

# Cognitive Load Theory: How Learning Works in the Classroom

Julia Daley

Hiroshima Bunkyo University

[daleysensei@gmail.com](mailto:daleysensei@gmail.com)

[www.mindbrained.org](http://www.mindbrained.org)



# Presentation Outline

- Quick Overview of Memory
- Introduction to Cognitive Load Theory
- Discussion
- Teaching Implications
- Q & A

# Types of Memory

*Three main kinds of memory*





# 1. Sensory Memory

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- Input from our five senses
  - Sound, sight, taste, touch, smell
- We're only conscious of a small amount
  - Exact number unclear
- Lasts 1-3 seconds at most



## 2. Working Memory (WM)

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*AKA Short-Term Memory (STM)*

**Definition:** The part of our minds dedicated to the conscious, real-time manipulation of information.

*(You're using it right now!)*

# Working Memory cont.

## Capacity is finite

- Storage lasts from 15 to 30 seconds without active effort

## Capacity cannot be increased\*

*\*The research on this is still controversial*

- Efficiency can be improved with strategy instruction, using techniques like...
  - Subvocal rehearsal
  - Chunking
  - Mnemonic devices

# 3. Long-Term Memory

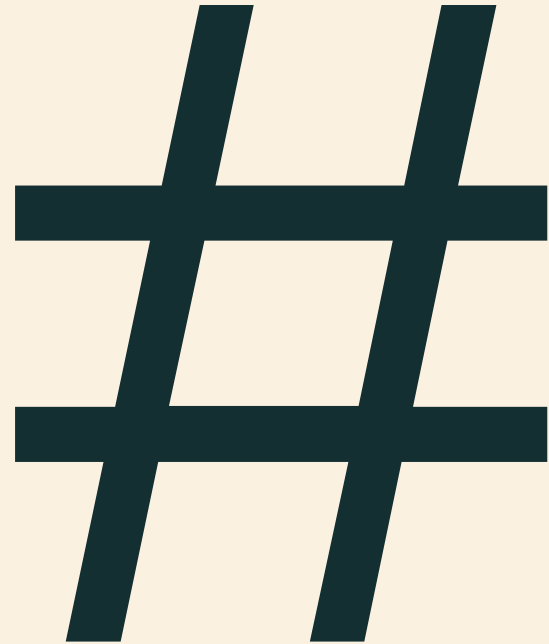
Memories that are stored over a long period of time  
(~2 minutes to a lifetime\*)

*\*theoretically*

- **Divided into two broad categories:**
  - Explicit (things you can remember with conscious effort)
  - Implicit (things you can remember unconsciously and effortlessly)
- **Memories are permanent\*\***  
*\*\*Theoretically*
- **Capacity is unlimited\*\*\***  
*\*\*\*Theoretically*

# Memory Demonstration

- Look at the symbol on the right.
- Shout out what you think it is called.

