Memorable models for learning: Modeling making (a meaningful multitude of) human- and AI-created mnemonics
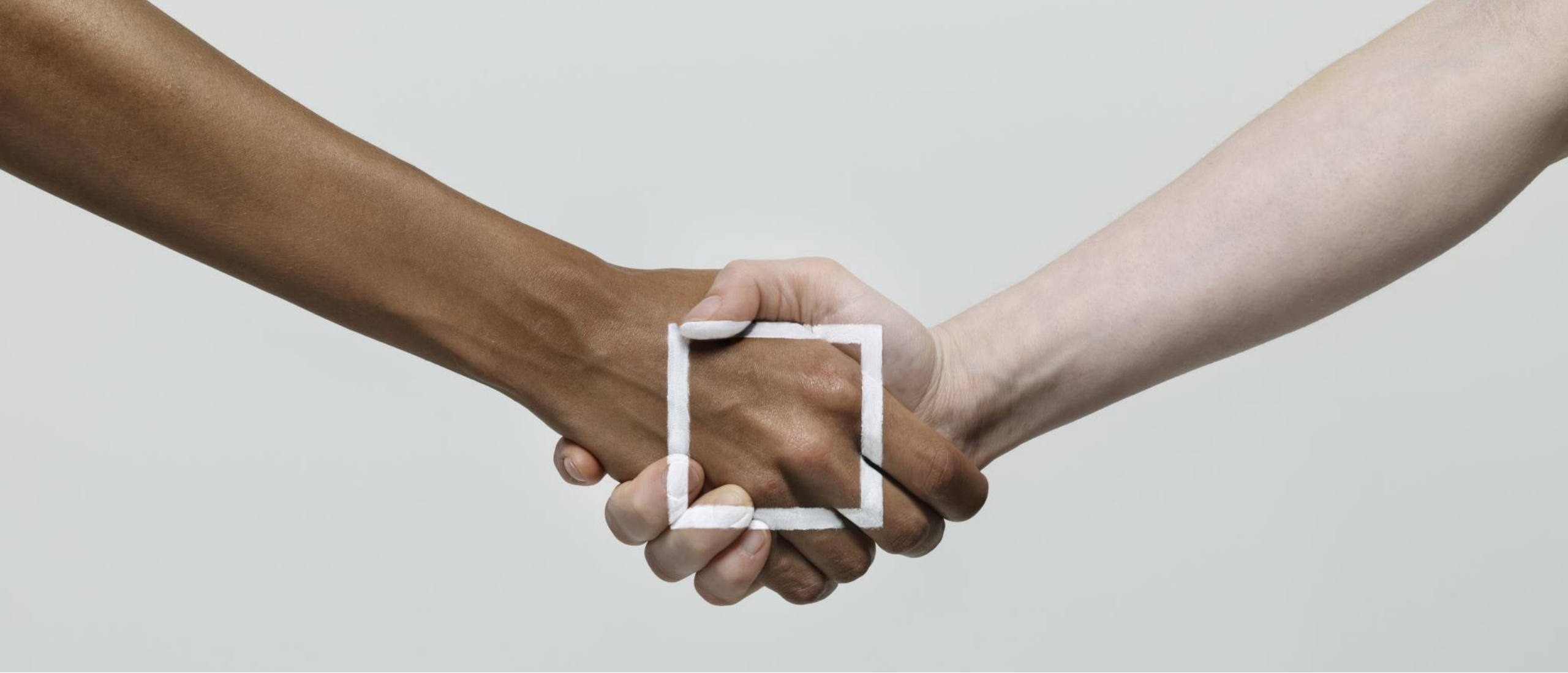
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Introductions

Introduce yourself to your neighbor

Agenda

+ Examples of Mnemonics

+ Discuss Student Struggle & Mnemonics

+ Discussion of Possible Models: Bloom's Taxonomy, Self-Regulated Learning, and....?

+ Mnemonic Creation Activity

+ Sharing of Mnemonics

definition from our 2017 *JSDSE* paper

"Mnemonic, a word derived from the Greek word mnemonikos ("of memory"), is a technique used to assist memory dating back to 477 BCE (Yates 1966).

