

Excerpts from *Make it Stick* by Peter Brown

Knowledge, skills, and experiences that are vivid and hold significance, and those that are periodically practiced, stay with us.

The effort and persistence of deliberate practice remodel the brain and physiology to accommodate higher performance, but achieving expertise in any field is particular to the field.

Mastery in any field, from cooking to chess to brain surgery, is a gradual accretion of knowledge, conceptual understanding, judgment, and skill...Memorizing facts is like stocking a construction site with the supplies to put up a house. Building the house requires not only knowledge of countless different fittings and materials but conceptual understanding too...Mastery requires both the possession of ready knowledge and the conceptual understanding of how to use it.

Pitting the learning of basic knowledge against the development of creative thinking is a false choice. Both need to be cultivated. The stronger one's knowledge about the subject at hand, the more nuanced one's creativity can be in addressing a new problem. Just as knowledge amounts to little without the exercise of ingenuity and imagination, creativity absent a sturdy foundation of knowledge builds a shaky house.

Periodic practice arrests forgetting, strengthens retrieval routes and is essential for hanging onto the knowledge you want to gain. When you space out practice at a task and get a little rusty between sessions, or you interleave the practice of two or more subjects, retrieval is harder and feels less productive, but the effort produces longer lasting learning and enables more versatile application of it in later settings.

...for kids to be able to evaluate, synthesize, and apply a concept in different settings, they're going to be much more efficient at getting there when they have the base of knowledge and the retention, so they're not wasting time trying to go back and figure out what the word might mean or what that concept was about. It allows them to go to a higher level.

Learning is at least a three-step process: initial *encoding* of information is held in short-term working memory before being consolidated into a cohesive representation of knowledge in long-term memory. *Consolidation* reorganizes and stabilizes memory traces, gives them meaning, and makes connections to past experiences and to other knowledge already stored in long-term memory. *Retrieval* updates learning and enables you to apply it when you need it.