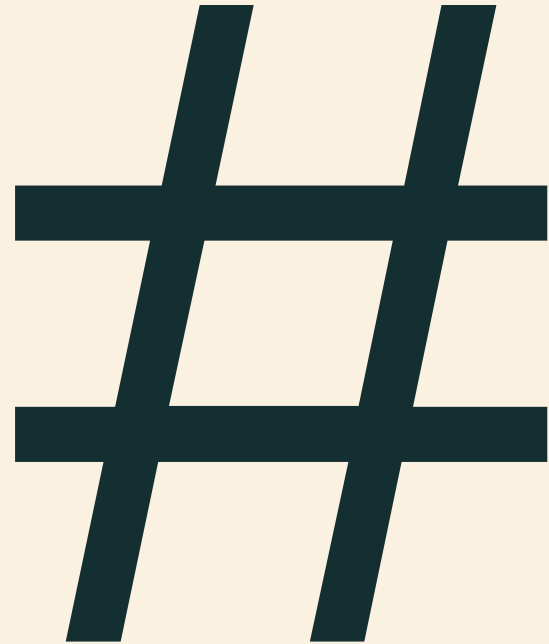




# Memory Demonstration

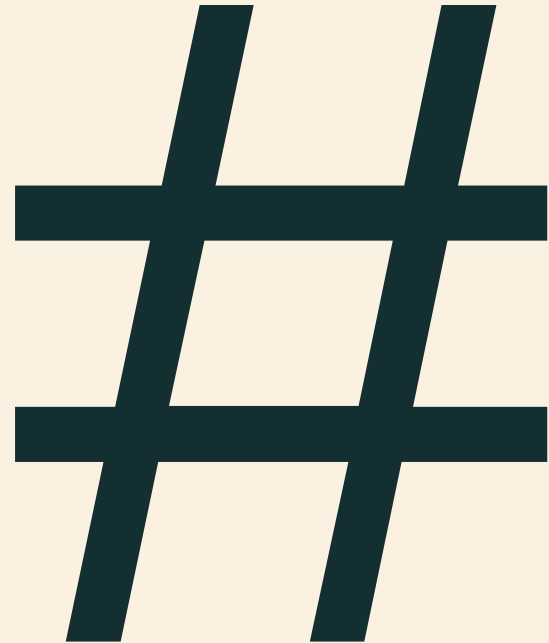
## Common Answers:

- Hashtag
- Number (sign)
- Pound (sign)



# Memory Demonstration

- **Octothorpe:** “*octo-* + *thorp*, of unknown origin; from the eight points on its circumference”



# Cognitive Load Theory

*Learning requires mental effort*

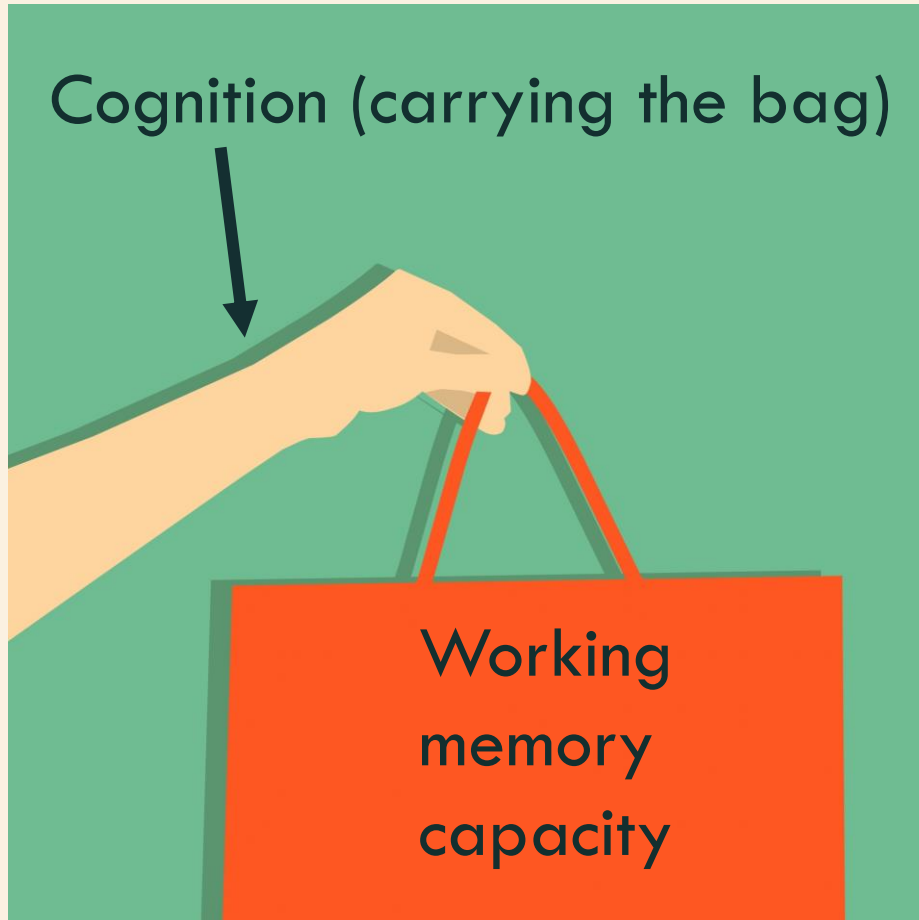


# Cognitive Load Theory

**The theory that learning requires mental effort**

- Theory focuses on the journey from WM to LTM
- Different ideas “weigh” differently in our WM and require more “effort” to think about
- Learning happens when we can balance the “load” of ideas in our limited working memories.

