

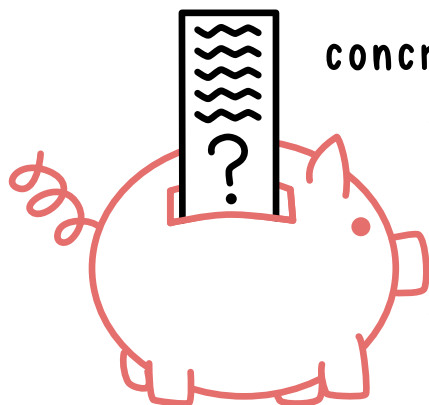


elaboration

- ask yourself questions whilst you study (maybe add them in different colour ink) and then find the answers later. you could find the answer in your notes or a textbook, or talk to your professor or teacher.
- make connections between concepts as you study
- make comparisons between different concepts

McDaniel, M. A., & Donnelly, C. M. (1996). Learning with analogy and elaborative interrogation. *Journal of Educational Psychology*, 88, 508-519. Wong, B. Y. L. (1985). Self-questioning instructional research: A review. *Review of Educational Research*, 55, 227-268.

concrete examples



- whenever you come across an example when in class or studying, make sure to highlight or make a note of it; add it to your bank of examples.
- you could share this bank with classmates and try to find as many examples as you can.

Rawson, K. A., Thomas, R. C., & Jacoby, L. L. (2014). The power of examples: Illustrative examples enhance conceptual learning of declarative concepts. *Educational Psychology Review*, 27, 483-504.

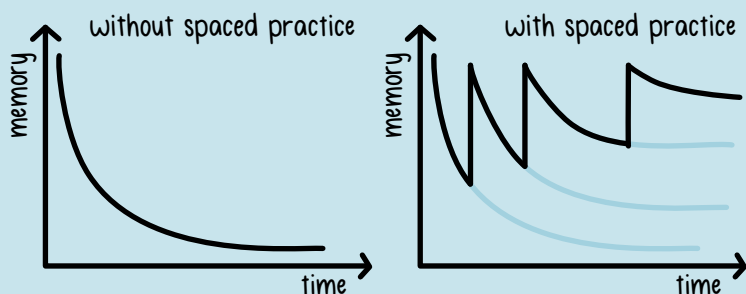
spaced practice



- don't leave studying to the last minute; start early and spread it out
- review your notes a few days after your class, or at the end of the week, as a way to space out your study
- revisit your study materials every few weeks or months (depending on your needs)

Benjamin, A. S., & Tullis, J. (2010). What makes distributed practice effective? *Cognitive Psychology*, 61, 228-247.

THE EBBINGHAUS FORGETTING CURVE



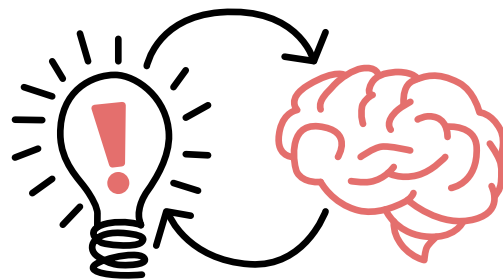
the ebbinghaus forgetting curve describes how our memory weakens over time. the rate at which we forget something depends upon the steepness of the slope - the steeper the slope, the faster you lose your memory of something.

if you revisit a topic a day or so after first studying it, your memory will then decay more slowly, and you will forget it less. if you repeat this, each time leaving a little more time between the reviews, each time you review you will forget more slowly after that.

1. Murre, J. M. J., & Dros, J. (2015). Replication and Analysis of Ebbinghaus' Forgetting Curve. *PLoS One* 10, e0120644.

created by alexia alexander wight (@missneutrino), 2024, with the support of the learning scientists.

retrieval practice



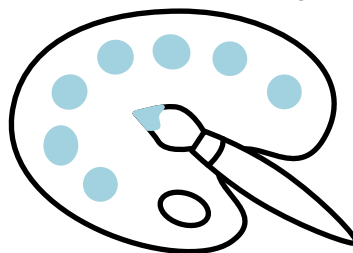
the focus of retrieval practice is testing yourself; retrieving the information from your brain

a few ways you can do this:

- put away your notes, then write and sketch out everything from memory. check against your notes to see what you missed and your weak points.
- make flash cards in a question & answer format and use these to test yourself.
- do as many practice questions, exams, and essays as you can!