A mnemonic can be classified by its **form** (e.g., an acronym based on initial letters of the target material) and by its **function** (e.g., recalling a fact versus recalling a process)…"

examples of mnemonics

Sentence or phrase mnemonic (with alliteration)

- In a **l**eft skewed distribution, the tail points to the **l**ower values.
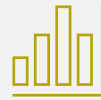
First-letter mnemonic

- **Phantom**
  - **P**roblem
  - **H**ypotheses
  - **A**ssumptions
  - **N**ame of the Test
  - **T**est Statistic
  - **O**btain a p-value
  - **M**ake a conclusion

Mnemonic usage in statistics courses

(Mocko et al., 2017)

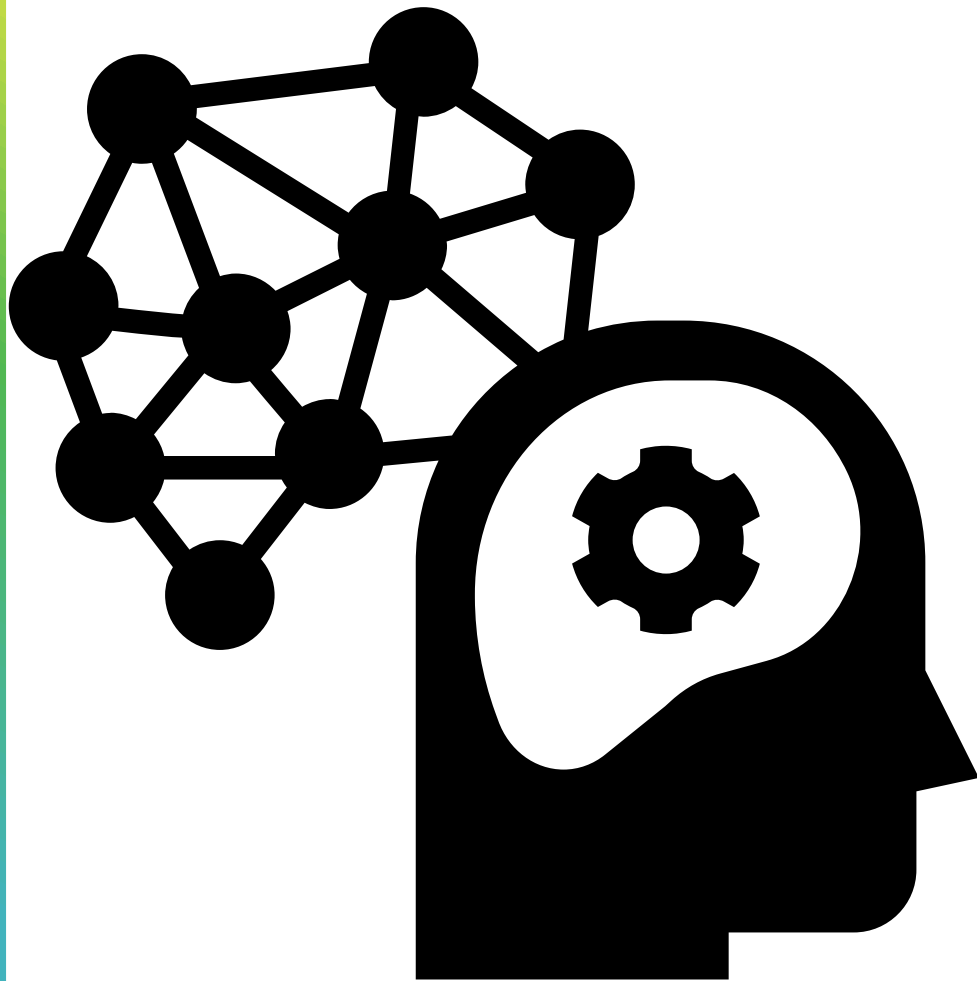**91.8% of students had used mnemonics frequently or often in *any* past courses,**

only 78.4% had used mnemonics frequently or often in a past mathematics/statistics course.

Over 40% said that mnemonics helped to reduce test anxiety or that they helped to reduce learning the material anxiety

Students prefer brief mnemonics (57.8%) and those well connected to content (43.9%).

"Students cannot apply what they understand if they do not remember it.

Moreover, a good memory expands the repertoire of cognitive capabilities upon which new understandings can be developed and expedited."

neuroscience professor William Klemm (2007, p. 61)

Recall: which mnemonics do students recall more often when asked to list mnemonics to which they've been exposed?
(Mocko et al., 2024)

SOCS (60.1% at time point 1)

- When summarizing a dataset or describing a histogram, remember to talk about "SOCS" – **S**pread, **O**utliers, **C**enter, **S**hape.

