

Designing Activities to Promote Robust Learning

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All workshop materials are online at

Taking Learning Seriously

<https://takinglearningseriously.com>

Workshop Premise

The science of learning can help us understand which teaching practices are likely to support learning, how to implement them, and what to do when they don't work.

Workshop Objectives

. . . better able to *explain* how

1. learning strategies can support robust learning
2. various factors influence the effectiveness of learning strategies
3. to incorporate learning strategies in your teaching and classes

Robust learning?

Robust

Frail

Durable, lasting

Fragile, temporary

Meaningful

Rote, superficial

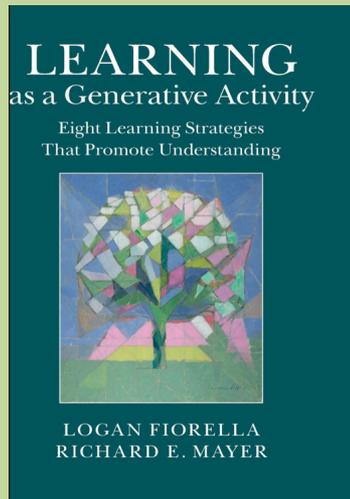
Flexible

Inert

Robust learning is more likely when students . . .

- self-test by trying to recall what they studied
- translate info into own words
- predict and explain what will happen if . . .
- create examples
- explain concept to classmate
- draw a diagram to represent an idea
- apply concept to new problems
- enact and reflect on a procedure or skill
- think of an analogy
- study *worked* examples

Sources for Learning Strategies

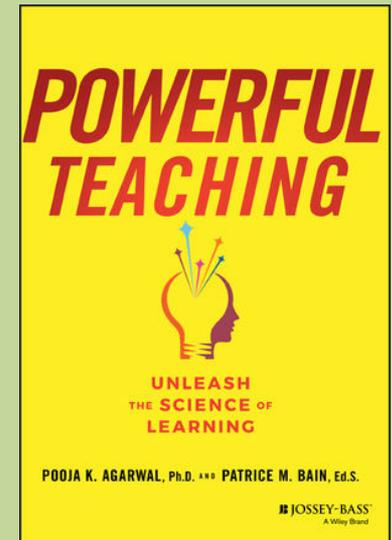
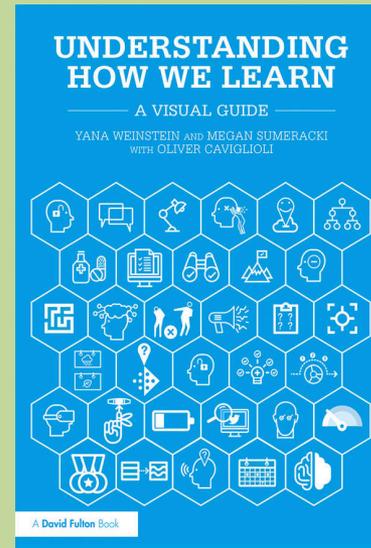
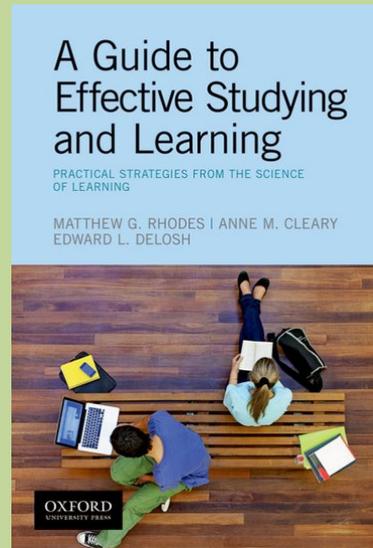
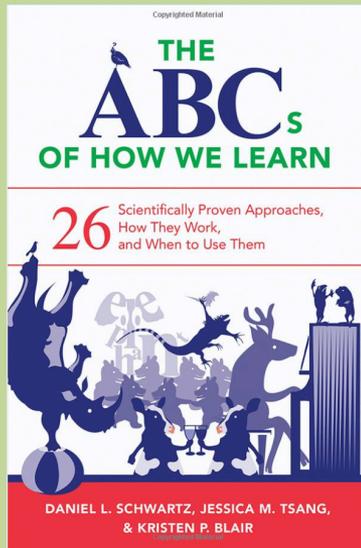
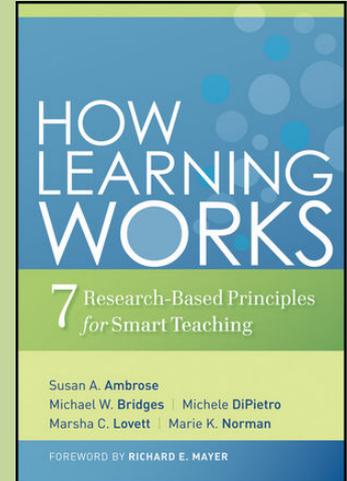


