Cognitive Principles of Learning and Memory

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How to Encourage Good Notetaking

- Get students to **actively participate**
  - Ask questions, do demos, have them read before class
    - Get them to critically analyze the information you are covering
- **Notetaking strategies**
  - Have them take notes in their own words, rather than just regurgitating yours from **short-term memory**
  - Incorporate notes from the book into lecture notes
  - Taking notes by hand vs. on a laptop (Mueller & Oppenheimer, 2014)

Goals of this Workshop

- To help students *learn* more effectively in class
- To help students *study* what they have learned more effectively

Why Learning Can Be Difficult

- **PROBLEM:**
  - "There is so much information that I can't write everything down."
  - Why this is a problem:
    - Notes end up being incomplete
    - Aren't processing the meaning of the lecture
- **SOLUTION:**
  - Allow students to record the lecture
  - Provide PowerPoint outlines of lecture
  - Encourage students to swap notes with someone

Why Learning Can Be Difficult

- **PROBLEM:**
  - "When I'm listening in class, it all makes sense (so I don't need to write anything down)"
  - Why this is a problem:
    - **Long-term memory** is good at retaining the gist, not the details
- **SOLUTION:**
  - Encourage students to take good, *comprehensive* notes, which become the basis for their subsequent studying

Why Studying Can Be Difficult

- "There is too much material, so I can't possibly study everything."
- "When I'm studying, I feel like I know the material."
- "I studied SO MUCH, but I still didn't do well on the exam."

How to Study More Effectively

- What to do:
  - Elaborate
  - Test
  - Organize
  - Take breaks
  - Use variable encoding

Levels of Processing Theory

- Craik & Tulving (1975)
  - Presented nouns one at a time, and one of three types of questions:
    - Shallow processing: Is the word in capital letters?
    - Less shallow processing: Does the word rhyme with _____?
    - Deep processing: Does the word fit in the sentence…?

Get Students to Elaborate

- Elaborate
  - Associate what they are learning with other things they have stored in memory
    - **Levels of processing theory**
      - The depth at which we process information **during encoding** determines how well we recall it (Craik & Lockhart, 1972)
        - » Shallow vs. deep processing

Levels of Processing Theory

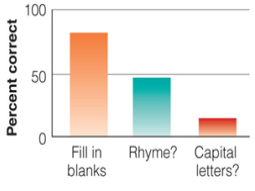
In our demo:

- Shallow (features):
  - book, snow, flower, tree, fox
- Less shallow (sounds)
  - safe, weight, color, hall, day
- Deep (meaning)
  - duck, house, student, robin, textbook

- Recall all the words that you saw earlier (the ones paired with the different questions)

Craik & Tulving (1975)

- Results:
  - More likely to recall words judged on meaning
  - Least likely to recall words judged on appearance
- Conclusion:
  - Better memory for words processed more deeply



Deep Processing

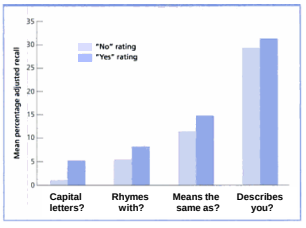
- In what other ways can people process information deeply?
  - **Self-reference**
  - **Imagery**
  - **Generation**

Generation Effect

- Slamecka & Graf (1978)
  - Manipulated whether pairs of related words were read or generated
    - Read: sea-ocean
    - Generate: sea-oc_____
  - Also manipulated depth of processing
    - Deep: words related in meaning, e.g., sea-ocean
    - Shallow: words related in sound (rhymes)
      e.g., save-cave
  - Then gave a recognition test:
    diamond ocean light

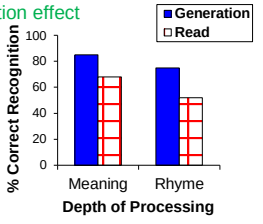
Self-Reference Effect

- Rogers, Kuiper, & Kirker (1977)
  - Encoding with respect to oneself increases memory: self-reference effect



Slamecka & Graf (1978)

- Results:
  - Generation led to better memory than reading, *independent of* depth of processing
    - generation effect



Imagery

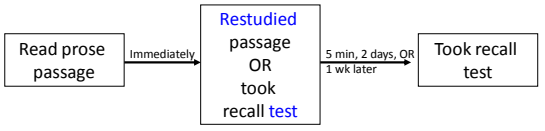
- Create images that link things, and visualize them interacting with each other