BINS (50.0% at time point 1)

- **B**inary outcomes, **I**ndependent outcomes, **N**umber of trials fixed in advance, **S**ame chance p of success on each trial."

PHANTOM (51.2% at time point 2)

- **P**arameter, **H**ypotheses, **A**ssumptions, **N**ame of Test, **O**btain a p-value, **M**ake a conclusion.

PANIC (25.6% at time point 2)

- Don't PANIC, because you know the steps. – **P**arameter, **A**ssumptions, **N**ame of interval, **I**nterval, make a **C**onclusion.
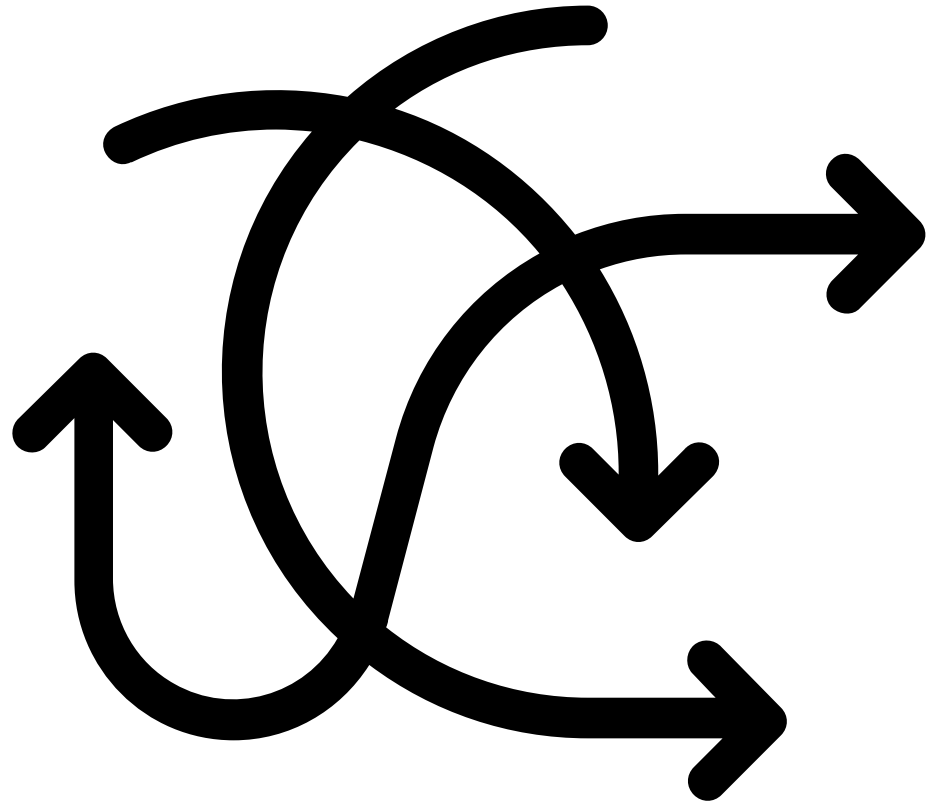
Apply: what mnemonics do students apply correctly to exam-like questions (given on the extra-credit surveys) that would benefit from using mnemonics? (Mocko et al., 2024)
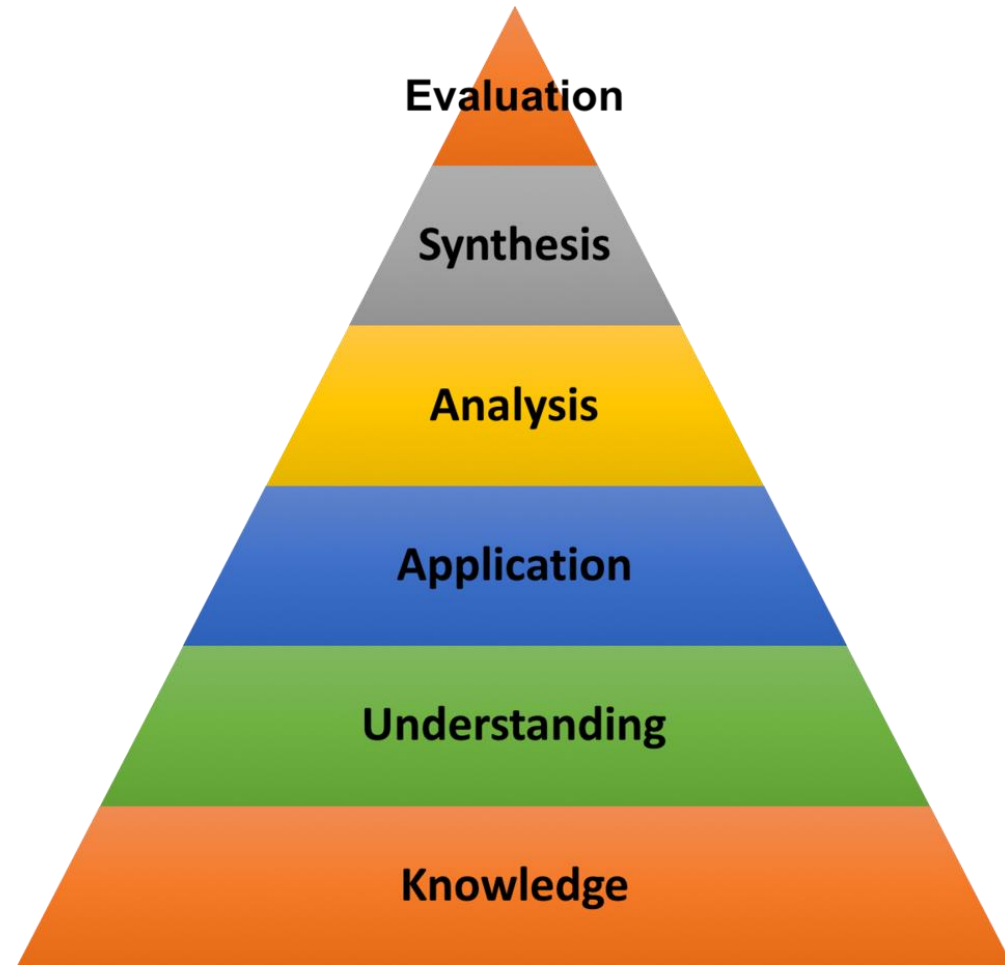
Time Point 1
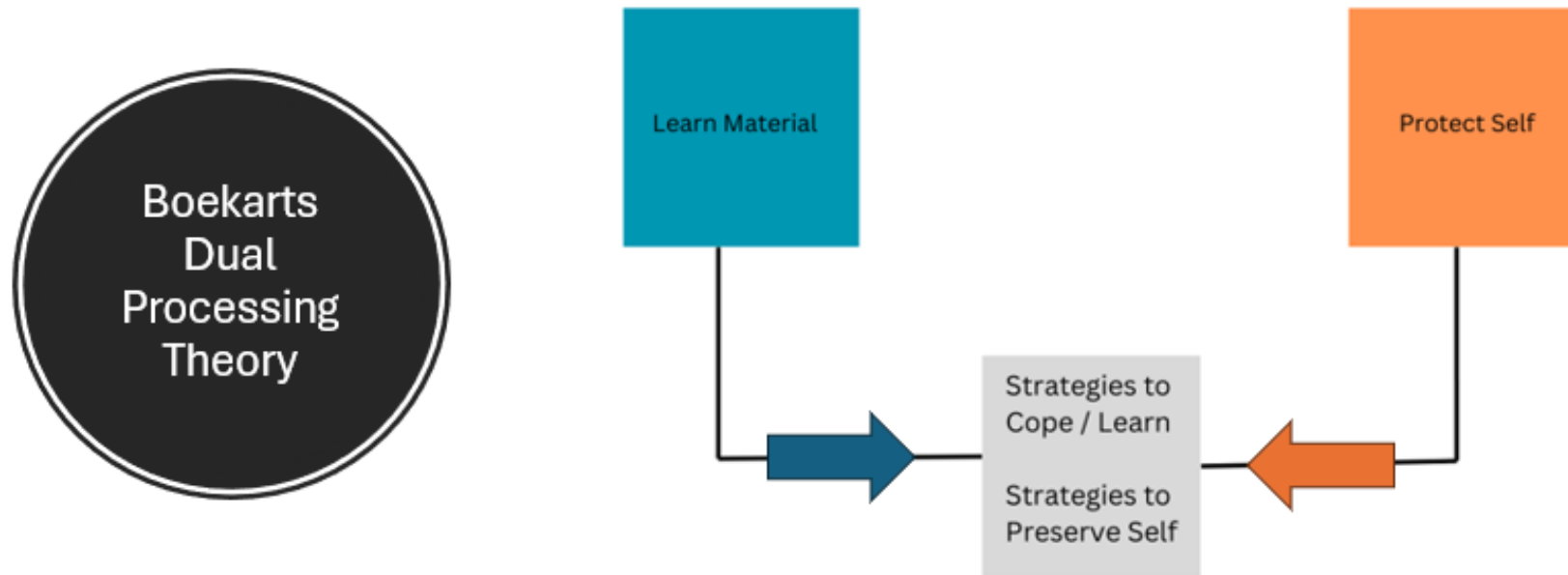
- X axis
- Left skewed