Improving Students' Learning With Effective Learning Techniques: Promising Directions From Cognitive and Educational Psychology

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Relative Utility of 10 Learning Techniques

Technique	Utility	Description
Practice Testing	High	Self-testing or taking practice tests over material
Distributed Practice	High	Practice that spreads out study activities over time
Self-explanation	Med	Explaining how new info is related to prior knowledge
Elaborative Interrogation	Med	Generating an explanation for why an explicitly stated fact or concept is true
Interleaved Practice	Med	Practice that mixes different types of problems within a single study session
Summarization	Low	Writing summaries of material
Highlighting	Low	Marking portions of material while reading or listening
Keyword Mnemonic	Low	Using keywords and images to associate verbal materials
Imagery for Text	Low	Forming mental images of text material while reading
Rereading	Low	Restudying text material again after an initial reading

Adapted from: Dunlosky J et al. *Psychological Science in the Public Interest* 2013;14:4-58.

Selected Learning Strategies

Practice testing*

Spaced (distributed) practice*

Self-explanation*

Drawing/visualizing

Create examples

Worked examples

Reciprocal teaching

Think-pair-share

Minute paper

Predict-explain-observe-re-explain

Group grid

Modeling

Retrieval Practice

Active Ingredient

Recalling information from memory without looking back at the material.

Test effect

Recall of previously learned information increases the likelihood that it will be recalled in the future.

Common names – retrieval practice, practice testing, self-testing, retrieval-based learning, test-enhanced learning

Retrieval Practice Produces More Learning than Elaborative Studying with Concept Mapping

Jeffrey D. Karpicke*, Janell R. Blunt

+ See all authors and affiliations

Science 11 Feb 2011:

