Unleash the science of learning

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How many bones in the human body?

Retrieval!
What's one thing you've learned so far?
We focus on getting information IN.
Let’s focus on getting information OUT.

Science of Learning

- Foundation: Retrieval Practice
- Power Ups: Spacing, Interleaving, Feedback
- Teaching Strategies
- What’s next?

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Retrieval Practice
The foundation for effective learning

Retrieval Practice
- Bring information to mind
- Pull information out
- Doubles learning
- Improves transfer
- Benefits all students

The Basics
Retrieval Practice vs. Re-Reading

How much will you remember in one week?

<table>
<thead>
<tr>
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<th>Prediction of Learning</th>
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<tbody>
<tr>
<td>Re-Reading</td>
<td>4.8</td>
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<tr>
<td>Retrieval Practice</td>
<td>4.0</td>
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In the Classroom
Including fire alarms and snow days!

10+ years of research in K-12 classrooms
1,500+ students
Raised grades: C to A

Challenge learning
Retrieval practice is a "desirable difficulty"
**Retrieval Benefits**
- Long-term retention
- Higher order and transfer learning
- Engagement and attention
- Flexible and foundational

**Retrieval Strategies**
- Free Recall ("Brain Dump")
- What are two things you remember?
- What’s one takeaway?
- How does this apply?

**Example Questions**
- Describe 2 things we learned last week.
- Design an experiment to test...
- Are all humans scientists?
- Least favorite ice cream?

**Retrieval in Action**
- Paper and pencil!
- Think-Pair-Share
- Weekly retrievals
- Blackboard & Moodle
- Clickers or Plickers
- FlipGrid

**Retrieval Guidelines**

Less than one minute
- Engage all students

Low or no stakes
- Challenges are good!

—

Here’s what we did.

vs.

What did we do?
How many bones in the human body?

“Power Ups”
Spacing, Interleaving, & Feedback

Spacing
- Space retrieval over time
- Forgetting is a good thing
- Another desirable difficulty

Spacing Guidelines
- The more the better
- Make it quick!
- Use a “hybrid” approach
  “Blast from the past”
“What did you learn today? vs. What did you learn yesterday?”

Interleaving
- Mix up content
- Key is discrimination
- Another desirable difficulty!

Interleaving Guidelines
- Mix similar topics
- Use a “hybrid” approach
- Think of a fruit salad!
- Dice or fishbowl games
Use a strategy vs. Choose a strategy

But I studied for hours!

Ineffective study strategies

- Re-reading
- Highlighting & Underlining
- Note taking
- Flashcards (sometimes...)

Metacognition

- Illusion of Fluency
- Illusion of Confidence
- Judgments of Learning

Feedback

- Reinforces knowledge
- Corrects misinformation
- Critical for metacognition
Feedback Guidelines

Immediate or delayed  Correct/incorrect is good
After retrieval  Elaborative is best

Retrieve!

What are the four strategies?

Retrieving!

But not in the classroom.

"How can we flip retrieval from a negative to a positive?"

Does retrieval practice make you more or less anxious for unit tests?

72% less anxious
22% same
6% more

Agnew et al. 2019
Combine strategies!

Harness retrieval, spacing, interleaving, and feedback

Pooja's Classroom

- Weekly retrieval practice (2% each)
- FlipGrid assignments
- Group/individual Projects
- Participation

Retrieval practices are the bomb.
Retrieval practices once a week! ♡
Love that we have nothing for a final! Best thing ever!

Start small!

- Tweak what you’re already doing
- No extra prep, grading, or class time
- Save time in the long run

Be supportive!

- No consequences, no stakes
- Acknowledge it’s challenging
- How you do now = later
- Share the research

Retrieve!

One strategy you can use tomorrow?
Let’s transform learning by getting information out.

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