



The Effects of Refutation & Self-Explanation on the Learning Styles Misconception



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Background

Refutational texts have been shown to facilitate learning by countering misconceptions about math and science concepts. Refutation texts can be beneficial for revising misconceptions by re-organizing ideas in our knowledge networks¹. Despite its efficacy for learning, refutation can sometimes **backfire** and further entrench our beliefs in the misconceptions we hold emotional attachments to². When we attach emotions to our ideas, we are more likely to strengthen our hold on that belief in the face of refutation³. Our **emotional attachments** can further motivate us to reason against the refutation if we feel that a particular belief or concept relates to our identity³. For example, students might have emotional attachments to the misconception of **personal learning styles (LS)** because individuals are often emotionally attached to the beliefs deemed particularly unique to them³. To counter the backfire effect due to the emotional attachments we form to our beliefs, this study explores how **self-explanation** can enhance the benefits of refutation. Self-explanation is an effective tool for learning because it requires students to engage deeply with the material by generating inferences and causal relations⁴.

Current Study

We predict that self-explanation will enhance the benefits of refutation and counter the backfire effect.

Objectives:

- Evaluate how the effect of self-explanation can **improve learning** from a refutation text versus being prompted to take notes or re-read.
- Explore how a prompt to self-explain a refutation text can effect **belief revision** and **belief strength** in the learning styles misconception.

Method

Participants

- 206 UC San Diego undergraduate students.
- Used convenience sampling through SONA Systems

Design

- All participants read a refutation prompt
- 3-level **between-subjects experimental** design
- 3 levels of **instructional prompt** (Self-explanation, Note-taking, and Re-read)

Analysis

- Determine the **mean change in accuracy score** by instructional prompt.
- Determine the **mean change in belief strength in learning styles** by instructional prompt.
- Analyze the **change in learning style endorsement** by instructional prompt.

Materials

Refutation Passage

- The 2-page refutation was adapted from Rohrer and Pashler's, "Learning Styles: Where's the Evidence?" (2012)⁵ and Pashler et al.'s, "Learning Styles: Concepts and Evidence" (2009)⁶.

Instructional Prompts

Self-Explanation:

- "In your own words, **explain** the concept of learning styles."
- "In your own words, **explain** why instructors should or should not use learning style-based instruction."

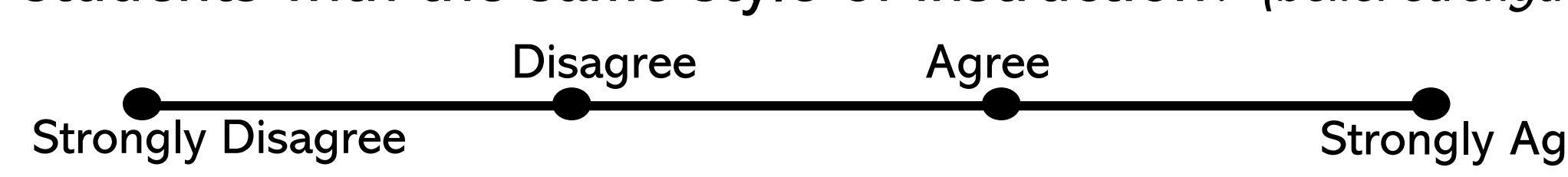
Note-Taking:

- "Use the space below to take notes on what you read. You should write anything you might be thinking about. This does not need to be organized. Use this space to freely express your thoughts as you read the passage."

