Getting Students to Think about their Learning: Self Regulation Skills

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Several students score poorly on your first exam.

They come to you for help, what advice would you give them?

Understanding Student Learning

More instructor understanding of student learning

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Learning assessment systems

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Less instructor understanding of student learning

- On-going assessment through student dialog in small classes
- Instructor grading of short answer and essay questions
- Computer grading of multiple choice questions using bubble-sheets

Understanding Student Learning

More instructor understanding of student learning

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Less instructor understanding of student learning

- On-going assessment through [illegible] small classes
- Computer grading of multiple choice questions using bubble-sheets

Observation #1

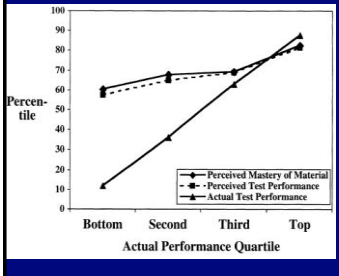
It is difficult for instructors in large classes to recognize student learning difficulties.

Students need to know how to assess their own learning and make adjustments.

Importance of accurate student reflection

- Students completed a task (e.g., logical reasoning test) and estimated how their score would compare with other students.
  - Strongest students typically underrated their performance but recognized they were above average
  - Underperforming students often did not realize that they did not understand key concepts and rated themselves at well above their level of performance.

Importance of Student Reflection

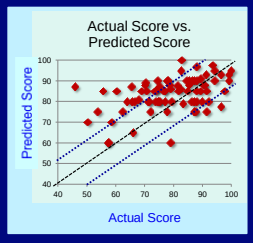


Low scoring students

- overestimated their own skill level
- failed to recognize skill in others
- failed to recognize the degree of their insufficient knowledge
- recognized their lack of skill, *only if* they were trained to improve

Dunning et al., 2003. Current directions in psychological science, v.12 #3, p.83-87

Importance of Student Reflection



Exam Wrapper

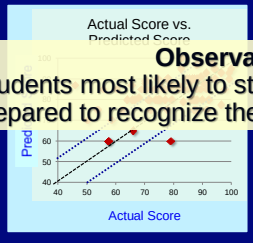
- Students predict their scores upon completion of exam
- Low scoring students most likely to overestimate result
- Take this opportunity to discuss options for next exam

Exam wrappers for Physical Geology exam

- What, if anything, will you do differently in preparing for the second exam?

Study More	No change other	Study Differently
I will study more, a lot more.	I will take the learning journals more seriously and read them when it comes to studying.	Make sure I understand the visuals.
I might try to study earlier than the night before.	I will use more charts and organizers . . .	I will definitely study more by reading something then try to write it.
Study longer and actually practice drawing things out.	I will try to study more, as well as stopping as I study to test myself on the material I am reviewing.	Quiz myself instead of just looking over notes.
Study differently. Summarize more.		I will make a better outline and study more in small increments.
Spend more time preparing and reading over the notes.	I have to study more and actually know what material to study.	I will make sure I understand the learning objectives better.

Importance of Student Reflection



Observation #2
Students most likely to struggle in class are least prepared to recognize their lack of understanding

Exam Wrapper

- Students predict their scores upon completion of exam
- Low scoring students most likely to overestimate result
- Take this opportunity to discuss options for next exam

Reflection Exercise

- After lectures on topic X
  - List 3 items that are clear
  - List 3 items that are muddy
  - Do individually for 2-3 min then discuss in groups of 3
  - Call upon groups (list on board)

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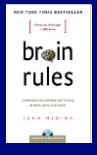
Enhancing Attention



- The more attention we give to a stimulus, the more strongly it is retained by our brain
  - We remember novel or emotional events best
  - We are better at seeing patterns than recording details - so memory is improved by making associations between items (outlines, labeled diagrams)
  - Multi-tasking is not possible – interruptions result in 50% longer to complete task with 50% more errors

Medina (2009)

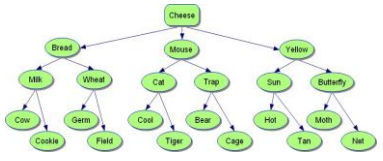
Group A

- Students examined a list of these 22 items for one minute and tried to remember as many as possible.

Who did better?

Group B

- Students examined a list of these 22 items for one minute and tried to remember as many as possible.



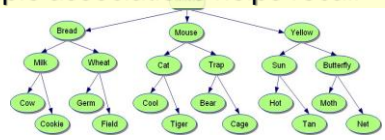
Group A

- Students examined a list of these 22 items for one minute and tried to remember as many as possible.

Observation #3

Organizing information into diagrams that show simple associations helps recall

- Students examined a list of these 22 items for one minute and tried to remember as many as possible.



Students completed a short reading assignment. Group X studied the passage twice (7 minutes each time). Group Y studied the passage once (7 minutes) and then took a recall test. Two days later, both groups were tested on their recall of information. Predict the result.

