



Comparing the Learning Effects of Self-Explanation in Different Modalities: Thinking, Writing, and Speaking

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BACKGROUND

Self-explanation (SE) enhances learning, but may be affected by the modality in which students explain.

SE by **speaking** triggers social involvement which leads to more elaborative processes (i.e. examples) (Lachner, et. al., 2017).

SE by **writing** helps to organize subject matter, especially in combination with drawing diagrams (Lachner, et. al., 2017, Scheiter, et. al., 2017).

SE by **thinking** is fundamental to children’s cognitive development (Vygotsky, 1962). SE by thinking is also linked to language abilities, cognitive control and flexibility, and emotional processing, but has not been compared to other SE modalities in educational settings (Cragg & Nation, 2010).

QUESTION & HYPOTHESIS

Specific Aim: Do learning outcomes differ depending on whether learners self-explain by speaking, writing, or thinking?

Hypothesis: Self-explanation modalities with overt action (writing & speaking) will lead to more learning than covert explanation (thinking).

PARTICIPANTS & DESIGN

414 undergraduates recruited through SONA

IV = Self-explanation modality (within subj)

- Thinking silently in one’s head
- Writing (typing)
- Speaking out loud

** Order was fully counterbalanced

DV = Improvement score from pre- to posttest

- 10 item multiple-choice and true/false quiz

MATERIALS

Participants read three scientific passages and explained them back to themselves by writing, talking out loud, and thinking silently, in a within-subjects design.

- Passage 1: What causes the phases of the moon
- Passage 2: Why space is not “zero gravity”
- Passage 3: What causes the seasons to change

Self-explanation prompts:

- Thinking:** “Please *silently think to yourself* an explanation of your understanding from the text of [why there are different phases of the moon] and how it works.”
- Writing:** “Please *write out (by typing in the box provided below)* an explanation of your understanding from the text of [why there are different phases of the moon] and how it works.”
- Speaking:** “Please *talk out loud to yourself* an explanation of your understanding from the text of [why there are different phases of the moon] and how it works.”

**Required to spend minimum 1 minute and maximum 3 minutes explaining
**Rated comfort and engagement with all 3 self-explanation exercises

RESULTS

- Improvement was not significantly predicted by self-explanation modality (**Fig 1**)
- Comfort ($F(2,754)=145.5, p<0.001$) and engagement ($F(2,754)=33.44, p<0.001$) differed significantly across modalities
- Improvement was significantly predicted by both comfort ($F(1,755)=11.72, p<0.001$) and engagement ($F(1,376)=21.83, p<0.001$)
- Controlling for comfort and engagement revealed a non-significant trend in which speaking lead to most improvement and thinking lead to least (**Fig 2**)

