

SCHOLARSHIP OF EXCELLENCE IN TEACHING - COHORT 2023

Retrieval Practice, and Feedback- Driven Metacognition

Sudha Kunhikrishnan

Mathematics, Statistics and Data Science

Rockville

Problem

Students in the Elementary statistics course often struggle with recalling fundamental concepts learned at the beginning of the semester and face challenges making connections and using correct methodology when solving complex problems later on.

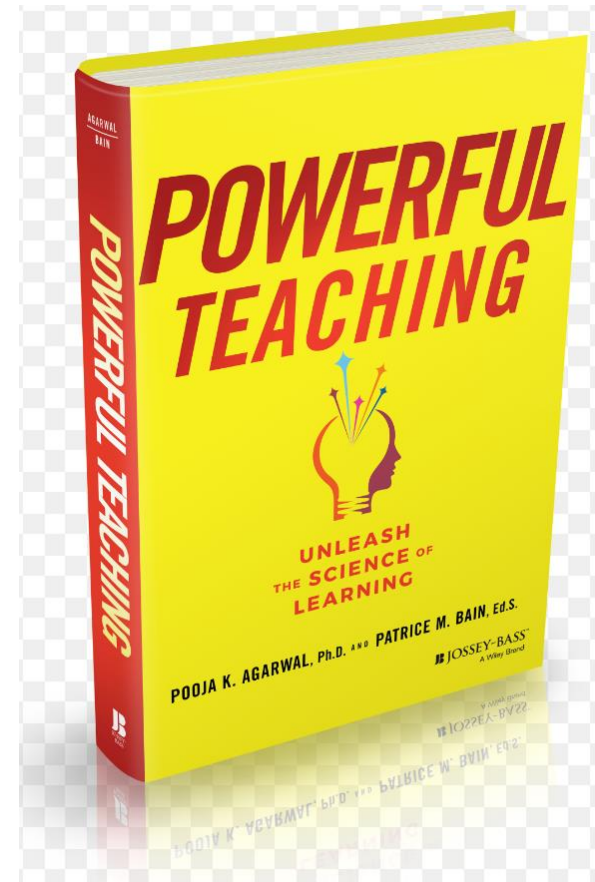
Goal

Help students retain concepts learned throughout the semester and develop proficiency in correctly identifying variables, statistics, parameter, using appropriate notations, and employing accurate statistical methodologies to solve complex problems correctly.