Real-World Examples of Generation

- Students can...
  - talk out loud when studying
  - Explain the material to someone else

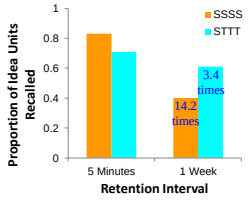
Testing Effect

- Roediger & Karpicke (2006, Expt 1)



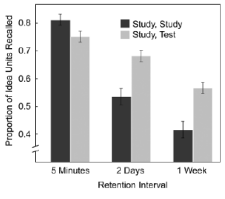
Roediger & Karpicke (2006)

- Repeated testing is better for long-term retention than repeated study, even with reading the passage much less!



Roediger & Karpicke (2006)

- Immediate testing resulted in better long-term retention than restudying

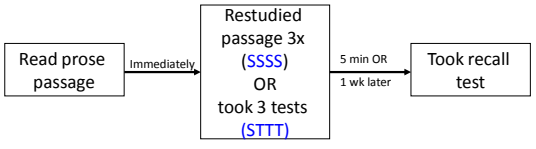


Get Students to Test Themselves

- Self-test by asking themselves questions
  - "Test Yourself" & "Think About It" questions
  - Create their own questions
- Complement individual studying with a study group
- Make sure they generate answers!

Testing Effect

- Roediger & Karpicke (2006, Expt 2)



Get Students to Organize

- Organize
  - They should go through their lecture notes and organize them that same day
    - "Should I rewrite my notes?"
      - If so, use different words this time
  - Make their own study guides for exams

Get Students to Take Breaks

- Take breaks
  - Study in a number of shorter study sessions rather than trying to learn everything at once
    - **Spacing effect**

Variable Encoding

- Smith, Glenberg, & Bjork (1978)
  - Studied lists twice, either in same or different contexts:

	Study	Study	Test
Studied in same context:	Room A	Room A	Test C (Recall = 40%)
Studied in different contexts:	Room A	Room B	Test C (Recall = 61%)

  - Studying in two different rooms led to greater recall than studying in one room

Spacing Effect

- Smith & Rothkopf (1984)
  - Gave an 8-hour statistics course, 4 lessons presented in one day (massed instruction) or four days (spaced instruction)

	DAY 1	DAY 2	DAY 3	DAY 4
Massed instruction	Lesson 1 Lesson 2 Lesson 3 Lesson 4			
Spaced instruction	Lesson 1	Lesson 2	Lesson 3	Lesson 4

How to Study More Effectively

- What students should NOT do:
  - Simply memorize their notes
  - Create illusions of learning
  - Rely on metacognition

Spacing Effect

- Smith & Rothkopf (1984)
  - Distributing lessons over four days was more effective than a single-day presentation
    - Memory tested five days later showed that spaced instruction led to 13% greater free recall and 14% greater cued recall than massed instruction

What NOT to Do

- They should not memorize their notes
  - Instead, apply what they have learned
  - Come up their own examples

What NOT to Do

- They should not create "illusions of learning"
  - Rereading
    - Leads to greater fluency, not better memory
  - Highlighting
    - Seems elaborative, but often becomes automatic

Abrams metacognition demo

- What measures from BEFORE the exam correlate with actual exam score?

	Above	Below
I felt prepared:	r = .21	r = .22
I studied:	r = .26	r = .03
Hours studied:	r = .34*	r = -.06
My score will be:	r = .25	r = .08

What NOT to Do

- Do not rely on metacognitive indicators
  - Our knowledge about our own memory is not always accurate
  - Encourage students to review their exams

Some Helpful Videos

- http://www.samford.edu/how-to-study/

Abrams metacognition demo

Please circle a rating for each statement:

- I felt prepared to take this exam.

Not at all prepared		A little prepared		Average		Prepared		Extremely prepared
1	2	3	4	5	6	7	8	9

- I studied for this exam. (also, put # hours here ___)

Not at all		A little		Average		More than usual		A lot
1	2	3	4	5	6	7	8	9

- I think that my score on this exam will be:

Poor		Fair		Average		Good		Excellent
1	2	3	4	5	6	7	8	9