Vol. 331, Issue 6018, pp. 772-775

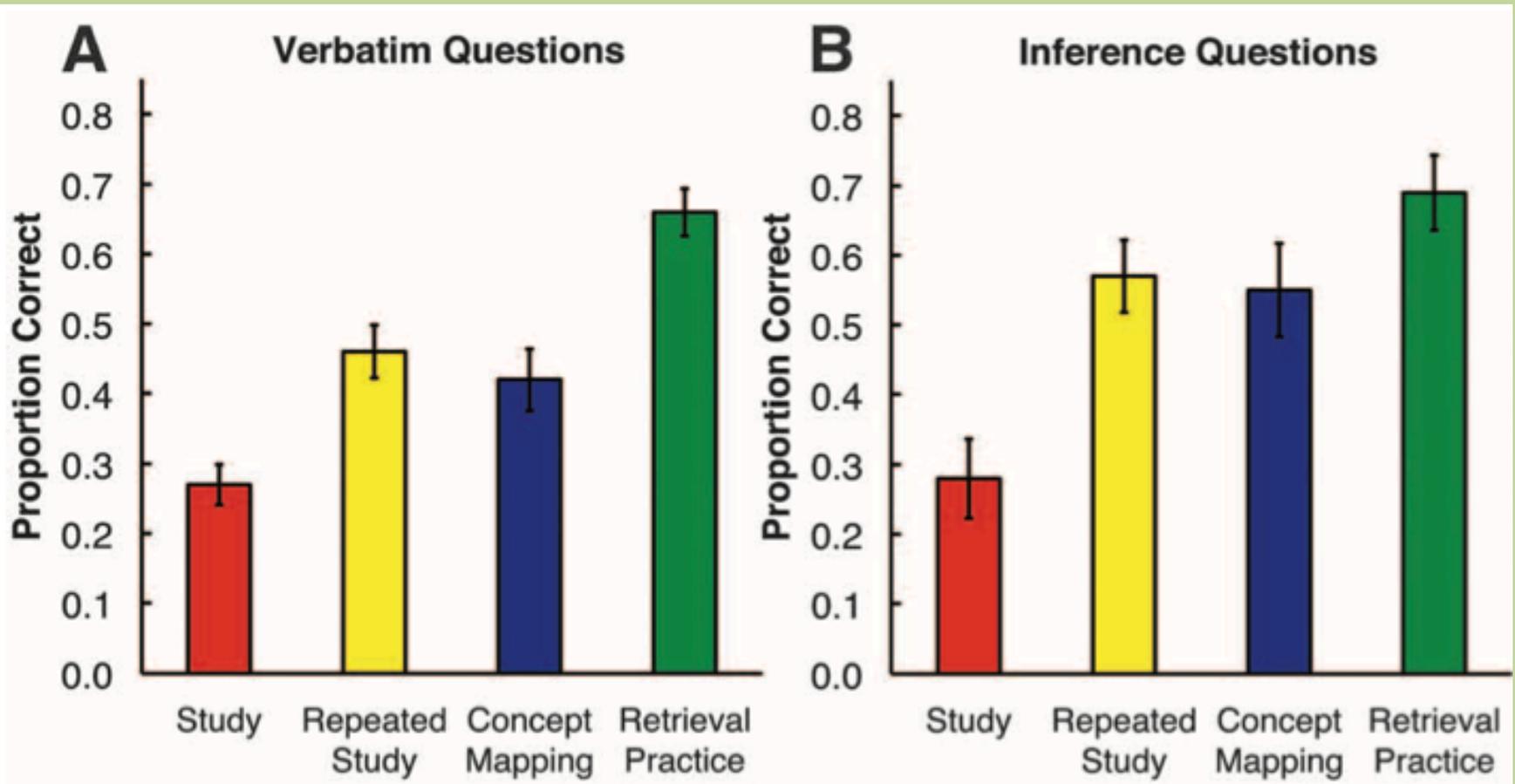
DOI: 10.1126/science.1199327

Learning phase. Students studied *Scientific American* article

1. Read the material one time
2. Read the material four times
3. Read the material one time and made a concept map of it
4. Read the material one time and then wrote down everything they could remember without looking back at the information

One week later took a test.

Retrieval Practice vs. Rereading



Source: Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science*, 331, 772–775. <http://dx.doi.org/10.1126/science.1199327>

Examples of Retrieval Practice in the Classroom

Distributed Concept Reviews (Blasiman, 2017)

Practice Quizzes (Lyle & Crawford, 2011)

Pop Quizzes (Khanna, 2015)

Cumulative Exams (Lawrence, 2013)

Guidelines for Using Retrieval Practice

See workshop handout p.2

Self-Explanation Effect

Active Ingredient

Constructing meaning of subject matter by explaining – elaborating, making inferences, connecting new facts and ideas to prior knowledge

Self-explanation effect

Even if learning materials are inadequate (such as not perfectly sequenced, with much missing information), students can learn, in fact even more effectively, if they try to explain the materials to themselves. Doing so allows them to infer the missing information, synthesize the presented information even if it is out-of-sequence, and so on. This has been coined the self-explanation effect.

Chi, 2017, *Counter-intuitive findings from the science of learning*

Be sure to hear Micki Chi's plenary talk on Saturday at 11:30

Self-explanation

Medical students prompted to generate self-explanations of cases were better able to diagnose unfamiliar cases than students who were not instructed to generate self-explanations (Chamberland and colleagues, 2011).

College students read as though “studying for an exam.” Those prompted to self-explain outperformed those who read and reread material (Griffin, Wiley, & Thiede, 2008).

Guidelines for Using Self-Explanation

See workshop handout p.4

Spaced (Distributed) Practice

Active Ingredient

Spreading out study activities over time, until student starts to forget material, e.g., a student studies a total of five hours for an exam in five, one-hour time blocks spread out over a week.