Inspiration

Evidence based strategies – Powerful tools

- Retrieval Practice
- Spacing
- Interleaving
- Feedback– Driven Metacognition



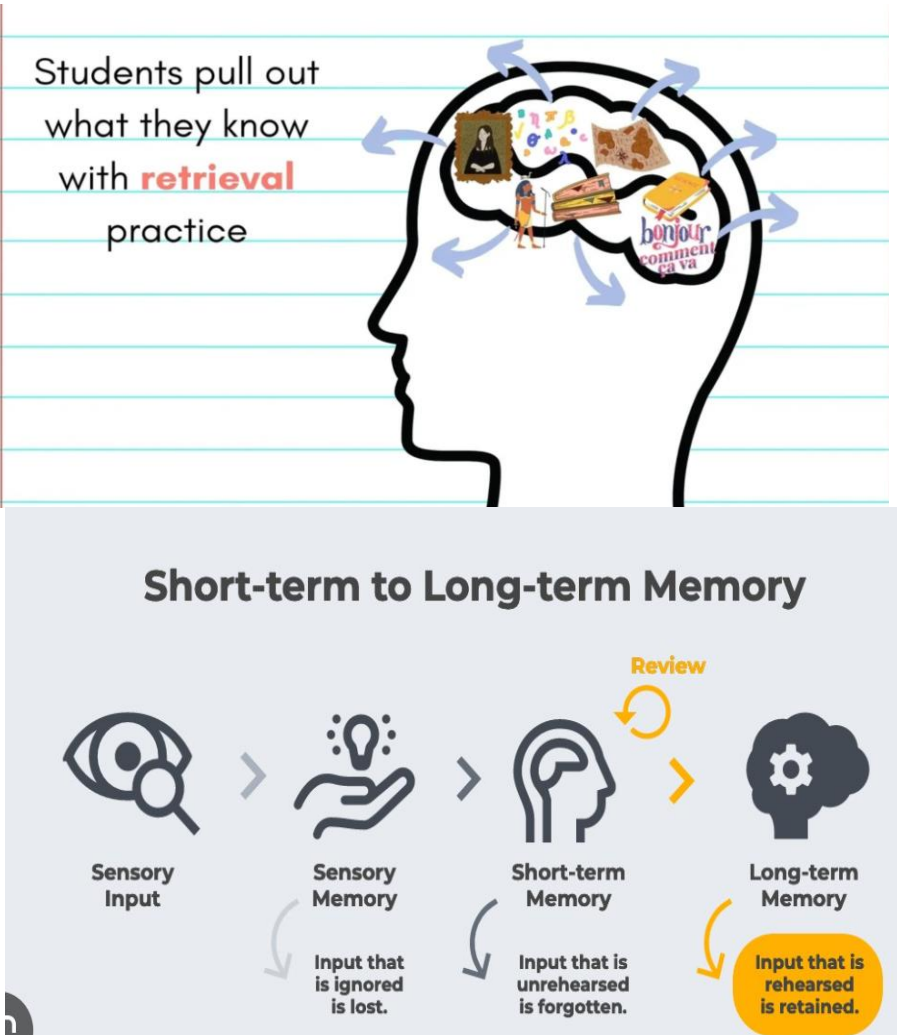
The Learning Strategies Implemented

Why Retrieval Practice?

- Boosts learning by pulling information out of the students' head, rather than cramming information into it.
- Improves students' learning and long term retention of information.
- Increases students' engagement and attention in class.
- Increases students' metacognition and awareness of their own learning.
- Increases higher-order thinking.

Why Feedback– Driven Metacognition?

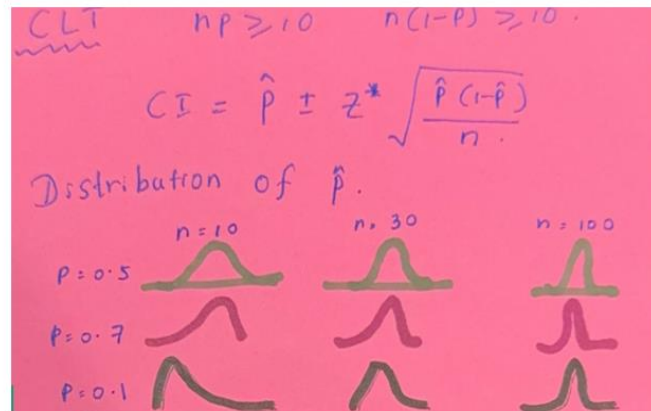
- Boosts learning by letting students know what they know and what they don't know.
- Build confidence in their metacognition and learning as students make errors in low-stakes environment.



Strategy #1

Brain Dump followed by pair and share- Implemented in every class

- Paused the lecture or activity after 25-30 minutes.
- Asked the students to write down everything they remember for 3 minutes.
- Students paired up and discussed their points for 2 minutes.
- Shared the information with the class for 2 minutes.



t distribution.
 $SE =$
 $CI = \text{Sample Statistics} \pm t^* \frac{s}{\sqrt{n}}$
 $= \bar{x} \pm t^* \cdot \frac{s}{\sqrt{n}}$
If sample size increases, $t^* \sim z^*$

Whenever we don't know the population standard deviation σ estimate it with the sample standard deviation, s

Strategy #2

Retrieval Quiz followed by feedback- Implemented weekly, starting week 2 except on exam weeks

- Two or three questions (Warm-ups) in the beginning of the class.
- Based on past topics, emphasizing basic concepts.
- Low-stakes: 2 extra credit homework points.
- Discussed the solutions immediately after the quiz.

Name: Maria Gillespie

The owner of a small pet supply store wants to open a second store in another city, but he only wants to do so if more than one-third of the city's households have pets (otherwise there won't be enough business). He selects a random sample of 150 households and finds that 64 have pets. Does this sample provide evidence for opening a second store?

Set up the Null and Alternate: Use the right notations

$H_0: p = 1/3$ $H_a: p > 1/3$ ✓

What is the statistic? Use the right notations

$\hat{p} = .427$ ✓

Week 12-11/15 B

Excellent! +2

Name: Alexa Keller

It is recommended, for most college age students, to get 8 hours of sleep each night. A random sample of 48 students at a large university reported getting an average of 7 hours of sleep on weeknights, with standard deviation 1.62 hours. Does this sample provide evidence that college students at this university get significantly less sleep, on average, than what is recommended?

