ALL STUDENTS CAN LEARN MATH

As long as they answer **YES** to these **7** questions first!

Liesl McConchie

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MA+H with the BRAIN in MIND

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ALL
STUDENTS
CAN LEARN MATH

We hang posters in our classrooms, make t-shirts, and theme conferences around the mantra: **ALL students can learn math.** Is that *really* true, though? In theory, yes. It is true. The reality is, however, that many students are not learning math. In fact, only 40% of 4th graders are proficient in grade-level math. It gets worse. By 8th grade, only 33% are proficient at grade-level math (NAEP, 2018).

WHY AREN'T THE POSTERS, T-SHIRTS, AND MANTRAS WORKING?

> We cannot preach that ALL students can learn math **when we teach in a way that makes learning math inaccessible to SO MANY.**

Many teachers have been searching for a solution to the seemingly unsolvable math problem of why some students are performing so poorly in math. Some call it closing the math achievement gap, centering our math instruction, or reaching the students in the margins. Whatever you call it, the solution (like many great math problems) is found by asking the right questions.

Many great teachers and school leaders spend time reflecting and wondering how they can be better. For many, their questions have the word "I" in them. "How should I set up my classroom? What programs or curriculum will I use this year? What is the latest tech tool that I could use in my classroom?" (and on and on). But using the word "I" puts the focus on the teacher, rather than the learner.

To create mathematical environments where ALL students can learn math, focus on the questions **students** are asking. Your students ask far different questions than you would as they prepare for a day at school or even another year. These questions, and the resulting answers you provide, determine whether learning math is truly accessible to ALL students.

Students are constantly gathering the answers to the following critical questions:

1. Is my teacher an ally or adversary?
2. Do I belong in this challenging math environment?
3. Is my math class a safe place?
4. Will I get any better at math if I work hard at this?
5. Do I feel ready to learn?
6. Do I have the capacity to learn this challenging math content?
7. Will I be able to remember any of this?

(Farrington, et al., 2012; Jackson, 2012).

You may have a hundred to-dos swirling around your head as you prepare for your next lesson or unit. Shifting your attention from your to-dos to your students' cognitive, emotional, and social needs is the critical shift that makes learning more accessible to ALL your students.

Teachers who focus on these seven questions create a learning environment that supports ALL students' learning.

A student-centered approach to learning math **is built on the foundation of students' social, emotional, and cognitive needs.**

This book highlights the under-used tools that will have students shouting "YES" to the seven questions above. There is more than one way to get to a "yes", so add these tools to those already working for your students.

A NOTE ON BIAS

The multitude of biases operating in all of us on an unconscious (and sometimes conscious) level suggests many readers will claim their students are answering these questions with a YES. Unfortunately, the research AND student experiences are telling a different story. If we assume all students are answering YES, there is no need to reflect or change. Things will remain as they are now. And we know that is not working for a large portion of math students. I invite you to engage with this e-book from the perspective of those who might be answering NO. I hope this book brings greater empathy, scientific understanding, and tools to your efforts to ensure ALL students can learn math.

QUESTION #1

IS MY TEACHER AN ALLY OR ADVERSARY?

The first question students are asking is: Whose side are you on? Do you have my back?

WHAT TO KNOW

Your student's brain is constantly gathering information from their interactions with you. Their amygdala registers data from your tone of voice, facial expressions, proximity, gestures, volume, positive vs. negative language patterns, and more to determine whether you are a potential threat or not (Adolphs, 2010).

Their amygdala filters through all that information to make a neurological decision as to whether you will be a source of **negative academic emotions** (anxiety, stress, threat, shame, anger, fear, hopelessness) or **positive academic emotions** (enjoyment, pride, relief, hope, excitement, happiness, calmness) (Lei et al., 2018).

When the amygdala is activated (dealing with too many negative emotional stimuli), the frontal lobe functions can become compromised. And the frontal lobe manages cognitive processing. In other words, students who perceive their teacher as a source of negative emotions may experience more difficulty learning.

