



# HOW TO MAKE LEARNING STICK

Most of the learning strategies we use today are ineffective.  
Use the right strategies for better results in education, training and lifelong learning.

## Ineffective Strategies



Massed Practice



Re-reading



Fast & Easy Learning

## Effective Strategies



Retrieval Practice



Effortful Learning



Space, Vary & Interleave



Learning Structures



Avoid Illusions of Knowing





Other Learning Strategies



## Use Retrieval Practice

Retrieval practice = recalling concepts, facts or events from memory.


 When you **periodically test or apply** what you know, it reinforces your neural pathways or retrieval routes.


 Instead of re-reading notes, **use quizzes, reflection or simulations** as they are more effective.

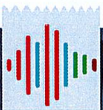


## Embrace Desirable Difficulties

Difficulties are desirable if they can be overcome with effort, and if the effort can enhance our skill.


 When you try to recall something from long-term memory or that's partially forgotten, it's **more effortful** and you must reconsolidate the learning. This strengthens neural paths & adds connections to deepen learning and improve mental models.


 When we **avoid mistakes**, we lose learning opportunities and waste limited working memory capacity on worrying rather than problem-solving.




## Use Spacing, Interleaving & Variation

Mix up and vary your retrieval practice to make it more effortful and effective.

 **Spaced Practice:** Leave a meaningful time-gap between your retrieval practices. This forces you to tap into long-term memory and expend more effort to fetch & consolidate forgotten info.


 **Interleaved practice:** Alternate between topics or sub-topics. This interrupts mindless repetition and boosts the ability to differentiate between problem/solution types.

 **Variation:** Vary the type & context of your retrieval practice. It helps you to spot similarities & differences across scenarios, and integrate ideas/skills into meaningful schemas or mental models.



## Focus on Learning Structures

Don't limit yourself to your preferred learning styles (e.g. visual or auditory learning).

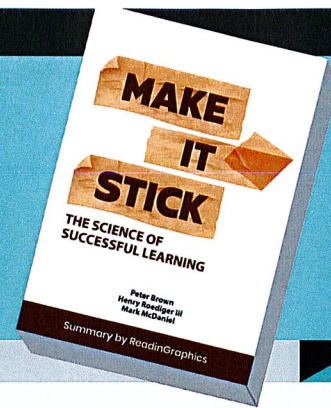
 Instead, **improve your learning structure**, i.e. how you find new material, extract key ideas and construct a coherent mental framework.

 Try to identify **underlying principles** or rules that cut across different situations and examples.

# MAKE IT STICK

## THE SCIENCE OF SUCCESSFUL LEARNING

Peter Brown, Henry Roediger III, Mark McDaniel



**Learning affects Success**  
All of us learn continually throughout our lives, be it for our work, hobbies or relationships. The ability to learn affects our level of success.

**Learning is Misunderstood**  
Most of us are learning the wrong way. Many of our learning strategies are based on theories or concepts that aren't empirically proven.

**Make Learning Stick**  
For learning to be effective, the knowledge and skills must be retained so we can retrieve them for future problems & opportunities. Use the right strategies to learn more deeply, precisely and durably.



## UNDERSTANDING LEARNING



### How Learning Occurs

Learning is at least a 3-step process:



**Encoding.** New info is received & encoded into memory traces which are held in short-term working memory. Most of it is forgotten.



**Consolidation.** Memory traces are reorganized, linked to past knowledge, stabilized and stored in long-term memory.



**Retrieval.** Material is fetched from long-term memory. This reinforces memory traces and reconsolidates them with new learning.



### Increasing your Abilities

Your brain and intellectual abilities are not fixed. They can be changed with new tasks, insights & experiences.



Practicing something can **strengthen** existing neural pathways or abilities.



Varying your learning experiences can build **new neural connections** & abilities.



You don't need great genes for **outstanding performance**. You can achieve mastery with discipline, persistence and the right strategies.



### Learning Effectively

Effective learning must be retained and applicable to future problems & opportunities.

Go beyond factual knowledge. Understand **underlying principles, rules and concepts** that can be applied to various problems & scenarios.



Link the material with a **wide range of cues**, so you can recall it more easily later.



**Anchor** the new material firmly when you encode, consolidate and move it to long-term memory.