Set up the Null and Alternate: Use the right notations

$H_0: \mu = 8$ ✓
 $H_a: \mu < 8$ ✓

What is the statistic? Use the right notations

$\bar{X} = 7$ ✓

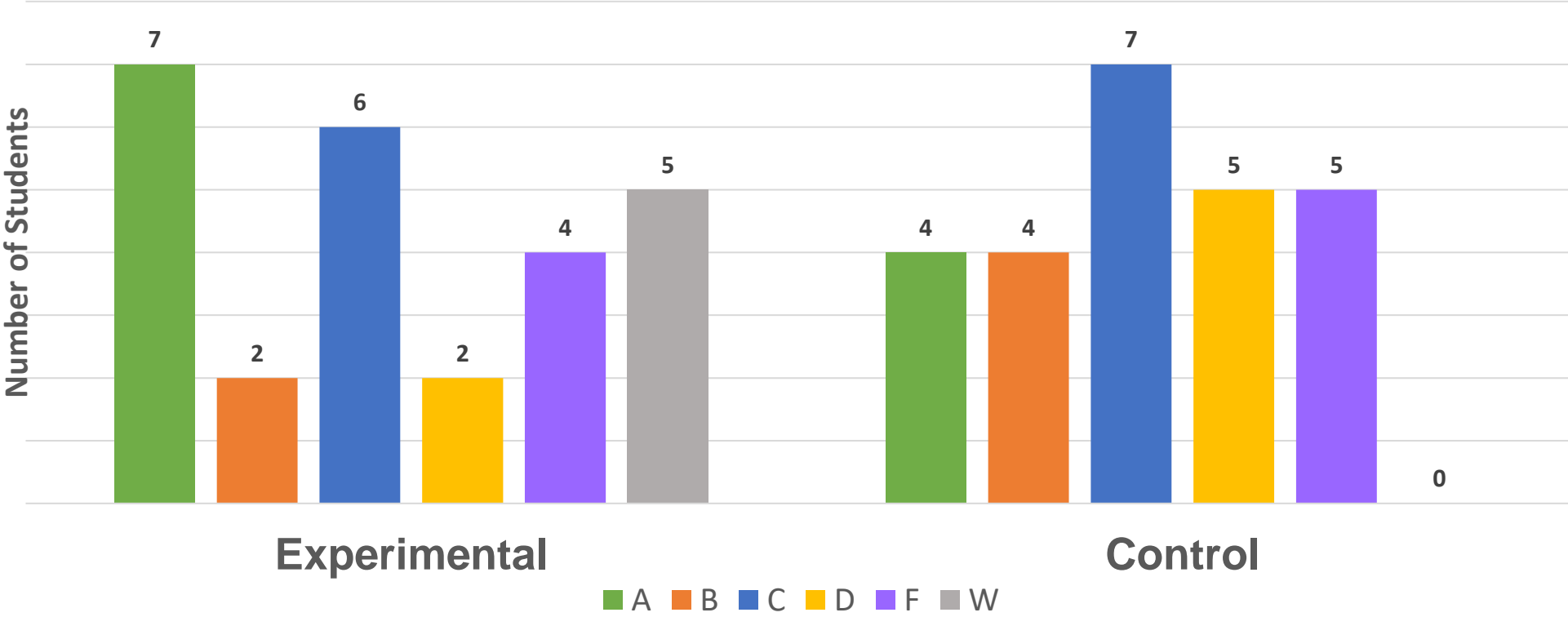
Assessment of the strategies

Out of the two sections of MATH117 (Elementary Statistics) taught during fall 2023, one was selected as the experimental class and the other as the control class.