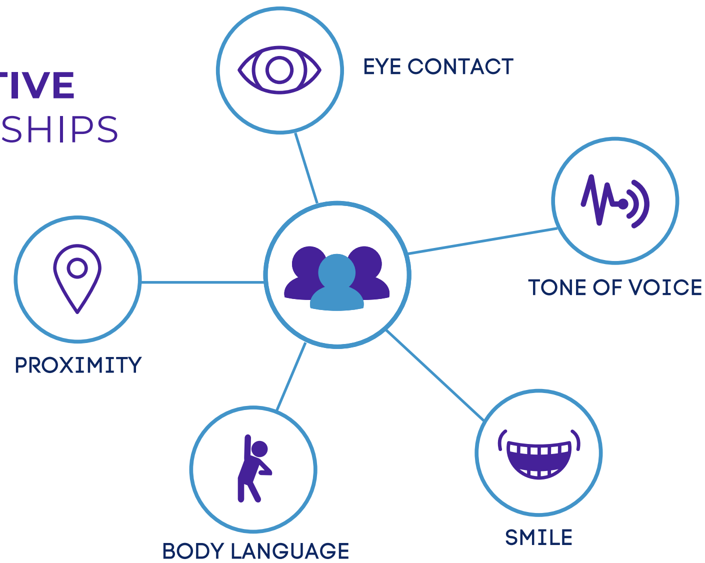
It's no wonder then, that the teacher-student relationship has an effect size of 0.74 (Hattie, 2017). That means your relationship with your students has the potential to improve their math learning by over 1.5 academic years.

One researcher conducted a simple study that asked students one question: "Does your teacher like you?" The results shocked the teachers. Why? More students answered "No" than the teachers anticipated. What's the message here? There is a gap between teacher and student perception of the relationship. And, according to the study, the gap is greatest among students who don't look like their teacher (Bishop et al., 2003; D'Hondt et al., 2016).

FACTORS THAT IMPACT POSITIVE TEACHER-STUDENT RELATIONSHIPS

THE KEY HERE IS THIS:

It's the student's **perception** of the relationship that matters.



WHAT TO DO

For students to see you as an ally, be explicit in communicating your unwavering commitment to their success. Tell your students, "I care about you. I am on your side. I am your ally." Repeat those words to them every day. And then show up in ways that align with those statements.

Healthy teacher-student relationships are built on **trust** and **warmth**.

Trust means a student can count on you. Students value a teacher who is honest, consistent, and fair (Peter et al., 2010). Students who feel their teacher is unfair experience greater levels of distress (Peter et al., 2013).

Warmth means a student believes you care about them. Students with a warm and caring teacher are more engaged and perform better academically. They also exhibit better psychosocial behavior (Hughes & Cao, 2018).

Make it a priority to learn your student's names within the first week of school. Give assignments that allow you to learn more about their family, hobbies, dreams, and fears. Create time in your lesson plans to allow for you to be with students one-on-one. An individual interaction with you will leave a student feeling seen, special, and a valued member of the learning community.

QUESTION #2

DO I BELONG IN THIS CHALLENGING MATH ENVIRONMENT?

Students need to feel like they belong in a mathematical learning environment. They need a teacher who believes ALL students can learn math.

WHAT TO KNOW

The data on this is clear: Students who don't feel they belong perform and behave below the norms of those who do feel a sense of belonging (Stanley & Adolphs, 2013). Why?

> Feeling excluded, isolated, or rejected increases the levels of cortisol in the brain. **Simply put, feeling a part of the "out-group" is stressful.** And the chronic stress experienced by minority cultures is causing devastating impacts on their body and brain.

The well-established "empathy gap" between teachers and students of different cultures creates a barrier to learning worthy of attention. Recognizing and respecting all cultures in your classroom will yield high results both relationally and academically (Bottiani et al., 2016). You can learn more about the science of culturally responsive teaching here.

A teacher's belief in a students' math ability is paramount in establishing a math environment where ALL students believe they can succeed. It has long been shown that teachers' expectations of students impact their academic performance (Rosenthal et al., 1969). How significant is this influence? The effect size of "teacher estimates of achievement" is a HUGE 1.29 (Hattie, 2017). Having high expectations begins with the belief that ALL students can and WILL succeed.

BELONGING

Am I good enough? Do I fit in?

Is who I am valued in this environment?

Is who I am (in relation to others) seen and valued in this environment?

Do I belong in this environment?

Do people care about me?

WHAT TO DO

HIGHLIGHT DIVERSE MODELS OF SUCCESS

Expose students to a variety of successful "mathematicians" that look like them and share cultural similarities. They can be famous mathematicians or students who succeeded in your class last year. The goal is for students to "see" themselves in these role models.

