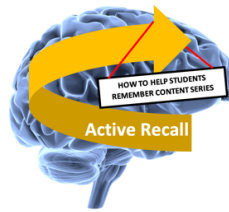


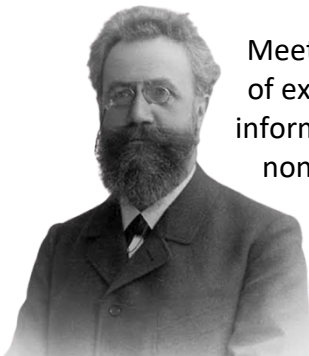
How to Help Students Remember Content:



Active Recall

I think it goes without saying that every teacher wants their students to remember the material that they teach...otherwise, why teach it? Of course, we all want our students to leave our classes being able to recall, apply and grow from what we've taught. This series is dedicated to helping classroom teachers know what the science of learning has discovered that really helps students retain the valuable information that you've taught them.

Today's topic: Active Recall



Meet Hermann Ebbinghaus. Between 1880 and 1885 Ebbinghaus did a series of experiments on himself trying to determine how quickly he forgot information if he did nothing with it. He studied a series of three-letter nonsense words (MIP, DER, FLS, TPR, etc) and then tried to recall them. He forgot them very quickly...as we all would. From his experiments he developed what has come to be known as the **Forgetting Curve**—the rate at which we forget new information. It's quite alarming actually.

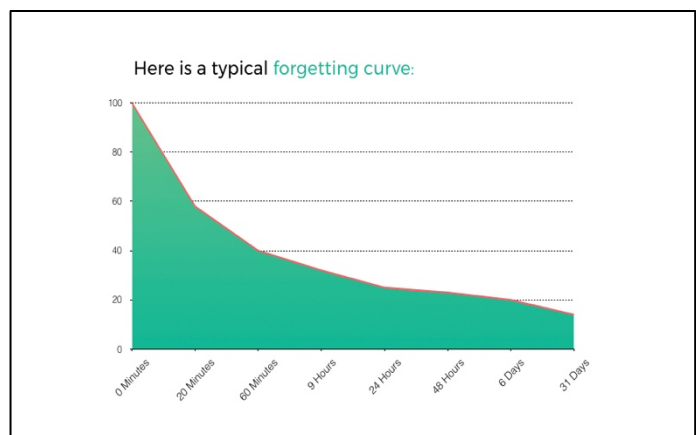
In later years this experiment has been replicated many times (e.g. Murre & Dros, 2015) and the results are extraordinarily similar to what Ebbinghaus discovered: **we forget almost immediately approximately 70% of new material that we've just heard or read**, and then the remaining 30% or so falls away more slowly over the next 30 days if nothing is done to interrupt the forgetting (Brown, Roediger & McDaniel, 2014).

“A central challenge to improving the way we learn is finding a way to interrupt the process of forgetting”

(Brown, Roediger & McDaniel, 2014; p.28).

So here's the good news!

We can interrupt forgetting and retain a much greater percentage of new information with a few simple, though effortful, behaviours.



Ebbinghaus Forgetting Curve 1885: Source: Enably

Active recall is one of those behaviours!

Active recall is the simple act of asking your brain to retrieve information from memory—trying to remember it—without first reviewing it or trying to hold it in short-term memory. In other words, it's simply trying to recall it after some time has passed...perhaps a day or two, or a week.

We've all been challenged to try to remember something and hold it in our working memories for a short period of time, such as a telephone number or shopping list, so that we can use it soon afterward. That's not the type of recall we're talking about here. In that instance you are relying on your short-term or working memory to hold on to the information just long enough until you use it....then you likely forget it. I don't know about you, but I still don't know my licence plate number (for some reason) and I have to repeat it 20 times during the time I am trying to punch in the numbers to pay for parking time. Again, that's not what I'm referring to when I use the term Active Recall.

