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TEACHER TOOLS

January 2019

The Missing Link to Math Fact Fluency

*Proven Methods for Improved Learning and
Recall According to Neuroscience*



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The Missing Link to Math Fact Fluency

*Proven Methods for Improved Learning and Recall
According to Neuroscience*

by Kathy Robinson

Have you tried every fact fluency trick in the book without results? Did your school invest in a math fact fluency software program that just isn't working? Then it is time to add multi-sensory memorization to your curriculum.

Multi-sensory memorization is the missing link between cognitive concepts and rapid retrieve and release. Using the multi-sensory memorization method brings classroom strategies to life. Multi-sensory memorization easily captures facts preparing learners to retrieve and release facts to the frontal lobes using sensory cues.

Most educators agree math fact fluency is beneficial, but how we get students there is hotly debated. The debate often rages around teaching memorization OR fact strategies. Research indicates we should do both!

Some strategies such as properties of ones and zeros; skip counting for 2s, 5s, 10s, and 11s; doubles and near doubles; etc. are more efficient than skill and drill. However, the multi-sensory approach to memorizing facts is also a strategy. For some facts, it is the best strategy!

Continued on next page...

How does multi-sensory memorization work?

The cerebrum of the brain is divided into four lobes: frontal, occipital, temporal, and parietal.

Frontal Lobe

Mathematical problem solving is processed in the frontal lobe using processing memory. This memory is limited and easily consumed especially in early learners.

Temporal Lobe

The temporal lobe is responsible for processing auditory information such as sounds and speech. It is what allows us to comprehend the words spoken to us.

Fact fluency has also been proven to reduce cognitive load and improve problem solving mathematically.





Parietal Lobe

The parietal lobe manages the input from all the senses and processes touch. It assesses numerical relationships and the size, shape, orientation in space. It processes language and coordinates attention.

Occipital Lobe

All visual information collected from the eyes is processed in the occipital lobe. This part of the brain processes visual input such as colors, shapes, size, dimensions, faces, written words, and objects.

In multi-sensory memorization...

The occipital, temporal, and parietal lobes are sentinels which reduce cognitive load by filtering out distractors. Reducing cognitive load on the frontal lobe is necessary for success in learning high rigor mathematics.

Multi-sensory math fact memorization begins here...

The occipital, temporal, and parietal lobes work in part to block out sights, sounds, and sensations so the frontal lobes can process information without interruption.

They are designed to block distractions in the frontal lobe. However, appealing to the sense of sight, touch, and sound in prescribed ways engages these three lobes in receiving and holding information.

Once memories are stored through sensory processing, they are easily retrieved through sensory recall using visual, auditory, and tactile cues. We call this the see, hear, say and write method.

It is considered by some as old school, but a growing body of evidence declares it may be the baby thrown out with the bath water.

Many in education are reluctant to revisit the past, but consider the following:

Today, only 1 of 10 college students can pass a basic multiplication test at 40 ppm.¹

In comparison, fifty years ago, sixth graders were expected to pass with 60 ppm!

¹ DeMaioribus, C. (2011). "Automaticity of Basic Math Facts: The Key to Math Success?" Masters Thesis, University of Minnesota, Duluth, MN.



The Only Multi-Sensory Software for Today's K-8 Classroom

There is only one tool that applies today's brain research to make the see, hear, say, and write method current for today's classroom. That tool is called Countdown and it was developed by Kathy Robinson, an award-winning teacher and the president of Schoolware Inc.



Only 3 minutes a day!

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Appealing to the Occipital Lobe

Displaying math facts in defined ways appeals to the occipital lobe. A fact should be displayed for an amount of time appropriate to learner maturation.

The younger the learner, the more viewing time necessary for the brain to capture and store facts in the occipital lobe through the sense of sight.

Traditionally, we display facts without answers on flash cards for practice. i.e. 6×8 . That is acceptable only in assessments and games. The brain recognizes when learners are in practice mode and will capture an

image of the equation for long-term storage. If the visual cue pulls $6 \times 8 = ?$, the frontal lobe will miss the very thing useful to the high rigor mathematical process... the answer!

Therefore, appeal to the occipital lobe by displaying math facts complete with the answer. i.e. $6 \times 8 = 48$. The learner will then appeal to the occipital lobe to retrieve math facts from memory using the stored image as a visual cue.