Figure 1: Improvement Scores by Modality
 $F(1, 754) = 0.148, p = 0.862$

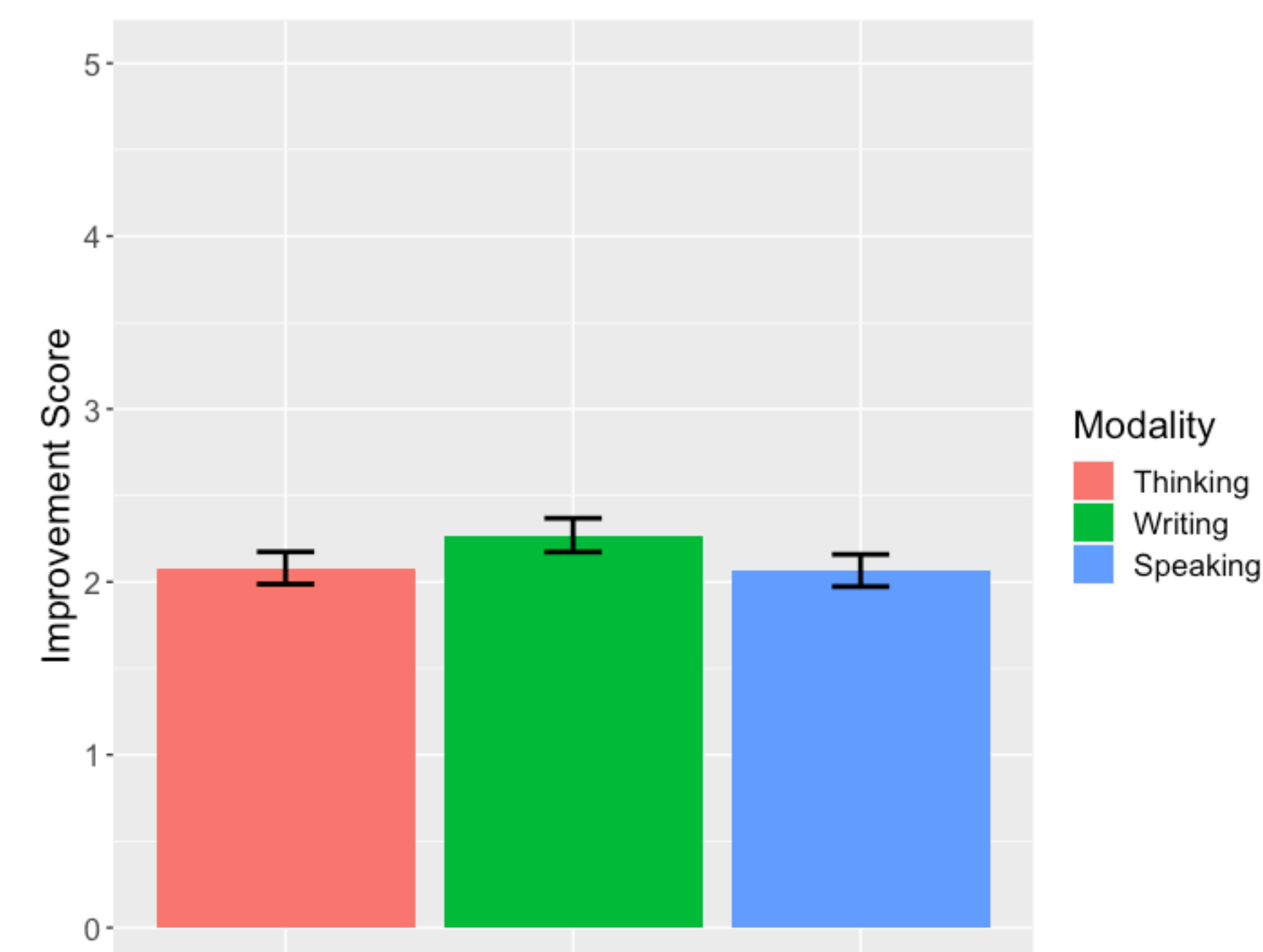
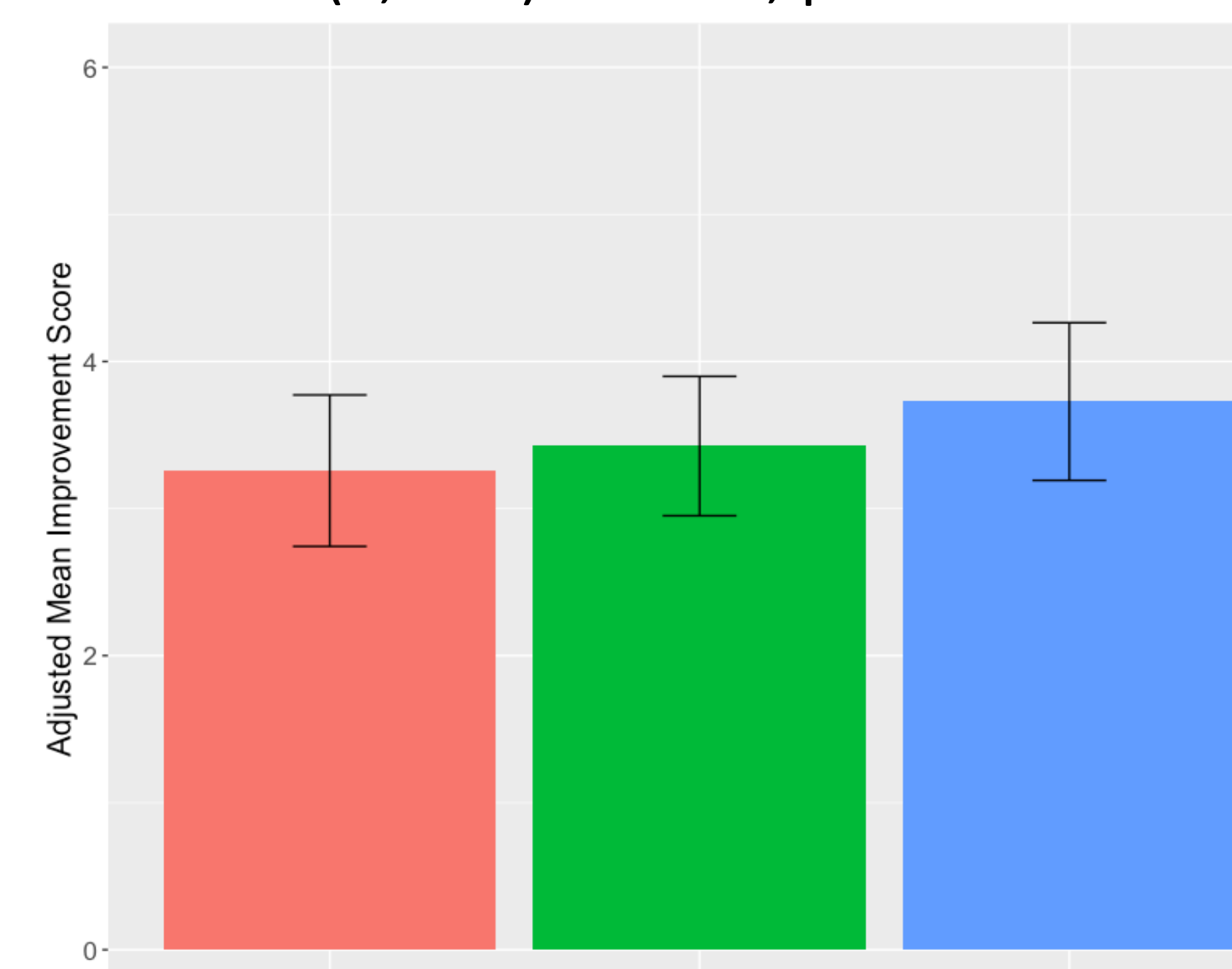


Figure 2: Adjusted Improvement Scores Controlling for Comfort and Engagement
 $F(1, 752) = 1.889, p = 0.152$



CONCLUSIONS

Self-explanation can help with memory retention and does not significantly differ across modalities.

This may be a person-to-person experience, such that comfort and engagement levels during self-explanation can each play an individual role in how impactful the self-explanation exercise is for learning.

Controlling for differences in comfort and engagement did reveal the expected trend, but was not enough to suggest the effect of modality is reliable.

LIMITATIONS & FUTURE DIRECTIONS

- Limitations**
- Study conducted online – environment and focus factors not fully controlled (did exclude 0 effort and failed attention checks)
 - No direct, within-subjects control comparison
 - Potentially unmotivated sample
 - Uneven difficulty of passages
- Future Directions**
- Analyzing the *content* of the written and spoken self-explanations (word count, examples used, time, etc. as covariates)
 - Allowing participants to still have passage when they perform self-explanation exercise

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