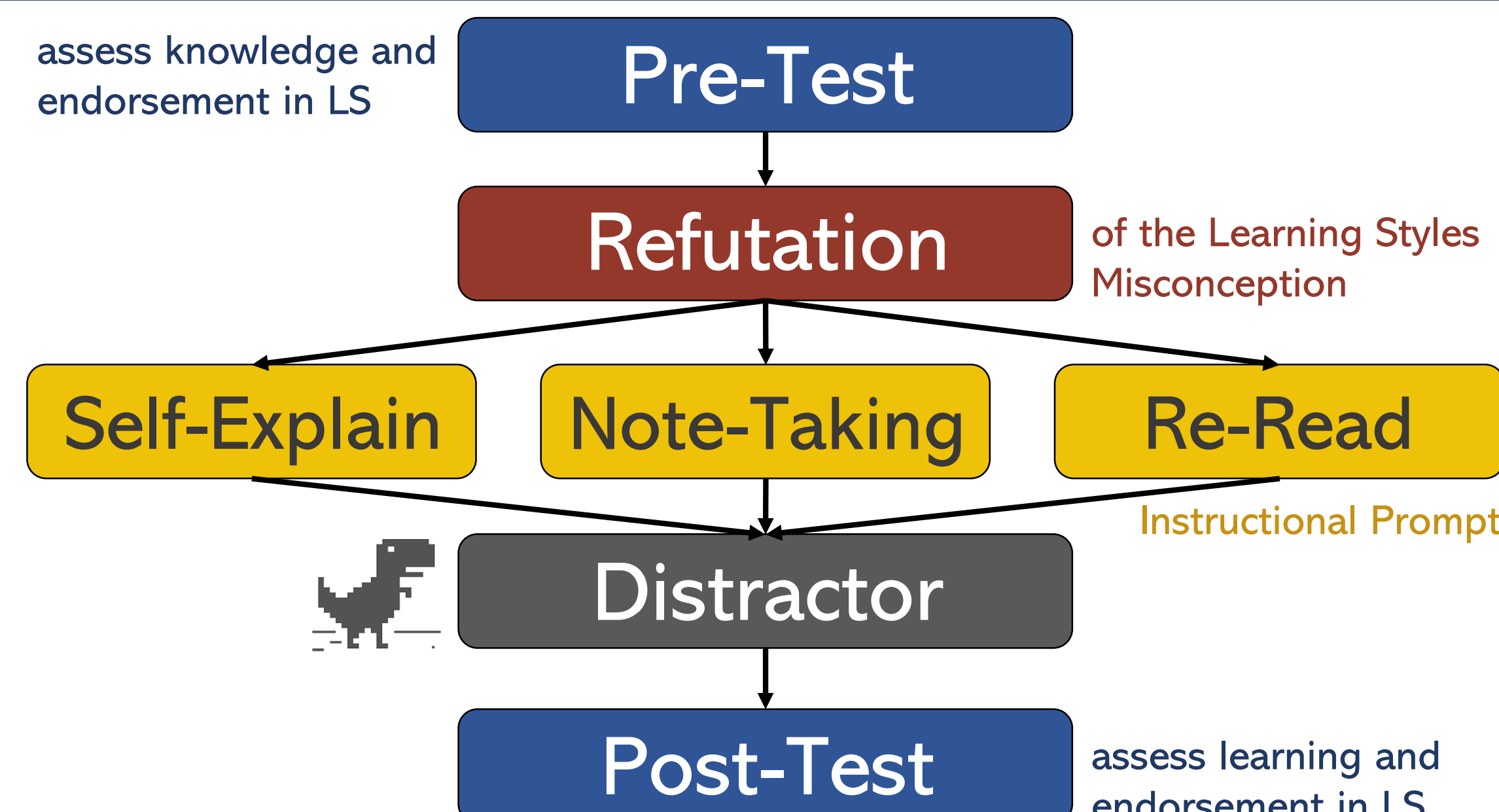
Re-Read:

- "Please use this time to re-read the passage."

