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Cognitive Science for the Classroom

Kyle Heys
Calvin University

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The background features a series of concentric, overlapping circles in light gray and white, some solid and some dashed, creating a dynamic, geometric pattern.

Cognitive Science for Students: Engaging Classroom Activities to Teach Basic Ideas about Learning

Kyle Heys, Calvin University

University of Arkansas, 4 August 2020



Welcome

- **Introduction**
 - **Presenter**
 - **Presentation**
 - **Learning Outcomes**
 - **Pedagogy**
- (Activity Warning)**

A red speech bubble graphic with a white outline, containing the text "Learning Studies".

Learning Studies

Research → Classroom

The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you need to go somewhere else due to a lack of facilities, then this is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run, this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the future, but then, one can never tell. After the procedure is completed, one arranges the materials into different piles again. Eventually they will be used once more and the whole cycle will then have to be repeated. However, that is part of life.

Doing Laundry/Washing Clothes

The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you need to go somewhere else due to a lack of facilities, then this is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run, this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the future, but then, one can never tell. After the procedure is completed, one arranges the materials into different piles again. Eventually they will be used once more and the whole cycle will then have to be repeated. However, that is part of life.



**What does
this activity
teach us?**



Meaningful context/structures
aid learning.

Metacognition



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26



**What does
this activity
teach us?**

The image features a central red speech bubble with a white outline, containing the text "Multitasking is a myth." in white. The background is white with several concentric circles, some solid and some dashed, radiating from the center. A dark grey shadow is cast by the speech bubble onto the background circles.

Multitasking is a myth.

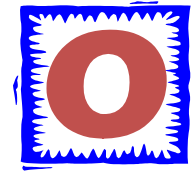
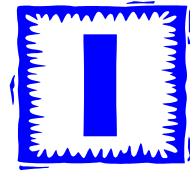
**Sensory
Information**



**Working
Memory**



Counting Vowels in 45 seconds



How accurate are you?

*Count the vowels
in the words on the next slide.*

Dollar Bill

Dice

Tricycle

Four-leaf Clover

Hand

Six-Pack

Seven-Up

Octopus

Cat Lives

Bowling Pins

Football Team

Dozen Eggs

Unlucky Friday

Valentine's Day


Quarter Hour



50 (no Ys)

51 (Y as vowel)

54 (with all the Ys)



**How many *words* or *phrases*
from the list do you remember?**



Let's look at the words again...

**What are they arranged
according to?**

Dollar Bill

Dice

Tricycle

Four-leaf Clover

Hand

Six-Pack

Seven-Up

Octopus

Cat Lives

Bowling Pins


Football Team

Dozen Eggs

Unlucky Friday

Valentine's Day

Quarter Hour



**NOW, how many *words* or *phrases*
from the list do you remember?**

Dollar Bill

Dice

Tricycle

Four-leaf Clover

Hand

Six-Pack

Seven-Up

Octopus

Cat Lives

Bowling Pins

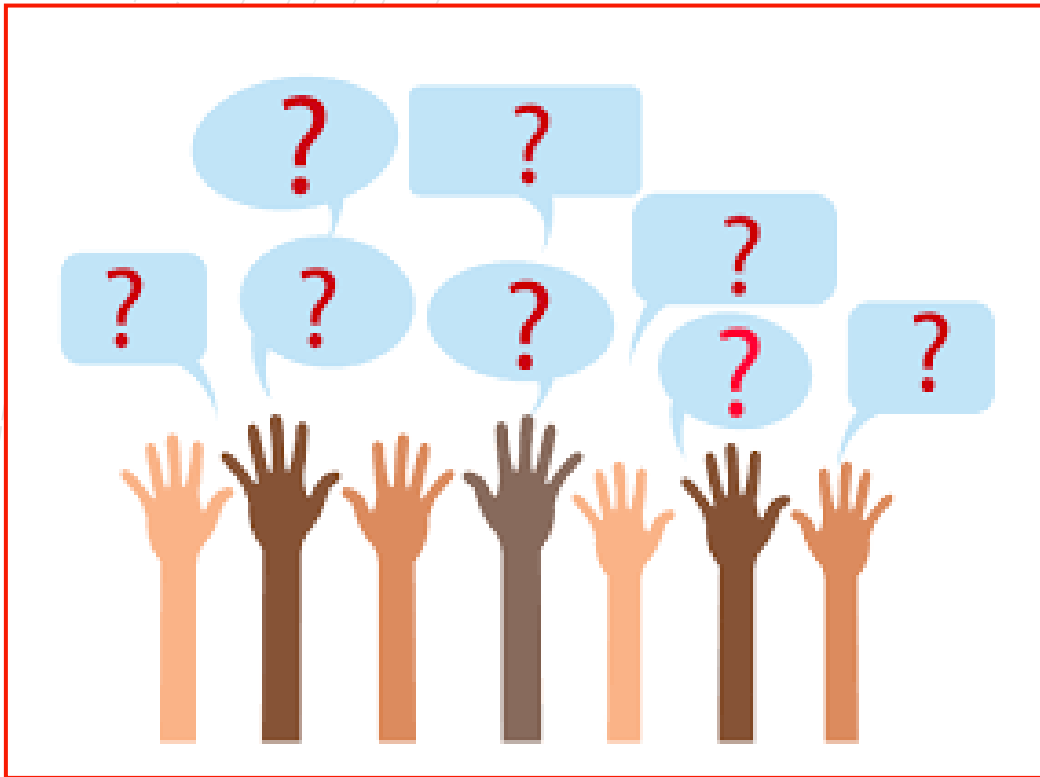
Football Team

Dozen Eggs

Unlucky Friday

Valentine's Day

Quarter Hour



**What does
this activity
teach us?**

A large, vibrant red speech bubble is the central focus, containing the text "You Learn What You Think About!" in a clean, white, sans-serif font. The bubble is positioned slightly to the right of the center. The background is white and features a series of concentric circles in light gray, some solid and some dashed, creating a subtle, circular pattern. A dark gray, curved shape is visible on the left side, partially overlapping the red bubble, suggesting the tail of the speech bubble.

“You Learn What You Think
About!”



What is the most important factor in successful learning?

1. The time you spend studying
2. The intention and desire to learn
3. What you think about while studying
4. Paying close attention to the material as you study
5. Learning in a way that matches your own learning style



What is the most important factor in successful learning?

