Learning and the Brain Conference November 2026

Show Your Work

Motivating Students with the Science of Learning



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Show Your Work

10 Chapters

- Working Memory
- Clarity for Learning
- Prior Knowledge and Schema Building
- Focus and Diffuse Modes
- Rich Encoding
- Getting the Most from Discovery Learning
- Modeling and Scaffolding
- When to Memorize
- Retrieval Practice
- Formative Assessment

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- **Working Memory**
- Clarity for Learning
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- **When to Memorize**
- **Retrieval Practice**
- Formative Assessment

Working Memory

What do we mean?

- The mental capacity allows us to **select, hold, reorganize,** and **combine** bits of information - Andrew Watson
- The bad news - it is limited.
- The worse news - we cannot make it bigger
- The even worse news - overloading working memory demotivates students.
- The good news - we can plan around its limitations
- The better news - we can take advantage of long term memory
- The even better news - finding the sweet spot of working memory load fuels motivation



Working Memory

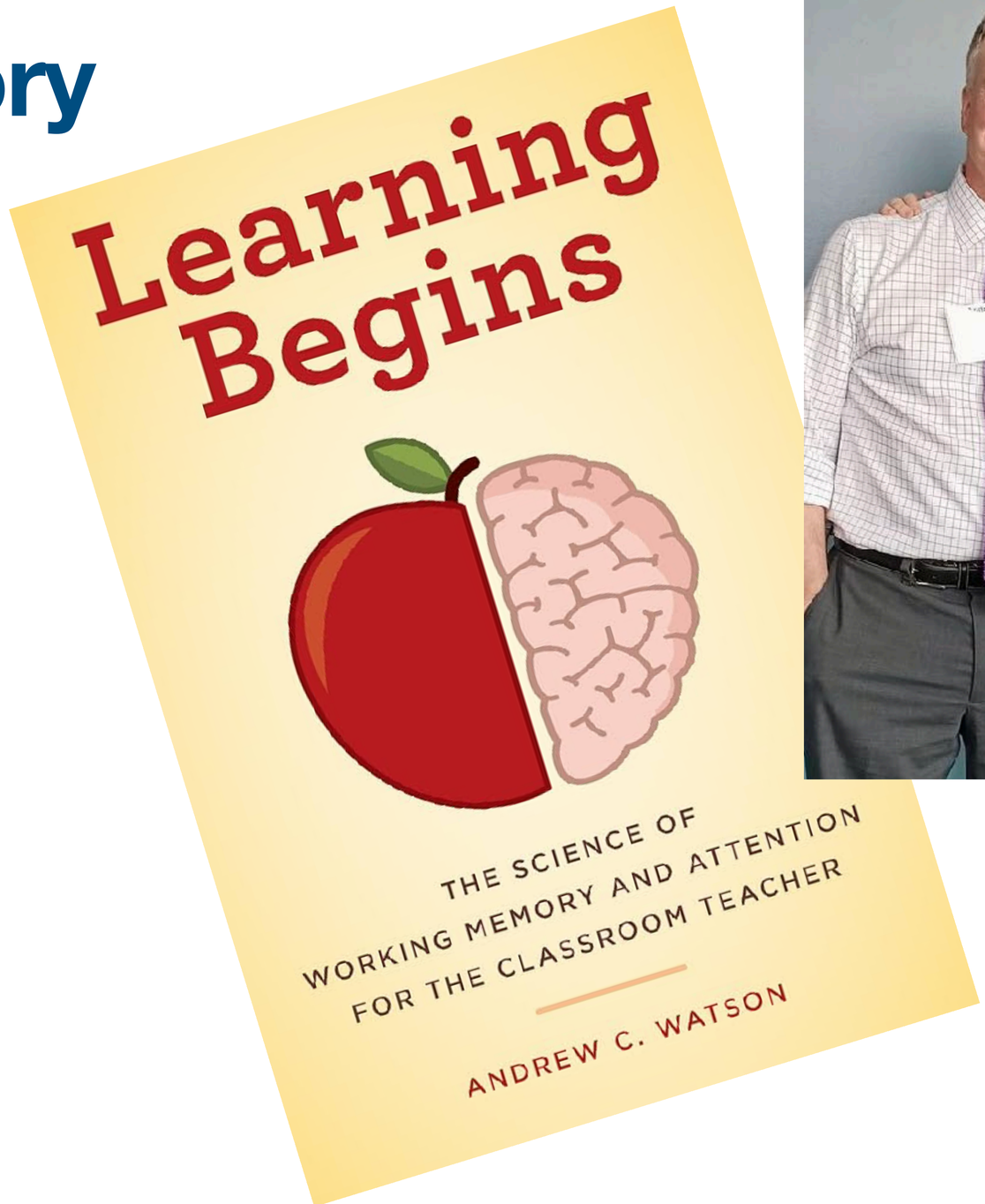
Managing it through planning

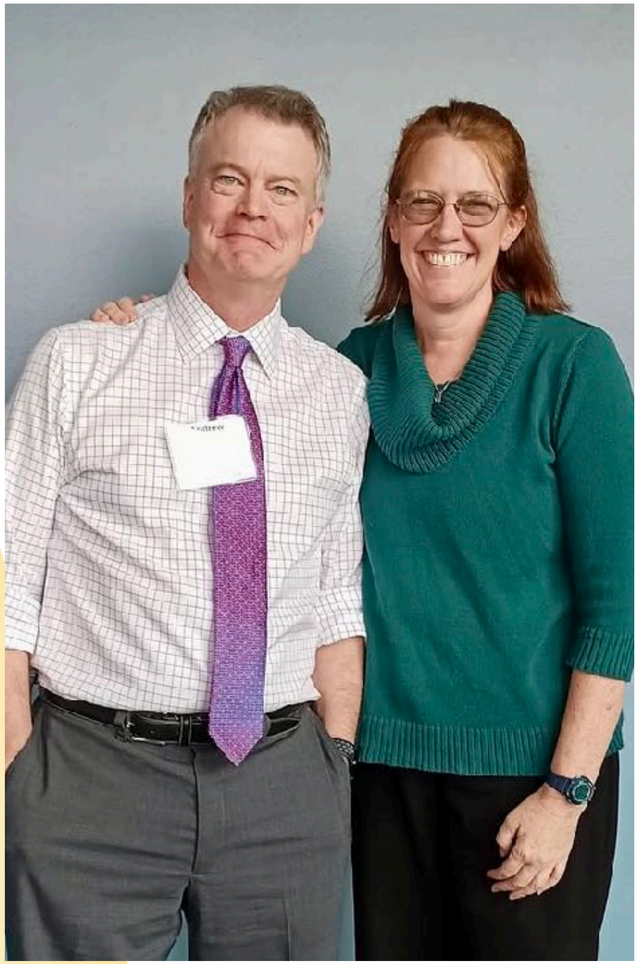
- Plan for appropriate presentation style (explicit instruction will take less, discovery learning will take)
- Plan enough time for practice (converting procedures from working memory to long term memory)
- Chunk lessons and assignments
- Plan pauses for processing

Working Memory

A Simple Thought

Don’t teach two new things simultaneously.





Working Memory

Managing it through noticing and adapting

- Look for signs of overload
- On the fly brain breaks -
    - formative assessment
    - retrieval
    - quick diversions
- Save something for tomorrow