# An Analogy



Long term  
memory  
formation  
(learning)

The text is contained within a black circle, representing the final stage of the analogy: the transfer of information from working memory to long-term memory through the process of learning.

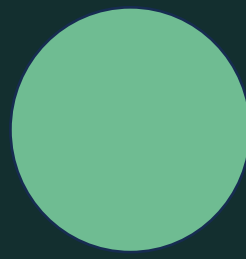
# 1. Intrinsic Load

**The difficulty level of an idea at the time of encountering it**

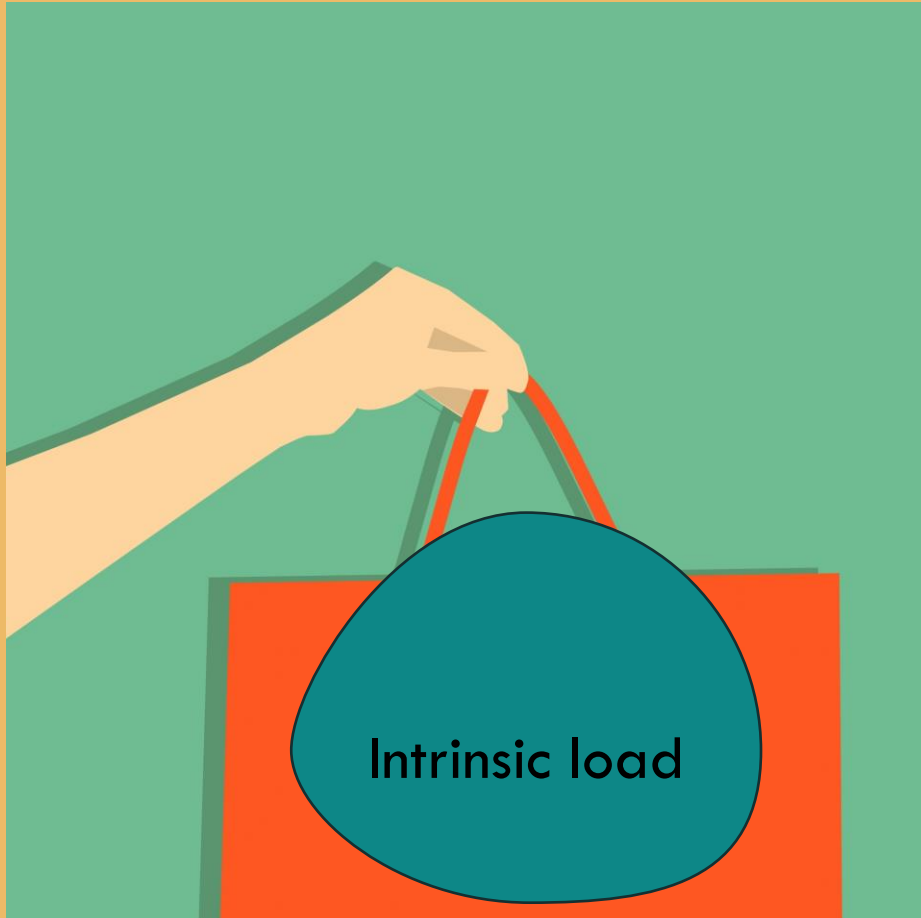
- Novice = “heavy weight”
  - Expert = “light weight”
- Repeat encounters will (hopefully) reduce the **Intrinsic Load** over time, as familiarity builds



# Teaching math: $A = \pi r^2$



## Novice



## Expert



## 2. Extraneous Load

**The environment in which an idea is presented to the learner**

- Nosy & Distracting = “heavy weight”
  - Quiet & Relaxing = “light weight”
- 
- Sometimes this can be out of our control (e.g., nearby construction during class)





# 3. Germane Load

**How an idea is presented to the learner (teacher-centered “weight”)**

- Many new words = “heavy weight”
- Diagrams & mastered words = “light weight”

**The teacher makes new ideas more salient to the learner**

- This helps them draw connections to existing long-term memories.



