

MAKE IT STICK!

Making it Stick: Effective Practice of Strategies, Skills, Vocabulary, Facts, and Information

Part 2 of three part webinar

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For additional information on practice see Chapter 8 in:

Archer, A., & Hughes, C. (2011). *Explicit Instruction: Effective and Efficient Teaching*. NY: Guilford Publications.

www.explicitinstruction.org

Learning Intentions

What **principles** can we use to optimize benefits of practice?

- a. Deliberate practice
- b. Retrieval practice
- c. Distributed practice (Spaced practice)
- e. Varied practice
- d. Mixed practice (Interleaving)

What are purposes of practice?

1. **Minimum competency**
- 2.
- 3.
- 4.
- 5.

Purposes of Deliberate Practice

The purposes of **deliberate** practice are:

1. To gain **minimum competency** on a skill
2. To **improve** and gain **proficiency** on a skill
3. To gain **automaticity** on foundation skills needed for higher order skills
4. To **protect against forgetting**
5. To improve **transfer** of skills

How can we optimize practice?

1. Deliberate practice
2. Retrieval practice
3. Distributed practice (Spaced practice)
4. Varied practice
5. Mixed practice (Interleaving)

Deliberate Practice? Why?

Why is A an example of *deliberate practice* and B is not?

- A. As you write your paragraph, stop and reread your paragraph to be sure it makes sense. Add transition words or phrases to make your paragraph flow.
- B. Using your paragraph plan, write a paragraph.

Deliberate Practice?

Why is A an example of *deliberate practice* and B is not?

- A. You are going to tell your partner the history of suffrage in the United States. To prepare, make a list of the major historical advances in suffrage.

Ones, tell your partner a history of suffrage.
- B. Tell your partner the history of suffrage.

Deliberate Practice

Deliberate practice is goal-oriented practice consciously devoted to improvement of a skill.

Retrieval Practice ? Why?

Which is the best example of retrieval practice? Why?

The students have been taught how to change a fraction to a decimal.

- A. We have learned how to change a fraction into a decimal. Watch me change $\frac{3}{7}$ into a decimal. (*Teacher demonstrates dividing 7 into 3, placing the decimal correctly.*) Now it is your turn. Change $\frac{5}{8}$ into a decimal.
- B. Change $\frac{5}{8}$ into a decimal. (Teacher monitors.) Let's do this together. (Teacher provides feedback by guiding the student through the problem.)
- C. Here is a worked problem that we did yesterday when we changed fractions into decimals. (*Teacher displays the calculations needed to change $\frac{3}{7}$ into 0.23*) Please change $\frac{5}{8}$ into a decimal.

Retrieval Practice - Why

“One of the most striking research findings is the power of active retrieval testing to strengthen memory and that the more effortful the retrieval, the stronger the benefit.”

Brown, Roediger, McDaniel, 2014

Retrieval Practice – Why

Retrieval Practice makes learning STICK far better than re-exposure to the original material.

Retrieval Practice – Why

Protzko, Aronson, & Blair, 2013

Learning content in 8th grade science

Participants: 8th graders in science classes

Test Condition: Portion of the material was covered in 3 low-stakes quizzes with feedback

Review Condition: Portion of material reviewed 3 times

Results: A- On material that was quizzed
C+ On material that was not quizzed but reviewed

Retrieval Practice – Why

Learning Social Studies content in Middle School

Participants: Middle school students in Social Studies Classes

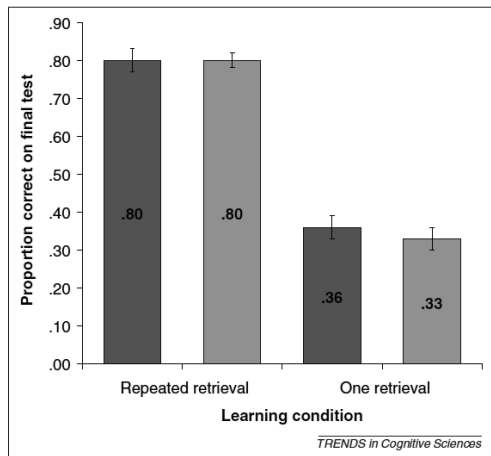
Given 3 quizzes on 1/3 of the content (Beginning of class on assigned reading, at end of class, 24 hours before unit exam)

Results: Students performed full grade level higher on material quizzed than not quizzed.