Pre-Test & Post-Test Questions

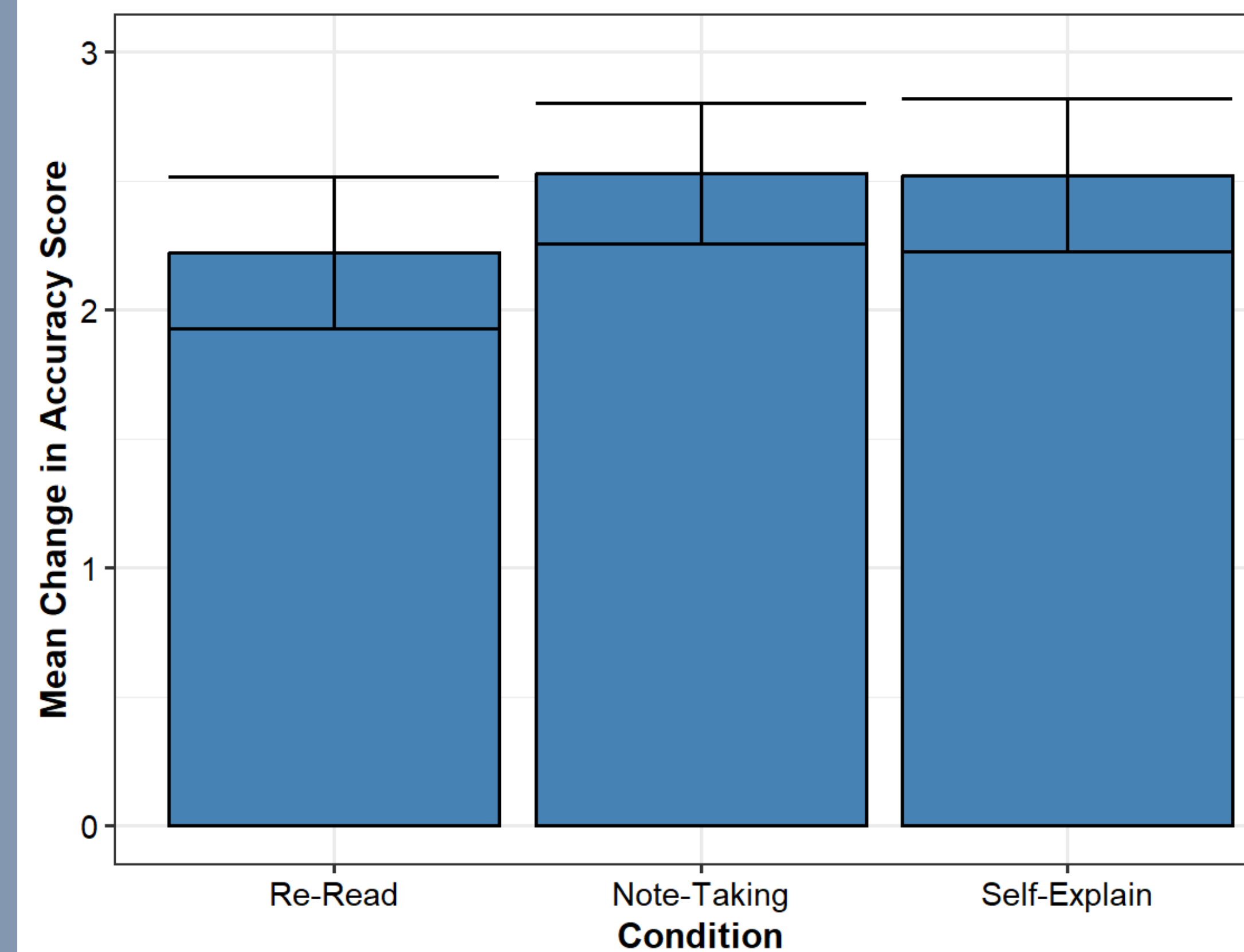
- Do you believe in individual learning styles? (*endorsement*)
 - Yes
 - No
- If someone denied your belief by saying learning styles do not exist, how would you feel? (*emotional attachment*)
- How strongly do you believe that individualized instruction leads to better learning versus teaching students with the same style of instruction? (*belief strength*)

- Imagine you are a teacher, and your students ask you to accommodate to their personal learning style. Based on research, which of the following will yield better learning outcomes? (*accuracy*)
 - Accommodate to everyone's different styles.
 - Tailoring the course to the most dominant learning style in your class.
 - Consider different ways you might teach the material and choose materials most coherent and mutually reinforcing.
 - Choose a curriculum that best fits your teaching style.