Quick Retrieval

Don’t Hold Up Board Until I Ask for Them

Define Working Memory

Quick Processing Moment

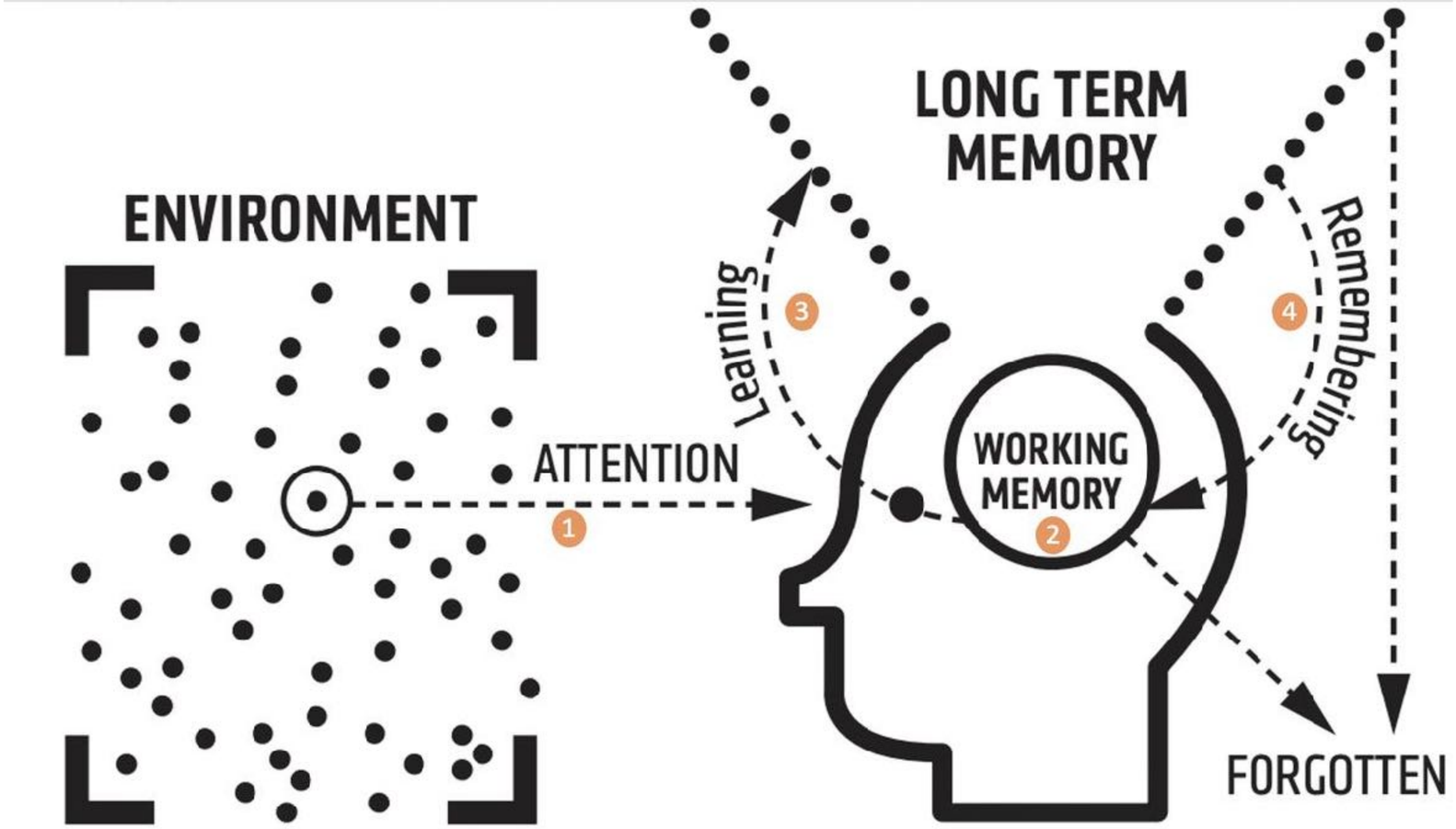
Hold Up Board When You Have It

1. When you get home, what is one way you will plan for working memory limitations?
2. How will you advise your students to work in light of the limitations of their working memory?

Long Term Memory

Memorizing is Your Working Memory's Best Friend

- Not Limited
- Aided by Retrieval
- Does not take up space in working memory
- Is not boring once a student starts using it to help with more complex tasks.



Long Term Memory

What to Memorize

- Students don’t need to memorize EVERYTHING, but they do need to memorize SOME things.
- How do you decide?
- It depends on what you want them to do with the knowledge.

“Let’s be honest. Despite the fact that most everything factual can now be found quickly via technology, some information still possesses its greatest value when it is memorized.

At its best, memorizing enables efficiency in thinking and acting.”

