THE HUFFINGTON POST

Edition: U.S.

FRONT PAGE | POLITICS | BUSINESS | ENTERTAINMENT | TECH | MEDIA | WORLDPOST | HEALTHY LIVING | COMEDY | HUFFPOST LIVE | ALL SECTIONS

T E C H

Posted on 09/19/2013

Critical Thinking and Our Children's Need for Deep Practice

by Robert Sun

A visit to Baldi Middle School, located in an economically challenged neighborhood in Philadelphia, is a lesson in education that works. That's because all of Baldi's 1,200 students are engaged, empowered and energized.

The school's leadership, with support from parents and the community, has instilled a high-performing culture characterized by three traits: The children feel attached to their school's mission; the environment supports productivity and performance; and students are energized to sustain accelerated effort over time.

Nowhere is Baldi's culture more fully realized than in its commitment to math. In a nationwide online math competition involving 6,000 schools in 45 states, Baldi ended this season ranked #5, as students solved more than 17 million math problems correctly in just 10 months. Baldi has consistently ranked among the top 10 schools in the nation in this competition for each of the past five years.

How was this productive culture established? Why do Baldi students embrace math with such enthusiasm when the subject intimidates so many children?

It begins with a concept known as Deep Practice. In sports, when we swing a bat and miss the ball, we receive instant feedback through our senses. Players learn easily and naturally through a practice loop where proficiency is attained through immediate awareness of success or failure.

When solving math problems, there is no similar form of encouragement. Create a Deep Practice system that provides an immediate and non-judgmental feedback loop, however, and math is suddenly no longer intimidating. By allowing students to tackle a complex subject in manageable parts—stopping when an error occurs and practicing until that one skill is perfected—they march steadily toward mastery. This is the hallmark of Deep Practice.

Using such techniques, skills that might take months of conventional practice can be mastered in a matter of days. What's more, the benefits of Deep Practice go beyond curriculum attainment. They're vital to meeting the most ambitious requirements in modern education, including the critical-thinking objectives of the Common Core State Standards in Mathematics (CCSSM).

Robert Sun is president and CEO of Suntex International, and creator of First In Math, an online program designed for self-paced learning in mathematics.

Critical thinking is one of the hardest mental skills to acquire, mostly because we humans don't like to think. We find thinking difficult and generally avoid it if possible. That's because our brains were not designed to think. Our brains evolved to quickly process vast quantities of visual information. The portion of our brain allocated to critical thinking—the neo-cortex or "working memory"—is by nature limited. That is why we have difficulty carrying on more than two conversations simultaneously; overtax our working memory and our ability to reason slows or breaks down altogether.

There are two ways for information to enter our working memory for processing. The first is from the environment—what we experience through our senses and problems that we encounter. The second is to draw from our "long-term memory," which is our storehouse of accumulated factual knowledge.

In his book *Why Don't Students Like School*, Daniel

Willingham states we have developed two distinct ways around the limitations of our working memory:

1) Through repeated practice, humans turn tasks into habit loops that become automatic. These are held in our long-term memory as stored procedures that can be summoned without taxing our working memory. When a child is learning to tie his shoes, almost all of his working memory capacity is devoted to the task, but after building automaticity he is able to tie his shoes without thinking.

2) Humans possess the ability to "chunk" data by grouping information. Chunking reduces the number of variables that our working memory needs to retain. If I present 12 letters of the alphabet randomly and ask you to quickly memorize them, it will tax your working memory--but if I present them as CNN, FBI, IBM, ABC, the task is easier because the letters are "chunked" in your long-term memory—as long as the acronyms CNN or FBI already have meaning to you.

If we are to succeed in implementing the primary objective of the CCSSM--to enable students to think critically and thereby approach math with focus, coherence and rigor—we need to encourage repeated Deep Practice to build automaticity and insure that their long-term memory contains stored knowledge related to mathematics.

Put another way, relying solely on classroom instruction to achieve CCSSM is like asking our children to not merely be able to cook, but to become gourmet chefs. If a child's pantry is sparse, he cannot fulfill those expectations. Stocking our children's pantries with knowledge gained through Deep Practice is essential if we want them to think critically.

Imagine a teacher lecturing and relaying facts and figures—essentially laying important ingredients onto a table—and hoping they will be put away into the pantry. When a student is not actively engaged, those items never get stored, but pile up and eventually fall off the table's edge.

We have known for more than 100 years, thanks to studies by Hermann Ebbinghaus in the 1800s and confirmed by modern research, that 90 percent of what a child is taught in class is forgotten within 30 days. Without students taking ownership through active engagement, we are basically on a treadmill.

We must remember the importance of stocking the pantry through Deep Practice if we want our children to develop strong critical-thinking skills. We need to learn from successes such as those at Baldi Middle School. Stocking the pantry may not be the most glamorous aspect of math education; but when our students' pantries are full, there's no limit to what they can accomplish—or to the future they will be inspired to invent.