

# Seven Rules to Optimize Your Learning

Good study habits are crucial to success!

Below are tried and true techniques to enhance the quality of your learning and retention. These rules are based on extensive evidence from the learning and memory literature.

## 1. Test Yourself

Testing yourself often is a strong, proven technique for enhancing your learning and retention.

Roediger and Karpicke (2006) reliably showed that testing leads to better results than studying the material a second time! Quiz yourself or have a friend quiz you on the material. Immediate feedback helps you correct yourself and improve learning and understanding.



Tip: Create flashcards, each with one question on the front and the answer on the back.



## 5. Vary Learning Contexts

We associate what we learn with the context in which we learn. Vary your learning routines, study locations and times of day for better results.

Contextual retrieval effects were demonstrated by Godden and Baddeley (1975). They showed that being in the original environment in which the learning took place enhanced subsequent retention. Varying the contexts in which we learn gives us many more possible routes to retrieval.



Tip: Learning to actively manipulate the information you learn for problem solving can also create different contexts.



## 2. Rewrite Notes

Review and re-write your notes after you integrate related content into them.

Active note-taking is all about "deep encoding". Create your own figures and associations. Integrate content from the assigned readings. Craik and Tulving (1975) showed that this type of elaborative rehearsal is much more likely to lead to better learning and retention.



## 6. Use Schemas

Associate what you learn with what you already know. Use your schemas (mental models) to integrate new information.

Schema-based learning was described most aptly by Sir Frederick Bartlett (1932). In his most famous experiment, he had participants read a Native American story about ghosts and had them retell the tale later. Because their backgrounds were so different from the cultural context of the story, the participants changed details in the story that they could not understand to fit with their knowledge and beliefs (their schemas).

Are you a painter? a musician? a mechanic? a card player? Discover your schemas and learn to use them to better integrate new learning.



## 3. Space Study Sessions

Think of this as the "No-cramming Rule". Spacing your study sessions over days improves long-term retention.

The "Spaced Practice Effect" was first described by Hermann Ebbinghaus in 1885! We now know that spacing your study sessions across days can almost DOUBLE the amount of information you can retain. In 1987, Bahrck and Phelps showed that this type of enhanced retention can last up to 8 years!



## 7. Get Restful Sleep

Sleep is critical for "consolidating" what we learn. A good night's sleep is an absolute must for you to retain information.

Walker and colleagues (2002) showed that sleep can help strengthen learning and improve retention after 24 hours. Walker also subsequently showed in 2006 that sleep deprivation leads to worse memory retention. The link between sleep and memory is one of the most well-reproduced findings in neuroscience. During sleep, memories created while we are awake are replayed and consolidated (made resistant to forgetting). Sleep loss is devastating for learning and memory. Sleep to remember and remember to sleep!

## 4. Use Your Imagination

Mental Imagery is the best method to creating long-lasting associations and memories.

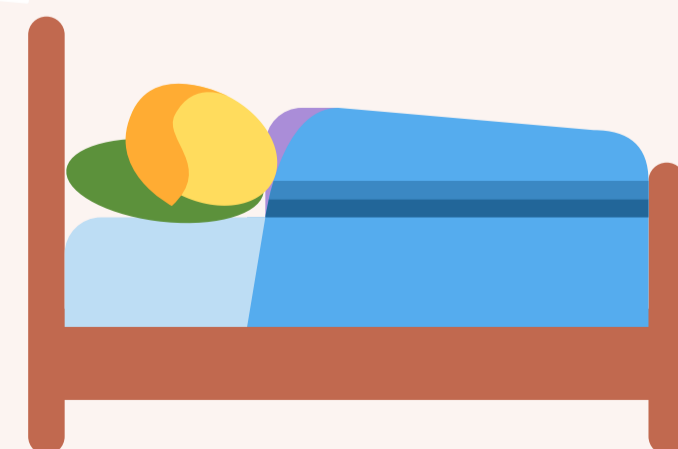
Our imaginations are incredibly powerful. Creating mental images helps us encode and store new information more efficiently. Create personal associations and connect the material with your own experiences. They say a picture is worth a thousand words. Roger Shepard demonstrated this empirically in 1967. John Richardson authored an entire book on the effect of mental imagery on human memory in 1980.