Retrieval Practice – Why

Karpicke & Roediger, 2008

Learning pairs of words (Swahili – English)



Retrieval Practice – Why

Retrieval Practice **strengthens memory** and interrupts forgetting.

Retrieval Practice makes that knowledge **easier to retrieve** in the future.

Neural pathways that make up a body of learning get **stronger**.

Retrieval Practice – Teacher - Guided

Example Procedures :

1. Practice without scaffolding
2. Low-stakes quizzing (pop quiz)
3. Rapid retrieval practice
4. Retrieval Practice Games
5. Quick write
6. Quick draw
7. Flash cards
8. Multiple-choice items using hand signals, Clickers, or Plickers
9. Written answers
10. Writing frames

Retrieval Practice – Low stakes quizzing Example

Social Studies Teacher's Plan

Friday Quiz: A short quiz (one short answer on new material, 3 multiple choice on new material, one short answer on old + new material) 20 points

Unit Test: Unit test every three or four weeks 100 points

Retrieval Practice

Example

Rapid Retrieval Practice

Irregular Verbs

- The suffix ed is NOT used to form the past tense of irregular verbs.

Today I speak.	Yesterday I spoke.
Today I write.	Yesterday I wrote.
Today I go	Yesterday I went.
Today I drink.	Yesterday I drank..
Today I swim.	Yesterday I swam.
Today I see.	Yesterday I saw.
Today I sing.	Yesterday I sang.
Today I fall.	Yesterday I fell.
Today I hide.	Yesterday I hid.

Irregular Verbs

- The suffix ed is NOT used to form the past tense of irregular verbs.

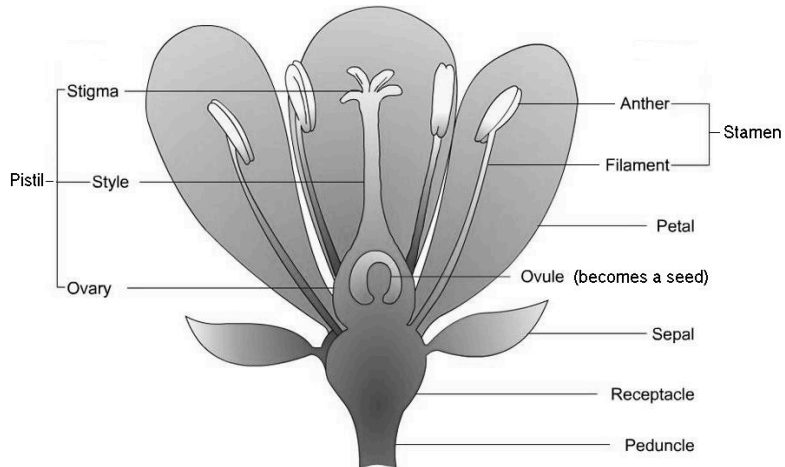
Today I speak.	Yesterday I _____.
Today I write.	Yesterday I _____.
Today I go	Yesterday I _____.
Today I drink.	Yesterday I _____.
Today I swim.	Yesterday I _____.
Today I see.	Yesterday I _____.
Today I sing.	Yesterday I _____.
Today I fall.	Yesterday I _____.
Today I hide.	Yesterday I _____.

Retrieval Practice - Teacher- guided Quick Write

Example

List some benefits of retrieval practice.

Retrieval Practice - Teacher-guided Quick Draw



Retrieval Practice - Teacher- guided Quick Draw

Retrieval Practice - Teacher- guided Flash Cards

Set # 1

**New Content and
Difficult from the past**

Set #2

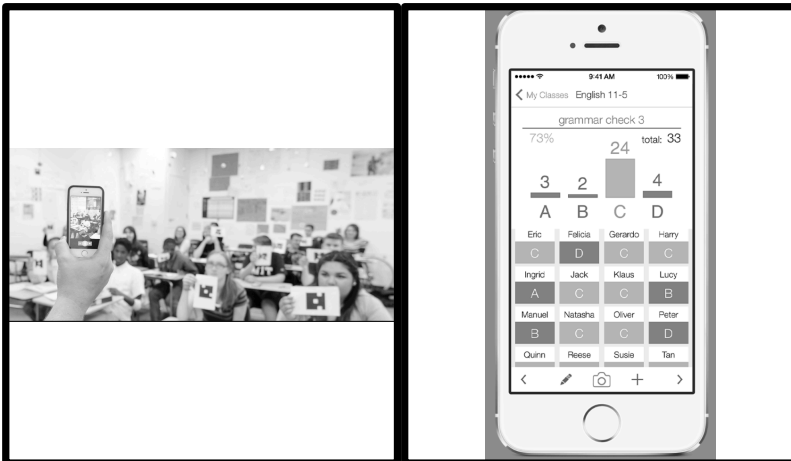
Mastered Content

Retrieval Practice - Teacher-guided Hand Signals, Clickers, or Plickers

Select the best answer.

