

Make It Stick: The Science of Successful Learning

Peter C. Brown, Henry L. Roediger III, Mark A. McDaniel. Harvard University Press, Cambridge MA 2014

Make It Stick, is the joint work of two cognitive scientists and a writer. Together they use real world examples to show how research-based principles of learning can make a powerful difference in the effectiveness of learning and teaching. Included here are a few of the many practical strategies outlined in the book:

Retrieval Practice (AKA Frequent Quizzing)

What it is: Recalling facts or concepts from memory, such as in the context of a quiz or test. To be effective, it must be *repeated*, *spaced out* over time, and require some *cognitive effort*. One aspect of the Thayer Method employed at West Point, requires students work in groups at blackboards to collaborate on answering questions given by the professor. Given that these are higher order ideas, students have to integrate ideas from the readings and apply them at a conceptual level.

What it looks like: A professor of Economics at Washington University in St. Louis replaced his 2 major exams with 9 quizzes. The material and the questions were the same, and the quizzes themselves were cumulative. After switching to the new format, he reported that the “quality of discussions in class has gone way up” and that in written work, “the quality is comparable to what he’s seeing in his upper-division classes” (38).

Interleaving (ABCABCABC Practice vs AAABBBCCC Practice)

What it is: Studying multiple concepts or skills by practicing them mixed together. The key is to switch before each practice is complete rather than moving from a complete set of one topic and then going to another. For example, on quizzes include questions from throughout the semester.

What it looks like: The former football coach at the University of Georgia interleaved elements of individual and team skills during practices. Practices began with a focus on player’s positions followed by players practicing in small groups where they worked on maneuvers involving several positions. Next, they practice as a team.

Varied Practice (Exposure to multiple versions of a problem)

What it is: Practicing frequent changes of tasks in order to help learners assess changing conditions and adjust responses to fit. In instruction and assessment, systematically incorporate a variety of topics and problems from previous lessons.

What it looks like: A small group of eight years old practiced tossing bean bags into a bucket three feet away and another small group mixed it up by tossing bean bags into buckets two and four feet away. When tested twelve weeks later on their ability to toss bean bags into a bucket three feet away, those who had practiced the varied distances did far better.

Generation: (Better to try to answer and even if it is incorrect, it is better to try)

What it is: The act of answering a question or solving a problem before seeing the answer. Make an initial effort before learning something new to make your mind more receptive to learning.

What it looks like: At Washington University in Saint Louis in the Physics Department, students are required to work problems before class.

Desirable Difficulties (Difficulties needed to strengthen skills and make learning stronger)

What it is: “Short term impediments that make for stronger learning” (Elizabeth and Robert Bjork, 68). Provide difficulties that learners can overcome with increased effort and coach them in the distinction between performance and the actual learning (more long term). Recognize that when there are difficulties, people can make errors and feel their practice isn’t productive. Guide students to avoid being discouraged and to work through the difficulties for it is worth the effort.

What it looks like: A football player learns some of the principles of ballet to improve his balance and movement.

Put This In Your Syllabus!: [After revising your schedule, include the language below for your students to understand the reasoning behind the course structure.]

Why Is the Course Schedule Set Up This Way?

This course schedule is designed in accordance with cognitive science-backed best practices, which recommend the use of frequent quizzing, generation exercises, interleaving, and varied practice. Rather than taking one topic at a time, and only revisiting the older ones only once or twice a semester, you'll have regular opportunities to retrieve those concepts from your memory, keeping them fresh and helping you retain your knowledge and skills.

How Can You Use This to Improve Your Study Habits?

Incorporate these same principles in your own study habits! Rather than "cramming" for a quiz or exam, space out your practice over time. Instead of studying one topic at a time, mix up all the topics you've covered so far, focusing on what you struggle with most. Don't assume you've "got it" once you've succeeded once. Avoid re-reading, which can trick you into thinking you know things you don't. Instead, keep testing yourself, using flashcards and practice problems.

	Old Version	New and Improved Version
Wk 1	Topic: Chapter 1 HW: Practice Problems - 10 from Ch. 1	Topic: Chapter 1 In-class Activity: Pre-assessment on prior knowledge HW: Practice Problems - 10 from Ch. 1
Wk 2	Topic: Chapter 2 HW: Practice Problems- 10 from Ch. 2	Topic: Chapter 2 HW: Practice Problems - 8 from Ch. 2, 2 from Ch. 1 Quiz: Ch. 1 & 2 (20pts)
Wk 3	Topic: Chapter 3 HW: Practice Problems - 10 from Ch. 3	Topic: Chapter 3 In-class Activity: Muddiest Point - write down the issue you are having the most difficulty with, consult with a peer HW: Practice Problems - 7 from Ch. 3, 1 from Ch. 2, 2 from Ch. 1
Wk 4	Topic: Chapter 4 HW: Practice Problems - 10 from Ch. 4	Topic: Chapter 4 HW: Practice Problems - 7 from Ch. 4, 2 from Ch. 3, 1 from Ch. 2 Quiz: Ch. 1-4 (20pts)
Wk 5	Topic: Chapter 5 HW: Practice Problems - 10 from Ch. 5	Topic: Chapter 5 In-class Activity: Note Comparison - compare your notes with a peer to check your knowledge & identify misconceptions HW: Practice Problems - 7 from Ch. 5, 1 from Ch. 4, 1 from Ch. 3, 1 from Ch. 1
6	Topic: Chapter 6 HW: Practice Problems - 10 from Ch. 1	Topic: Chapter 6 HW: Practice Problems - 7 from Ch. 4, 2 from Ch. 5, 1 from Ch. 2 Quiz: Ch. 1-6 (20pts)
7	Midterm Exam: Ch. 1-6 (60pts)	Topic: Chapter 7 In-class Activity: Minute Paper - In one minute, explain the most important concept from the day's lesson, discuss HW: Practice Problems - 7 from Ch. 7, 1 from Ch. 6, 1 from Ch. 5, 1 from Ch. 3

Students (and their instructors) often have trouble determining what they do and don't know. A pre-assessment can help identify any gaps in the foundational knowledge students need in order to move forward.

Rather than having one large, cumulative exam, quizzes are spaced out periodically. This retrieval practice ensures that earlier learning doesn't fade, and promotes stronger long-term retention, even after your course ends. ***Note that the quizzes are still cumulative and worth the same number of total points as the exam!*

Activities that require students to generate an original response, rather than just select from a set of choices, strengthen retrieval cues and help to consolidate learning in the long-term.

Instead of HW that only addresses content from the current week's lesson, these HW assignments incorporate interleaved and varied practice. This strategy helps students develop their ability to "discriminate between different kinds of problems and select the right tool from their growing toolkit of solutions" (65).

By restructuring the course schedule this way, you can actually cover MORE content! This reworked schedule gets students one chapter further by mid-semester than the old version!