- Kevin Washburn

Long Term Memory

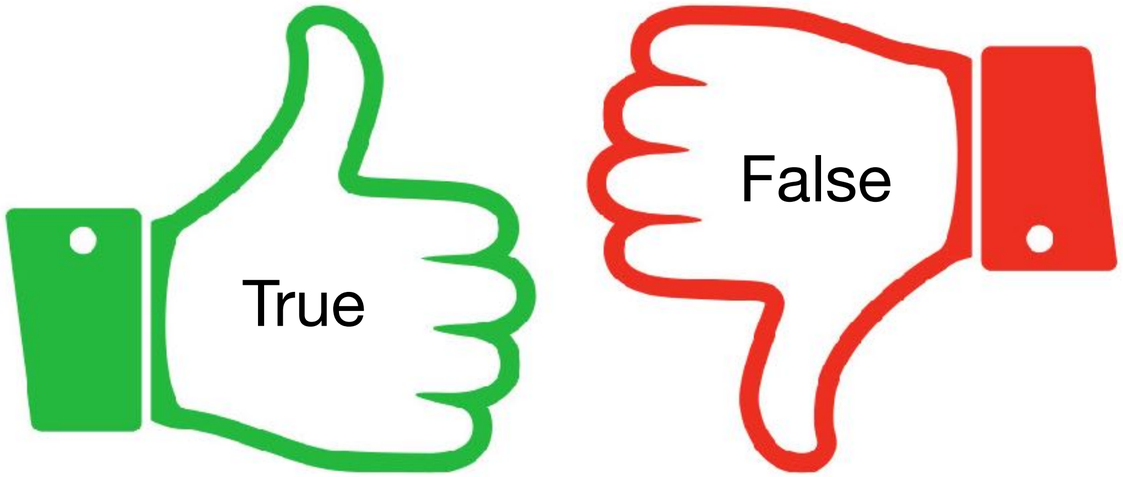
Questions to Ask Yourself

- How often will students use this?
    - My polyatomic ion disaster
    - “If a child knows their times tables, they can use this knowledge to solve more complex problems without placing any extra stress on the working memory.” - Andy Tharby in *How to Explain Absolutely Anything other than Absolutely Anyone*
- What do I want them to do with it?
    - Will it enable fluidity with higher level thinking, thus increasing rigor and motivation?

Quick Retrieval

True or False

- Students don’t need to memorize anything in the age of Google and AI.
- Memorization helps prevent working memory overload because information pulled from long term memory takes up less space.
- I should have students memorize facts that will be used frequently or used for higher level thinking.



Okay, Let's Address It



Discovery Learning

Defining Discovery

What do we mean?

- Inquiry Learning, Unguided Learning, Self-Guided Learning, Challenge Based Learning, or Minimally Guided Instruction

- “Discovery Learning is an approach to learning in which the learner is allowed to explore and become actively engaged with concepts, objects, or the physical environment in order to develop their understanding of it. In this process, the teacher is a facilitator rather than an instructor, and it is their role to organize a rich or appropriately resourced learning environment and to encourage the learner's self-directed curiosity and problem-solving skills, rather than to demonstrate or provide ‘correct’ answers.” (Oxford Reference Online Dictionary)

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My Self-Teaching Experience

With the School Copy Machine

- Making booklets
- Wasted time, paper, toner, etc.
- Frustration level = high
- **I STILL CANNOT DO IT!!!!!!!!!**

Using Guided Discovery Well

After Explicit Instruction

- Observation alone does not teach.
- Observation alone does not motivate.
- Once a student knows underlying principles, it is helpful to observe them “in real life.”
- If you don’t provide the answers, the student will not deduce them for themselves.