You will recognize learners using visual cues to pull facts forward when they look away and stare at something unseen by you.

See Method

Appealing to the Temporal Lobe

Memorization of facts is improved when learners hear facts by a trusted source. Learners trust the teacher as an expert. Since the brain believes what it hears this information appeals to the temporal lobe. Facts captured by the temporal lobe are easily retrieved by auditory cues.

You will know the learner is pulling a fact from long-term memory with an auditory cue when you hear them softly repeat to themselves, “Six times eight equals... Six times eight equals... Oh yeah, six times eight equals forty-eight!”



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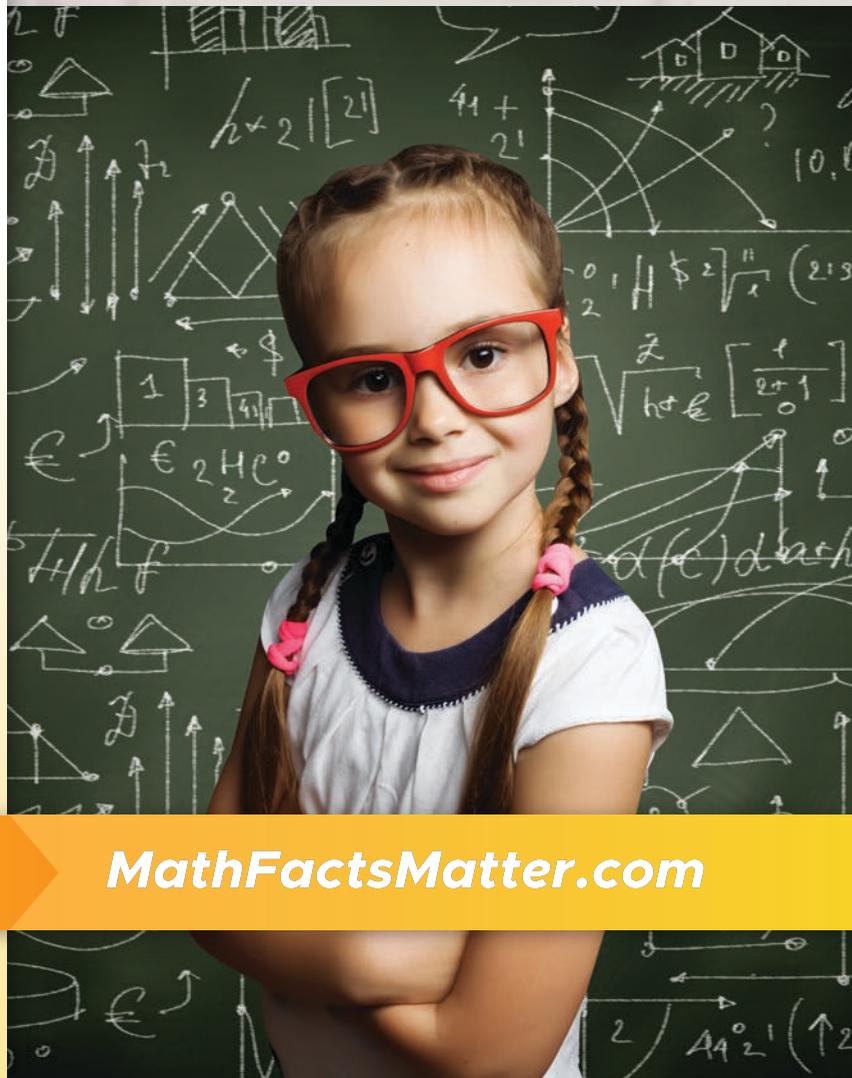
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Hear Method



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Appealing to the Parietal Lobe

The fourth and final lobe within the cerebrum is the parietal lobe which has to do with taste, temperature, and touch. Our students could not appreciate the sense of touch without a parietal lobe.

When we think of touch, we think of fingers and skin covering our outer body. However, one of the greatest sensory areas regarding touch is found in the mouth.

When babies explore something, they first pick it up, usually with their hands. Then, the object goes straight to their mouth for further exploration!