HIGH EXPECTATIONS

A teacher's expectation for a student is rarely heard out loud. Rather it is felt by students who recognize their teacher doesn't believe they can excel. The research points to a few key areas where students get this vibe: ability grouping, classroom climate, and the level of challenge.

TO CREATE A MATH ENVIRONMENT WHERE ALL STUDENTS FEEL
THEY BELONG AND HAVE WHAT IT TAKES TO SUCCEED:

- **Eliminating Any Ability Groupings**
  These are detrimental to students' belief in themselves and their achievement. (Dumont et al., 2017).
- **Create a Positive Classroom Climate**
  The foundation is built on positive relationships. Use positive behavior modifications (instead of punishments) to teach students appropriate behavior.
- **Set Challenging, Mastery-Focused Goals for Your Class**
  "By the time you leave this class and move onto 10th grade, you will all be able to __________. I will be here to support you every step of the way."

A teacher's
EXPECTATION FOR A STUDENT
is rarely
HEARD OUT LOUD

QUESTION #3

IS MY MATH CLASS A SAFE PLACE?

For students to engage in rich mathematical thinking and learning, they must feel safe – physically, emotionally, and socially.

WHAT TO KNOW

The brain is constantly processing inputs from the environment to determine the level of threat or safety. This constant filtering is led by the amygdala. When a potential threat is detected, brain function is diverted away from the learning activity and toward the threat. Why? Because the brain's primary function is survival. Learning to factor trinomials is far lower on the brain's list of priorities.

SAFETY
PHYSICAL, EMOTIONAL, & SOCIAL

Am I safe from any physical harm?
Do I enjoy being in this learning environment?
Is it socially safe for me to ask for help?
Do I feel happy, calm, and excited here?

PHYSICAL SAFETY

For students to learn, they need an environment free from any potential threats. These potential threats can come from being seated near a bully, or even a teacher who rarely smiles. The brain processes the expression of someone's face faster than it perceives their gender (Czekala et al, 2015). Why? Knowing they are a "safe" person is more important for your survival than whether it is a male or female.

EMOTIONAL SAFETY

To be a high-achieving math learner, students need to feel safe to make mistakes and ask for help. Students who reach out for help have a HUGE advantage in learning math. To be specific, the effect size of "help-seeking" is 0.72 (Hattie, 2017). To get those results, students must first feel safe enough to ask for help.

SOCIAL SAFETY

When a student is experiencing social connection, portions of their medial prefrontal cortex become activated and involved in the experience (Hutcherson et al., 2014). And that part of the brain is highly involved in learning/memory formation and retrieval (Euston et al., 2012). In simple terms, students learn better when they are socially connected.

Students who have good relationships with their classmates are more intrinsically motivated, have higher levels of cognitive attention (because they aren't consumed with worry about whether their peers like them/will tease them), and ultimately demonstrate higher levels of achievement (Mikami et al., 2017).

WHAT TO DO

Here are a few suggestions on where to start when creating a safe environment for ALL students to learn math.

PHYSICAL SAFETY

Work to remove any non-conscious stimuli that may be interpreted as a threat. Smile. Be conscious of your non-verbal communication. Create a classroom environment free from bullying, racism, micro-aggressions, homophobia, bigotry, etc.

EMOTIONAL SAFETY

Teach your math students the value of mistakes in being a mathematician. Model mistake making. Celebrate what is learned through making mistakes.

Promote help-seeking. Normalize asking for help – from their peers and also from you. Instead of saying, "Does anyone have a question?" ask, "What questions do you have?" Or, "What is a question someone might have about this topic?"

Avoid teaching practices that promote speed or a "one-right-way" approach. Instead, let student's voices be heard as they share their unique mathematical thinking. Celebrate multiple pathways as a way to learn more from each other.

SOCIAL SAFETY

In addition to YOU learning student names, set a goal for all students to learn the names of their classmates within the first couple weeks of school. Ask yourself daily, "Is this something students must do alone, or could they benefit from working with a partner?"

QUESTION #4

WILL I GET ANY BETTER AT MATH IF I WORK HARD AT THIS?

Students need to know if it's worth it to bust their butt and give their best effort to learn math. If it's not worth it, why bother? Apathy is easier and safer. It is easier to reject the label of "failure" if I know I never really tried in the first place.