However, if I tried to recall my licence plate number two hours later, or the next day, and I worked to think about the numbers and letters— "I know it begins with the letter C and has a 9 and a 5 in there somewhere"—I am now beginning to practice active recall. By the way, the image used here is a random image....I hope it's not yours!!



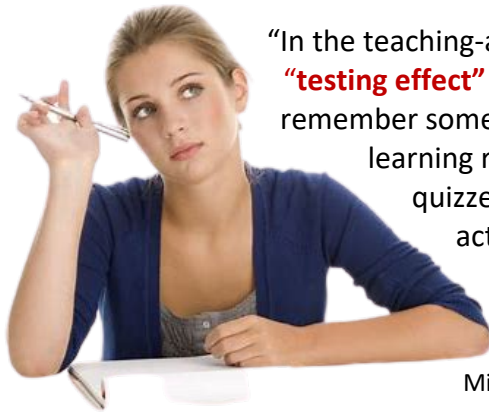
Random image Google Images. Not my personal plate.

The **illusion of knowing** is a common problem in learning. We gain a familiarity with the text as we reread it, repeat words and phrases, and underline things or put notes in the margin. As we reread it we say to ourselves, “yeah, I know this, I understand this” and we become even more convinced of our mastery with subsequent readings of it. But put the passage down and try to write out the key points....immediately afterwards and then, say, an hour later. You will notice that you don't actually know it, you aren't actually able to recall it...so truly, it's hard to say that you know it. Rereading of text as a study method creates a false sense of mastery (Brown, Roediger & McDaniel, 2014).

Believe it or not, the act of trying to remember information that we've supposedly forgotten is one of the best ways to strengthen your memory.

Teachers work very hard to teach in such a way that their lessons and content is memorable—and so they should, this is a good thing to do—but if we really want our students to remember the lesson of the day we need to promote active recall frequently. Daily. And we must allow forgetting to part of the process.

As counterintuitive as it may seem, a little forgetting of the material, and then mental effort to recall it actually produces better results because your neural memory pathways strengthen and become more efficient through resistance and mental effort to remember.



“In the teaching-and-learning world, the phenomenon known as the **“testing effect”** has received much ink. Put very simply, if we want to remember something, we have to practice remembering it. To that end, learning researchers have demonstrated over and over again that quizzes and tests not only measure student learning, but can actually help promote it. The more times that students have to draw information, ideas, or skills from memory, the better they learn it.” (James Lang series, Small Changes in Teaching: January 11, 2016, Small Changes in Teaching: The First 5 Minutes of Class)

Instead of “testing effect,” I prefer to use the more technical term, **“retrieval practice,”** because what many people have understood testing to mean is not required to help students practice retrieving material from their memories, but it could. Any effort they make to remember course content — without the help of notes or texts — will benefit their learning.

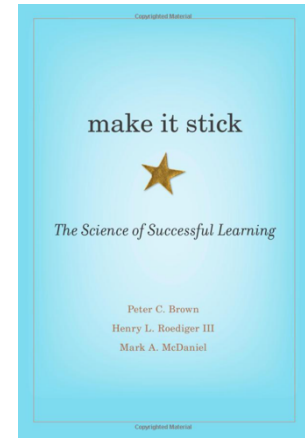
“One of the most striking research findings is the power of active retrieval—testing—to strengthen memory, and that the more effortful the retrieval, the stronger the benefit. Think flight simulator versus PowerPoint lecture. Think quiz versus rereading. The act of retrieving learning from memory has two profound benefits. One, it tells you what you know and what you don't know, and therefore where to focus further study to improve the areas where you're weak. Two, recalling what you have learned causes your brain to reconsolidate the memory, which strengthens its connections to what you already know and makes it easier for you to recall in the future. In effect, retrieval—testing—interrupts forgetting. (Make it Stick, p.20)

One important caveat: Students should be asked to try to retrieve information from memory without notebooks, texts, or laptops nearby. Retrieval practice only works when they are retrieving the material from memory — not when they are retrieving it from their screens or pages.