1. The time you spend studying
2. The intention and desire to learn
- 3. What you think about while studying**
4. Paying close attention to the material as you study
5. Learning in a way that matches your own learning style

**Sensory
Information**



**Working
Memory**



**Long-term
Memory**



A red speech bubble graphic with a white outline, containing the text 'Cave Story'.

Cave Story

Solved Problem Correctly:

**75% of American college
students**

25% of Chinese college students

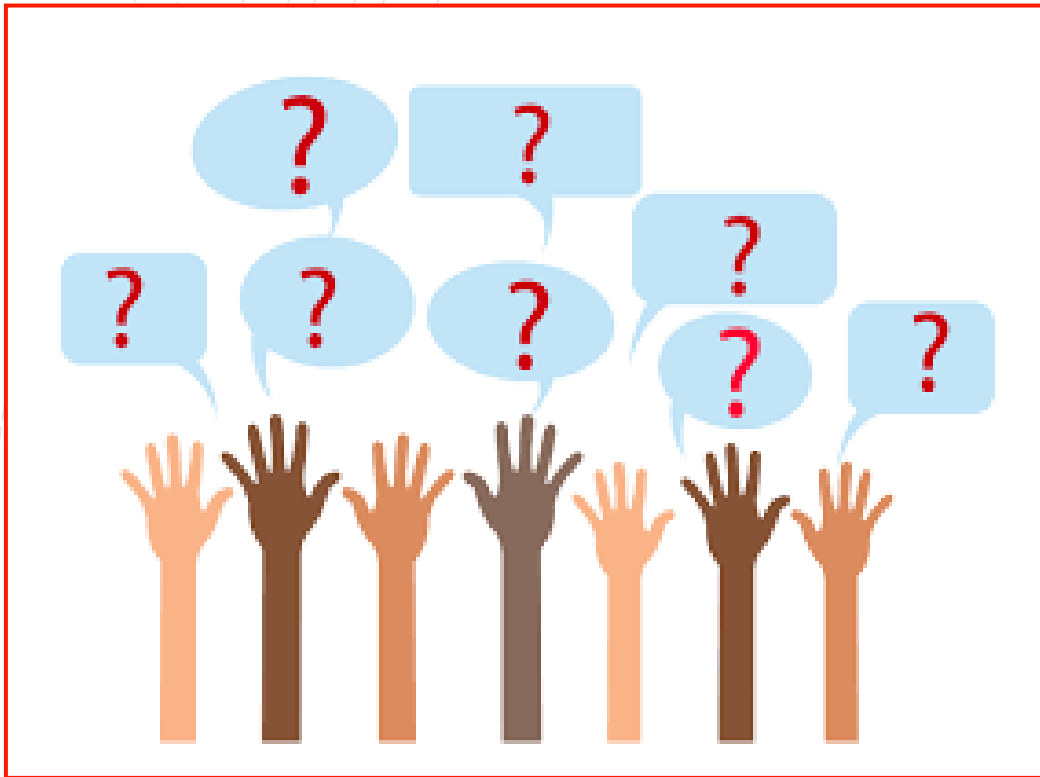


Canoe Story

Solved Problem Correctly:

8% of American college students

69% of Chinese college students



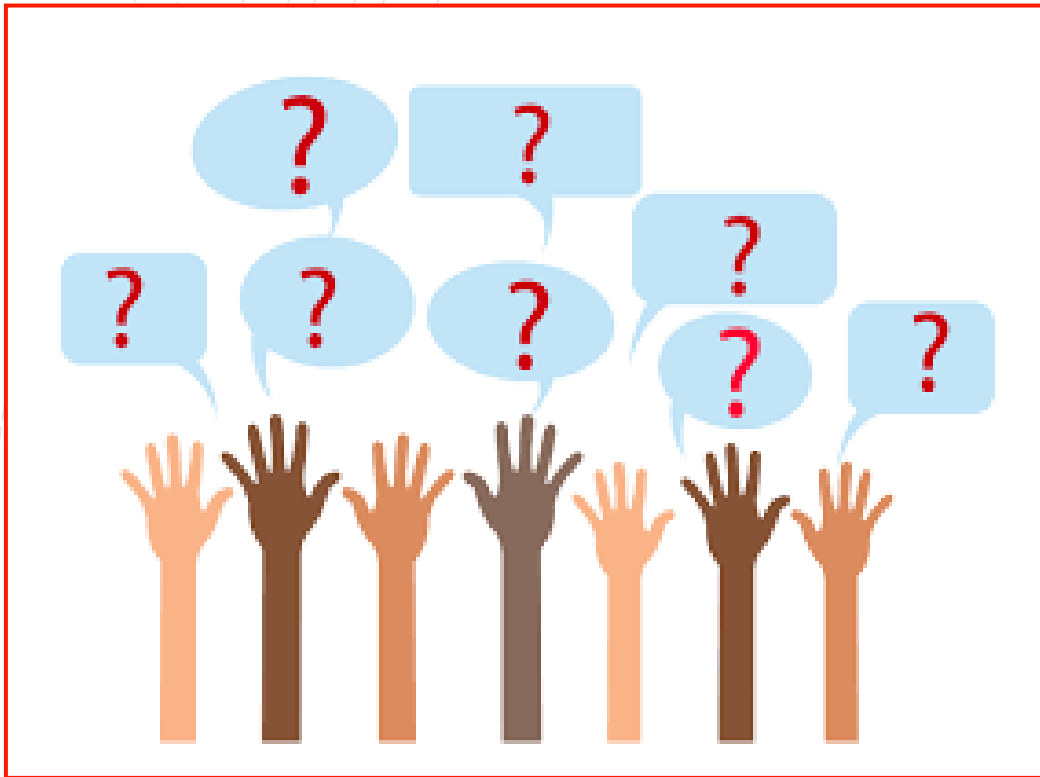
**What does
this activity
teach us?**



Prior knowledge guides
learning.



**What is a
pomelo?**



**What does
this activity
teach us?**



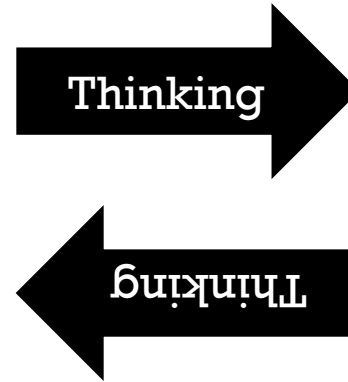


Dual coding aids
learning.