Time Point 2

- t vs. z
- P-value decision
- df

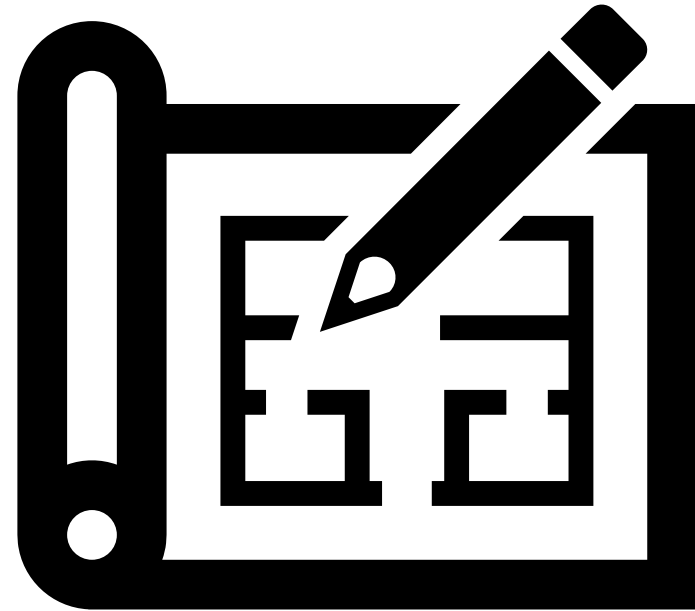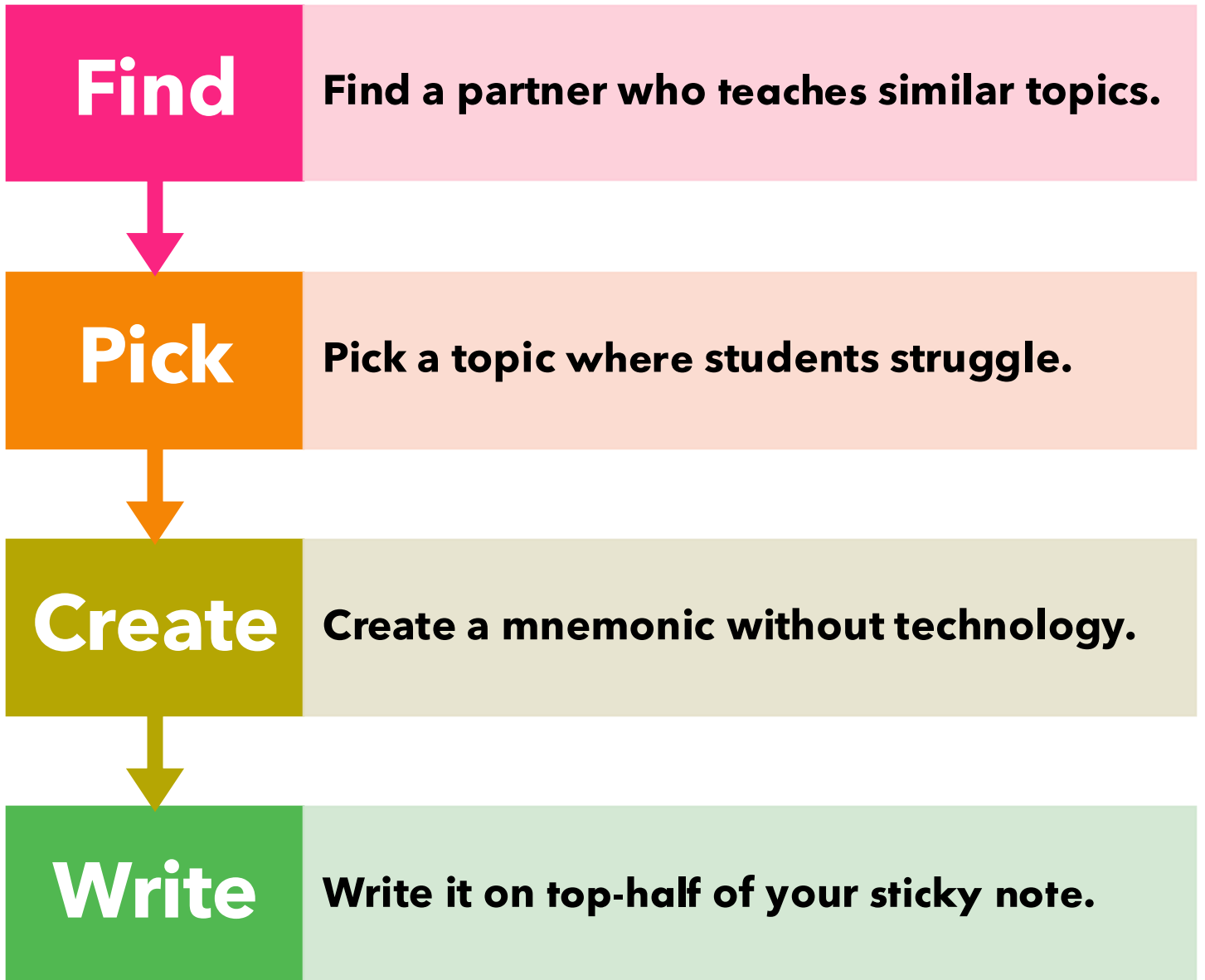Where do students struggle?