1. Retrieval practice that is effortful promotes more learning.
2. Retrieval practice should occur after modeling and guided practice.
3. Retrieval practice reduces forgetting and strengthens learning.
4. All of the above.

Retrieval Practice - Teacher- guided Hand Signals, Clickers, or Plickers



Summary - Retrieval Practice

Retrieval Practice Benefits

- learning
- durable retention

Summary - Retrieval Practice

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Effortful Retrieval Practice

- stronger learning
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Delayed Effortful Retrieval

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Repeated Retrieval

- more learning
- more ease of retrieval

Summary - Retrieval Practice

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- stronger retention

Delayed Effortful Retrieval

- more learning
- more retention

Repeated Retrieval

- more learning
- more ease of retrieval

Corrective Feedback

- more learning

Reflection is a form of Retrieval Practice

After reading

What are the key ideas?
What are some examples?
How do these ideas relate to what I already know?
(Verify)

After doing something

What happened?
What did I do?
How did it work out?

How will I change this in the future?

Your Summary

Write a statement that summarizes retrieval practice.
Make the statement memorable.

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Mass vs Spaced Practice

Mass Practice vs Spaced Practice –
Effect size $d = 0.71$ Hattie, 2009

Gains achieved in massed practice are transitory
and melt away quickly. Brown, Roediger, McDaniel, 2014

Spaced VS Mass Practice – Why?

Same time
Same effort
but Remember More

Spaced VS Mass Practice – Why?

“Distributed learning, in certain situations, can double the amount you remember later on.”

Carey, 2014

Spaced Practice - Why

Subjects: 36 Surgical Residents

Content: Four short lessons on how to reattach tiny vessels

Condition A: All four lessons in a single day

Condition B: A week between the four lessons

Results : Residents in Condition A scored lower on all measures. 16% damaged vessels in rats beyond repair.

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Spaced Practice

- **Initial Practice**
- **Distributed Practice**
- **Cumulative Review**

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Spaced Practice

Initial Practice

- Occurs under watchful eye of the teacher
- Provide numerous practice opportunities within the teacher-directed lesson to build accuracy. Provide immediate feedback after each item.

Spaced Practice

Distributed Practice

- Studying or practicing a skill in short sessions overtime.
- Distributing practice overtime (versus massing practice in one session) aids retention in a variety of academic areas.

Spaced Practice

Cumulative Review

- Provide **intentional review** of previously taught skills/strategies/concepts /vocabulary/knowledge.
- Goal is to increase long-term retention.

Spaced Practice

What interval?

- Enough time that a little forgetting has set in leading to more effort.
- Not so much time that retrieval requires relearning of the material.

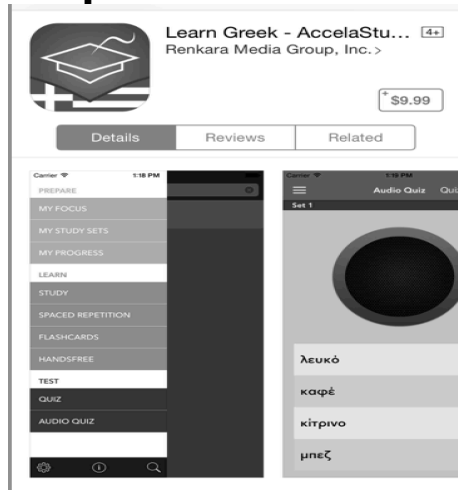
Spaced Practice

To retain factual information, foreign vocabulary, scientific definitions, use a schedule such as:

- Initial practice and study
- Retrieval practice one or two days later
- Retrieval practice a week later
- Retrieval practice a month later

(See Super Memo)

Spaced Practice



Example – Spaced Practice

Vocabulary – Core Reading Program

Monday	Tuesday	Wednesday	Thursday	Friday
Introduction of vocabulary for Passage A	Quick retrieval practice		Quick review and expansion of difficult words	
Introduction of vocabulary for Passage B	Quick retrieval practice		Quick review and expansion of difficult words	Game - Mixed practice of difficult words A and B
Introduction of vocabulary for Passage C	Quick retrieval practice		Quick review and expansion of difficult words	Game - Mixed practice of difficult words A, B, and C

Your Summary

Write a statement that summaries spaced practice.
Make the statement memorable.