**Sensory
Information**



**Working
Memory**



**Long-term
Memory**



**What were the
five cognitive
principles we
learned today?**

Principles

- **Meaningful structures aid learning.**
- **Multitasking is a myth.**
- **You learn what you think about.**
- **Prior knowledge aids learning.**
- **Dual Coding aids learning.**



Group Discussion:
What idea or activity will you integrate into your class? Why?



S



S



S



SSSS



S



S



S S S S



S S S T



S



SSSS

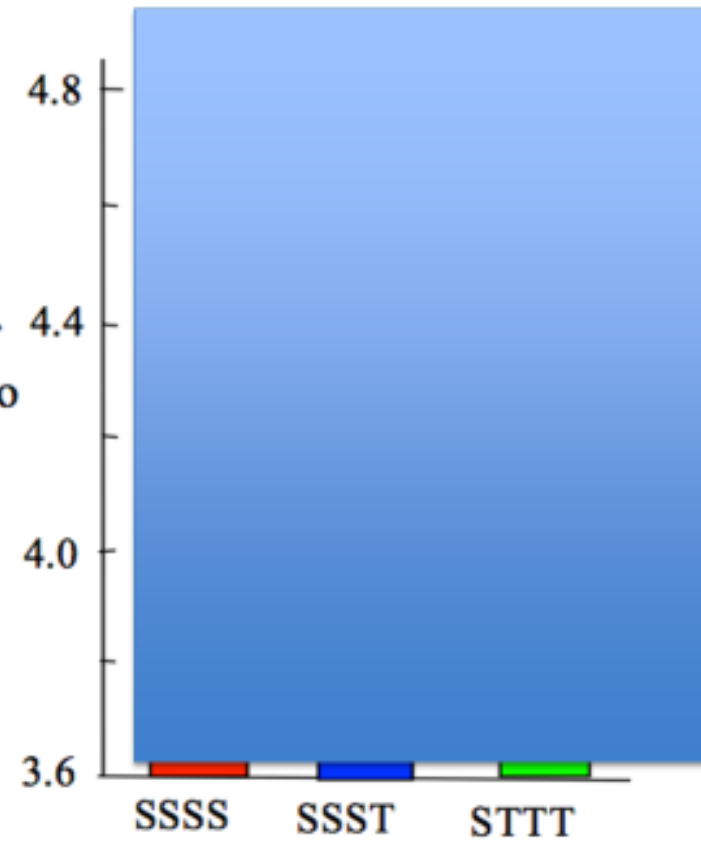


SSST

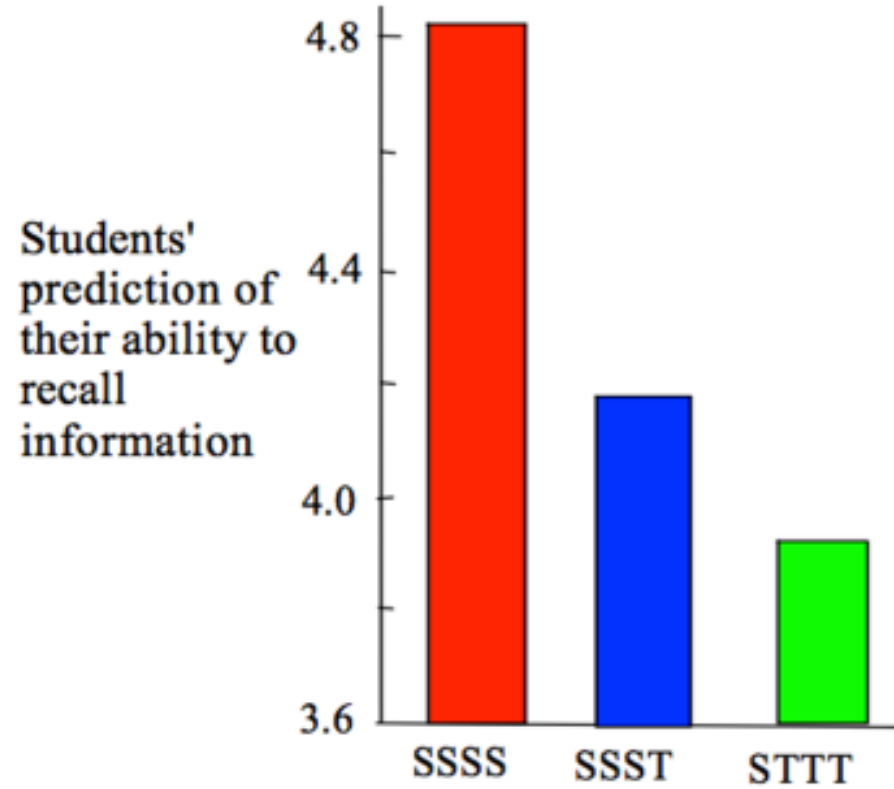


STTT

Students'
prediction of
their ability to
recall
information

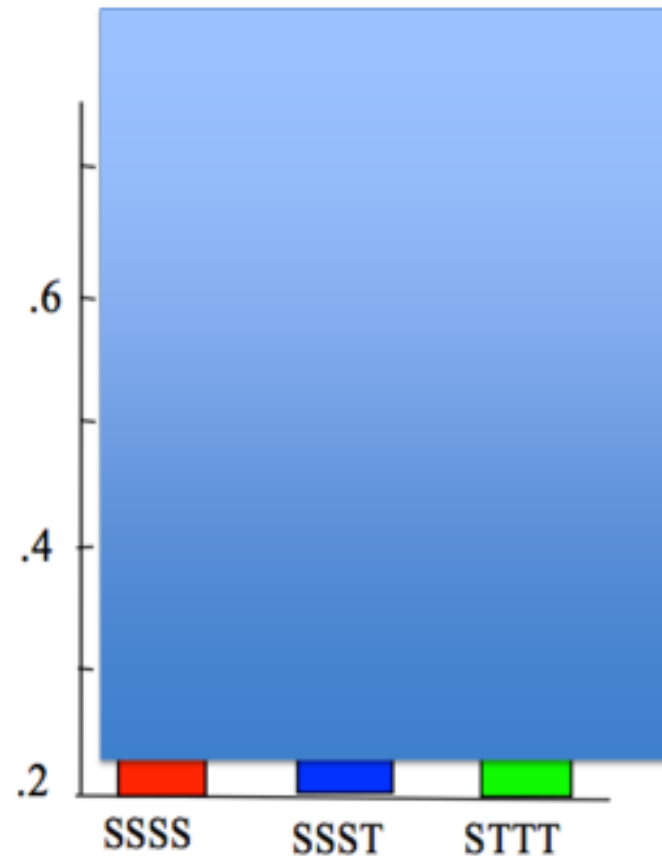


Results adapted from Roediger, H.L., & Karpicke, J.D. (2006). Test enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17, 249-255.