Bloom's Taxonomy

Does Bloom's Taxonomy or Boekarts' Self-Regulated Learning Theory provide a **useful model** for thinking about use of mnemonics in learning?

What other theories may offer or inform **useful models**?

Make a new mnemonic with a partner.

Find	**Find a partner who teaches similar topics.**
Pick	**Pick a topic where students struggle.**
Create	**Create a mnemonic without technology.**
Write	**Write it on top-half of your sticky note.**

Demo:
Make a mnemonic with AI

+ <u>Practice Prompt</u>: Pretend you're a supportive tutor for statistics students in introductory statistics course. The student is having trouble remembering the assumptions for the one-sample t test. Can you help provide a mnemonic and explain its meaning?
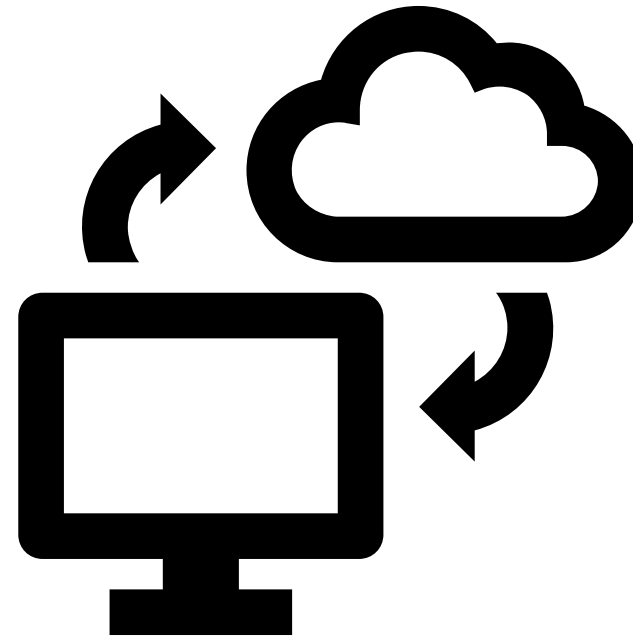
Create a mnemonic useful to your course with a partner, but now use a **Large Language Model**, such as:

