Make It Stick: The Science of Successful Learning

Peter C. Brown, et al. Harvard UP, Cambridge MA 2014

PREMISE
Development of your intellectual abilities lie to a large degree within your own control. Consider these facts:

- Most of our intellectual ability is not hardwired.
- When learning is easy, it is often superficial and soon forgotten.
- Striving often results in setbacks, but these are needed in order to adjust and achieve mastery.
- You learn better when you wrestle with new problems before seeing the answer or solution.
- Cramming, massed practice, and rereading don't last.

Your brain is like a forest with memories hidden in different places among the trees. You're here and a memory is over there. The more times you make a path to that memory, the better the path becomes and the easier it is to locate. If you rely on notes and other aids, it is harder to find on your own.

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DESIREABLE DIFFICULTY
Real learning is usually difficult. You will experience setbacks. These are signs of effort, not failure. Effortful learning changes your brain, making new [neural] connections, building mental models, increasing your capability.

RETRIEVAL
Self-quizzing to recall facts or concepts from memory should become your primary study strategy instead of rereading. Pause during review to ask yourself questions, such as "What are the key ideas? What terms or ideas are new to me? How would I define them? How do they relate to what I already know?"

SPACING
It's important to space your practice. When learning names and faces, for example, let a little time elapse between practice sessions. When learning deeper concepts, let more time elapse—take a break—before resuming study.

INTERLEAVING
Study different concepts or skills, even different subjects, by practicing them mixed together. For example, a baseball player who practices by swinging at fifteen fastballs, then fifteen curveballs, then fifteen change-ups will perform better in practice than a player who mixes it up, but the player who asks for random pitches during practice builds his ability to decipher and respond to each pitch as it comes his way, and he becomes the better overall hitter.

ELABORATION
Relate the material to what you already know, explaining to somebody else 1. in your own words or 2. how it relates to your life outside of the classroom. Discover a metaphor or visual image for the material.

GENERATION
Attempt to answer a question or solve a problem before being shown the answer or solution. This will help you contrast mistaken assumptions or flaws in reasoning when the process or answer is revealed. It will help you create new neural pathways, distinct from those you've relied on previously.

REFLECTION
Take a few minutes to review previous learning and ask yourself questions about it. What went well? What could have gone better? What should you do next time? What else does it remind you of?

CALIBRATION
Seek and consider feedback from a study partner or teacher to avoid a false sense of security, the illusion of mastery that takes many learners by surprise at test time.

MNEMONIC DEVICES
Use mental structures to retrieve information when you need it, like rhymes, physical gestures, acronyms, etc.