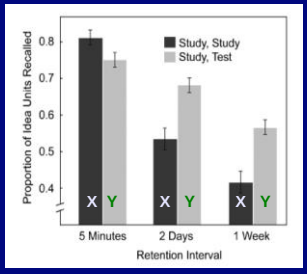
A. Group X scored higher on the test.
B. Group Y scored higher on the test.
C. There was no difference in test score.

Roediger & Karpicke, 2006, Perspectives in Psychological Science, v. 1, p.181-210.

Test Enhanced Learning

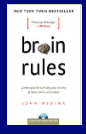
120 college students complete a reading assignment (~250 words)

- Group X studied the passage twice (7 minutes each time)
- Group Y studied the passage once and then took a test
- Both groups then tested at 5 minute, 2 day, and 1 week intervals
- **Group Y retained more knowledge after 2 days, 1 week**



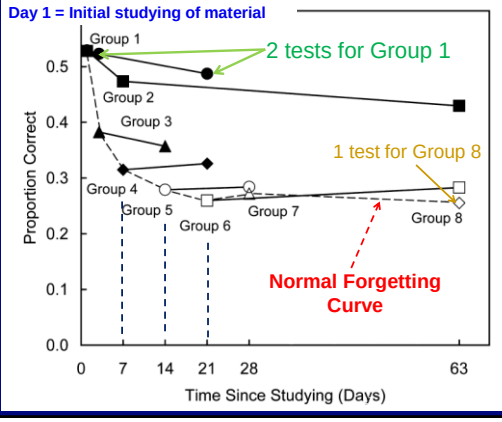
Roediger & Karpicke, 2006, Perspectives in Psychological Science, v. 1, p.181-210.

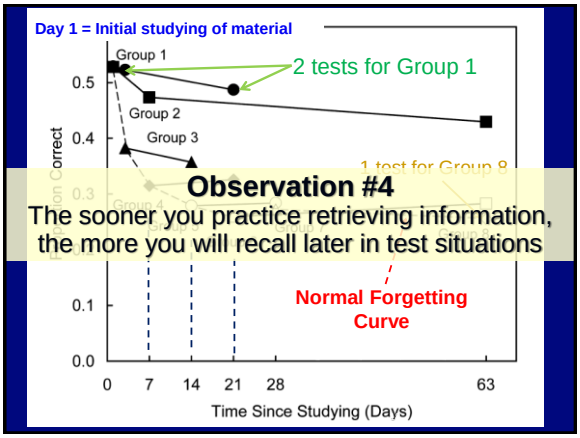
Repetition Aids Retention



- Short-term memory – Repeat to remember
  - The more effort we put into encoding information at the moment of learning, the more we remember
  - **Listening → writing → drawing/ organizing**
- Long-term memory – Remember to repeat
  - Thinking or talking about an event immediately after it occurs enhances memory of the event
  - Reviewing material at fixed, spaced intervals enhances memory (after class reflection, online quizzes, recitations, tutorials, study groups, etc.)

Medina (2009)





Observation #4

The sooner you practice retrieving information, the more you will recall later in test situations

What is retrieval practice?

- Study material for initial study period
- Put material away and on a blank piece of paper **practice retrieval** by recalling and writing down as much information as possible.
- Do it the first time within 24 hours
- Repeat retrieval process at regular intervals prior to exam (e.g., weekly)

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Retrieval Practice

200 students studied science texts:

- **Group A** – Created concept maps - diagrams that illustrate the relationships in the material.
- **Group B** – Read the texts and put the material away and practiced recalling the concepts.

One week later:

- The group that studied by practicing retrieval showed 50% better scores than the group that studied by creating concept maps.

Roediger & Karpicke, 2006, Perspectives in Psychological Science, v. 1, p.181-210.

Research on learning shows that retrieval practice is the most effective study method

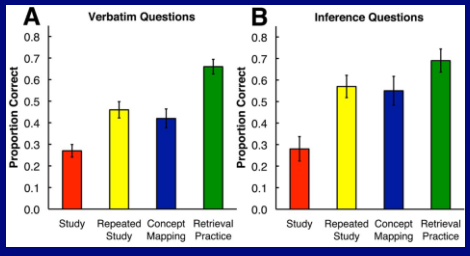
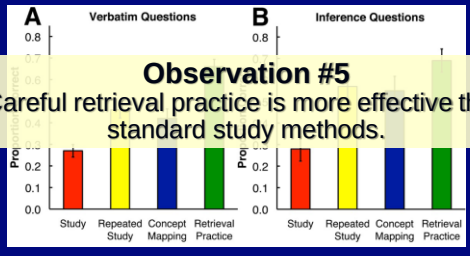


Figure from Karpicke and Blunt 2011 (SciencExpress)

Research on learning shows that retrieval practice is the most effective study method



Observation #5
Careful retrieval practice is more effective than standard study methods.

