

# Making It Stick

by James M. Lang

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Last month I was on a plane to Albuquerque via Chicago and Denver. Two stopovers would already have made for a draining flight but a storm was brewing in the Chicago area, so we made an initial and unsuccessful pass at Midway airport before being rerouted to Louisville. After a brief delay there, we headed back to the Windy City, where the storm was still clearly in play. After bursting through the cloud cover above Chicago at a very low altitude, we braced for landing only to feel the engines kick in again as we reared back up into the sky.

By strange coincidence, the book I happened to be holding in my lap during that ordeal began with the story of an airplane pilot navigating his way through a midflight emergency. *Make It Stick: The Science of Successful Learning*, out this month from Harvard University Press, describes the range of options that were available to that pilot, considers the implications of each of his choices, and explains how his training helped him manage the crisis successfully.

The book's authors—Peter C. Brown, Henry L. Roediger III, and Mark A. McDaniel—use the story to complicate a distinction we teachers like to make between "facts" and "critical thinking," especially in the digital age. Having students learn facts, memorize information, or drill on fundamentals seems pointless to many of us when so much information is available at our fingertips. Don't worry so much about the facts, we say, you can Google those. We want you to think.

Even students buy into that attitude, the book suggests, pointing to those popular T-shirts they wear that quote Albert Einstein praising creativity over knowledge. And yet, the book notes, "You wouldn't want to see that T-shirt on your neurosurgeon or on the captain who is flying your plane across the Pacific."

The pilot in their story, like the pilot of my flight, had to master a sizable body of knowledge before either of them could climb into the cockpit.

Countless hours of drilling on basic skills, memorizing information about weather conditions and aerodynamics, committing to memory the successes and mistakes they had made in simulations and in actual flights—all of those things enabled them to think critically and creatively about how to respond in an emergency.

Whatever thinking they did in those emergencies depended upon a vast body of knowledge constructed of facts, drills, and fundamentals.

Many educators are interested in making use of recent findings about the human brain and how we learn. In last month's column, I wrote about a helpful if somewhat dry scholarly book on the direct implications of these findings for teachers, especially in the college classroom. This month, we turn to *Make It Stick*, the single best work I have encountered on the subject. Anyone with an interest in teaching or learning will benefit from reading this book, which not only presents thoroughly grounded research but does so in an eminently readable way that is accessible even to students.

Mastery of a subject or skill, as the book points out, requires "both the possession of ready knowledge and the conceptual understanding of how to use it." You can't think creatively, in other words, unless you have something to think about; you can't think critically unless you have something to critique. Yet despite such seemingly evident truths, I often hear faculty members speak dismissively about memorization or drilling, as if it somehow is beneath them to help students acquire knowledge that they will need to engage in the kinds of creative thinking that we all hope to foster.

In their opening chapter, "Learning Is Misunderstood," the authors sweep away much of what people think they know about human cognition and learning—such as the false distinction between memorizing and thinking—in order to prepare the way for a half-dozen chapters that present the most recent research we have about how people learn and the implications for both learners and for college and university professors.

The book's readable quality likely stems from a very smart decision made by Roediger and McDaniel, both professors of psychology at Washington University in St. Louis, to enlist a novelist as their co-author. Peter Brown, the author of *The Fugitive Wife*, helped the two psychologists

write in what Roediger told me was "a more anecdotal style than we're accustomed to writing." Examples like the pilot story in the book's opening arose from that collaboration, and helped them understand how to reach a wider audience than they typically achieve with their (widely published) more traditional research on memory, learning, and cognition.

Their collaboration was a long and fruitful one, as Roediger explained to me in an interview: "Mark and I knew the research, but Peter knew how to go out and find a story and tell it in a way that brought the research to life. Then we would read drafts, fill in gaps, fine tune the language, and look for ways to knit the anecdotes more tightly to the underlying message. It was a great collaboration. We spent about three and a half years working on the book."

The extended time and effort shine through in the book, which hits upon every major fundamental learning principle that I have encountered in the primary research in the field. Among the insights that the authors provide:

The practice of retrieving information from your brain is very important for learning. Sometimes referred to as the "testing effect," this principle argues that students need continual practice at retrieving newly learned content in order to make it available to them when they need it. "Practice at retrieving new knowledge or skill from memory is a potent tool for learning and durable retention," the authors write. That practice can come in the form of testing but, as they point out, teachers can incorporate retrieval practice into their courses in a variety of ways, and students can likewise incorporate it into their study habits.

It's better to mix it up than focus solely on one thing. Our intuition about learning would suggest that just the opposite was true, but this is one of many areas in which our intuition about learning is not well supported by the research. "Massed study" is the term researchers use to describe when students focus their studying entirely on one skill or set of knowledge before moving on to the next. "Interleaving" is when students shift their studying back and forth between different topics on a regular basis. Massed study produces short-term retention, which is why cramming for tests can be effective. But if you compare test scores, the interleaving students demonstrate much higher long-term retention, even though they often report feeling as if their studying was ineffective.

Learning can be fun, but that doesn't mean it should be easy. In fact, much research suggests that when learners have to work at generating answers to questions, rather than simply being given those answers, they learn the material more deeply. For example, as the book notes, "being required to supply an answer rather than select from multiple-choice options often provides stronger learning benefits." The authors cite a large-scale study in which students in an introductory psychology course were tasked with summarizing concepts in their own words for some course material, and with copying down information on slides for other material. In both short- and long-term tests, the students scored significantly higher on the material they had summarized in their own words than on the material they had copied.

My quick summaries here don't do justice to the engaging and thoroughly convincing ways in which the authors' arguments are presented in the book. Every learning principle they describe comes grounded in laboratory experiments, real-world classroom research, or brain science, much of it conducted by the authors themselves. "Through a series of grants," Roediger told me, "we have conducted a considerable amount of research in Columbia, Ill., at both the middle school and high school there. We applied retrieval practice in actual classrooms and got excellent results. We and others have also produced robust results in other academic settings—university classes on statistics, introductory psychology, and other courses."

Those research results are continually bolstered in the book by engaging examples that will help faculty members apply the findings to their course design, classroom practices, and assessment plans. The book could equally help students understand how to study and practice more effectively, whether they are doing so for a formal course or on their own.

Both books I have recommended in this two-part series will provide invaluable assistance to educators at any level as they help to sweep away myths and misconceptions about learning and ground our teaching in what we know about human cognition. Of course, that doesn't mean these ideas will automatically transform your classroom into a guaranteed learning laboratory.

"Most of our cognitive techniques," Roediger pointed out to me, "assume a motivated learner, and in talking to teachers and observing

classes, we know that many students do not seem motivated to learn. So research in cognitive psychology can aid the process of education, but many other issues remain to improving the educational process."

The problem of motivating students to engage with our course material has always struck me as one of the most fundamental challenges that we face as faculty members. But I suspect that, at least in some cases, we can inadvertently demotivate students through teaching strategies that work against the ways they learn most naturally. With books like *Make It Stick*, we have all the help we need to create courses that offer students every tool they need to engage in successful learning. And that may prove to be an invaluable first step in motivating them to do so.

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