

The Science of Learning (and Why It Matters)

Here's a frustrating truth most students discover too late: re-reading your notes the night before a test feels productive, but it barely works. You might ace the quiz on Friday and remember almost nothing by Monday. That's not a personal failing; it's just how the brain works when you study the wrong way.

The good news? Researchers have spent decades figuring out how learning (getting information into storage in the brain) and memory (retaining and retrieving stored information) actually function. The strategies that come out of that research can make teaching and learning dramatically more effective, and often shorter. Here are some key findings from the science, all of which can be put to work to help students learn.

Your Brain Remembers What It Has to Think About

Imagine you're shown the word "*elephant*." If someone asks you whether it's written in capital letters, you'll look and answer, but you probably won't remember the word an hour later. Contrast that with what would happen if someone asks you, "*Does an elephant have feelings?*" That's a question that makes you actually think. And you'll remember it.

This is called *deep processing*: the more mental effort you invest in engaging with something—such as by analyzing it, questioning it, or connecting it to your own life—the more firmly it gets stored in your long-term memory. Shallow tasks (highlighting, re-reading, copying notes) feel like studying but barely move the needle, if at all.

Practical takeaway: Effective teaching needs to draw students in, so that they actually think about the material. In fact, you sometimes need to struggle a little. That discomfort is learning happening.

Memory Is a Web, Not a Filing Cabinet

Your brain doesn't store facts in separate folders. It stores them as a network of connections. It's easier to dig out a memory when it has more connections to other ideas, to personal experiences, to images, or to emotions. That's why a history lesson sticks better when you connect the date to something personal, or a math formula makes sense once you see the real world problem it solves.

Scientists call this elaborative encoding, which requires finding or building rich associations around new information rather than treating it as an isolated fact to memorize.

Practical takeaway: Effective teaching needs to lead students to ask: "What does this remind me of? Where have I seen this before?" The more bridges teachers help you build between new material and what you already know, the stronger the memory.

Spread It Out: Don't Cram

One of the oldest and most reliable findings in memory research goes back to the 1880s: studying something once for four hours is far less effective than studying it for one hour across four separate sessions. The brain consolidates memories during the gaps between study periods, especially during sleep.

This is called spaced (aka "distributed") practice. What makes it especially powerful is that returning to material just as you're starting to forget it, when it is right at the edge of your recall, forces your brain to work to retrieve it, and that effort strengthens the memory each time. You also associate the information with different contexts each time you study it.

Practical takeaway: We help you use information repeatedly over the different sessions.

Testing Yourself Is the Best Way to Study

Here's something surprising: the act of *trying to remember something* is more powerful for learning than re-reading the material. When you struggle to pull information out of your memory, even if you get it wrong at first, you strengthen the memory far more than passively reviewing it would.

This is called retrieval practice or the testing effect, and it's one of the most consistently replicated findings in all of learning science.

Practical takeaway: We ask you to use information you learned earlier in the course, so you need to dig it out of memory or look it up—both of which will help you learn.

You Don't Always Have to Try to Learn

Most people assume learning only happens when you're deliberately trying to memorize something, sitting at a desk, highlighter in hand. But research shows that some of the most durable memories form without any intention to remember at all. This is called *incidental learning*.

Think about the last movie that genuinely moved you. You didn't study it, but you can probably still describe the plot, the characters, what the ending meant. That's because the material was *meaningful and emotionally engaging*. Deep processing happened automatically.

The key insight: it's not whether you're *trying* to learn: it's whether you're *genuinely engaged* with the material. Learning environments that make content inherently interesting and relevant can produce lasting knowledge without the grind of forced memorization.

Practical takeaway: We have designed projects based on activities that students find inherently rewarding and build up to those projects a step at a time during the course. Moreover, the group interactions during the final project are inherently motivating for most students, which leads them to become engaged.

The Sweet Spot: Not Too Easy, Not Too Hard

A Russian psychologist named Lev Vygotsky identified something important decades ago: there's a sweet spot for learning that lies just beyond what a student can already do on their own, but within reach with a little guidance or support. He called this the *Zone of Proximal Development*, or ZPD.

Tasks that are too easy feel boring and produce little growth. Tasks that are far too hard are overwhelming and frustrating. But tasks at the right edge of your current ability, which are challenging but doable with effort, are where real learning happens.

Practical takeaway: Our AI-based instruction carefully tracks student progress and adjusts the material so it isn't too easy or too difficult for each student.

The Bottom Line

Effective learning isn't about working longer: it's about working in alignment with how your brain actually stores and retrieves information. The students who thrive are rarely the ones who re-read everything twice. They're the ones who quiz themselves, space out their practice, make meaningful connections, and seek out material that genuinely interests them. Our instruction takes advantage of these and similar principles to ensure that learning is engaging, efficient, and effective!