10 Retrieval Activities to Boost Student Learning & Retention

UPGRADING THE TRADITIONAL MATH WARM-UP WITH THE BRAIN IN MIND

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Why Retrieval Practice Matters

One of the more frustrating experiences of being a teacher is witnessing the reoccurring tragedy of "forgetting" play out right before your eyes. You spend hours prepping, give your all during the lesson, only to have students forget (or falsely remember) what you taught within days. There are reasons why this happens, and better yet, solutions to eradicate it.

Our Brain's Imperfect Memory Systems

It is a long and complicated road for new information to be consolidated into a memory. It involves the thalamus, amygdala, frontal lobe, hippocampus, as many sensory cortices as applicable, and a few other key parts of the brain. With so many twists, turns, and forks in this neurological road it really isn't surprising that some things get a little mixed up or lost along the way.

I'll spare you the exciting details of how memories are formed and just remind you that in the end all of the details of an experience get dispersed to various parts of the brain – there is no one specific place in the brain where long-term memories are stored.

So, when it comes time to retrieve (aka remember) something, the frontal lobe works with several other parts of the brain, bringing bits and pieces from numerous brain regions together to reconstruct a memory. Although it is possible the wrong information gets consolidated in the first place, most scientists agree it is the reconstructive process that is susceptible to distortion.[1]

What does all this mean? This simple truth is: **Your students almost NEVER learn something right the first time.**

There also seems to be an "information overload" protection system in the memory process of the brain that leads people to only remember the general gist of what they experienced. The details get lost, forgotten, or just omitted.[2] Your brain makes a rough draft and holds it until it you decide to either upgrade the details or delete it all together. Your students might remember that you learned about trigonometry last week, but the details and distinctions between the Law of Sines and the Law of Cosines might get mixed up in the shuffle.

How Retrieval Practice Helps

The idea that students forget things (or learn things wrong) is not new to teachers. But the ancient strategies of looking over your notes or re-reading the textbook do very little to improve test scores or learning. [3,4]

One of the most powerful remedies to the ailment of mass forgetting is **retrieval practice**.

Much different (and better) than *reviewing* or *studying*, retrieval is any exercise that challenges the learner to retrieve information from memory. Essentially, it is a strategy to reactivate the neural pathways associated with previously learned information. Consider retrieval a way for students to "test" their memory. When done properly, it strengthens those pathways to better solidify the learning.

The evidence is clear: retrieval practices enhance learning, recall, and improve test scores.[5]

When to Do Retrieval Practices?

Studies show that students retain information better (and more correctly) when they re-engage with the content periodically.[6]

Retrieval practices should happen the DAY new information is learned, the day AFTER it is learned, AND in intervals for two weeks afterward.[7]

Retrieval practices can take as little as 30 seconds, or as long as you'd like. When implemented effectively, it is always time well spent.

How to Maximize the Impact of Retrieval Practices

A few hot tips to help you maximize the power of retrieval practices:

- A pure retrieval exercise is done without the support of a textbook, notes, or other aid.
- Add an extra boost to your retrieval exercises by having students recall with a classmate. When students talk about what they have learned it reactivates their memories and solidifies the learning.[8]
- Remember to build in an "error-correction" safeguard to ensure students are retrieving the correct information. This could be answers on the back of flashcards, ways to self-grade their mini quiz, or hints hidden at each learning station.
- Be careful to NOT assume that a retrieval exercise needs to count towards a grade – it can simply be used to improve their learning.[9]

What follows is a collection of 10 retrieval activities to guide your efforts to improve student learning and recall. Modify them to fit your content area, student needs, and available time.

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[1] Lacy, J. W., & Stark, C. E. (2013). The neuroscience of memory: Implications for the courtroom. *Nature Reviews Neuroscience, 14*(9), 649-658.
[2] Schacter, D. L., Guerin, S. A., & Jacques, P. L. (2011). Memory distortion: An adaptive perspective. *Trends in Cognitive Sciences, 15*(10), 467-474.
[3] Bartoszewski, B. L., & Gurung, R. A. (2015). Comparing the relationship of learning techniques and exam score. *Scholarship of Teaching and Learning in Psychology, 1*(3), 219.
[4] Dirkx, K. J. H., Camp, G., Kester, L., & Kirschner, P. A. (2019). Do secondary school students make use of effective study strategies when they study on their own?. *Applied Cognitive Psychology*, *33*(5), 952-957.
[5] Karpicke, J. D. (2012). Retrieval-Based Learning. *Current Directions in Psychological Science, 21*(3), 157-163.
[6] Kang, S. H. (2016). Spaced Repetition Promotes Efficient and Effective Learning. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 12-19.
[7] Roediger, H. L., & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences, 15*(1), 20-27.
[8] Sekeres, M. J., Bonasia, K., St-Laurent, M., Pishdadian, S., Winocur, G., Grady, C., & Moscovitch, M. (2016). Recovering and preventing loss of detailed memory: differential rates of forgetting for detail types in episodic memory. *Learning & Memory, 23*(2), 72-82.
[9] Barber, S. J., Rajaram, S., & Marsh, E. J. (2008). Fact learning: How information accuracy, delay, and repeated testing change retention and retrieval experience. *Memory, 16*(8), 934-946.