WHAT TO KNOW

The idea of "getting better" at math is rooted in the science of neuroplasticity – the brain's capacity to change. Brains are dynamic, flexible, and always changing. There is always hope for a student.

The science of neuroplasticity disproves any claim that "*I am not a math person*." Although it is scientifically false, many students still make the claim. It is that narrative and mindset that is limiting their mathematical progress.

In whatever way a person needs to learn, grow, or heal, it is possible. Whether it be a skill, a content area, or a self-regulation toolkit, **it can be learned.**

MINDSET

Dweck's research on mindsets is rooted in the science of neuroplasticity. Dweck labeled the ways people perceive intelligence and learning as a fixed mindset or growth mindset (Dweck, 1999). Those with a fixed mindset believe that intelligence, abilities, and talents are fixed traits.

With a growth mindset (rooted in neuroplasticity), intelligence and abilities can be developed through effort and perseverance. Through our thoughts, words, and actions we can rewire our brain to think in new ways. We no longer have the excuse of "That is just the way I am" because we can, and DO, change.

FIXED	GROWTH
Intelligence is fixed	Intelligence can be developed
I'm not a "math person"	I can get better at math
Some kids are good at math	All students can succeed in math
I'll never be good at math	I can be great at math
We aren't good at math in this family	You are making so much progress in math

WHAT TO DO

The goal here is to harness the power of neuroplasticity to help students shift their thinking and beliefs about their mathematical capabilities. Here are a few ways to get started.

QUICK SUCCESSES

Design activities and assignments for the first few days of school that are a guaranteed success for ALL students. Depending on the grade you teach, it could be drawing something from geometric shapes, learning a quick math "trick", or demonstrating mastery of a previous skill. The purpose is to build the mindset of "I know I can be successful in this math class". The flood of dopamine they'll receive early on will keep them motivated as you engage with new material.

SKILL BUILDING

Invest time early to teach students learning skills that will be used in your class. Teach students that they recall information better and do better on assessments when pictures or other diagrams are incorporated in their learning (Bui et al., 2015).

Teach them how to be active listeners when classmates are sharing how they approached a math problem. This can expand their mathematical thinking.

DAILY MATH AFFIRMATION

One powerful tool to help shift a student's mindset in their abilities is positive self-talk (Tod et al., 2011). The brain believes what you tell it. If students are telling themselves they are bad at math they will believe it, and find evidence to confirm this bias. One way to push back on this is to create a class-wide math affirmation. Let your students co-create it with you. Start each day by saying it loud and proud.

Before we can help students develop their mindsets, we first need to acknowledge the direction of our own. Our mindset as educators can have a profound influence on the developing mindset of our students (Dweck, 2014). Remember to check your biases and expectations for your students. Believe that ALL students can learn math. Then your students will believe you and believe it about themselves.

MORNING MATH MINDSET AFFIRMATION

I am a math master.
I have the power to think, work, and improve every day.
These numbers and letters don't know who they are up against.
I am a math master!

SIDE NOTE

These first four questions deal primarily with the social and emotional needs of students. When these needs are met, students are more prepared for the cognitive journey of learning math. The final three questions match the cognitive needs for learning. Brain-friendly instruction engages three stages of learning (R-C-C): Readiness, Construction, and Consolidation.

For a more detailed explanation of these three stages of learning, check out Chapter 10 of my best-selling book, Brain-Based Learning, with leading brain expert Dr. Eric Jensen. These final three tools match up with the R-C-C formula for building cognitive capacity.

QUESTION #5

DO I FEEL READY TO LEARN?

It is rare for students to walk into a math class feeling ready to learn. Trying to teach new content or skills to students who aren't "ready" is a waste of everyone's time. Luckily, there are many tools teachers can use to have students ready to explore the beauty of mathematics.

WHAT TO KNOW

Brains do not learn whatever is taught. That's a myth most teachers have painfully discovered. Brains need circumstances, selection, and triggers (that's context or better yet, readiness). You are in a classroom or online. The environment is culturally friendly or oppressive. In short, the "place" you are in has a huge impact on your learning potential. If something's not right (you don't feel supported to learn, there's bias against you, or you feel threatened by your teacher or classmates), learning readiness is compromised.