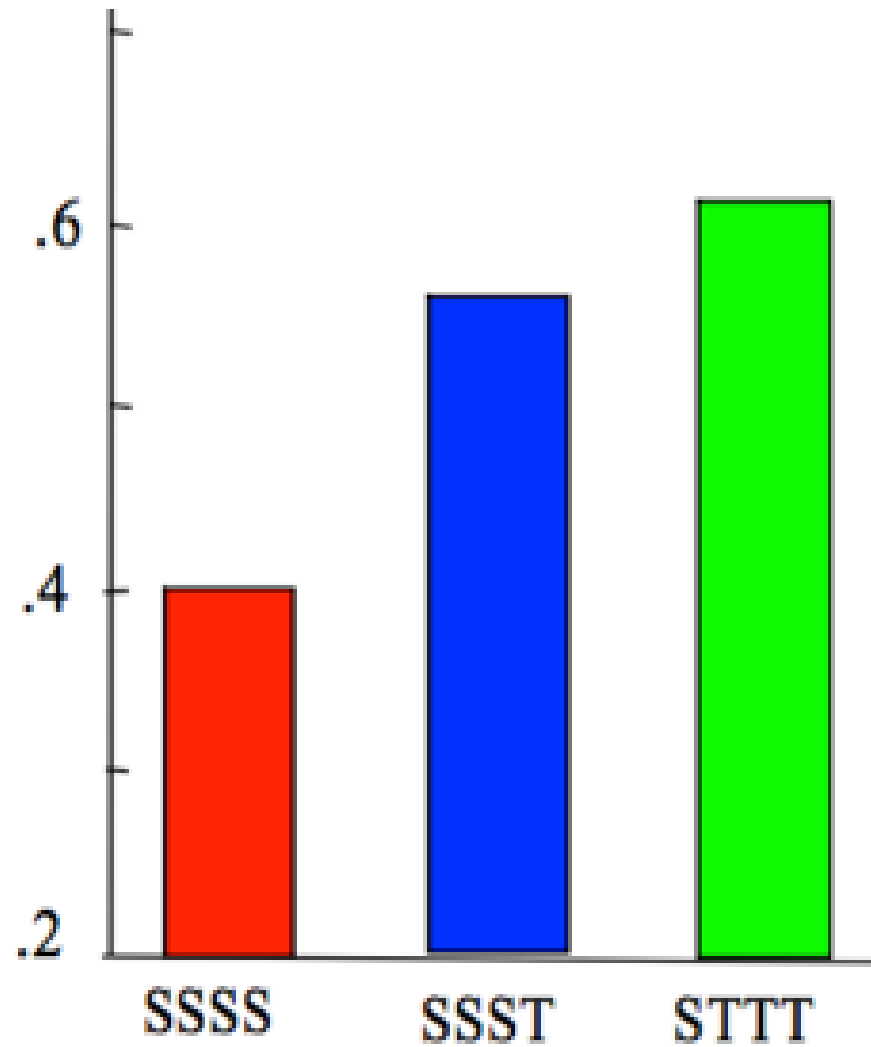
Results adapted from Roediger, H.L., & Karpicke, J.D. (2006). Test enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17, 249-255.

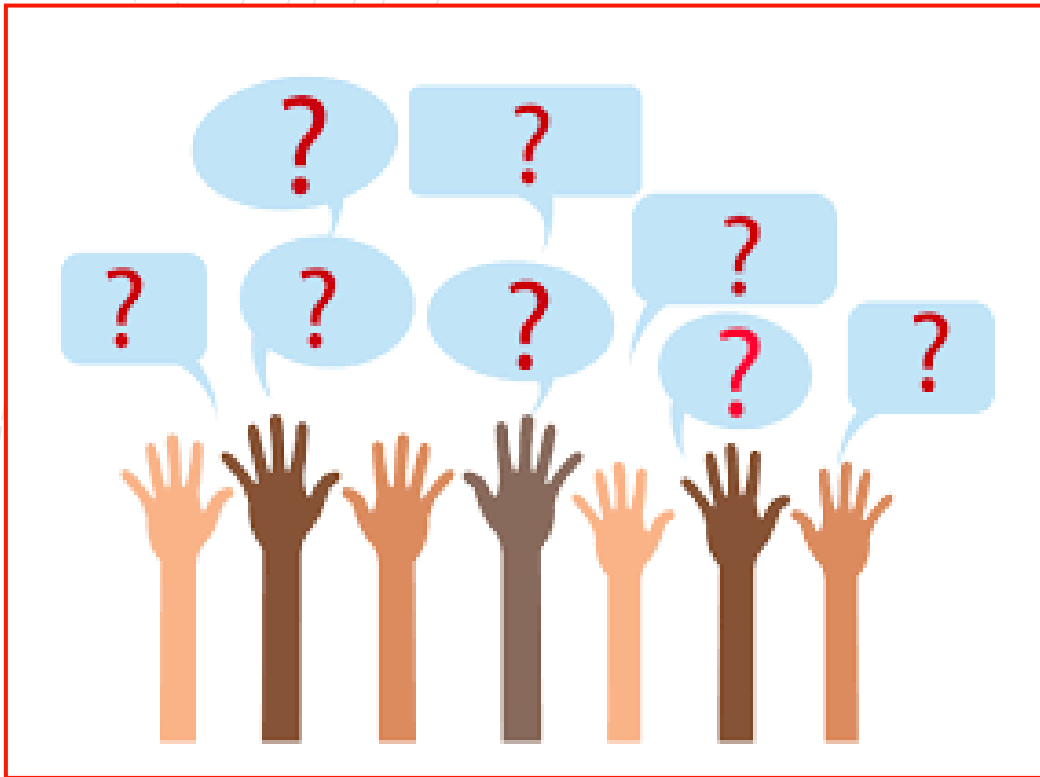
How well
students
actually recall
information



Results adapted from Roediger, H.L., & Karpicke, J.D. (2006). Test enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17, 249-255.