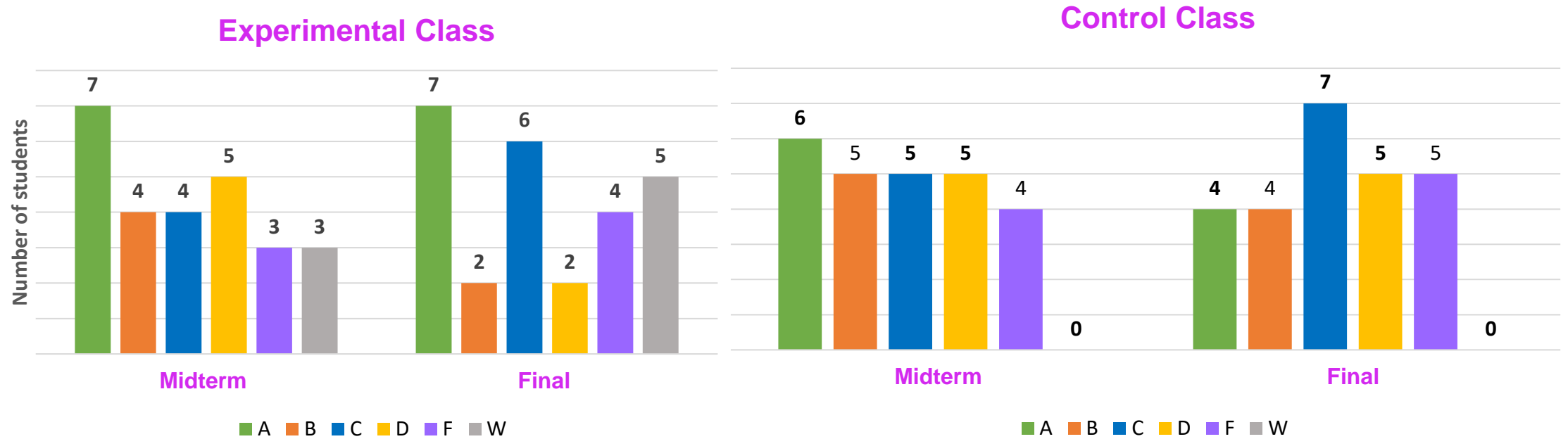
1. Final course grade comparison of the two sections- Experimental vs. Control.
2. Grade distribution change in each section over the semester- Midterm vs. Final.
3. Student survey results about the strategies.

