

“Make it Stick: The Science of Successful Learning”

“What does Chapter 1 say about trying to solve a problem before being taught the solution?”

- Trying to solve a problem before being taught the solution is better learning, even if errors are made

“What does Chapter 1 say is more effective: rereading notes or making and using flash cards?”

- Flashcards are more effective
 - Retrieval strengthens the memory and interrupts forgetting
 - Neural pathways get stronger when memory is retrieved rather than reading off of a page -- exercises memory; strengthens retrieval routes

Preface

- The most effective learning strategies are not intuitive
- Generally, students rely on less-than-optimal study strategies; learning is being approached in the wrong ways
- This field of research goes back 125 years but is particularly fruitful in recent years
- Henry Roediger and Mark McDaniel
 - Cognitive scientists dedicated to studying learning and memory
- Peter Brown
 - Storyteller
- Written not as a compilation of research, but as a collection of success stories of people who mastered their knowledge and skills
- 2 primary learning principles are applied in the writing of the book itself:
 - Spaced repetition of key ideas
 - Spreading out the study of a topic and returning to it periodically allows learners to remember the material better
 - Interleaving of different but related topics
 - Each subject is learned better than if they were studied one at a time in sequence

Chapter One

- Anecdote about pilot illustrates this main point: learning = “acquiring knowledge and skills and having them readily available from memory so you can make sense of future problems and opportunities”
- Immutable aspects of learning:
 - Requires memory
 - We need to keep learning and remembering all our lives
 - Is an acquired skill, and the most effective strategies are counterintuitive
- Claims:
 - Learning is deeper and more durable when it’s effortful
 - We are poor judges of when we are learning well and when we are not
 - Rereading text and massed practice of a skill/knowledge are preferred study strategies, but are some of the least productive
 - Fluency is equated to mastery, but this is untrue
 - This learning is temporary

- Retrieval practice (retelling facts or concepts or events from memory) is a more effective learning strategy than review by rereading
- Spacing out practice at a task and interleaving it with the practice of other subjects is productive - produces longer-lasting learning
- Learning is more productive when you don't limit instruction to a certain learning style; instead, you "go wide"
- Being able to extract underlying principles or rules that differentiate different types of problems is key in deciphering solutions out of unfamiliar situations
- We are all susceptible to illusions that can hijack our judgement of what we know and can do
 - Testing calibrates our judgements of what we've learned
 - Identifies and brings up areas of weakness
- All new learning requires a foundation of prior knowledge
- If one practices elaboration, rather than mechanical repetition, there is no limit of what you can learn
 - Elaboration = the process of giving new material meaning by expressing it in your own words and connecting it with what you already know
- Extracting key ideas from new material and organizing them into a mental model
 - Mental model = mental representation of some external reality
- The brain is changed - we become capable through the development of mental models that enable us to reason, solve, and create
- How we teach and study is a mix of theory, lore, and intuition
- Cognitive psychology, the basic science of understanding how the mind works, strives to clarify the strategies that work/don't
- Easier/faster learning is weaker than and not as long lasting as harder learning
- Re-reading is time consuming, doesn't result in durable memory, and develops a deception: familiarity = mastery (which is untrue)
 - The illusion of mastery
 - Penny memory and fire extinguisher examples
 - Prior exposure does not aid later recall
- The concept of unknown unknowns - the things that we do not know we don't know
- Mastery requires the possession of ready knowledge and the conceptual understanding of how to use it

In math - help develop a new mindset