How well
students
actually recall
information



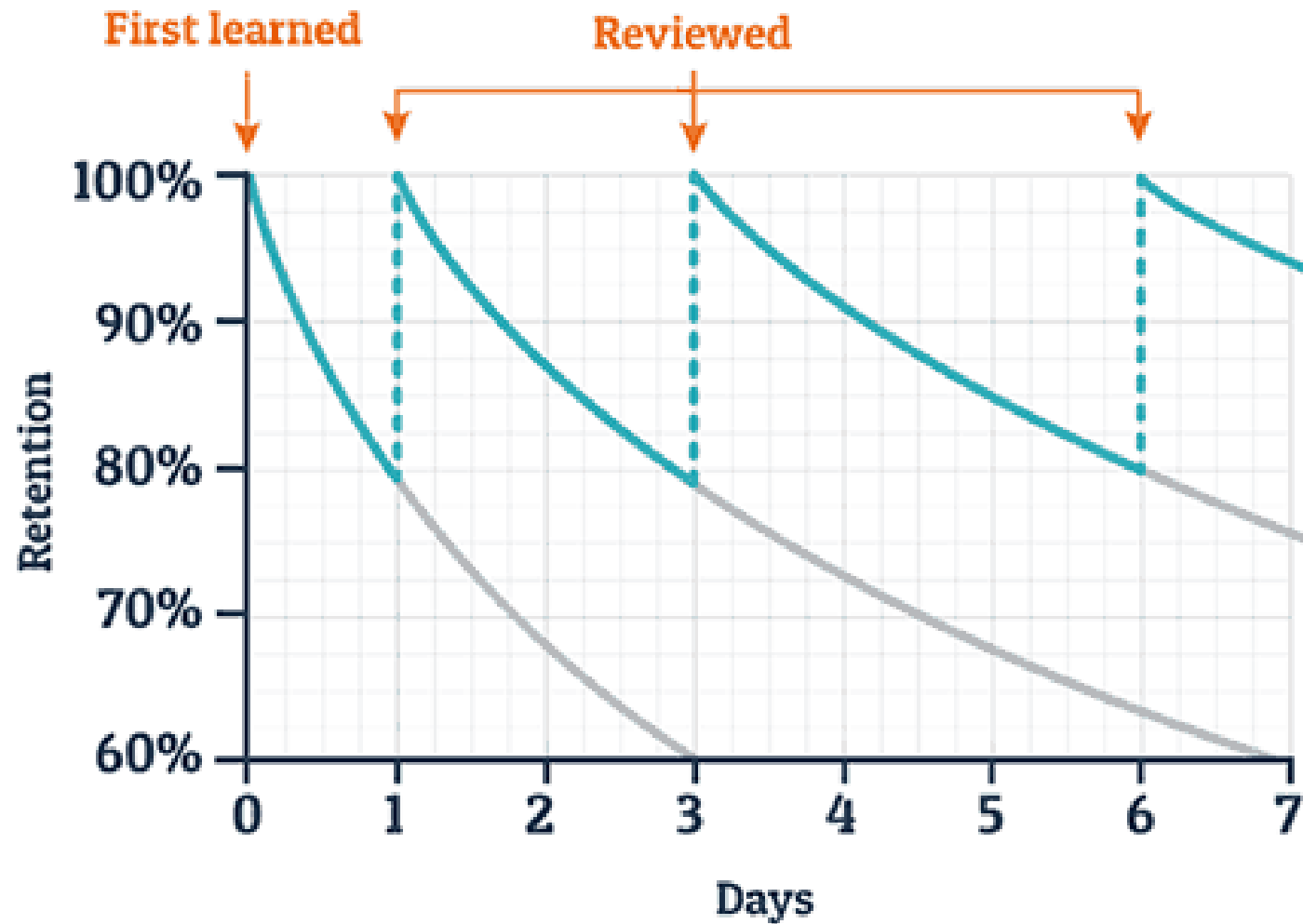


**What does
this activity
teach us?**



We learn what we retrieve...
repeatedly.

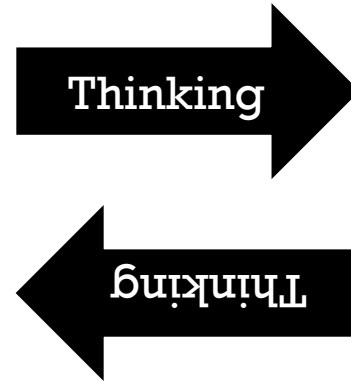
Typical Forgetting Curve for Newly Learned Information



