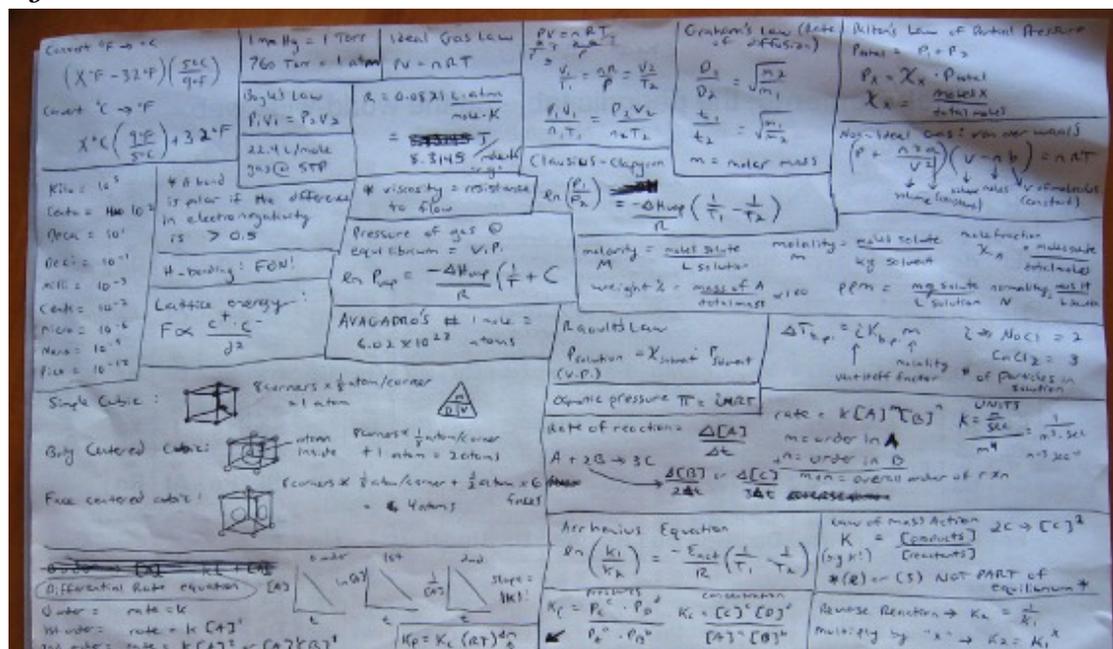




## When Memorization Gets in the Way of Learning

By Ben Orlin



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I once caught an 11th-grader who snuck a cheat sheet into the final exam.

At first, he tried to shuffle it under some scratch paper. When I cornered him, he shifted tactics. "It's my page of equations," he told me. "Aren't we allowed a formula sheet? The physics teacher lets us." Nice try, but no dice. The principal and I rejected his alibi and hung a fat zero on his final exam. That dropped his precalculus grade down from a B+ to a D+. It lingered like a purple bruise on his college applications.

Looking back, I have to ask myself: Why *didn't* I allow a formula sheet? Cheat sheets aim to substitute for memorization, and I hate it when my students memorize things.

"What's the sine of  $\pi/2$ ?" I asked my first-ever trigonometry class.

"One!" they replied in unison. "We learned that last year."

So I skipped ahead, later to realize that they didn't really know what "sine" even meant. They'd simply memorized that fact. To them, math wasn't a process of logical discovery and thoughtful exploration. It

was a call-and-response game. Trigonometry was just a collection of non-rhyming lyrics to the lamest sing-along ever.

Some things are worth memorizing--addresses, PINs, your parents' birthdays. The sine of  $\pi/2$  is not among them. It's a fact that matters only insofar as it connects to other ideas. To learn it in isolation is like learning the sentence "Hamlet kills Claudius" without the faintest idea of who either gentleman is--or, for what matter, of what "kill" means. Memorization is a frontage road: It runs parallel to the best parts of learning, never intersecting. It's a detour around all the action, a way of knowing without learning, of answering without understanding.

Memorization has enjoyed a surge of defenders recently. They argue that memorization [exercises the brain](#) and even fuels deep insights. They say our haste to purge old-school [skills-driven teaching](#) from our schools has stranded a generation of students upriver without a paddle. They recommend [new apps](#) aiming to make drills fun instead of tedious. Most of all, they complain that rote learning has become taboo, rather than accepted as a healthy part of a balanced scholastic diet.

Certainly, knowledge matters. A head full of facts--even memorized facts--is better than an empty one. But facts enter our heads through many paths--some well-paved, some treacherous. Which ones count as "memorization"?

I define memorization as **learning an isolated fact through deliberate effort**. The process can unfold two basic ways.