Procedure



Results

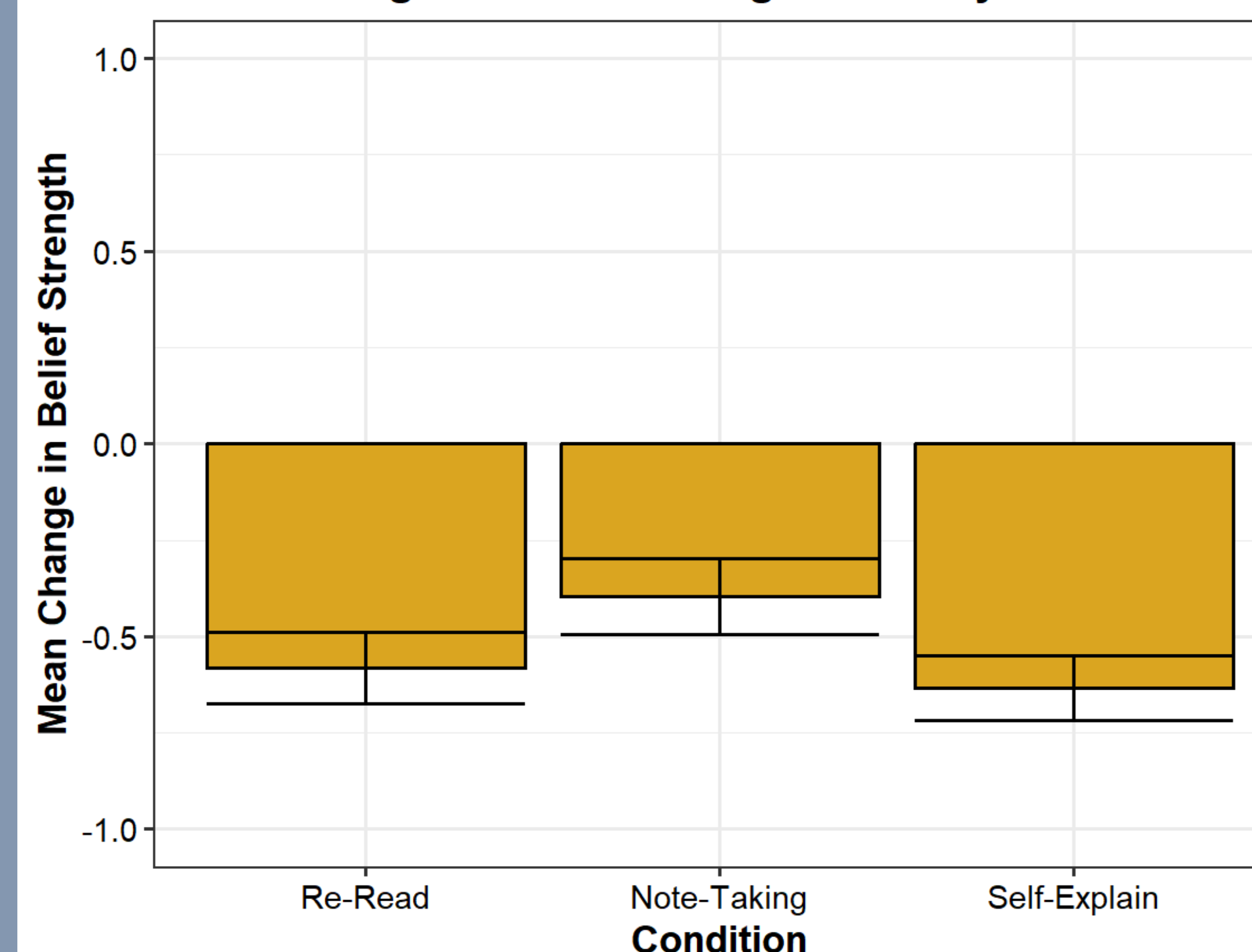
Mean Change in Accuracy Score by Condition



One-Way ANOVA
There was not a significant effect of instruction prompt on change in accuracy score ($\alpha = .05$) for three conditions [$F(2, 203) = 0.36$, $p = 0.699$].

*Error bars are the standard error of the mean.