**Sensory
Information**

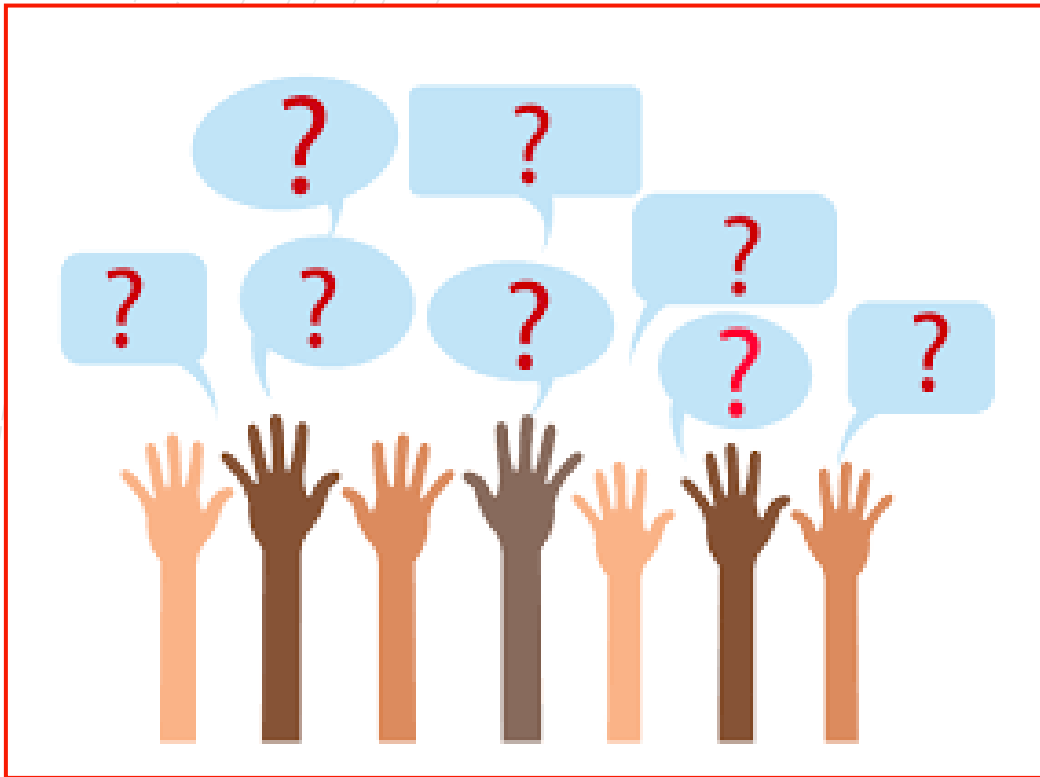


**Working
Memory**



**Long-term
Memory**





**What does
this activity
teach us?**

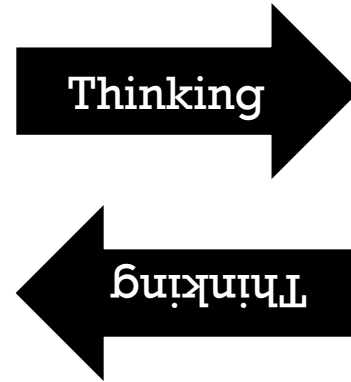


Working memory is limited.