Final Course Grade Comparison: Experimental vs. Control

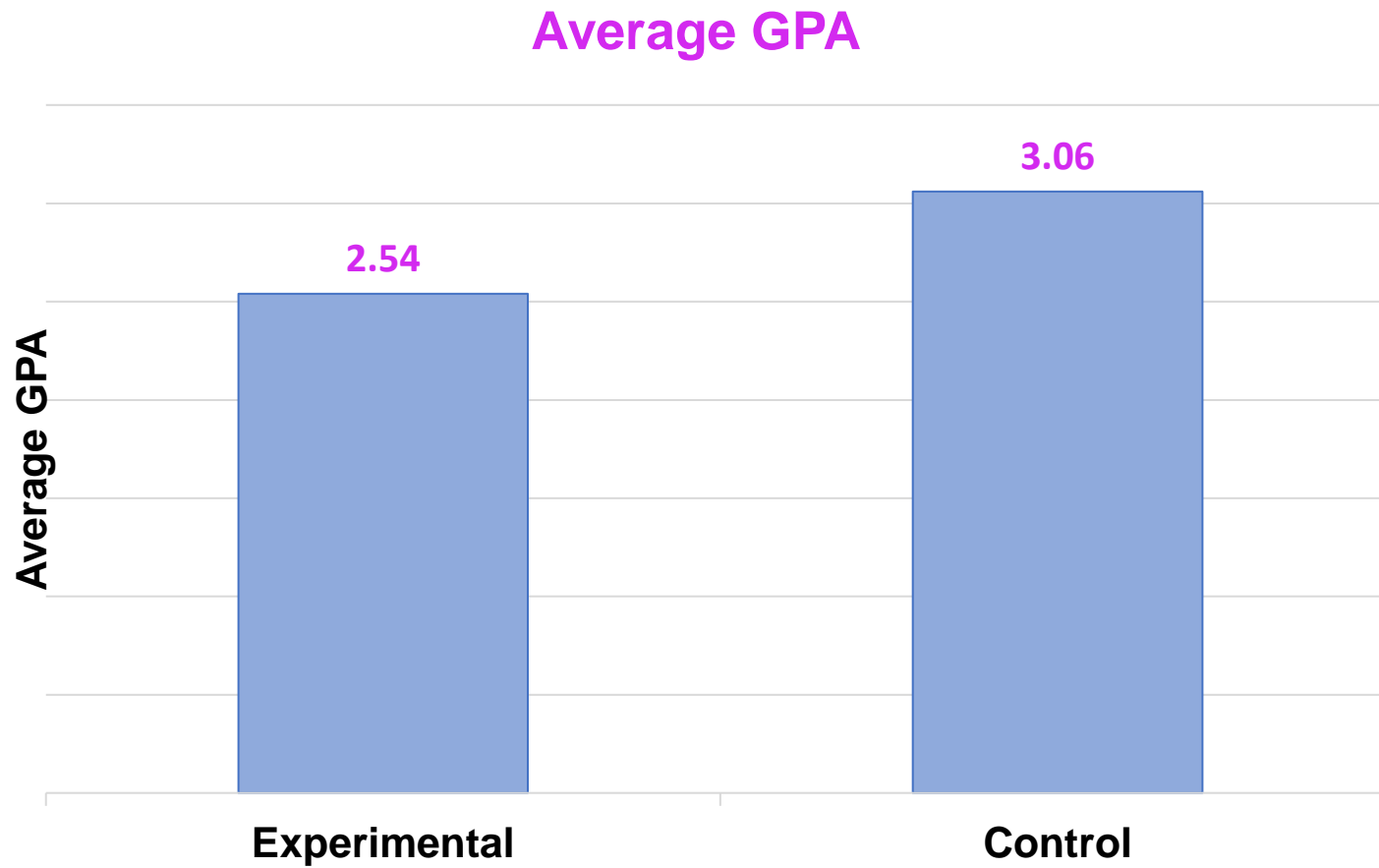
Final Grade Experimental vs. Control



Grade distribution change: Midterm vs. Final

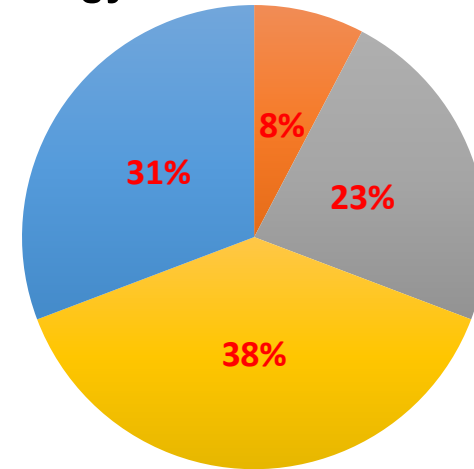
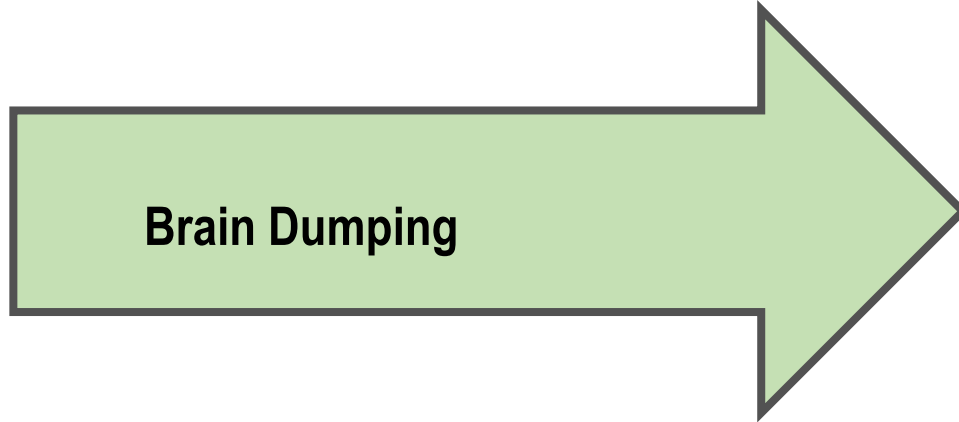