chatgpt.com
gemini.google.com
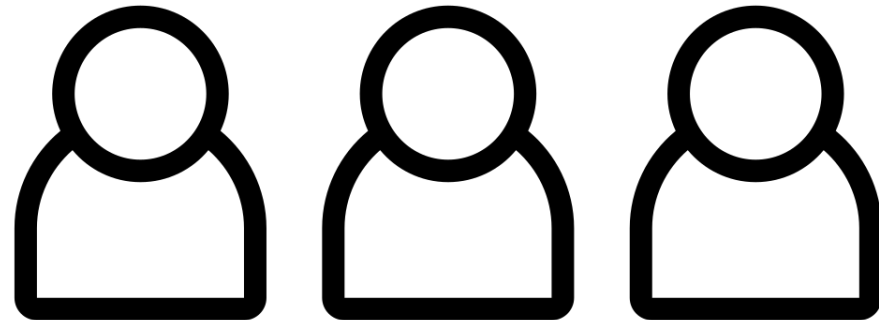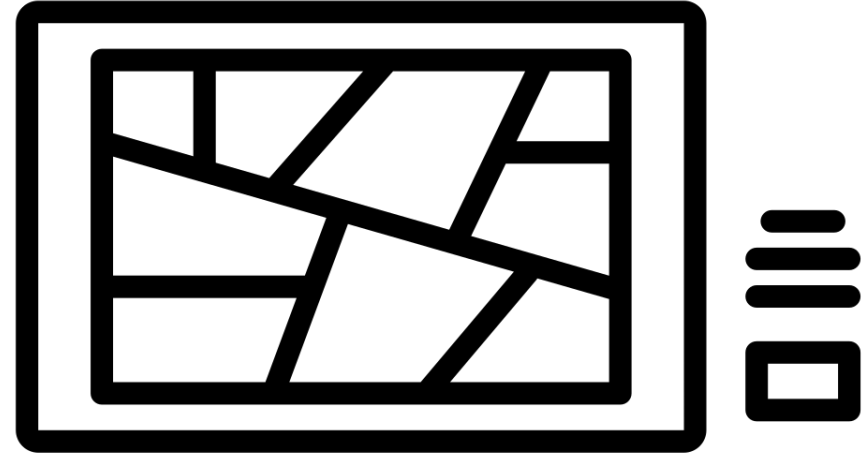copilot.microsoft.com

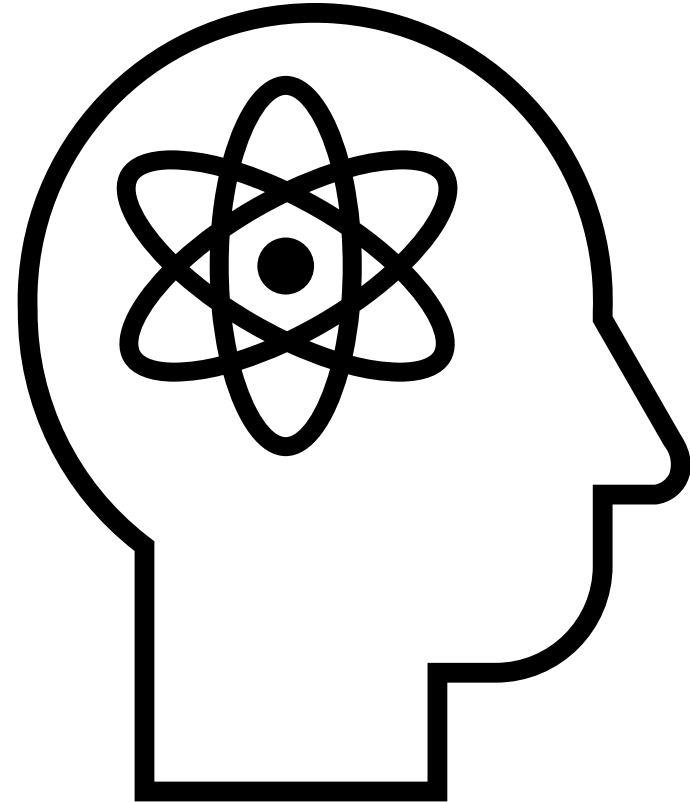Write it on the bottom half of your sticky note.

Gallery Walk

+ Now, let's tour the room and see the created mnemonics!

Reflect: What are
benefits and
challenges
of each approach?

Mnemonics in Statistics

+ Hunt, N. (2010), Using mnemonics in teaching statistics, T*eaching Statistics*, 32(3), 73–75. https://onlinelibrary.wiley.com/doi/10.1111/j.1467-9639.2009.00402.x

+ Lesser, L. M. (2011). Making statistics memorable: New mnemonics and motivations. In American Statistical Association *Proceedings of the 2011 Joint Statistical Meetings, Section on Statistical Education* (pp. 1118–1124). http://www.statlit.org/pdf/2011Lesser-JSM.pdf

+ Lesser, L. (2011). On the use of mnemonics for teaching Statistics. *Model Assisted Statistics and Applications*, 6(2), 151–160. https://journals.sagepub.com/doi/pdf/10.3233/mas-2011-0183