Figure from Karpicke and Blunt 2011 (SciencExpress)

The Value of Peer/Self Reflection

Experimental Group: Three 2-minute pauses per lecture, student discussion of lecture content with peer.

Control Group: No pauses for discussion in lecture.

Students completed a free recall exercise after lecture

- Experimental Group – number of facts recalled: **22.97***
- Control Group – number of facts recalled: **16.63**

Ruhl, Hughes, and Schloss., 1987. Teacher Education and Special Education, v.10 #1, p.14-18

The Value of Peer/Self Reflection

Experimental Group: Three 2-minute pauses per lecture, student discussion of lecture content with peer.

Control Group [illegible] in lecture.

Observation #6

Simple reflection exercises during or *following* lecture will improve later recall of information

- Experimental Group – number of facts recalled: **22.97***
- Control Group – number of facts recalled: **16.63**

Ruhl, Hughes, and Schloss., 1987. Teacher Education and Special Education, v.10 #1, p.14-18

From a Freshman Class for Meteorology Majors

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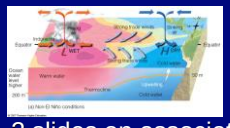
Setting up for retrieval practice

- Eight slides on the SST patterns associated with El Niño, Normal and La Niña



- 2 slides on associated weather patterns
- Clicker Question
- 4 slides on current forecast
- Retrieval Practice

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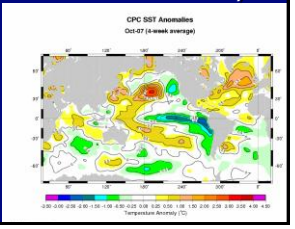
Based on SST map which ENSO pattern is present?

28% 1. El Niño

72% ✓ 2. La Niña

0% 3. Neutral (neither El Nino or La Niña)



Practice Retrieval

- On the maps provided:
  - Draw and label a diagram illustrating the SST anomaly associated with El Niño conditions
  - Draw and label a diagram illustrating the SST anomaly associated with La Niña conditions
  - Draw and label the 3 important ocean currents near North America

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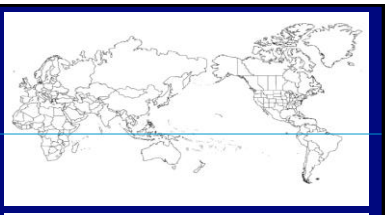
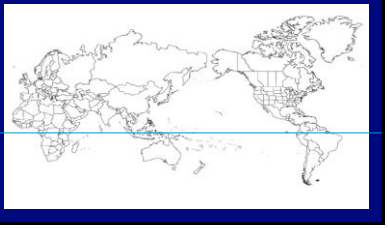
Draw El Niño SST Anomaly

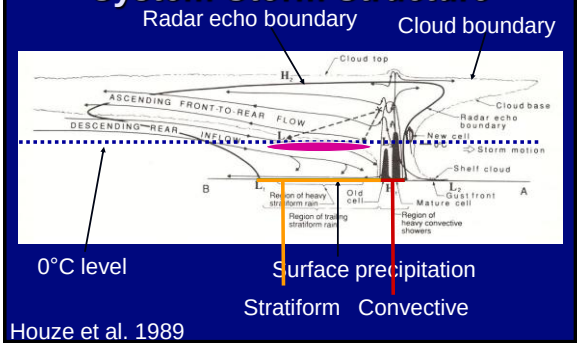


Draw La Niña SST Anomaly



From a Graduate Class in Atmospheric Sciences

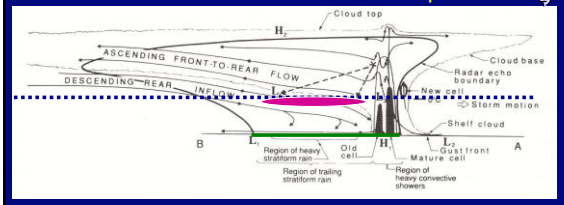
Idealized Mesoscale Convective System Storm Structure



Houze et al. 1989

Given this structure, predict how storm evolves over time. How do SF area fraction and conv area fraction change as total storm size increases? [bigger or smaller or ~same]

Groups of 3



Houze et al. 1989

7 slides later (~ 20 min)

Retrieval Practice

- Draw Houze (1989) cross-section of an idealized MCS
- Include radar and cloud boundaries, convective and stratiform precipitation regions, and the 3 main mesoscale flows

Summary

1. Paying attention (attendance) and monitoring the student learning process is important in determining how much a student gets out of a lecture, reading assignment, or lab.
2. Students should learn to test themselves or reflect on material soon after they receive it, and repeat the process again at spaced intervals prior to an exam.
3. Students should have opportunities to compare their understanding with others to better assess their true comprehension of concepts

Any Questions?