STUDENT STATES

One powerful readiness factor is the "state" of your students. It is rare for students to enter a math classroom in one of the many optimal readiness states for learning: curiosity, anticipation, challenge, etc. Recent evidence (Oosterwijk et al., 2012) reminds us of the critical (and often overlooked) importance of fostering those states. Each releases a powerful learning readiness concoction (e.g. dopamine, norepinephrine, and cortisol) inside the brain.

The reminder here is simple: positive emotions (curiosity, anticipation, and caring about the content) will biologically crowd out other emotions which undermine learning (boredom, frustration, distress, fear, or anxiety).

WHAT TO DO

There are dozens of ways to help students feel ready to learn math. I dive deep into this topic in my online workshop you can find here. Save yourself 15 years of trudging through the burnout-inducing game of "guess and check" and get the evidence-based tools to boost student readiness.

One under-used strategy to prepare the brain for new learning is **pre-exposure.** Pre-exposure is any strategy that introduces the content to the brain before formal learning occurs (Moravec et al., 2010).

Think of this like a movie trailer – something that provides a big-picture overview of what is coming ahead. Ideally, there is plenty of curiosity and anticipation built-in, just like with the movie trailer. Pre-exposure provides learners with a foundation on which to build connections. The more background you provide, the better and faster learning may occur (Shin et al., 2019).

In addition, giving students prior exposure to a topic days (or even a week) ahead of time can reduce the cognitive load (Moos, 2013). It helps to build schema and store relative information in long-term memory before it is retrieved during the actual lesson on the topic.

HERE ARE A FEW SIMPLE PRE-EXPOSURE TOOLS:

- **Display a partially completed content poster or mind map of an upcoming unit.**
  Designate a special area of one wall as a "Sneak Preview" board. Leave diagrams, clues, questions, or partially completed formulas (Volume of a sphere: $V= ?\pi r^{?}$) for students to notice and wonder about.

- **End class with a verbal pre-exposure.**
  "I can't wait for tomorrow. We will be discussing why it's not a good idea to wear underwear on the outside of your pants. And how that relates to math. Just a heads up: my outfit might look a little different tomorrow." **(pre-exposure for introducing order of operations)**

STATES THAT POSITIVELY IMPACT LEARNING

- Curious
- Anticipation
- Hopeful
- Confident
- Confused
- Skeptical

STATES THAT NEGATIVELY IMPACT LEARNING

- Fearful
- Anxious
- Frustrated
- Bored
- Disinterested
- Insecure

QUESTION #6

DO I HAVE THE CAPACITY TO LEARN THIS CHALLENGING MATH CONTENT?

If the brain simply “copied” new information onto its “hard drive” (long-term memory), there would be no need for this question. However, we rarely learn what we hear with 100% accuracy. Students need affirmation that they will be able to learn what is being taught. This is where effective pedagogy comes into play.

WHAT TO KNOW

With a “ready” brain, the construction of new learning is next. Outlining all effective math pedagogies is beyond the scope of this e-book. Two of the most well-researched (and under-used) tools are chunking and multisensory instruction.

CHUNKING

When too much content is coming at a student too fast, it is unlikely to get processed correctly and saved accurately (Schacter et al., 2011). Our untrained working memory is quite limited. This mental workspace for the “now” moment can process approximately 1-4 chunks of information at a time, for about 30 seconds (Paas et al., 2014).

What happens when we invite a student to learn something that has more than 2-4 parts? Like solving a 3-digit multiplication task. Or a multi-step “real-world problem”. Or nearly every traditional math task. When a task consumes more cognitive space than a student has the capacity for, it is called “excess cognitive load”. And it impairs learning.

From the outside, the student may appear disengaged, apathetic, or pretending as if they understand (with head nods and "uh-huh"s). These reasons make it tricky to identify when a student may be experiencing cognitive overload. The safest approach is to avoid labels of unmotivated or lazy, and break your content into smaller pieces to reduce the chances of excess cognitive load. Follow the simple formula in the graphic below to support ALL students learning math.

MULTI-SENSORY INSTRUCTION

The once-popular Learning Styles theory suggested that a learner best learns through one favorite learning "style" (Cassidy, 2004; Pashler et al., 2008). As convenient as that notion might be, the original theory has never been scientifically validated or replicated. Moreover, it contradicts our current understanding of how to best construct new learning (Willingham et al., 2015; Newton et al., 2017).