Roediger, H. L., Putnam, A. L., & Smith, M. A. (2011). Ten benefits of testing and their applications to educational practice. In J. Mestre & B. Ross (Eds.), *Psychology of learning and motivation: Cognition in education*, (pp. 1-36). Oxford: Elsevier.

dual coding

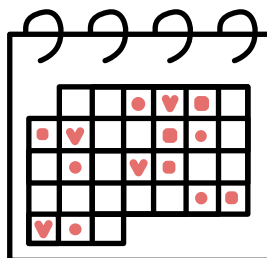


dual coding is all about using both visuals and words to understand concepts

- if you're trying to learn a concept explained in words; can you create a sketch which explains the same concept? or if you're learning a visual concept, can you explain it in words?
- in many subjects you can use sketches to help lay out a problem, and make connections between different ideas. for example, in physics and engineering, you might do a force diagram sketch to understand what's happening better.

Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology*, 84, 444-452.

interleaving



- switch between different topics or ideas during your study session
- make links between ideas as you switch between them
- when reviewing topics, change the order your study them in each time

Rohrer, D. (2012). Interleaving helps students distinguish among similar concepts. *Educational Psychology Review*, 24, 355-367.

WHY SHOULD I USE THESE METHODS?

it's important when you study to use methods that are actually effective, and backed by science. just because something 'feels' like it's working, doesn't mean it is; for instance, whilst reading over your notes is shown to provide a feeling of increased recall, it doesn't actually translate into this, and doesn't improve grades. all the methods here are study strategies backed by science; scientifically proved to increase understanding and your grades!

if you want more info on any of these study methods, check out the references, or for a nice summary, learningscientists.org

HOW TO USE THIS NOTEBOOK

① make notes



make your notes in the main space, and leave the margin blank

② review notes



- summarise notes in the margin
- highlight concrete examples and dual coding
- add elaboration where needed

by spacing out steps 1-3 you're already adding interleaving & spaced practice into your studies!

③ make flashcards



go over the notes you made in the margin and make them into flashcards. make sure the flashcards are in testable, Q&A format

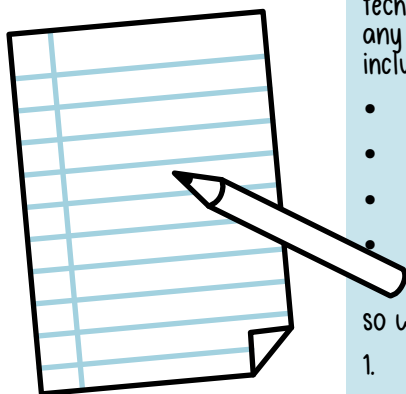
④ retrieve and interleave

review the flashcards regularly, making sure you're using spaced practice and interleaving.

⑤ practice practice practice

do as many practice questions (or essays) as you can!

- go above and beyond with your answers, using elaboration to make sure you're learning everything you can from them.
- if you're struggling with a question, can you use dual coding techniques and represent the concepts visually, by sketching?
- if a practice question is a good example of a phenomena, put it into a bank of concrete examples to refer to later!



what if I really really don't like flashcards?

technically, you don't have to make flashcards. you can use any method that utilises retrieval practice. some other options include:

- making a mind map of everything in the topic;
- sketching a labelled diagram;
- just writing down everything you know about the topic;
- or anything else you can think of, as long as it involves doing stuff from memory and testing yourself!

so why do I recommend flashcards? two reasons:

1. flashcards are easy to put into the format of question & answer, and so are very good for retrieval practice;
2. if you make flashcards in an app like anki, it'll do built-in spaced practice without you having to do anything extra - and if you review all decks at once it'll also include interleaving!

you can also do steps 1-3 on any problem sheets or practice exams you do, and add anything you learnt whilst doing them to your flashcards!

don't see any stickers? head to missneutrino.com/evidence-based-notetaking/ to download or print them

STICKERS GALORE

these stickers can be used in your notes to indicate where you used a certain study method