GPA Comparison: Experimental vs. Control

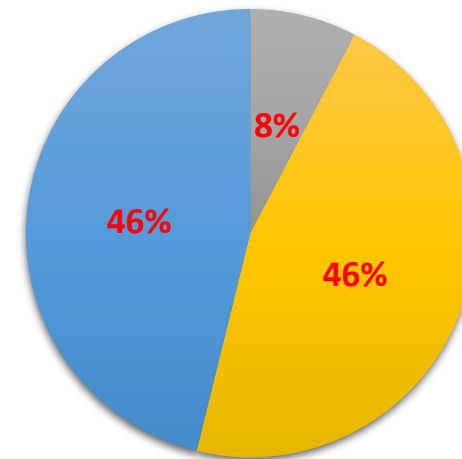
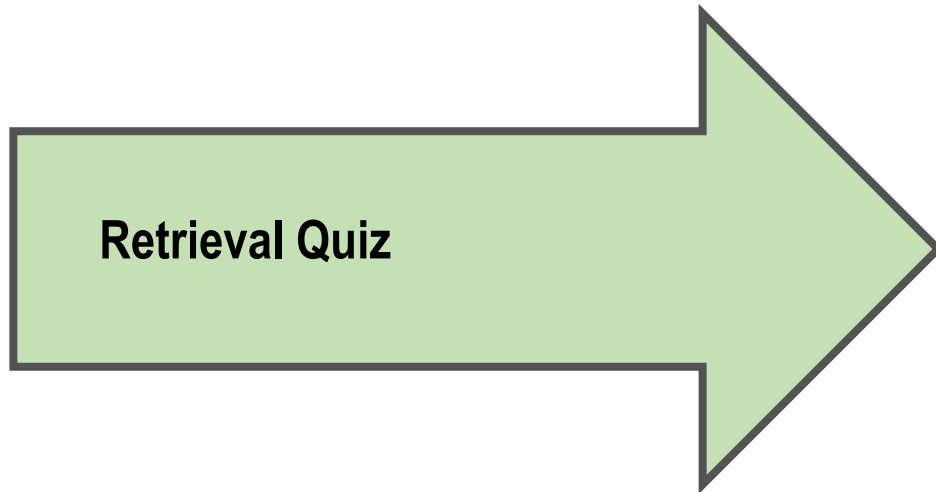


Were the strategies helpful to students?– Survey results

On a scale of 1(Not helpful) to 5 (Most helpful) how helpful was the strategy?



■ 1 Not Helpful ■ 2 ■ 3 ■ 4 ■ 5 Most Helpful



■ 1 Not Helpful ■ 2 ■ 3 ■ 4 ■ 5 Most Helpful

Survey results



Benefits of Brain Dumping

It helped me summarize what I learned in class, which allowed me to remember the main things that helped me complete the assignments.

I have noticed my memory has become better and during tests I am able to recall information faster.

Forced me to recall things from the lesson.

By recounting information it motivated me to focus on our topics and helped me to remember more info.

Forced me to really digest the information I was learning so I can remember to write it down.

Survey results



Benefits of Retrieval Quizzes

The weekly retrieval quizzes allowed me to recall earlier concepts we learned that week.

It showed me how well I know the material, which tells me what I need to more time studying before I take the test.

Helped me remember basic things so I felt more confident knowing them.

- If I got a question wrong, I am able to learn for my mistakes and avoid making the same one on an actual test.

- Going over the quizzes after taking them gives me an understanding of how to do it if I took a guess.

It helped me by giving me extra practice and examples to apply what I knew and learn from what I got wrong.

Survey results

Whether these strategies contributed to your long-term memory?

Yes, I normally forget topics right after a week of learning, but because of this I am able to retain info back from many months ago.

I feel like it's very helpful to understand the factors we learned in the class and it helps to my long-term retention improvement of the topics and to improve problem solving and critical thinking.

I think it was beneficial especially when it came time to take test I could see my studying along with these techniques helped.

They did because typically, I would not practice past concepts causing me to forget them easily / not have a strong understanding of them. But being able to constantly retrieve these concepts have engraved them into my memory as I am able to constantly
...is? Practice them avoiding them getting lost in my mind.

Survey results

Do you recommend implementing retrieval practice in other courses?

Yes, I do. Actually, I use them in my other courses, and I will continue to use them.

I highly recommend implementing these retrieval practices especially if a course revolves on a build up from past concepts. I recommend having a strong base knowledge and practicing key concepts as much as possible to have a strong understanding of them.

Depending on the course/class, implementing practices is useful to better understand the subject. Especially in math and tech courses.

Yes. Other math courses. Any courses that require calculations STEM courses.

I think that science & history courses could benefit from these practices.

Conclusion

Looking at the data, I believe my strategies helped students that consistently attended class achieve higher grades at the end of the semester either through improvement in grades over the course of the semester or by retaining their sufficiently passing grades.

Thank You!

I would like to thank Joan for her leadership, guidance and support! I also want to thank all my SET colleagues for the valuable discussions and suggestions during the program.