When new inputs are received by the brain, they are dispersed to various sensory cortices for processing and storage. The more sensory cortices involved, the stronger the memory. Each cortex provides unique details to the memory that create a clearer picture when the brain retrieves the information and reconsolidates it for application (Schneider et al., 2018).

CHUNKING REDUCES COGNITIVE LOAD

- Chunk new content down to 1-3 pieces at a time.
- Help students learn, rehearse, apply those new ideas and then go back and add some more.
- It will be moved to a "virtual long-term memory", allowing for more cognitive space.

WHAT TO DO

SMALLER PIECES OF CONTENT

To work within the natural limits of working memory, **chunk** the new information into smaller pieces of information (Thalmann et al., 2018). Learn, rehearse, apply those new ideas and then go back and add some more until the big picture is complete. In a math setting, this could mean stopping mid-problem to discuss what has happened so far, reviewing the process, practicing some more, before finishing a problem.

HERE ARE A FEW OTHER PROACTIVE STRATEGIES TO REDUCE COGNITIVE OVERLOAD:

- **Give one set of instructions at a time.**
  Make the instructions visible so students are not expected to hold them in their memory. Save that space for the learning material.
- **Maintain a moderately decorated classroom.**
  An overly decorated physical environment can produce too many visual stimuli and lead to cognitive overload.

TARGET MULTIPLE SENSORY CORTICES

Since memories are stored in different regions of the brain, your goal is to input new learning in different parts of the brain. This will improve the memory formation process (as well as retrieval).

HERE ARE A FEW REMINDERS OF HOW TO ACTIVATE VARIOUS SENSORY CORTICES:

- **Activate the Visual Cortex**
  With color, graphs, short video clips, and visual language patterns ("imagine"; "picture this").
- **Activate the Auditory Cortex**
  With mnemonic rhymes, songs, callbacks, and variations in your voice.
- **Activate the Motor Cortex**
  With manipulatives, gestures, note-taking, and model-building.

QUESTION #7

WILL I BE ABLE TO REMEMBER ANY OF THIS?

It is discouraging to think you learned something, only to be reminded on a high-stakes test or elsewhere that you didn't remember it correctly (or at all). Emotionally, it adds to the hopelessness too many math students feel. Cognitively, it severely limits the amount of application and deep mathematical thinking we hope for our students.

WHAT TO KNOW

Memories are not as "concrete" as you (or your students) might hope. They are flexible, dynamic, and thus susceptible to distortion (Schacter et al., 2011). That might seem maddening, but the brain's ability to change (neuroplasticity) is what allows us to learn, change, and grow individually and as a society.

There are two main types of memory flaws that can frustrate both you and your students – **Forgetting** and **false memories** (remembering, but inaccurately).

FORGETTING

First, it is very common to learn something and then forget it. Your brain is constantly pruning away connections (learning) it deems irrelevant. The challenge comes when the brain prunes connections that you (or they) hope to retain. How does it decide whether something is worth keeping? **Relevance** and **repetition**.

Typically, the less relevant the new information is, the more likely you are to forget it (Ozubko et al., 2016). Math students (and sometimes teachers) find it difficult to find the relevance in some math curriculum. Updating the current math curriculum to include more data science, financial literacy, and other relevant topics can help in this regard.

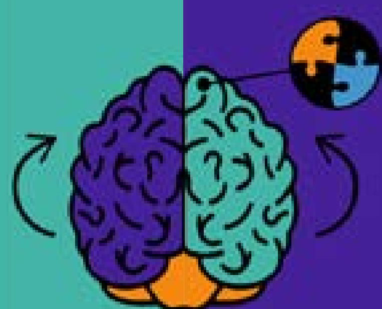
The currently less popular (yet highly effective) approach to reduce forgetting is repetition. The frequent firing of neurochemical impulses across pathways strengthens the new learning. Does this mean students should sit in front of "drill and kill" worksheets all day? NO! There are countless ways to imbed play, positive emotions, and a multisensory approach to repetition.

FALSE MEMORIES

The second source of memory error is when students learn something… but learn it wrong. The truth is, we rarely learn something perfectly the first time.