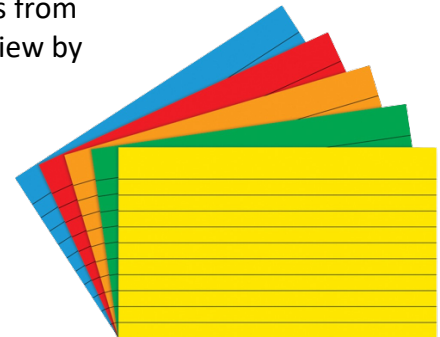
A few very important points about learning that I want to lift directly from *Make it Stick* (Brown, Roediger & McDaniel, 2014; p.2-4):

Learning is an acquired skill, the most effective strategies are often counterintuitive.

1. **Learning is deeper and more durable when it's effortful.** We are poor judges of when we are learning well and when we're not. When the going is harder and slower and it doesn't feel productive, we are drawn to strategies that feel more fruitful, unaware that the gains from these strategies are often temporary.
2. **Rereading text and massed practice** of a skill or new knowledge are by far the preferred study strategies of learners of all stripes, **but they are also among the least productive.** By massed practice we mean the single-minded, rapid fire repetition of something you're trying to burn into memory, the “practice-practice-practice” of conventional wisdom. Cramming for exams is an example. Rereading and massed practice give rise to feelings of fluency that are taken to be signs of mastery, but for true mastery or durability these strategies are largely a waste of time.
3. **Retrieval practice**—recalling facts or concepts or events from memory—is a more effective learning strategy than review by rereading. Flash cards are a simple example. Retrieval strengthens the memory at interrupts forgetting



Flash cards for study are an excellent method for retrieval practice that all children should be encouraged to try. It takes effort to remember material and that's good for the brain.



Teachers should instruct students how to use flash cards and help them craft appropriate types of questions. There will be various types of questions that students can use, from factual recall (e.g. the years of the first Peloponnesian War), to questions that ask students to state their opinion or evaluate a set of statements (e.g. Why were the Peloponnesian wars fought, provide a defence of your answer). The questions are placed on one side of the card and the answers are placed on the other side of the card. Students should be encouraged to practice retrieving information for short periods of time on a daily basis.

Questions for recall should reflect the content or curriculum objectives. In other words, we should ask students to recall content that is important to know and remember, and this information should align with what we intend for students to know from learning in our course.

Quizzing & Review Questions: It's not about marks, it's about recalibration of understanding Practicing active recall and retrieval practice should be a normal daily practice for teachers but it doesn't have to be unpleasant or punitive for students. The goal is to give students a

measure of their understanding and knowledge and can readily serve the purpose of self-regulation and metacognition when used for those purposes. Regular quizzing and review questions—whether from the teacher or as a means of self-quizzing—helps to recalibrate our understanding of what we know and don't know.

Fun daily quizzes such as Kahoot!, Quizzuz, or any readily available software, or paper/pen methods or simply off-the-cuff and spur of the moment quizzes given by the teacher are effective, as long as everyone has the chance to participate. Teachers regularly ask their students to recall what they learned the class before or to recall salient points from the previous lesson, but often we rely on choral responses or responses from individuals who are confident in their answer. We might miss out on reaching the very students we want to monitor with those approaches. Quizzing, review questions, and writing exercises that ask students to recall a previous lesson without first reviewing their notes is a good way to gauge actual understanding of concepts and new material.

The Power of Sleep

Most educators know that sleep plays a powerful role in helping to consolidate memory formation after a day of learning. Researchers have shown that sleep yields a positive effect on recall of information after a night of sleep and separation from studying (Gais, Lucas & Born, 2006). It is during sleep that the brain does important work of making sense of learning and it strives to organize new information in the brain and stabilize the memory traces that it was exposed to during the day of learning. I won't go into any more of the details here but its quite easy to find a lot of information on the role of sleep in learning from a quick Google search.