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1. 2 Things

This quick retrieval activity can happen at any time during your lesson/unit.
Before a new lesson:

- What are **2 things** you learned yesterday?
- What are **2 things** you've learned so far in this chapter/unit?

During a lesson:

- What are **2 things** you have learned so far today?
- What are **2 things** you'd like to learn more about?

End of a lesson/unit:

- What are **2 things** you want to remember from this lesson/unit?
- What are your **2 biggest** learnings from this lesson/unit?

Students can record their responses on a scratch piece of paper or share them verbally with a neighbor.

2. 5 New Words

Present your students with a topic or theme. Instruct them to write down **5 words** that relate to that topic. That's it!

Potential topics: Slope, circle, fraction, parabola, radius, vertex, exponent, tangent, percentage, function, parallel lines, decimals, ratios, scalene, irrational, derivative, cosine, ...

You might feel inclined to go further with this retrieval exercise, but you don't always need to. Keep in mind there is a lot more going on in your students' brain when they complete this simple retrieval. They are reflecting on the topic, and making connections with each of the 5 words they write down.

If you want to extend the retrieval activity, partner students up after writing their 5 words. Have them define each term and how it relates to the topic. This will strengthen their learning and provide an opportunity for any needed clarification or error correction.

3. Brain Dump

Give students a specific (and relatively short) amount of time to write down everything they can think of that relates to the topic you choose. Depending on the complexity of the topic, 3-5 minutes is often a good range.

(The potential topics listed for the strategy above would also work great here.)

To extend the activity further, students can partner up afterward and reflect:

- What did we both add to our brain dump?
- Is there anything we both wrote down, but remembered differently? (need for error-correction)
- Are there any concepts you considered adding but didn't?

Hot Tips:

- For your first time, show a model of a "brain dump" page – often a scratch piece of paper with writing scribbled in different directions and maybe a few icons. Help them see the goal is to get as much information on the paper, not to create something neat or organized.
- On a "content heavy" day, pause a few times throughout the lesson for a brain dump.

4. Brain, Book, Buddy*

Create a simple 3-column retrieval think space for students.

Topic	Brain	Book	Buddy
Parabolas			

This retrieval activity happens in three phases:

Phase 1: Students add as much information as they can retrieve, only using their brain, in column 1.

Phase 2: Students consult their book (or notes) to see what details they can, in column 2.

Phase 3: Students share with a classmate, adding further information, in column 3.

*This retrieval activity comes from Blake Harvard.

5. Donut Time

Organize students into two standing concentric circles – one circle inside another, like a donut. Both circles should have the same number of students in them. The outer circle is facing inward to the center of the circle. The inner circle is facing outward with their back toward the center of the circle. The two circles are close enough together so that one person from the outer circle can have a one-on-one conversation with a person from the inner circle.

Give the students a topic (or question) to discuss with their partner. After 1-2 minutes, give directions for the circles to shift. For example: instruct the outer circle to rotate 7 people to the left; the inner circle then rotates 3 people to the right.

Potential topics:

- Discuss what you know about slope.
- Share what you know about graphing logarithmic functions.
- Discuss the difference between (greater than) and (greater than and equal to)
- How would you describe factorial to someone who'd never heard of it before?
- Define the difference between acute, scalene, and right triangles.
- Use your hands to demonstrate the difference between the following transformations: translation, rotation, reflection.

6. List it!

Within a short timeframe, have students make a quick list. Possible list topics:

- 5 facts you know about the slope of a line.
- Questions you (or someone else might) have about logarithmic functions.
- 7 things you know to be true about fractions.
- Questions that could be asked on an assessment on the topic of _____.

Hot Tips:
As always, create a system for error correction.

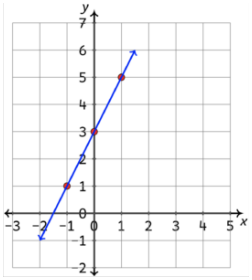
- You could collect the lists and briefly scan them while students engage in a different activity so you can clarify any misconceptions.
- Students can also work in small groups to share their lists to ensure accuracy.

7. Mini Quiz

Prepare a short mini quiz (3-5 questions) that focuses on retrieving key content. Questions could be multiple choice, T/F, short answer, etc.

Students can check their answers with a neighbor, small group, or as a class.

