also relays motor impulse from the cerebral cortex through the brain stem and out to the muscles. In addition, the thalamus interprets pain, temperature, light touch, and pressure sensations, and it functions in emotions and memory.

The hypothalamus controls the pituitary gland and normal body temperature, food intake, thirst, and the waking and sleeping states. It is also the center for mind-over-body phenomena, allowing enormous feats of strength and endurance during emergencies. In addition, the hypothalamus is involved in rage, aggression, pain and pleasure.

The amygdala has links to brain area involved in cognitive and sensory processing, as well as those involved in bodily states related to a combination of emotions. It is involved with the recognition of facial expressions and body language. It allows us access to a situation by coordinating bodily reactions so we respond appropriately with fear or anxiety.

The hippocampus uses sensory input from the thalamus and emotions in the hypothalamus to form short term memory. Short term memory, with nerve net activation in the hippocampus can then enter permanent storage as long term memory throughout the brain.

Neurotransmitters:  
GABA gamma-aminobutylic-acid  
Adrenalin  
Cortisol

The neocortex is command central.

*From pages 31 and 53 from **Smart Moves** by Carla Hannaford*

## **Brain Rules**

From  
Dr. John Medina  
University of Washington School of Medicine

EXERCISE | Rule #1: Exercise boosts brain power.

SURVIVAL | Rule #2: The human brain evolved, too.

WIRING | Rule #3: Every brain is wired differently.

ATTENTION | Rule #4: We don't pay attention to boring things.

SHORT-TERM MEMORY | Rule #5: Repeat to remember.

LONG-TERM MEMORY | Rule #6: Remember to repeat.

SLEEP | Rule #7: Sleep well, think well.

STRESS | Rule #8: Stressed brains don't learn the same way.

SENSORY INTEGRATION | Rule #9: Stimulate more of the senses.

VISION | Rule #10: Vision trumps all other senses.

GENDER | Rule #11: Male and female brains are different.

EXPLORATION | Rule #12: We are powerful and natural explorers.

Visit Dr. Medina's website: [brainrules.net](http://brainrules.net)

From his book *Brain Rules: 12 Principles for Surviving and Thriving at Work, Home and School*, (Pear Press) 2008.

## **Brain-Gym Exercises from *Smart Moves* by Carla Hannaford**

Below is a series of movements called PACE. They are surprisingly simple, but very effective. Everyone has a unique PACE and these activities will help both teacher and student become **Positive, Active, Clear and Energetic** for learning.

### **Drink Water**

As Carla Hannaford says, "Water comprises more of the brain (with estimates of 90%) than of any other organ of the body." Having students drink some water before and during class can help "grease the wheel." Drinking water is very important before any stressful situation, as we tend to perspire under stress, and de-hydration can effect our concentration negatively.

### **"Brain Buttons"**

This exercise helps improve blood flow to the brain to "switch on" the entire brain before a lesson begins. The increased blood flow helps improve concentration skills required for reading, writing, etc.

- Put one hand so that there is as wide a space as possible between the thumb and index finger.
- Place your index and thumb into the slight indentations below the collar bone on each side of the sternum. Press lightly in a pulsing manner.
- At the same time put the other hand over the navel area of the stomach. Gently press on these points for about two minutes.

### **"Cross Crawl"**

This exercise helps coordinate right and left brain by exercising the information flow between the two hemispheres. It is useful for spelling, writing, listening, reading and comprehension.

- Stand or sit. Put the right hand across the body to the left knee as you raise it, and then do the same thing for the left hand on the right knee just as if you were marching.
- Do this either sitting or standing for about two minutes.

### **"Hook Ups"**

This works well for nerves before a test or special event such as making a speech. Any situation which will cause nervousness calls for a few "hook ups" to calm the mind and improve concentration.

- Stand or sit. Cross the right leg over the left at the ankles.
- Take your right wrist and cross it over the left wrist and link up the fingers so that the right wrist is on top.
- Bend the elbows out and gently turn the fingers in towards the body until they rest on the sternum (breast bone) in the center of the chest. Stay in this position.
- Keep the ankles crossed and the wrists crossed and then breathe evenly in this position for a few minutes. You will be noticeably calmer after that time.