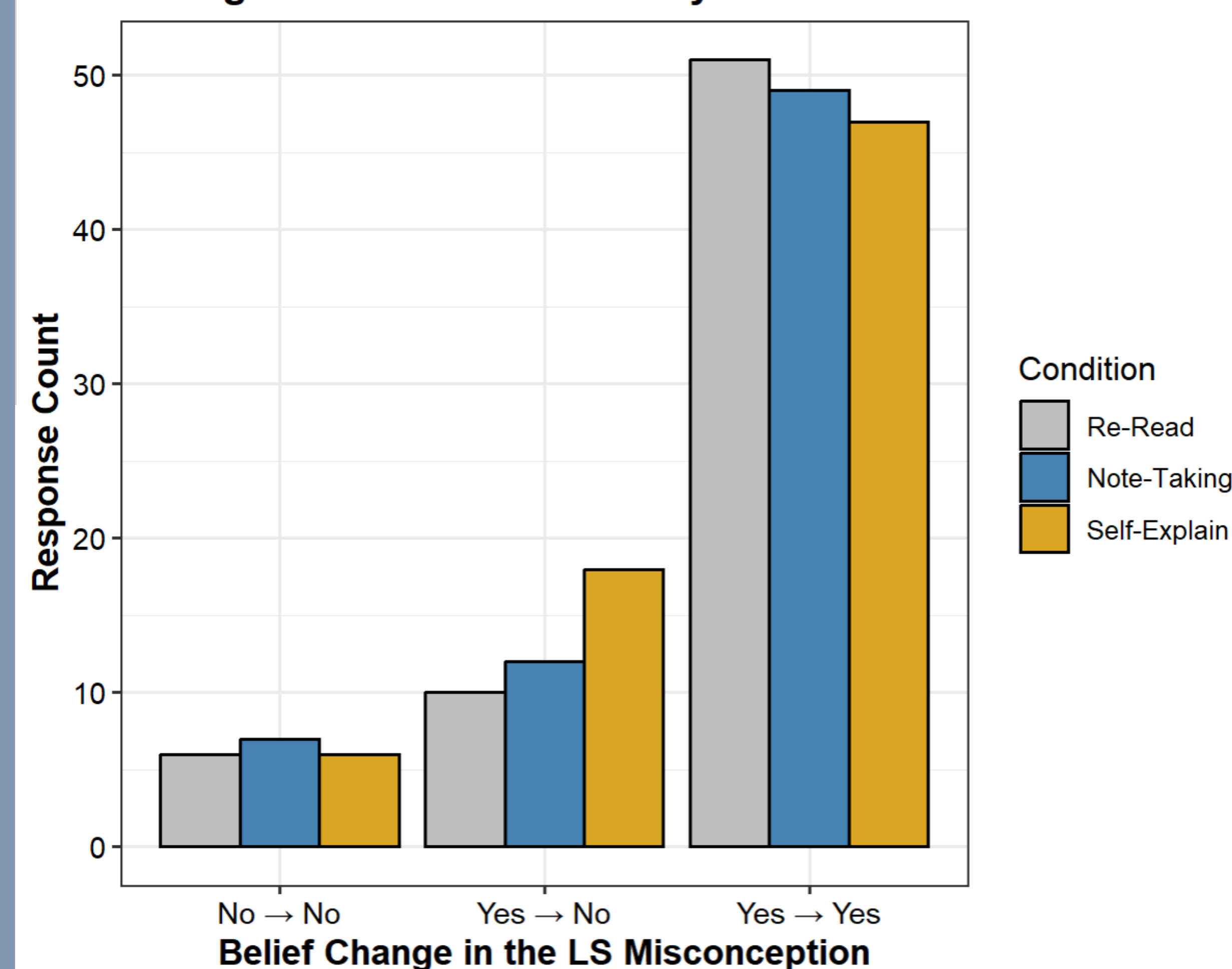
Mean Change of Belief Strength in LS by Condition



One-Way ANOVA
There was not a significant effect of instruction prompt on change in belief strength in LS ($\alpha = .05$) for three conditions [$F(2, 203) = 1.85$, $p = 0.16$].

*Error bars are the standard error of the mean.

Change in LS Endorsement by Condition



Pearson's Chi-squared test
There was not a significant effect of instruction prompt on the change in LS endorsement ($\alpha = 0.05$) for 3 conditions [$\chi^2(4, N = 206) = 2.712$, $p = 0.607$].

Discussion

Conclusion

- Students who **self-explained** the refutation passage showed **greater change in their endorsement** of the learning styles misconception than those who took notes or re-read the text.
- Students who **took notes** or **self-explained** the refutation text showed **greater changes in mean change in accuracy score** than those who only re-read the refutation.
- Students who **took notes** on the refutation passage expressed the **lowest** mean change in **belief strength** of the learning styles misconception.
- Findings do not support our hypotheses** because we failed to find significant effects of instructional prompt on learning and endorsement in LS.

Limitations

- Perpetual belief in unique learning styles could be due to a lack of understanding of its conceptual definition. Some students continued to describe the misconception using examples of study habits and techniques (e.g., "Pomodoro method," "trial and error," etc.).
- Students may also continue to believe in the misconception because of personal experiences regarding learning styles that goes against the refutation. When asked to report on scientific evidence of learning styles, some students answered by claiming a lack of scientific evidence, but explained their support based on experiences where perceived learning styles affected their performance in class.

Future Directions

- To address the lack of understanding of the conceptual meaning of learning styles, the study could be replicated in an in-person setting and instead have students *watch* a refutation to aid in engagement with the intervention.
- To address the limitation that students may continue to believe in the learning styles misconception based on personal experiences, other interventions could be used to enhance the benefits of refutation such as analogies, graphics, or application of what was learned to similar concepts.

References

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