Remarkable Recall

A math lesson built from memory alone

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The students were shouting over each other. "*Show Me the Money!*" exclaimed one student.

"*Race Day!*"

"*Winter Wonderland!*"

"The one where they are trying to, oh yeah, *Escape from Mars!*"

"*Slope of Sprouts*" said another student. "That's the one where we learned about change in x over the change in y."

It's Mrs. Hodges' 2nd period class. Students are working together in groups of three to remember the names of math lessons, and the math learned in them.

It wouldn't be all that remarkable except for two things. The lessons students are trying to recall spanned over six months, from August to January. Students are asked to remember the lessons and the math, entirely from recall.

"OK," begins Mrs. Hodges. "So far you've done a good job of recalling just what's up here," while tapping her fingers on her head to signify using only their brains to remember.

"Your next task is to create a poster of everything you can remember from one of those lessons. Write down all the math, the vocabulary, and create a visual representation, from just what's up here," again reminding students this math lesson should be recalled from memory.

Students chatter excitedly about what lesson to choose for their poster, sharing what the lesson was about and what math they learned. One group organized, "Miles and I will work on the math description, and we can help you with the visual representation." Another group member responded, "We could draw a graph – we need graph paper. Oh, and we could put our names here and draw a picture of a dead guy from *Cholera Outbreak*."

The excitement in the classroom is unmistakable as students draw visuals with descriptions and mathematical calculations on their posters.

> "These must be **very gifted students.** My students **could never do that.**"

When teachers watch the five-minute video of Barret Middle School students creating a poster with a lesson title, a drawing depicting the story, along with the math description and a visual representation of the math, you can imagine how astonished mouths drop as students complete the task almost effortlessly.

One response encapsulates the majority: "That's incredible. These must be very gifted students. My students could never do that."

I knew, of course, that these weren't students with extra computer memory chips installed. They were students of average proficiency at a public magnet school.

And now, a year later, I've seen the Recall Lesson replicated in Green Bay Public Schools, Portland Public Schools, Santa Maria Bonita Public Schools, Livonia Public Schools, and many other districts around the country.

What's more, I've seen the Recall Lesson completed in classes with students that have scored lowest on state tests, with astonishing engagement and results.

A question remains: how are students remembering?

The research behind memory

Most people I know experienced math class by answering the same type of question over and over, sometimes 10, 20 or 30 of the same math problems. Certainly, the intention of drilling math problems by my middle school math teacher was to ensure that I wouldn't forget what I was learning.

On the surface, this approach seems plausible to support the basics of what we know about human memory: If we memorize a fact or some piece of new information, it begins to build a neural pathway to that information, which should be more easily accessed later. Practice a math fact over and over and the pathway becomes larger and faster to access.

Strangely, that's about where the memorization benefit starts to end and even starts to cause a memory problem. By building a singular neural path, what's lost is access to the fact.

When you look at any neural network, you'll immediately notice something amazing: that there are a vast number of pathways to access the same synapse. And those pathways connect with each other. It's this aspect that makes the idea of teaching math in a way that connects to many pathways so essential to the learning process.

Imagine the difference for the Barret Middle School students if they spent their year drilling math problems. Students could have repeatedly practiced examples showing the relationship between two numbers and solved them to create a "line of best fit." Asked months later about what lesson they did in the beginning of the year, there would be no access point for students to recall why they learned the math. The multitude of math problems are not connected to a network of neurons made through visual context or story concept. Consequently, there are no synaptic connections for students to readily recall.

In contrast, if students were given a lesson, *Escape from Mars*, where the math made sense in context to a story, the relationship of the variables is no longer abstract. Students would remember the story of how the life and death of a person driving a Mars rover depended on whether their calculations were correct. Moreover, once the students recalled the story, they could remember how the variables (the charge on the rover, the type of terrain they travel that depletes that charge, and the distance) were used to make the calculation.

> "The story lights up **a vast neural network** while connecting the math. **And students remember that math.**"

The research behind memory lies in human history and the way humans learned to survive. *Escape from Mars* provides the context of life and death based on the amount of food or water and distance needed to travel that is universal to our human survival.

The story lights up a vast neural network while connecting the math. And students remember that math – the Mars context, the relationship between battery charge and distance traveled, and line-of-best-fit – long enough that they can pull it out of their brains without assistance many months later.

Making the math connections

After allowing students 20 minutes to complete their posters, Ms. Hodges approached her first group, still deep in enthusiastic discussion (in math class!).

"What was happening in that story?" asks Mrs. Hodges.

"Oh, she was trying to figure out how many miles she could go to win the race" answered two students almost in unison.

"What is the Y-Intercept?" Mrs. Hodges asks another group.

"It's where it crosses the Y-axis" they answer together.

"What's it mean?" she prompts.

"It's where it starts," one of the students replies.

"What's it mean for your sprouts?" she nudges.

"It's how much the sprouts have grown in 0 minutes."

"Nice! I'm impressed," she responds and moves to the next group, asking a few more probing questions, then regroups the class to finalize the lesson.

Their final task is to walk around the room and look at their peers' posters and select the one that they believe evokes the greatest recall in their own minds. The students chat noisily as they place stickies with their names on them, with every poster receiving several stickies.

"I thought the student work was really amazing," Mrs. Hodges tells us. "It's January right now and students were able to recall lessons from August and September with no guidance from me. I've found with MidSchoolMath, students can make connections. They remember the videos. They remember the events. And I'm starting to see more and more how they relate it to themselves."

See the video @ www.midschoolmath.com