+ Mocko, M., Lesser, L. M., Wagler, A. E., & Francis, W. S. (2017). Assessing effectiveness of mnemonics for tertiary students in a hybrid introductory statistics course. *Journal of Statistics Education*, *25*(1), 2–11. https://doi.org/10.1080/10691898.2017.1294879

+ Mocko, M., Wagler, A. E., Lesser, L. M., Francis, W. S., Blush, J. M., Schleicher, K., & Barrientos, P. S. (2024). What they remember may not be what they understand: A study of mnemonic recall and performance by introductory statistics students. *Journal of Statistics and Data Science Education*, 32(4), 416-431. https://doi.org/10.1080/26939169.2024.2334905 (webinar: https://causeweb.org/cause/webinar/jsdse/2024-09)

+ Stalder, D. R., & Olson, E. A. (2011). *t* for two: Using mnemonics to teach statistics. *Teaching of Psychology*, *38*(4), 247–250. https://doi.org/10.1177/0098628311421321

Articles on using AI in the Classroom

+ Ellis, A. R., & Slade, E. (2023). A new era of learning: Considerations for chatgpt as a tool to enhance statistics and data science education. *Journal of Statistics and Data Science Education*, *31*(2), 128–133. https://doi.org/10.1080/26939169.2023.2223609

+ Southworth, J., Migliaccio, K., Glover, J., Glover, J., Reed, D., McCarty, C., Brendemuhl, J., & Thomas, A. (2023). Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers and Education: Artificial Intelligence*, *4*, 100127. https://doi.org/10.1016/j.caeai.2023.100127

+ Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, *2*, 100041. https://doi.org/10.1016/j.caeai.2021.100041

+ Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: The relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*, *21*(1), 15. https://doi.org/10.1186/s41239-024-00448-3

Self-Regulated Learning Theory

Boekaerts, M. (2011). Emotions, emotion regulation, and self-regulation of learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of Self-Regulation of Learning and Performance* (pp. 408–425). Routledge.

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, *8*, 422. https://doi.org/10.3389/fpsyg.2017.00422
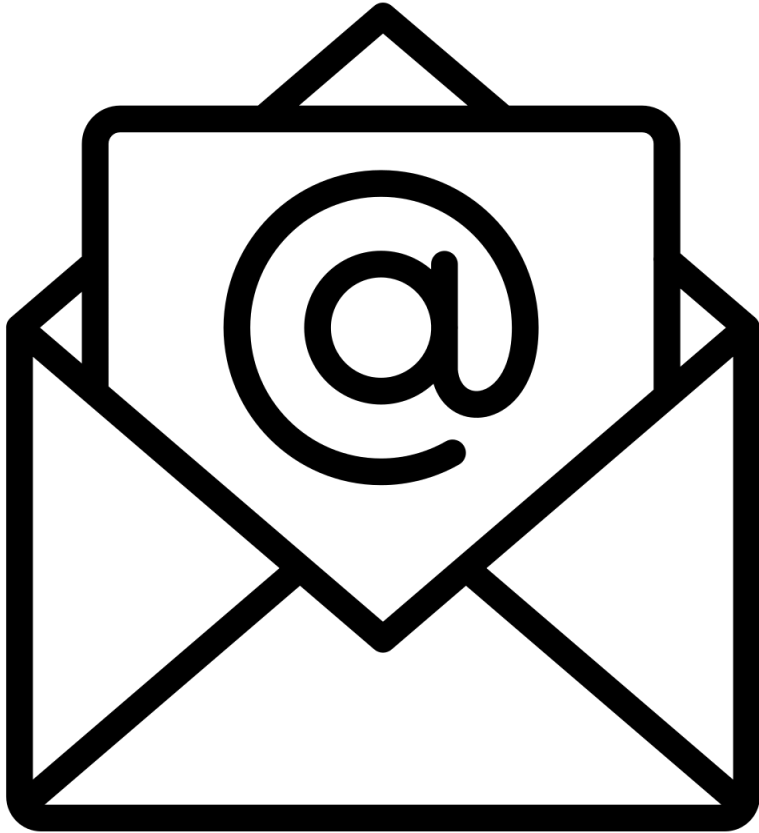
Bloom's taxonomy –

Check out the University of Arkansas's information https://tips.uark.edu/using-blooms-taxonomy/#gsc.tab=0

Collaborators in this strand

+ Megan Shein

+ Alejandra Lugo

+ Amy Wagler

+ Wendy Francis

+ Jennifer M. Blush

+ Karly Schleicher

+ Patricia S. Barrientos

We hope this was *memorable!*

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