Quick Retrieval

Turn and Talk

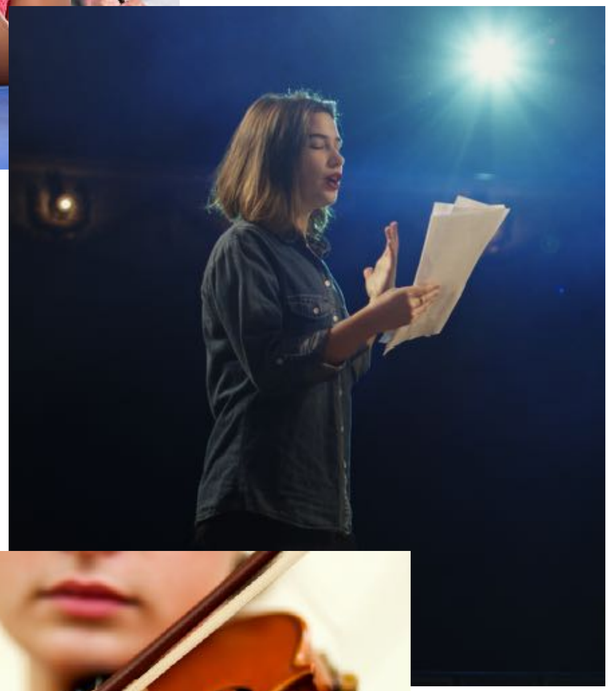
- Give one reason why discovery learning might DEMOTIVATE students.
- When might it be appropriate to use it?

Retrieval Practice

What do we mean?

- Actively bringing things up from long term memory
- Myelinates neurons
- Builds confidence which, in turn, builds motivation
- Outside of academics, we don’t even question it









Retrieval Practice

Bonuses

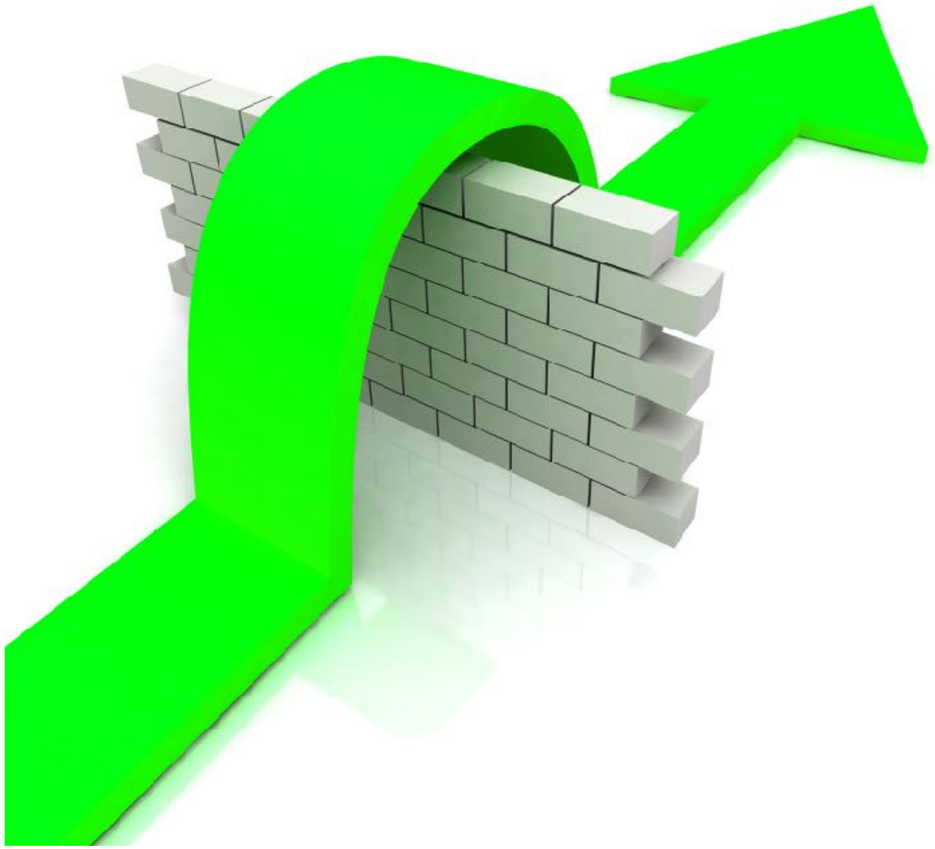


Using it in class:

