Powerful Teaching: Unleash the Science of Learning
by Pooja Agarwal and Patrice Bain

Think you might want to read this book?
Powerful Teaching takes the reader through a journey to develop a deeper understanding of powerful teaching strategies by exploring cognitive science research. These scientifically based strategies apply to all grade levels and content areas, and can be implemented without additional preparation, resources, or required time for grading. Through their writing, Agarwal and Bain help educators think critically about their current teaching practices and lead them in developing tools to incorporate the science of learning with their students.

What would Socrates ask?

- How can you support your students to become more accountable for their learning?
- How do the three stages of learning apply to your everyday life?
- When it comes to teaching, are you supporting short-term or long-term learning?
- Does your teaching focus more on encoding, storage, or retrieval?
- Why is it fun to retrieve information in real life (outside the classroom), but nerve-wracking inside the classroom?
- What exactly do you want students to remember from your class?

Research

- Lyle and Crawford found students who engaged in retrieval practices scored significantly higher on tests than students who had only studied a review sheet.
- Roediger, Agarwal, McDaniel, and colleagues noted that student performance was significantly higher on quizzed material versus nonquizzed material.

Concepts

- Learning occurs in three stages
    - 1. Encoding - obtaining and absorbing knowledge
    - 2. Storage - keeping knowledge
    - 3. Retrieval - pulling back out something already learned
        - Learning strategy, not an assessment strategy
        - Appropriate for all Bloom's levels
- While we can impact the encoding and storage stage of learning, as teachers, we should focus more on the retrieval stage, implementing teaching strategies that are based on the science of learning.
- These teaching strategies include:
    - 1. Retrieval - pull information out of students heads
        - Quizzes and flashcards

        - Writing to learn - have students write down everything they could remember
        - Short answer questions at the end of a lesson
        - Brain dump
            - Pause your lesson and ask students to write down everything they can remember. Then continue with your lesson.
        - Think-Pair-Share
        - Knowledge Prompts
            - At any point during the lesson, stop and have students answer a question about the content.
                - What are Two Things you learned so far today?
                - What are Two Things you learned yesterday (or last week)?
                - What are two examples from your own life that relate to today's lesson?
        - Exit Tickets
        - Clickers or labeled index cards (A, B, C, D) to show response
        - Individual Whiteboards to answer questions
    - 2. Spaced Practice - spreading lessons and retrieval opportunities out over time
        - Combining engaging in multiple opportunities for retrieval while also engaging in retrieval over time.
    - 3. Interleaving - mixing up closely related topics and encouraging discrimination
        - Mixing things up during spacing - rearrange the order of retrieval strategies during spacing without changing the content
        - What happens in between spacing.
            - "When you're spacing content, you could fill the gap with unrelated content (this would be spacing) or highly related content (this would be interleaving)."
    - 4. Feedback - provide students an opportunity to know what they know and do not know
        - Useful for correct and incorrect answers
        - Combine Brain Dumps with Turn and Talk
        - Make it Three Things
            - Students write down Two Things about a topic then swap papers with a peer and the peer adds one more thing before returning the paper to the original owner.
        - Think-Pair-Square
            - Two pairs of students get together in a square for a small-group discussion
        - Ask follow-up questions
- We often spend most of our time working to get information into our students' heads, but research shows it is more important to try to get information out of students' heads (i.e., retrieval).

Quotes from the authors

- " ...transfer happens when students take something familiar and apply it to something unfamiliar."
- "...spacing things out and coming back to them increases learning by harnessing forgetting...a little forgetting is the key to spacing: When we let time pass and space things out, students' knowledge has time to solidify and simmer."

Quotes from others

- "A great deal has been written about the impact of retrieval practice on memory. That's because the effect is sizable, it has been replicated many times and it seems to lead not just to better memory, but deeper memory that supports transfer." - Daniel Willingham, Cognitive Psychologist

Organizations/schools working on answers

- American Psychological Association

Gateways to further learning

- Retrieval Practice
- Ten Ways to Use Retrieval Practice in the Classroom
- A Powerful Way to Improve Learning and Memory

Referenced books with the potential to impact leading and learning in education

Author(s) Last Name	Title
Willingham	*Why Don't Students Like School?*
Roediger & McDaniel	*Make it Stick*
Jones	*Love to Teach*

The applicability of this book to education is ….