*The **distributed practice effect** . . . distributing learning over time typically benefits long term retention more than does massing learning opportunities back-to-back or in relatively close succession.*

Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013, p.35

Spaced practice study

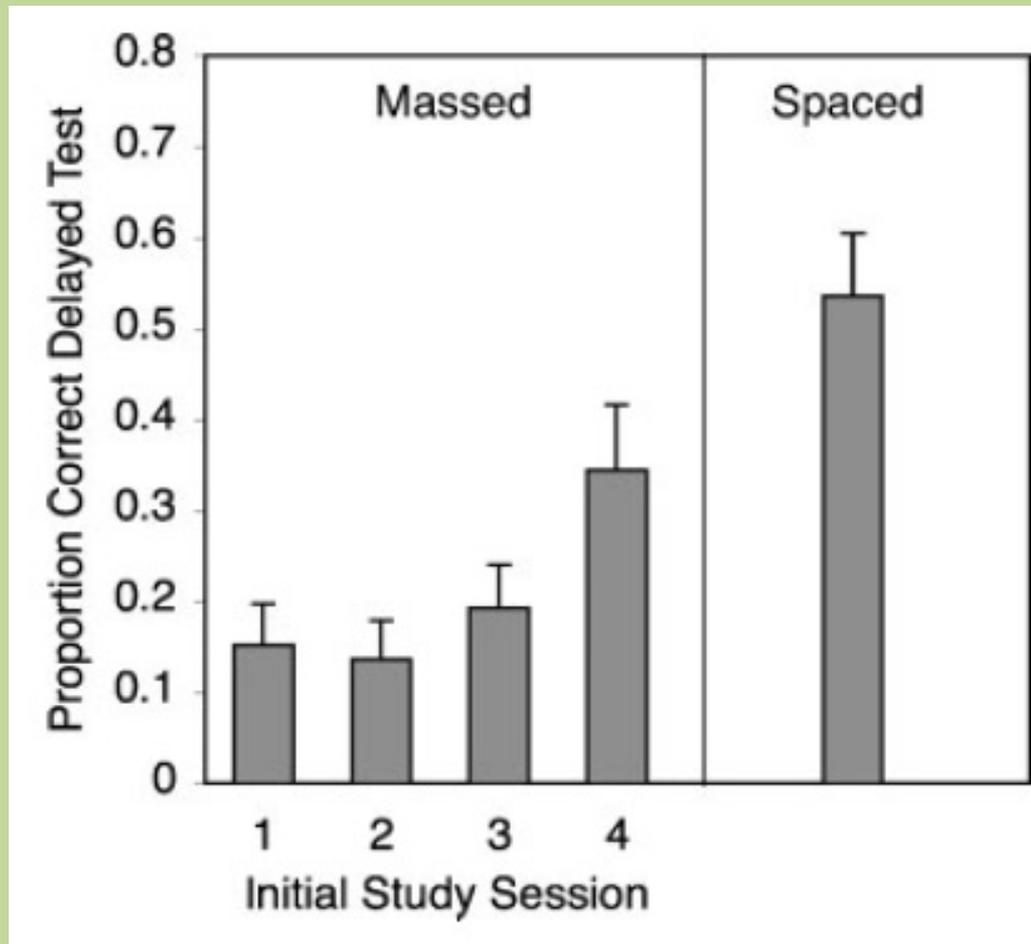
Students learned a list of synonyms using flashcards (GRE type word pairs, e.g., apotheosis-deification).

Studied either by massed or spaced practice. Time was controlled; all students had the same amount of study time.

Massed – studied in one lengthy session before taking the test.

Spaced – studied the material in short sessions on different days.

Spaced Practice Effect



Kornell, N. (2009). Optimising learning using flashcards: Spacing is more effective than cramming. *Applied Cognitive Psychology*, 23, 1297–1317.

Spaced practice examples

Successive Relearning (Rawson & Dunlosky, 2015)

- Select most important concepts/content for practice
- Create questions, mc and short-response
- Schedule delay between study and test
- Give delayed explanatory feedback