Creating new memories is a complicated process that involves multiple systems and structures in the brain **dispersing** information to various regions of the brain. When it is time to retrieve (remember), the frontal lobe and hippocampus work with several other parts of the brain to **reconstruct** all the important pieces from various brain regions to recreate the memory. As all the pieces get pulled back together, it is VERY common for things to get mixed up (Schacter et al., 2011). The more details the brain has to work with, the more accurate the memory. Hence the case for multisensory instruction.

When "remembering", the frontal lobe gathers relevant information from sensory cortices to reconstruct the learning.



Therefore, the more cortices involved the more accurate the memory will be.

WHAT TO DO

Fortunately, there is a lot a teacher can do to reduce the amount of forgetting and false memories. Check those links for a more in-depth understanding and tons more tools. Here is a quick overview of two high-powered tools to help students say YES to "Will I be able to remember any of this?" Remember, a YES on this question builds greater student math efficacy, which improves their learning.

RETRIEVAL PRACTICES

One powerful tool to keep learning in the brain is to draw it out of the brain. The process of retrieval not only strengthens the memory but can also improve the accuracy of the learning (Karpicke, 2012).

Retrieval is any activity that challenges the learner to mentally, verbally, or visually retrieve the information they have previously learned. Ideally, they do this without any support from a book, notes, or classmate.

A FEW EXAMPLES OF RETRIEVAL PRACTICES INCLUDE:

- Have students write down everything (or three things) they remember learning yesterday
- Practice tests
- Flashcards (individual or with a partner)
- Learning stations
- With any retrieval activity, remember to establish a system to "error-correct" so students avoid reinforcing incorrect information.

Remember, you want your students to have key pieces of information stored in their long-term memory to be retrieved when needed. Being able to retrieve and apply previously learned math to new situations is a critical component of deep mathematical thinking.

DIFFERENTIATE INSTRUCTION

When students can predict what is going to happen in math class because "*we always do xyz in so and so's class*" it creates a breeding ground for false memories. The tricky part here is well-designed pedagogical practices are not immune to creating false memories. If a student spends every day doing math tasks on your favorite online platform, or vertical non-permanent surface, or answering the same two notice and wonder questions, they are highly susceptible to creating false memories. Why? The sameness of the medium muddles the uniqueness of each distinct memory in the brain.

A couple of differentiating modifications can support these tasks and mediums to minimize false memories.

- **Differentiate your medium of delivery.**
  Step aside occasionally from what is most comfortable for you (PowerPoint, your go-to math program, common language patterns of 'notice and wonder') and give your students a new and unique experience. Let me be clear – there is nothing wrong with these tools. It is monotony that is bad for learning.
- **Differentiate your location.**
  Vertical, non-permanent surface tasks are a great way to get students out of their chairs and in a new location. Keep expanding your options. Swap classrooms with a colleague for a day. Grab some sidewalk chalk and head outside. The "where" learning happens is a key feature of a memory (Moscovitch et al., 2016). When students stay in the same location, memories are more likely to get mixed up.

CONCLUSION

With all the "shiny objects" of Edu-trends and new tech tools vying for your attention, stay focused on what your STUDENTS need from you. These seven questions are constantly running through their mind. And you hold the answers to determine whether ALL students truly can learn math.

Take time to truly reflect on who is answering YES to these questions. Chances are it is the students who are experiencing the greatest academic success. Give that opportunity to ALL your students by acting today to expand the boundaries of YES to include your entire class.

NOW WHAT?

No one wins when students' cognitive, social, and emotional needs are not being met. It is bad for student learning. It is just as bad for teacher morale as they work tirelessly with minimal results. If you are struggling to boost your staff's skills, give them the support THEY NEED.

High engagement, high energy, with evidence-based tools for teachers is my professional development expertise. I'd love to help.

Contact me at: liesl.mcconchie@gmail.com

ABOUT THE AUTHOR

Liesl McConchie is an international expert on how the brain learns, and co-author of the best-selling book Brain-Based Learning with Dr. Eric Jensen. She has also been published in ASCD's Educational Leadership journal. With over 20 years of experience in education, Liesl bridges her knowledge of how the brain best learns with her experience of teaching math to create tangible strategies to support teachers and schools across the globe. She has a rich background in education that includes creating new schools, leading whole-school reforms, delivering workshops to educators, and speaking at conferences. Liesl brings the highest quality of research, professionalism, and engagement to all her contributions to the field of education.

CITATIONS

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