

# Illusions of Competence, the Importance of Recall, Mini-testing, and Making Mistakes

By Barbara Oakley, PhD

- Recall
- Illusions of competence
- Mini-testing
- Value of making mistakes



- Recall

# Retrieval Practice Produces More Learning than Elaborative Studying with Concept Mapping

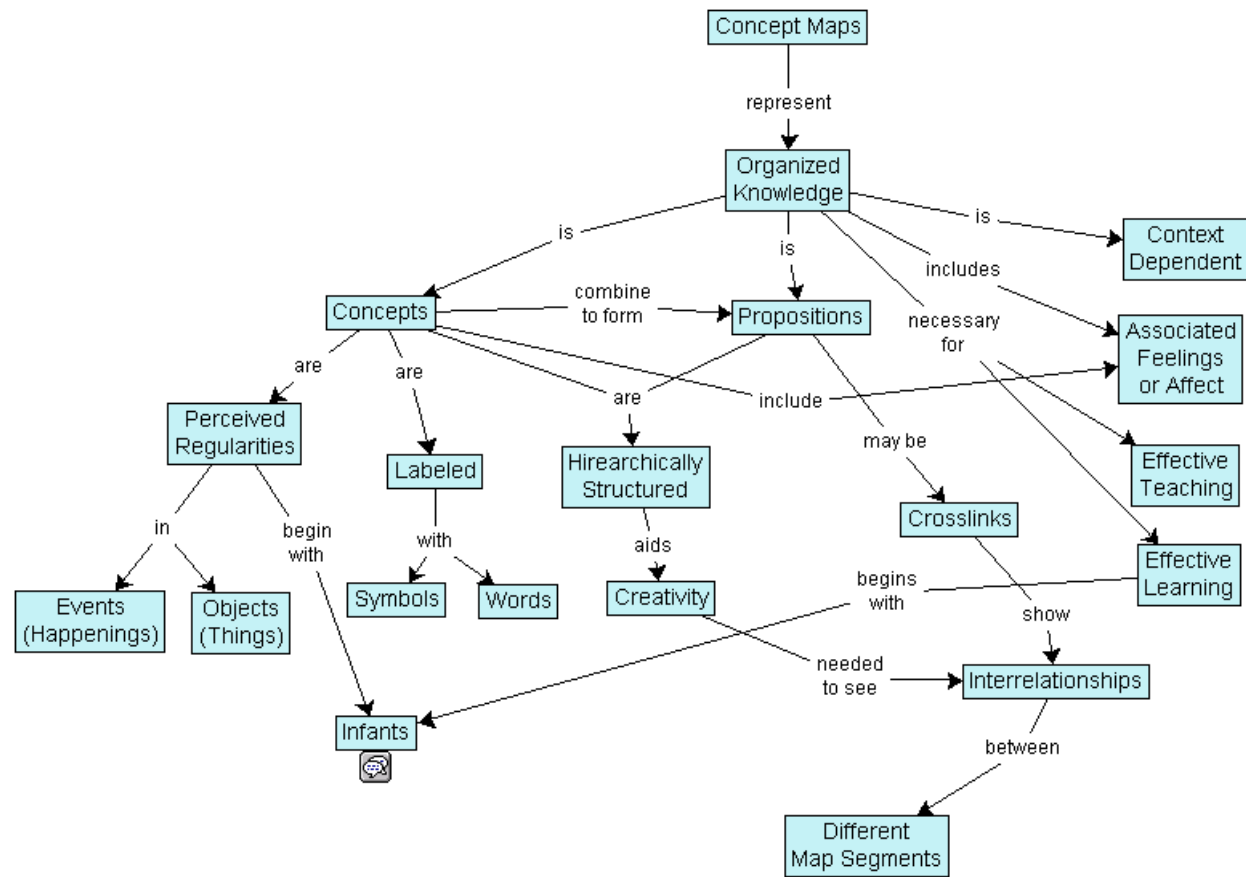
Jeffrey D. Karpicke\* and Janell R. Blunt

Educators rely heavily on learning activities that encourage elaborative studying, whereas activities that require students to practice retrieving and reconstructing knowledge are used less frequently. Here, we show that practicing retrieval produces greater gains in meaningful learning than elaborative studying with concept mapping. The advantage of retrieval practice generalized across texts identical to those commonly found in science education. The advantage of retrieval practice was observed with test questions that assessed comprehension and required students to make inferences. The advantage of retrieval practice occurred even when the criterial test involved creating concept maps. Our findings support the theory that retrieval practice enhances learning by retrieval-specific mechanisms rather than by elaborative study processes. Retrieval practice is an effective tool to promote conceptual learning about science.

Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science*, 331(6018), 772-775. doi: 10.1126/science.1199327

- By simply practicing and recalling, students learned far more and at a much deeper level

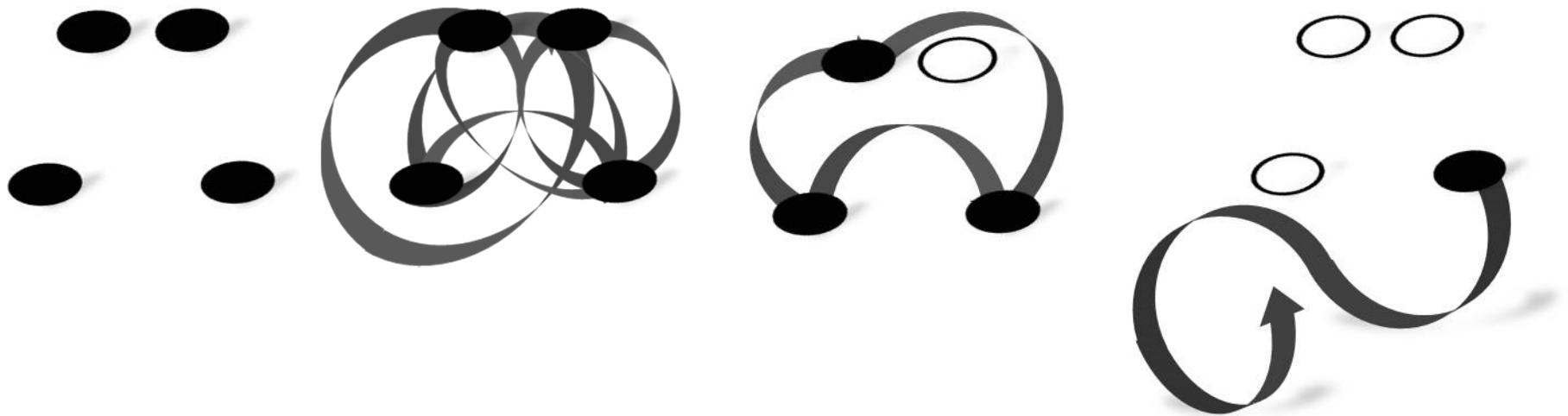




# Recall!



# Working memory





you are studying. If you just look at a solution, for example and then tell yourself, “Oh yeah, I see why they did that,” then the solution is not really yours—you’ve done almost nothing to knit the concepts into your underlying neurocircuitry. Merely glancing at a solution and thinking you truly know it yourself is one of the most common illusions of competence in learning. **You must have information persisting in your memory if you are to master the material well enough to do well on tests and think creatively with it.**

In a related vein, you may be surprised to learn that **highlighting and underlining must be done carefully**—otherwise it can be not only ineffective but also misleading. It’s as if making lots of motions with your hand can fool you into thinking you’ve placed the concept in your brain. If you do mark up the text, try to look for main ideas before making any marks, and try to keep your underlining or highlighting to a minimum—one sentence or less per paragraph. On the other hand, words or notes in a margin that synthesize key concepts are a VERY good idea.

Jeff Karpicke—the same researcher who has done such important work related to recall, has also done research on a related topic—*illusions of competence* in learning. The reason students like to keep rereading their notes or a textbook is that when they have the book (or Google!) open right in front of them, it provides the illusion that the material is also in their brains. *But it’s not.* Because it can be easier to look at the book instead of recalling, students persist in their illusion—studying in a way that just isn’t very productive. **fix video quiz**

be careful  
of highlighting  
too  
much!

## **Metacognitive strategies in student learning: Do students practise retrieval when they study on their own?**

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Basic research on human learning and memory has shown that practising retrieval of information (by testing the information) has powerful effects on learning and long-term retention. Repeated testing enhances learning more than repeated reading, which often confers limited benefit beyond that gained from the initial reading of the material. Laboratory research also suggests that students lack metacognitive awareness of the mnemonic benefits of testing. The implication is that in real-world educational settings students may not engage in retrieval practise to enhance learning. To investigate students' real-world study behaviours, we surveyed 177 college students and asked them (1) to list strategies they used when studying (an open-ended, free report question) and (2) to choose whether they would reread or practise recall after studying a textbook chapter (a forced report question). The results of both questions point to the same conclusion: A majority of students repeatedly read their notes or textbook (despite the limited benefits of this strategy), but relatively few engage in self-testing or retrieval practise while studying. We propose that many students experience *illusions of competence* while studying and that these illusions have significant consequences for the strategies students select when they monitor and regulate their own learning.



## Testing Promotes Long-Term Learning via Stabilizing Activation Patterns in a Large Network of Brain Areas

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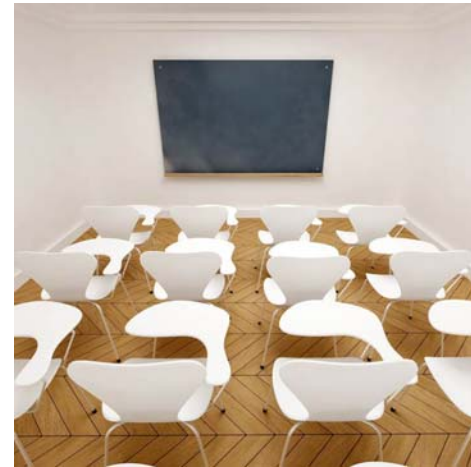
Gyula Kovács and Mihály Racsmany contributed equally to this study.

**The testing effect refers to the phenomenon that repeated retrieval of memories promotes better long-term retention than repeated study. To investigate the neural correlates of the testing effect, we used event-related functional magnetic resonance imaging methods while participants performed a cued recall task. Prior to the neuroi-**

**performance (Spitzer 1939; Tulving 1967; Carrier and Pashler 1992; Roediger and Karpicke 2006a).**

The finding that additional retrieval practice promotes better long-term retention and a slower forgetting rate than the simple restudy of the same information has been termed the





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