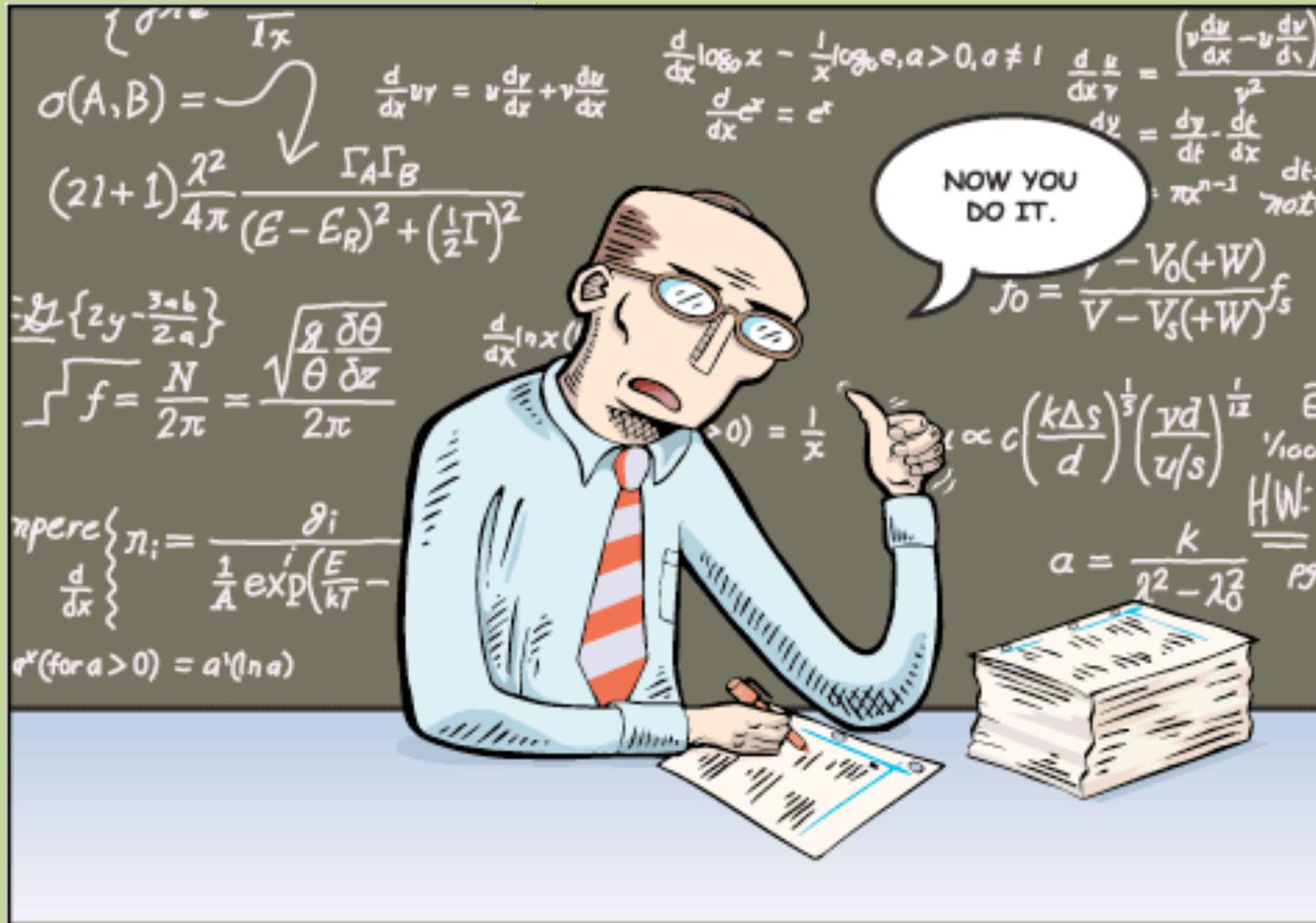
Online practice quizzes (Cerbin, 2016)

- 25 online quizzes, one for each reading assignment
- Each quiz included mc and short response items, some from previous quizzes
- Ss logged in after quiz to receive feedback
- Cumulative final exam with large number of previous quiz items
- Follow up test 4 months after the course

Guidelines for Using Spaced Practice

See workshop handout p.3

Implementing Learning Strategies to Promote Robust Learning in Your Class



Refer to One-page Worksheet

This exercise is an opportunity to start thinking about how to incorporate learning strategies in your classes

Outline a plan to implement (or upgrade) one or more learning strategies in your class.

OK to discuss and collaborate with colleagues!

References

References for Designing Activities to Promote
Robust Learning

The End

Thank You

Have a Great Conference