

MATHEMATICS CURRICULUM

THE CAUSE OF THE CURRENT MATH CRISIS

We have been hearing for years that Japanese students do better than U.S. students in math. The Asian students are ahead by the middle of first grade. And the gap widens every year thereafter.

There are many reasons for this, including family involvement, stricter requirements for teachers and a stronger work ethic. But the main reason involves HOW they learn.

FIRST, let's talk about their **philosophy of education**. The Asians adhere to the **Mastery Philosophy** of education, in contrast to the popular American **Spiral Philosophy**.

The **spiral approach** used in most schools is based on **behaviorism**, which says we are programmable machines and need **endless repetitions** to master something. Spiral curriculums cover the **same material year after year** in ever widening circles, with the anticipation that increased exposures will eventually lead to mastery of the basics. The number of topics covered is broad, but they never go deep. It is more of an exposure to the subject, rather than a mastery of it. This teaching philosophy is the leading cause of the **widespread math problems** in our country today, including both **fear and hatred of math**.

THE SOLUTION TO THE CRISIS

The **mastery approach** to learning builds sequentially. This philosophy states that you must not move to the next step until the preceding one is mastered. Therefore, lessons may take many days or even weeks, if necessary, for students to master the facts. Fewer topics are covered. Pre-testing and post-testing are done to assure mastery.

The human brain learns by attaching new information to something already known. The more ways information is attached in the brain, the better it is learned. Children need more than one exposure and more than one way to learn a topic. **The use of the abacus** provides a visual, auditory, and kinesthetic relationship to the subject.

The **SECOND** reason involves their **teaching methodologies**.

The Asians employ the following teaching methods that are far superior to those used in America:

- Emphasis on Quantity Recognition over Counting
- Logical Number Naming System for a Proper Understanding of Place Value
- Use of the Abacus for Mental Visualization

Japanese children are discouraged from counting; rather they are taught to see quantities in groups of fives and tens. For example, when an American child wants to know $9 + 4$, most likely the child will start with 9 and count up 4. In contrast, the Asian child will think that if he takes 1 from the 4 and puts it with the 9, then he will have 10 and 3 or 13.

In English we count ten, eleven, twelve, thirteen, and so on, which doesn't give the child a clue about tens and ones. But in Asian languages, one counts by saying ten-1, ten-2, ten-3 for the teens, and 2ten-1, 2ten-2, 2ten-3 for the twenties.

SUCCESS STORIES

The author of our mathematics program, Dr. Cotter decided to conduct research using some of these ideas in two 1st grade classrooms. The control group studied math in the traditional workbook based manner. The other class used the lesson plans Dr. Cotter developed based on Asian methods. The children used the Asian number naming system and the abacus. When one 5-year old child was asked to explain how he answered $11 + 6$, he replied, "I have the abacus in my mind."

Dr. Cotter asked the children to explain what the 6 and 2 mean in the number 26. 93% of the children in the experimental 1st grade group explained it correctly while only 50% of 3rd graders in another study could do so.

Dr. Cotter gave the children some base ten rods (none of them had seen them before) that looked like ones and tens and asked them to make 48. Then Dr. Cotter asked them to subtract 14. The children in the control group counted 14 ones, while the experimental class removed 1 ten and 4 ones. This indicated that they saw 14 as 1 ten and 4 ones and not as 14 ones. This view of numbers is vital to understanding algorithms, or procedures, for doing arithmetic.

Dr. Cotter asked the experimental class to mentally add $64 + 20$, which only 52% of 4th graders on the 1986 National test did correctly; but 56% of those in the 1st grade experimental class could do it.

ST. KNOX

A C A D E M Y

AN ACADEMIC DAYCARE

MATHEMATICS SAMPLE

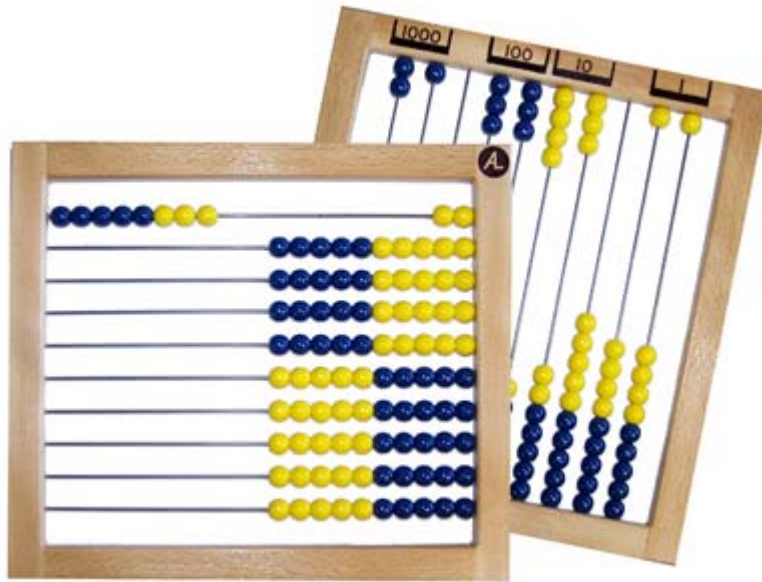
Below is a sample of our curriculum and how it is applied.

First the children are taught to recognize quantities from one to 5 (3 cups, 2 blocks, 4 carrots, etc.). The human brain can only recognize quantities up to 5. Greater quantities must either be counted or separated into smaller groups to be visualized.

Once the children can easily identify quantities up through 5 without counting, we move to the abacus and teach the children a song to help them remember quantities 6 through 10.

YELLOW IS THE SUN

Yellow is the Sun. Six is five and one.
Why is the sky so blue? Seven is five and two.
Salty is the sea. Eight is five and three.
Hear the thunder roar. Nine is five and four.
Ducks will swim and dive. Ten is five and five.



This song is used in conjunction with the abacus until the children can immediately recognize quantities 6 through 10 on the abacus. The beads change color at 6 to assist the children in recognizing these quantities.

Next the children are taught the multiples of 10, by starting with 1 row of beads on the abacus. The teacher moves 1 bead at a time teaching the children that the multiples of 10 are: 10 and 0, 9 and 1, 8 and 2, 7 and 3, 6 and 4, and 5 and 5.

The multiples of 10 & the 5+ principles taught in the “Yellow is the Sun” song provide a solid foundation for the addition, subtraction, multiplication and division work done through the rest of the program.