Potential Questions:
1. Adding two numbers together always makes a bigger number (T/F)
2. What is the slope of this line?



a) 3
b) -1.5
c) 2
d) -2

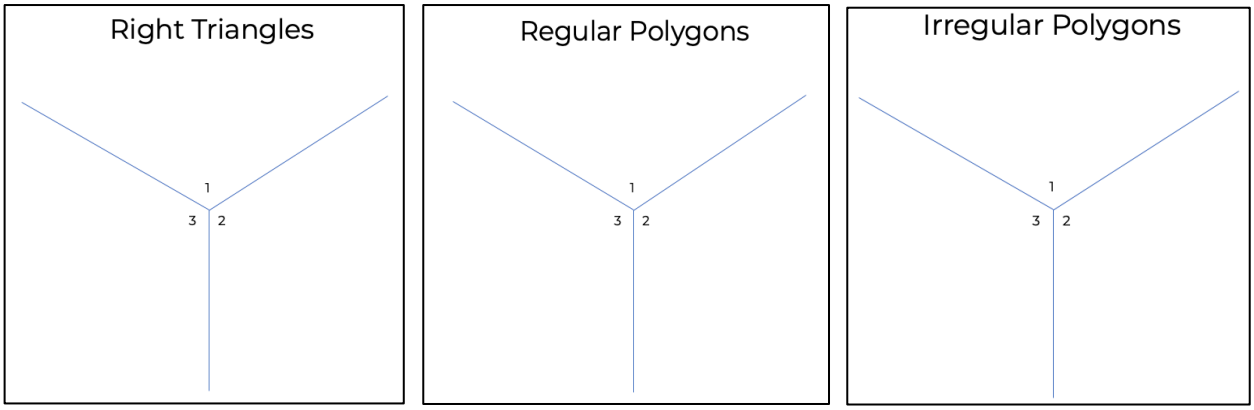
3. In your own words, describe a “line of symmetry”: _____
_____

Hot Tips:

- Remember the purpose of retrieval exercises is to improve learning and recall. They are learning tools, not assessment tools. Resist the urge to have these mini quizzes count for a grade.
- To save on time/preparation: have students generate questions for these mini quizzes earlier in the week, or for another class.

8. Pass the Paper

Students work in groups of three. Each student has a piece of paper, divided into three sections. There is a different topic listed on the top of each paper. Students are given 2-5 minutes to record everything they know about that topic in Section 1. On your cue, students rotate papers (and thus topics), review what previous group members contributed, and add anything else they know to Section 2 of that paper. The process is repeated a third time so each student is contributing to each paper/topic.



At the end, have students review everyone's contributions for collective learning and error correction.

9. Quiz, Quiz, Switch

Every student has a scratch piece of paper (or 3x5 card) with a question written on it. Students roam around the room and find a partner. Partner A asks Partner B their question, and Partner B answers the best they can. Then Partner B asks the question on their card to Partner A, who then answers that question. They work together to collectively deepen their understanding and ensure comprehension. The partners then switch pieces of paper and go to find a new partner. The process continues for as long as students are engaged, or as long as you'd like.

Hot Tips:

- You can create all the questions that are used or have students create the questions. You might want to consider giving them guidelines or a specific subtopic to create a question around.
- Once they have finished with their partner, have them raise their hand to show others they are looking for a new partner.
- Questions can be factual based, or more opinion/thought based.

10. 'Round the Room

Set up multiple "stations" around the room with 1-2 questions at each station. Students can travel in pairs or groups of three to each station. Guide them to read the question and think of their own response before jumping into a discussion with their partner(s). After coming to consensus, students check their answers before moving on to the next station.

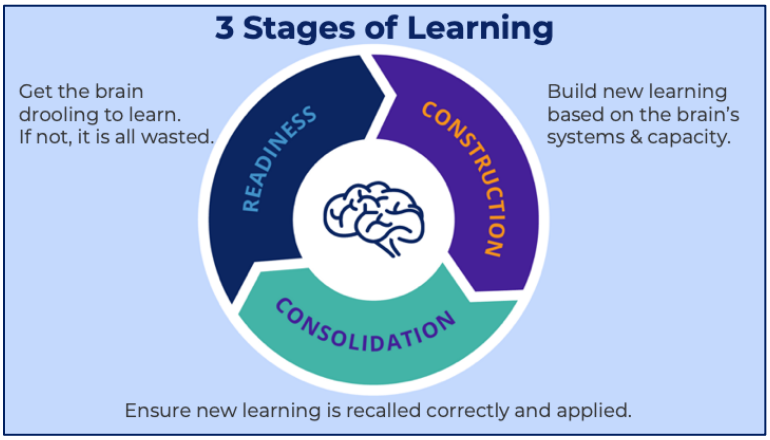
Hot Tips:

- Answers can be hidden in an envelope, under a chair, on the back of the paper, etc. The key is to have an immediate source of error correction available to students before moving on to the next station.
- Use music to cue students to move to the next station to avoid students clumping at stations. You can also use music to cue the transition from individual think time to partner sharing time.
- To minimize the time this activity takes, create sets of retrieval tasks and have those same tasks repeated a couple times in different areas of the class. That way each group can be at their own station, but only have four stops to make before completing the whole activity.

NOW WHAT?

No one wins when students forget what you taught last week. Retrieval practices are one tool to help consolidate new learning so it lasts beyond Friday's quiz.

Consolidation is the 3rd and final phase of the brain's learning process. Lasting, meaningful learning happens when teachers develop skills for all three phases: Readiness, Construction, and Consolidation.



If the staff at your school are struggling to get students ready to learn, constructing new learning, or consolidating that learning for retention, then reach out. High engagement 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.