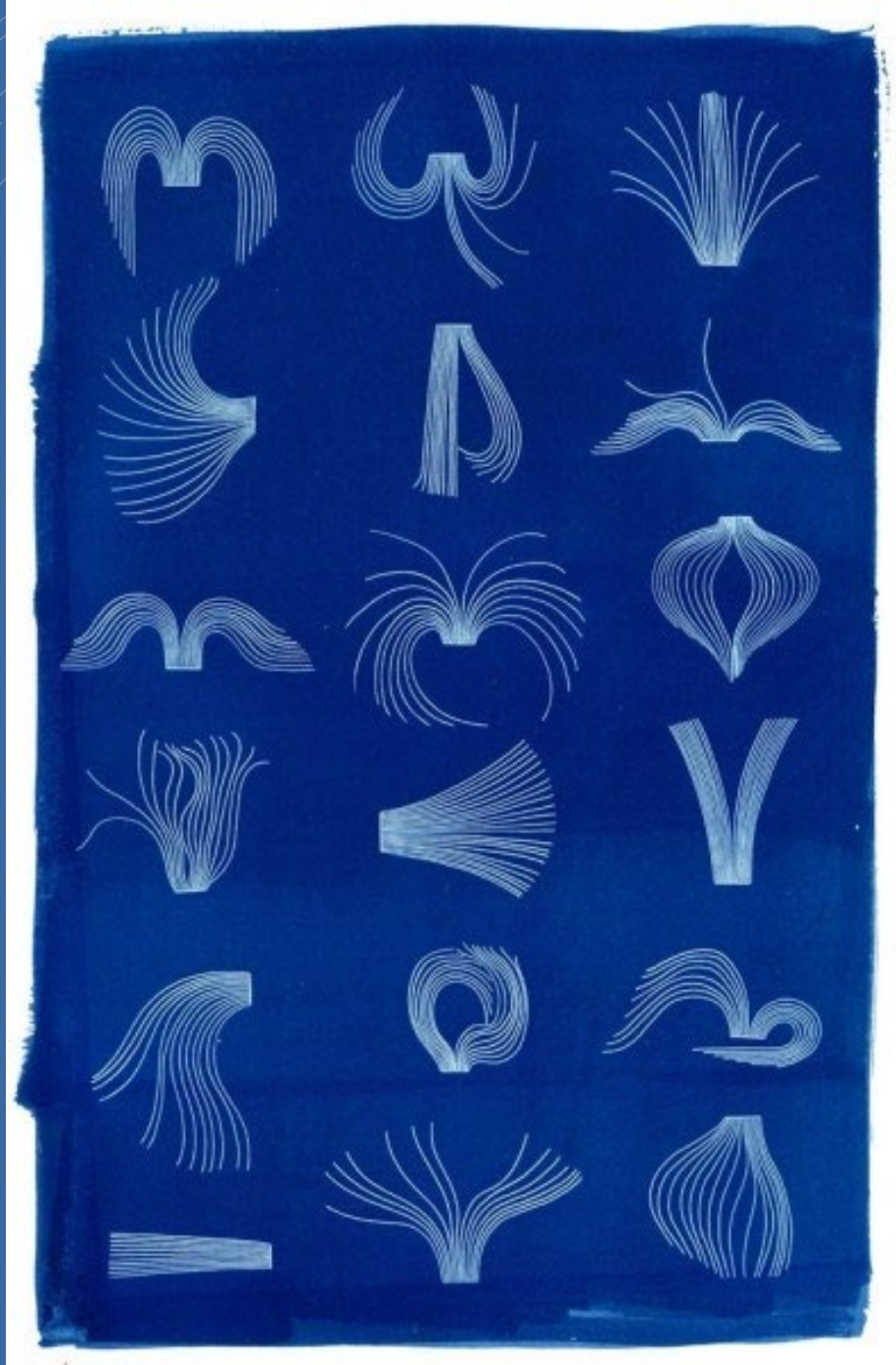
**Sensory
Information**

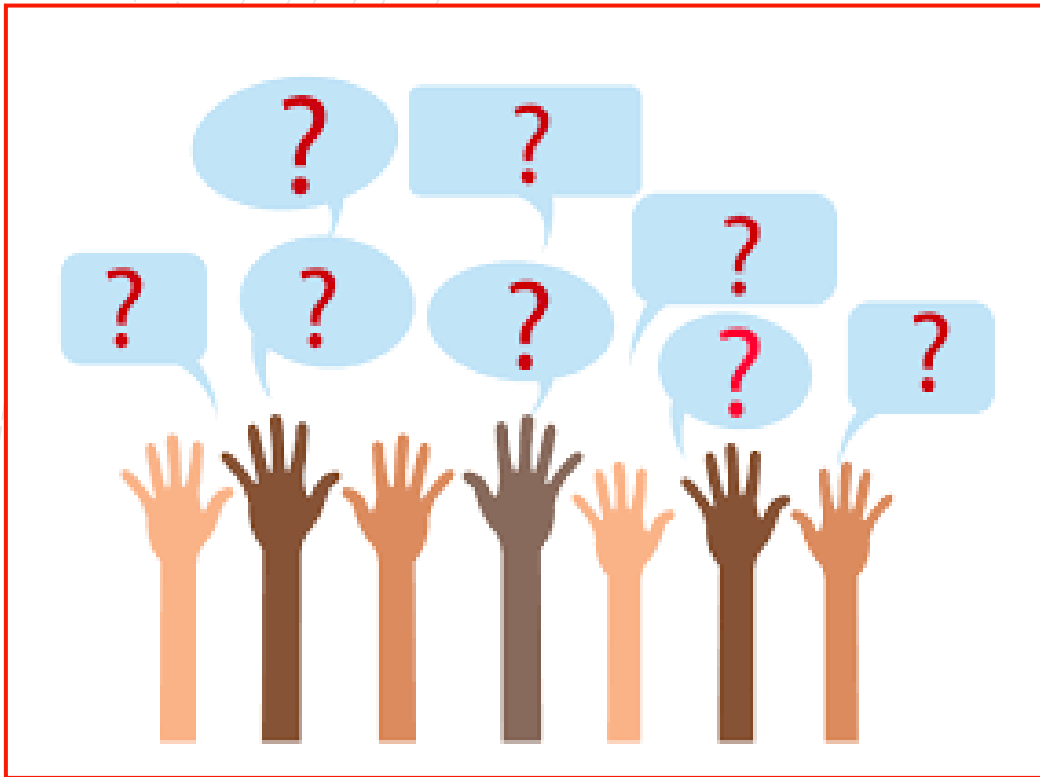


**Working
Memory**



**Long-term
Memory**





**What does
this activity
teach us?**



Don't throw hammers off
your roof.



Failure/feedback is
important for learning

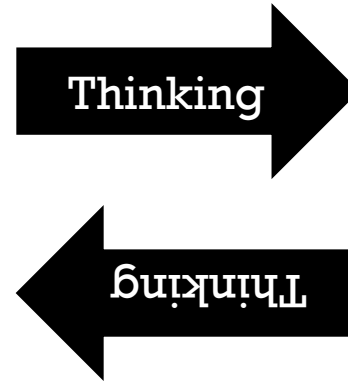


We pay attention to story.

**Sensory
Information**



**Working
Memory**



**Long-term
Memory**





**What were the
cognitive
principles we
learned today?**

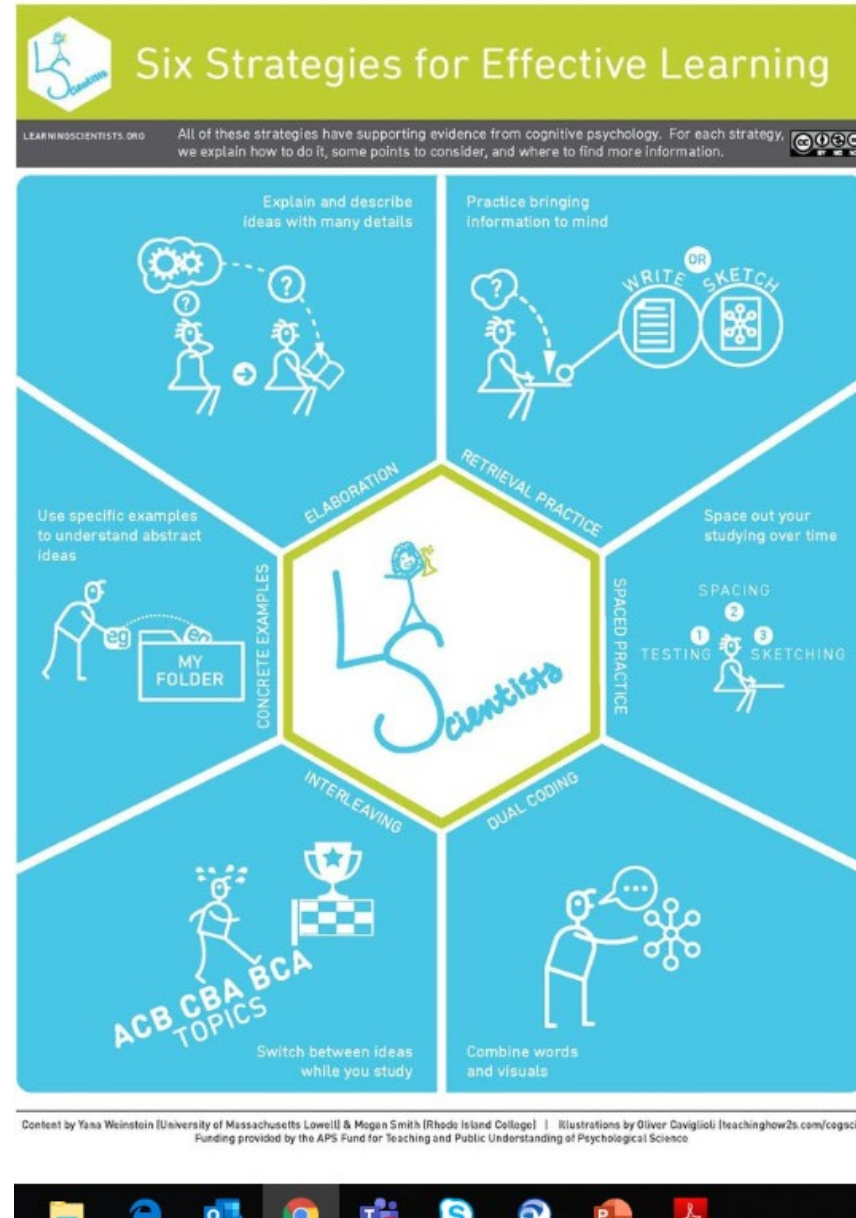
Principles

- **Meaningful structures aid learning.**
- **Multitasking is a myth.**
- **You learn what you think about.**
- **Prior knowledge aids learning.**
- **Dual Coding aids learning.**
- **We learn what we retrieve... repeatedly.**
- **Working memory is limited.**
- **We pay attention to story.**