# Cognitive Overload

## When the “load” is too heavy

All thoughts currently in WM disappear

- They cannot be independently recovered unless they already exist in the LTM

Overload interrupts the learning process

- It's a normal facet of cognition
- Harms can be minimized with some planning





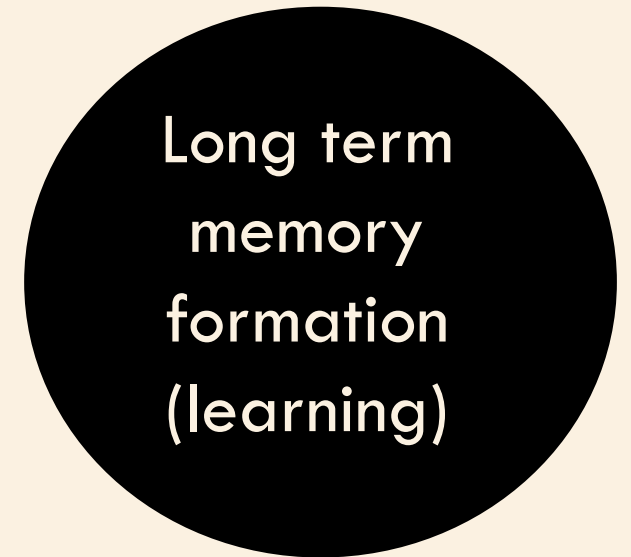
# Signs of Cognitive Overload

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## Overloaded students ...

- Suddenly drop activities or tasks
- Engage in off-topic chatter
- “Zone out” (*don’t pay attention*)
- Have incomplete recall of task directions
- Repeat already-completed parts of a task

# Cognitive Load Theory & Learning





## Your Turn: Discussion

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- What can teachers do to reduce chances of cognitive overload during class?
- How can we help students who have experienced cognitive overload?

# Teaching Implications

*Strategies to bring into our classrooms*



# Teaching Implications

## Reduce Extraneous & Intrinsic Load

→ Encourage Germane Load

- Keep classroom environments suitable for learning
- Connect new concepts to old with frequent reviews
- Revisit concepts in multiple ways to develop student “expertise”

## Draw on students' LTM

→ reduce reliance on WM

- Use what students already know to facilitate learning (e.g., choose readings on familiar topics to focus on grammatical concepts)

# Teaching Implications cont.

## Break down directions into chunks

- Check for student understanding by having them repeat back directions

## When appropriate, provide memory aids

- (*checklists, visual cues, prompts, written directions, etc.*)
- If students' WM becomes overloaded, encourage them to retrieve the information from the aid(s)

## Adjust use of corrective feedback

- Recasts are harder to notice if WM is crowded
- Keep feedback as short, simple, stressed, and as explicit as possible



# Teaching Implications cont.

**Provide language input that is simple, structured, and redundant**

**“Simple” does not mean “dumbed down”**

- Include only the most necessary / relevant information

**Structured input is easily accessible for learners**

- Focus on a single target feature at a time so it becomes more salient for learners