Varied Practice

Vary the practice conditions to increase ability to apply the skill or strategy to a new setting.

Non- example – 1st grade decoding

Day #1	Day #2	Day #3	Day #4
man	ran	can	van
pan	ban	Jan	ban
fan	can	man	Jan
tan	Dan	Nan	fan
ran	fan	tan	ran

Varied Practice

Vary the practice conditions to increase ability to apply the skill or strategy to a new setting.

Example – 1st grade decoding (*encoding)

Day #1	Day #2	Day #3	Day # 4
at	am	an	had*
am *	sad*	Pat	ram
Sam	nap	lad*	Pam*
ad	mad	sap	fans
fan*	Sam*	had	map
man*	man	Nan*	taps*
rat	mat*	tap*	ham
The rat ran.	The man had a nap.	Pat and Nan sat	Pam and Pat had
Sam had a fan.	Sam is a sad man.	on mats.	fans.

Varied Practice

Non-Example

bake + ing = baking
 rake + ing = raking
 make + ing = making
 brake + ing = braking

Example

ride + ing = riding
 fame + ous = famous
 excite + ing = exciting
 excite + ment = excitement
 race + ist = racist
 shame + ed = shamed
 shame + ful = shameful

Mixed Practice - Interleaving

Subjects: Elite baseball players on a college team

Content: Twice a week batting practice

Condition A: **Traditional practice**

45 pitches in 3 sets

15 pitches of one type (fast, curve, change up)

Condition B: **Mixed practice**

3 types of pitches randomly distributed across 45 pitches

Results: Randomly interspersed pitches displayed markedly better hitting

Mixed Practice (Interleaving)

Subjects: College Students

Content: Volume of 4 geometric shapes
 (wedge, spheroid, spherical cone, half cone)

Condition A: **Clustered**

4 – wedge

4 – spheroid

4 – spherical cone

4 – half cone

Condition B: **Mixed**

	1 st practice	week later
Clustered	89 % correct	20 % correct
Mixed	60 %	63%

Mixed Practice - Interleaving

When you understand a problem type, mix the problem type with other problem types.

cry + ed = cried	play + er = player	slice +ing = slicing
copy + ing = coping	stamp + ed = stamped	fame + ous = famous
refuse + al = refusal	harm + less = harmless	race + ist = racist
funny + est = funniest	envy + ed = envied	fury + ous = furious

Mixed Practice - Interleaving

Name _____ LESSON 58B
Date _____ Math 2


Write a number sentence for the story. Write the answer with a label.

1. Seven children chose chocolate chip cookies, three children chose ice cream, and eight children chose peanut butter cookies. How many children chose cookies?
Number sentence _____
Answer _____

2. Circle the numbers that are between 48 and 55.
Put an X on the number that is not between 48 and 55.

54 47 50 49 43

3. Someone drew a line of symmetry in each shape. Circle the shape with the incorrect line of symmetry.




4. Find each answer.


$95 - 10 =$ _____	$52 + 10 =$ _____	$69 - 10 =$ _____	$21 + 10 =$ _____	$84 - 10 =$ _____
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$38 + 10 =$ _____

5. Color one fourth green.
Color seven eighths yellow.
Color one half red.



6. What time do you usually go to bed at night?
Show the time on the clock.



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Your Summary

Write a statement that summaries varied and mixed practice. Make the statement memorable.

Summary – Principles of Practice

- There are a number of critical principles that need to be considered when designing practice.
- First, the practice must be _____.
- This is important because _____.
- Next, rather than just being re-exposed to the original material, students profit from _____.
- One benefit of Retrieval Practice is _____.
- All of the practice should not be massed in one session. Rather, the practice should be _____. Spaced retrieval practice is beneficial because _____.
- Finally, to enhance retention and application of skills and strategies, _____ should be used.

PRACTICE
makes
PROGRESS,
NOT
PERFECT.

“Practice isn’t the thing you do once you’re good. It’s the thing you do that makes you good.” - Malcolm Gladwell

There is no
glory in
practice, but
without practice,
there is no
glory...
—Unknown