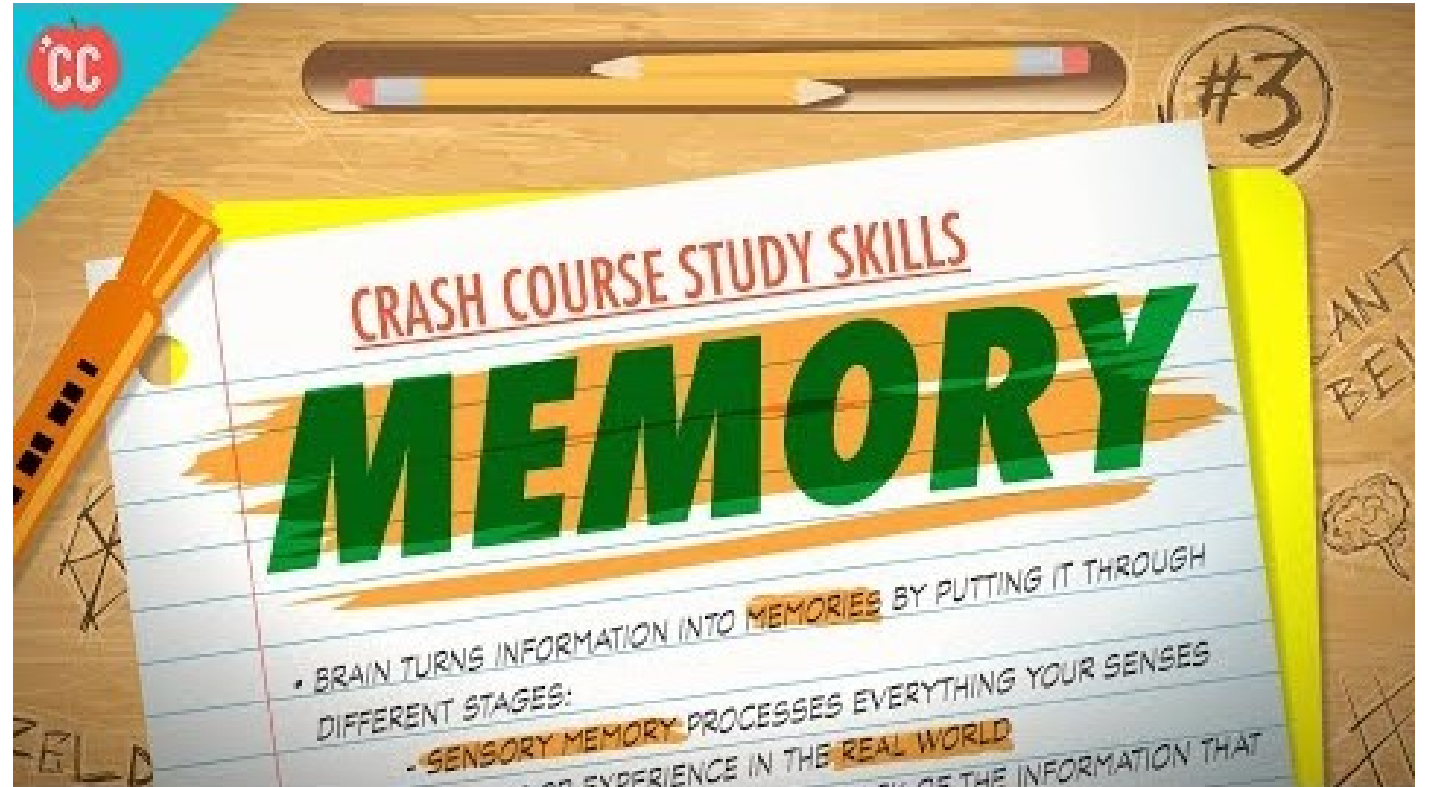


Group Discussion:
What idea or activity will you integrate into your class? Why?

Learning Scientists



Crash Course: Study Skills

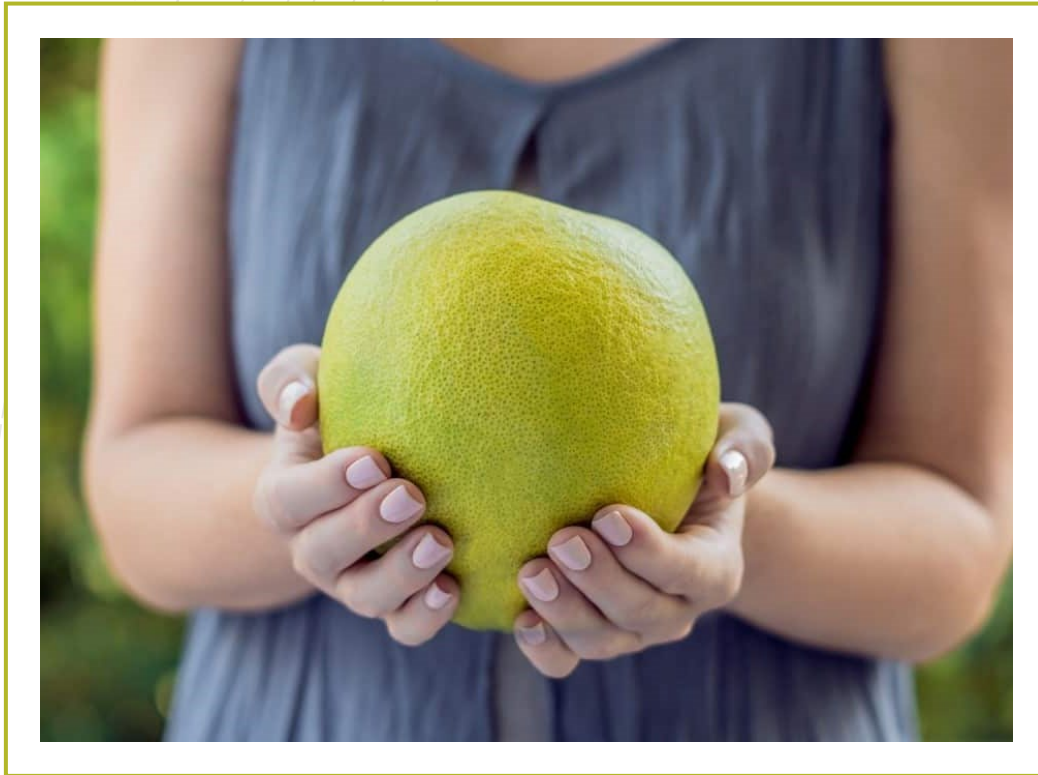


A red speech bubble graphic with a white outline, containing the text 'Question Generation'.

Question Generation

- **Brainstorm**
- **Share**
- **Filter**
- **Ask**





Resources:

[Learning Scientists](#)

[Stephen Chew](#)

[John Medina](#)

[Daniel Willingham](#)

[Saundra Yancy McGuire](#)

[Crash Course – Study Skills](#)