**Redundant input is more often in the WM**

- Increase chances for long term storage

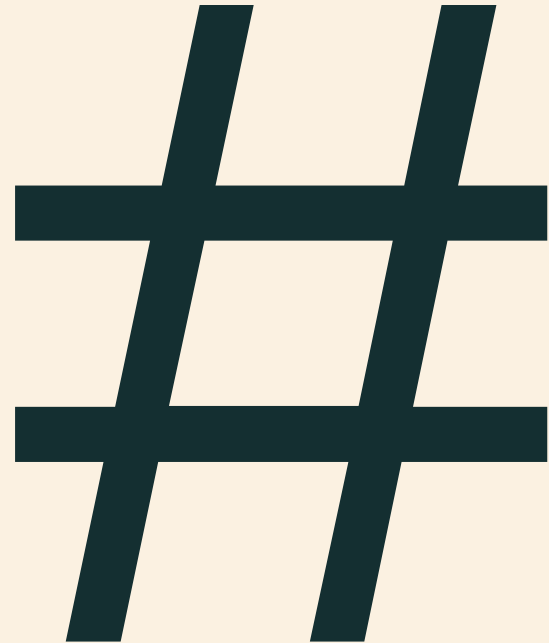
# Teaching Implications cont.

## Reduce language-learning anxiety

- **Anxiety and stress reduce WM capacity**
- **Use simple anxiety-reduction techniques**
  - Create opportunities for student success
  - Reduce the perceived difficulty of language learning
  - Build a safe learning space where making mistakes is okay

# Memory Demonstration

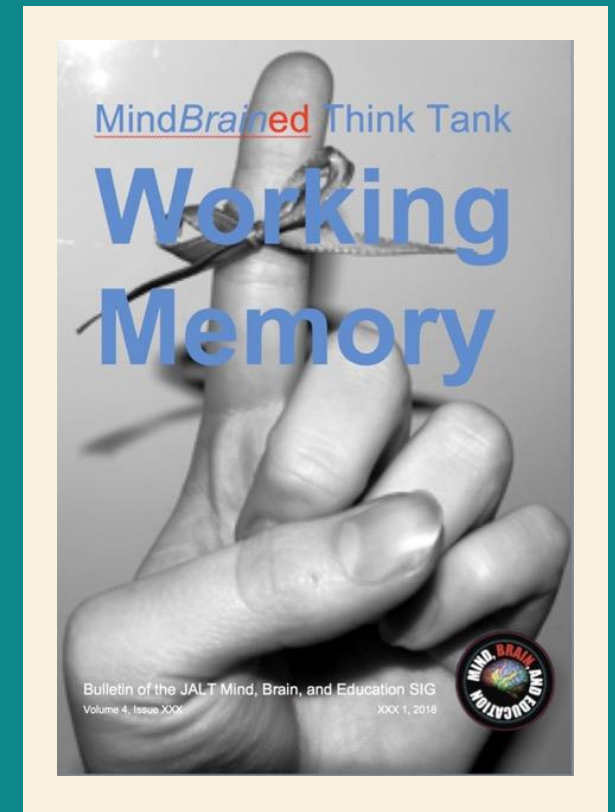
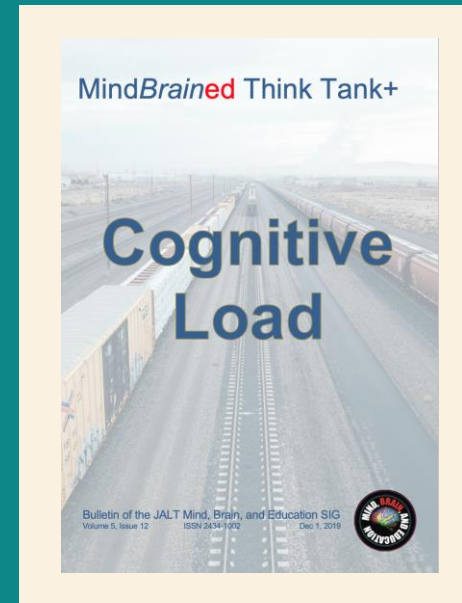
- Do you remember what this symbol is called?
- Shout it out!



# Further Reading

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- Check out our website at [www.mindbrained.org](http://www.mindbrained.org)
- Archives from 2018 to present, published monthly
- Free to read and enjoy!





# Q & A

What questions do you have?

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