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First, there's **raw rehearsal**: reciting a fact over and over. When I had to memorize a speech for ninth-grade English, I huddled in the school library for 90 minutes, whispering the words to myself again and again, until they settled into my memory. The process was slow, dull, and stilted. I forgot the speech within weeks.

Raw rehearsal is the worst way to learn something. It eats up time and requires no real thinking. So of course, it's popular among students ranging from my Oakland 15-year-olds to [Harvard undergraduates](#). During a unit on memory, I once heard a psychology student recite, "Raw rehearsal is ineffective," before proceeding to practice her vocabulary using the same technique she'd just denounced.

Second, there are **mnemonics** and other artificial tricks--songs, acronyms, silly rhymes. In sixth grade, for reasons only heaven knows, I memorized 48 prepositions (about, above, across, after...) to the tune of "Yankee Doodle." I can still recite them.

Such tactics certainly work better than raw rehearsal. But they don't solve the underlying problem: They still bypass real conceptual learning. Memorizing a list of prepositions isn't half as useful as knowing what role a preposition plays in the language.

So what are the alternatives? How can students *learn* facts, rather than *memorize* them?

First, there's **repeated use**. Like raw rehearsal, it relies on repetition to chisel a fact into memory, but unlike that method, it comes naturally (without "deliberate effort"). In 10th-grade English, I wrote a paper on Robert Frost's apocalyptic poem "Once by the Pacific." I read it dozens of times, dissecting every phrase. Months later, standing on a rocky, storm-swept beach, I found that I could recite the poem by heart. I never set out to memorize it. I just...*did*.

And second, there's **building** on already-known facts. Like mnemonics, this technique relies on connections and associations. But here, the connections emerge naturally from the material. The fact is no longer an isolated thread, held in place by a clever trick. It's part of a tapestry.

For example, suppose we're learning that Maryland fought with the Union during the Civil War. We could invent a mnemonic, like "Maryland starts with 'marry,' and a marriage is a union"--cheesy, but fine. Or we could build on other facts. For example, Maryland borders D.C., so if it had seceded, the American capital would have been surrounded by foreign territory. For exactly that reason, Lincoln worked hard to keep Maryland on the side of the North.

What separates memorization from learning is a sense of meaning. When you memorize a fact, it's arbitrary, interchangeable--it makes no difference to you whether sine of  $\pi/2$  is one, zero, or a million. But when you *learn* a fact, it's bound to others by a web of logic. It could be no other way.

Memorization's defenders are right: It's a mistake to downplay factual knowledge, as if students could learn to reason critically without any information to reason about. But memorization's opponents are right, too: Memorized knowledge isn't half as useful as knowledge that's actually understood.

More than any other battleground, this conflict plays out in tests. Not the controversial behemoths forged in our state bureaucracies. The little ones we teachers write and give, every day and week.

If you wanted to design a system of testing that catered to rote short-term memory, you'd struggle to improve on the classic model--the high-stakes, time-pressured, single-unit, in-class exam. Students know exactly where and when their tests will be--so it's easy to cram. They know the test will be time-pressured--so even if students could deduce a formula mid-test, they're better off memorizing in advance. Students know the teacher has too much to cover, so the test will address only the most recent unit--making it easier to memorize the relevant bits. And they know the teacher has too many tests to grade, so he'll be asking quick-to-correct factual and computational questions--exactly the type where memorization most pays off.

For efficient students, it's pretty clear what to do: Memorize the necessary facts in the ten minutes

before class, and forget them in the ten minutes after class.

Teachers can try to change the game, but only at a cost. Want to ease the time pressure, so students have a chance to reason logically? Then you'll need to cut questions. Want to pose richer, more complex problems? Get ready for a late night of grading. Want to encourage deeper, longer-lasting learning by including questions about older material? Good luck finding time to assess the *new* stuff.

This is where cheat sheets come in. It has become common practice to allow students a page of notes during tests. In theory, this frees them from the bog of memorization, so they can soar bird-like among the abstract concepts and big ideas. But unless the test questions demand that high level of thought--which is still a challenge, for all the reasons mentioned above--you're left with the worst of both worlds: a test that requires neither deep understanding nor basic factual knowledge.

With a cheat sheet, a question like "Why did the Confederacy use Richmond as its capital for most of the Civil War?" becomes equivalent to "Did you remember to jot this down on your page of notes?" Getting students to dive into the real issue--what makes for a good capital city, especially in light of the specific pressures facing the seceded states--might require a longer, more open-ended, slower-to-grade question such as, "If Montgomery and Richmond had the same population and industrial capacity, which would have made a more desirable capital for the Confederacy, and why?"

Overreliance on memorization is like most problems in education: systemic. One teacher can't topple the tyrant's statue alone. But she can begin to chip away at the base.

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