Tip: Don't just stop at pictures. Think in 4-D. Imagine colorful interactions and associations like a video reel. The more senses you engage, the more likely the memory will stick!

### DON'T FORGET

- ▶ Maintain a regular sleep schedule
- ▶ Use a calming bedtime routine
- ▶ Limit light exposure in the evening
- ▶ Eliminate screen time in bed
- ▶ Make your bedroom comfortable
- ▶ Avoid caffeine, food or alcohol too close to bedtime



# Further Reading

Bahrick, H. P., & Phelps, E. (1987). Retention of Spanish Vocabulary Over 8 Years. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 13(2), 344–349.

Bartlett, F. C., (1932). *Remembering: A Study in Experimental and Social Psychology*. Cambridge: Cambridge University Press.

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General*, 104(3), 268–294.

Ebbinghaus, H. (1885). *Memory: A Contribution to Experimental Psychology*. New York: Dover.

Godden, D. R., & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: On land and underwater. *British Journal of Psychology*, 66(3), 325–331.

Richardson, J. T. E. (1980) *Mental Imagery and Human Memory*. London: Palgrave.

Roediger, H. L., Karpicke, J. D. (2006) Test-enhanced learning: taking memory tests improves long-term retention. *Psychological Science* 17(3), 249–55.

Shepard, R. N. (1967) Recognition memory for words, sentences, and pictures. *Journal of Verbal Learning and Verbal Behavior*, 6(1), 156–163.

Walker, M. P. (2006). Sleep to Remember: The brain needs sleep before and after learning new things, regardless of the type of memory. Naps can help, but caffeine isn't an effective substitute. *American Scientist*, 94(4), 326–333.

Walker, M. P., Brakefield, T., Morgan, A., Hobson, J. A., & Stickgold, R. (2002). Practice with sleep makes perfect: sleep-dependent motor skill learning. *Neuron*, 35(1), 205–211.

# Helpful Digital Resources

*Knowing what resources are out there to help you study is half the battle. Don't be afraid to try new and different types of learning experiences, e.g. annotated videos, virtual lectures, digital flashcards, concept maps, games, etc. Remember that the more senses you engage while studying, the more likely you are to remember what you learn. Here are some resources for you to try out. Each has its strengths and you might like some and not others. Find your favorites!*

## Khan Academy

A comprehensive free resource with thousands of video lessons and online tools for students to track their progress and set academic goals.

[khanacademy.org](https://khanacademy.org)

## Quizlet

Create “sets” in any subject. Based on the set, the website will generate flashcards, quizzes, practice tests, matching games, and even auditory tools.

[quizlet.com](https://quizlet.com)

## Academic Earth

Video lectures for college courses on a wide range of subjects. Most of these lectures have been filmed at leading universities around the world.

[academicearth.org](https://academicearth.org)

## StudyStack

Create flashcard sets and use what others have already made. You can also turn your flashcards into tools and games for studying.

[studystack.com](https://studystack.com)

## HippoCampus

Access thousands of free instructional videos in many topic areas. You can create custom playlists and explore other linked content.

[hippocampus.org](https://hippocampus.org)

## TED-Ed

A collection of video lessons spanning various subjects. It also allows the user to create a customized lesson based on the video's contents.

[ed.ted.com](https://ed.ted.com)

## MIT OpenCourseWare

MIT OpenCourseWare has created a large bank of video and audio files from over two thousand MIT classes.

[ocw.mit.edu](https://ocw.mit.edu)

## Evernote

Evernote allows you to keep all your notes, figures, research, web clips, and other information together in one place, helping you organize across platforms.

[evernote.com](https://evernote.com)