- Creates opportunities for formative assessment.
- Increases engagement

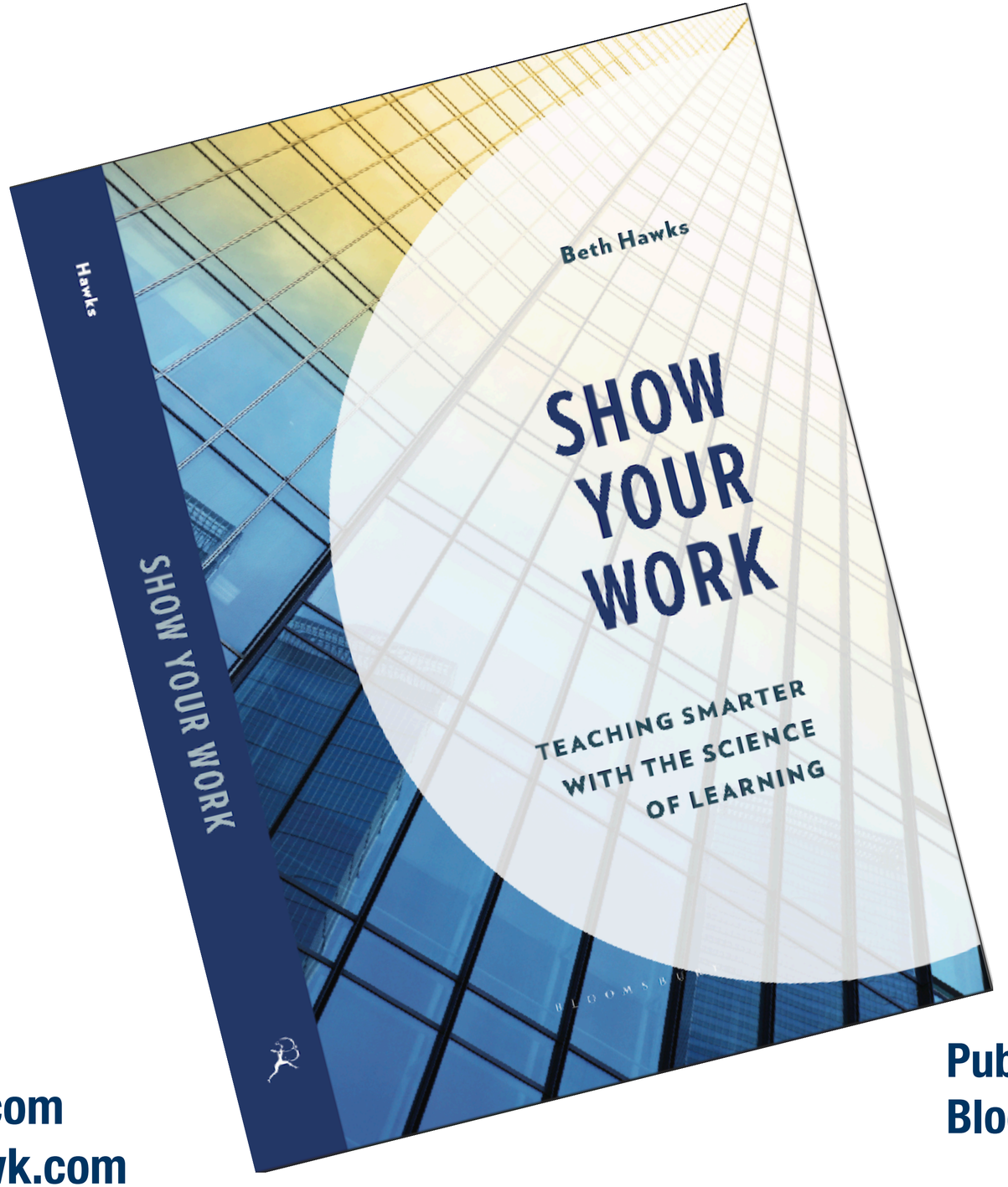
Processing Moment

Hold Up Board When You Have It



For the conference so far:

- What is one thing you have learned that you will use next week? Next semester?
- What's your plan for overcoming obstacles?





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Managing Working Memory Challenges

Continues During Class

- Recognize overload
    - Squirming
    - Middle distance stare
    - Far too quiet
    - Flipping through book or notes without destination
    - Giving answers that seem unrelated to the question you asked.
    - Kids that are normally “game” retreat.