As teachers say fact statements out-loud, an effective teacher requires learners to say the equation with her. Surprisingly, this method appeals to the parietal lobe through the sense of touch.

With each equation repeated by the learner, the tongue thrusts against the roof of the mouth thru the teeth as the lips purse in a distinct and peculiar way. This unique sensory sequence of mouth movement is recorded by the brain.

Learners pull facts forward with tactile cues by moving their lips...sometimes silently and sometimes audibly. Moving their lips synchronizes the unique sequence of $6 \times 8 = 48$. The brain recalls the recorded sequence and the equation $6 \times 8 = 48$ falls right out of the learner's mouth!

You will know learners are using a tactile cue to retrieve facts stored in the parietal lobe when you see them silently moving their lips recreating the sequence recorded by the brain.

One of the greatest sensory areas regarding touch is found in the mouth.

Say Method



Tying it All Together

In mentioning the sensory lobes, many believe writing is the tactile portion of the solution. Writing the fact statement does have a tactile element to it, but it is much more than that.

Writing the fact statement is an eye-hand-brain coordination activity that ties all the senses together so the appeal coming from the frontal lobe appeals to all three lobes simultaneously.

When the coordination of the various cerebrum lobes is complete during learner maturation, the facts are retrieved based upon the individuals preferred strategies, abilities, and learning styles.

With practice and as the learner becomes more mature the process becomes more fluid. It will become less apparent which cue pulls the fact forward first. The brain's response time to a sensory cue will ultimately result in a response time that is less than a second. How about .6 of a second!



Write Method

“Before rising mathematicians can measure the heavens, they must first learn to count the stars.”

*Kathy Robinson
President and CEO of Schoolware Inc.*

Practice Mode

Countdown is a highly effective computerized program providing homeroom teachers and/or math teachers with a quick, easy teacher tool. Teachers can be very specific regarding practice conditions with program settings.

-  **Fact level(s)** – Teachers can select mixed levels and operations allowing for review, new fact introduction and prep for the next level.
-  **How many facts are displayed?**
Teachers provide direct instruction of specified levels of facts but randomly select a grade appropriate sample.
-  **How long is each fact displayed?**
Increase the viewing time when using the see, hear, say and write method because learners can respond only as fast as they can write. Decrease the viewing time when using only the see, hear, and say method.
-  **Which view or a combination of views (horizontal, vertical and/or both)?**
Facts should first be delivered horizontally like a word. Once the horizontal view can be retrieved from long-term memory, the brain can more easily flip the stored horizontal view in response to the vertical view.

Test Mode

Countdown is also a computerized teacher tool with an assessment mode. It adds a means of accountability, especially for older learners. Please be aware early learners (K-2) may not be mature enough for timed fact tests.

Intermediate learners respond well to external motivation. Spelling quizzes build in accountability and so do weekly fact quizzes. Assign the appropriate level at least one week before the quiz. Some of the facts will be unknown at the time of the quiz so use the grade appropriate maximum viewing time and the fewest number of suggested facts. This method encourages the use of strategies within a liberal time frame.

Increase the number of facts and reduce the viewing time when appropriate. Your class direct instruction methods prepare learners to respond to the maximum grade appropriate facts in the least amount of time. Monitor your class for anxiety and adjust settings appropriately.

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Solutions For Teachers, By Teachers.

About Us

Math Facts Matter is a division of Schoolware, Inc., an educational software development company based in Durant, Oklahoma.

The president and CEO of Schoolware, Inc., Kathy Robinson, greatly values and understands the role teachers play in every student's life. Her background in education as an award-winning teacher and her heart for helping both students and teachers with their educational needs, led her to start Schoolware, Inc. in the year 2000.



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What Teachers are Saying...

"Even though this is above my grade level, I intend to use some of the methods with my 4 year olds when teaching numbers. The people that created this are brilliant!!"

"Kathy Robinson, CEO of Schoolware, Inc. has been serving schools in this area for a number of years. She is very responsive to our needs as a school and works diligently to help us obtain products at a reasonable price. The bottom line is Math Facts Matter works, it is user friendly, the students enjoy using it, and it improves their math skills. When you combine good products with a good company, this equals success."

Amy Walker
Boles Elementary

Jarvis Dobbs, Superintendent
Colbert Public School



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