Wrapping it Up

Today, after years of good research on how the brain learns most effectively, the Science of Learning promotes alternative and better approaches to memory consolidation and learning. Active Recall is one such preferred approach. Asking students to recall information from memory, even after some forgetting has occurred, requires mental effort that strengthens neural memory pathways and helps plant information more firmly in long term memory. It seems counterintuitive to suggest that trying to pull information out of memory is the best way to ensure that it sticks in memory, but it's true. We are tempted to believe that repetition, rereading, multiple exposures to the material and familiarity with the content is the best way to encode information in our long term memory, but this simply is not the case. Daily quizzing, answering review questions, writing out responses from memory and getting a good night sleep before trying to recall information are better approaches.

References

Brown, P.C., Roediger, H.L., & McDaniel, M.A. (2014). *Make it Stick*. Harvard University Press

Gais, S. Lucas, B., & Born, J. (2006). Sleep after learning aids memory recall. *Learning & Memory* 13, 259-262.

Kirschner, P. A., & Hendrick, C. (2020). *How Learning Happens: Seminal Works in Educational Psychology and What They Mean in Practice*. Routledge.

Murre, J. M. & Dros, J. (2015). Replication and Analysis of Ebbinghaus' Forgetting Curve, *PloS one*, 10(7). <https://doi.org/10.1371/journal.pone.0120644>

PEN Principle

Active Recall Trumps Passive Review



Ψ Psychology

What is the capital of Germany?

Active Recall:
The act of retrieving or re-accessing previously learned information without explicitly re-encountering it. Recall has been linked to deep memory formation and enhanced learning / performance.

What is the capital of Germany?
A) Berlin
B) Munich
C) Bern

Passive Review:
The act of simply recognizing previously learned information when the info is re-encountered. Review has been linked to shallow memory formation and impaired learning / performance.

Roediger, H. L., & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. Perspectives on Psychological Science, 1(2), 181-210.

🍎 Education

Language students who were asked to actively recall word-pairs during several study sessions outperformed students who were asked to simply re-read and review the same word-pairs by ~50% on a 1-week retention exam.

Roediger, J. D., & Karpicke, H. L. (2008). The critical importance of retrieval for learning. Science, 312(5863), 1161-1165.

English students who were asked to actively recall details from a reading passage outperformed students who were asked to simply re-read and review the same passage by ~20% on 2-day and 1-week retention exams.

McDaniel, M. A., Finn, D. C., & Rhodes, G. G. (2009). The benefits of active recall: A meta-analysis. Psychological Science, 20(2), 111-117.

🧠 Neuroscience

This brain is passively reviewing a list of previously seen words.

This brain is actively recalling a list of previously seen words.

The utilization of more and deeper brain regions during active recall suggests deeper processing and than does simply reviewing and passively recognizing learned information.

Chaloux, B., Koenig, S., Craik, F. I., Lockhart, A. S., Hwang, E., & Saksida, L. M. (2015). Functional neuroanatomy of recall and recognition: A PET study of episodic memory. Journal of Cognitive Neuroscience, 27(2), 289-302.

Classroom Applications

Active recall strategies include using flashcards with a prompt on one side and the correct answer on the other, asking students to recall & write as much as possible following a reading or lesson (then checking accuracy by reviewing), and the use of low- or no-stakes quizzes or exams that ask students to recall (rather than recognize) material.



Passive review strategies include re-reading passages from a novel or text book, looking over notes taken during a class period, re-writing or copying notes or passages, or re-watching / re-listening to a lesson or lecture.

Ideas and Future Questions...

How can *Recall* and *Review* strategies best work together?
Is there an ideal *Recall-to-Review* ratio to best facilitate deep, accurate memory formation?

