DID YOU KNOW?
A column for The Mirror in Federal Way, Washington (April, 2008)
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Brain-compatible/Brain-antagonistic; You choose

In a previous article, I suggested that math skills could be taught in a single day in a comprehensive way so students could readily apply those skills in other subject areas. It is essential to know how the brain learns if we want to produce students who are capable and competent in all of their subjects. So what defines something as brain-compatible or brain-antagonistic?

When the staffed space program was just about to be launched, my 6th grade class visited NASA (National Aeronautics and Space Administration) in Sunnyvale, California where one of my students' father was directly involved with the design of the space suit. He explained the most challenging part of the suit was the glove that covered the hands. It had to be protective while at the same time allowing the hand to do all that it is capable of doing. It had to be hand-compatible. A glove that encumbered the hand would be hand-antagonistic. Referring to the hand example, imagine what it takes to make tools, instruments, and keyboards, as well as performing tasks such as picking things up, doing microscopic work, and all the other things we do that involves using our hands without thinking.

The brain has the same need to be used as designed. The difficulty has been that we were unable to see inside the brain while it was learning and so we depended on controlling behavior to make learning happen. Some of the early research on learning and motivation through rewards and punishment was recognized in the Theory of Operant Behavior created by B.F. Skinner, who said, "It has long been known that behavior is affected by its consequences. We reward and punish people, for example, so that they will behave in different ways." In many instances in business, home, and schools, this premise is still in use.

Thirty years ago a breakthrough in understanding how the brain learns emerged and was called, neuroscience. **Neuroscience** is a field that is devoted to the scientific study of the nervous system. Such studies span the structure, function, evolutionary history, development, genetics, biochemistry, physiology, pharmacology, informatics, computational neuroscience and pathology of the nervous system. Traditionally, it is seen

as a branch of biological sciences. The gift of neuroscience is that we now know a great deal about what is going on inside our brains.

In 1975, Leslie Hart wrote, How *the Brain Works* and in it, introduced the idea of Brain-compatible schools. In 1983, his second book *Human Brain and Human Learning* clearly articulated what schools needed to do in order to capitalize on the brain's natural abilities.

Back to math -- the brain-compatible elements that support teaching a math skill, or any other skill, in a single day include:

1. Absence of Threat, nurturing reflective thinking
2. Meaningful Content
3. Enriched environment
4. Movement to enhance learning
5. Choices
6. Adequate time
7. Collaboration
8. Immediate feedback
9. Mastery (application)

While looking at the brain-compatible elements needed to develop a deep understanding, recall something you have learned and can still use routinely. How many elements on that list contributed to your basic understanding? These elements form a template through which an employer or teacher or parent can orchestrate the learning of something new.

The brain is a pattern-seeking device and learning is identifying those patterns that are important to your survival as well as creating a mental program to make it happen. For instance, if you heard that your child's car had a flat tire, you would know what that meant, and would know if they had skills to fix or change it. Knowing the words "flat tire" is a pattern; Fixing/changing it is a mental program. The challenge in the classroom is to move from pattern to mental program; meaning, the students have a solid foundation and can USE the skill. Think of your own school career: Which subjects took you to the application level? And can you call upon that understanding in your adult life? The most obvious examples are the career and technical education courses, or if you participated in a school sport, or drama, or marching band; You spent three hours each day honing your craft so it became part of who you are. When performance or a product is part of the class, adequate time and immediate feedback are essential.

Each morning, we call upon hundreds of mental programs to get through the day: turning off the alarm, showering, dressing, getting breakfast, reading the news, stopping for a latte, navigating traffic, getting to work, using a keyboard. All these programs are automatic, unless there is an upheaval of some sort to interrupt the mental program; you don't even have to think about what you are doing.

Skills are the same, they need to be automatic, useful in a variety of situations and solid enough that the next significant math skill can be built upon what you already know and understand.

Just this week I received a new book, *brain rules: 12 Principles for Surviving and Thriving at Work, Home and School* by Dr. John Medina, a molecular biologist and director of the Brain Center for Applied Learning Research at Seattle Pacific University. Using humor and everyday examples, he clearly summarizes the work of neuroscience over the past 30 years.

Math is a skill and the brain learns thousands of everyday skills routinely. The challenge is to teach the skill in a brain-compatible way.

Think about it…