Exploring the Potential of Integrating Physical Acting in the PAL Classroom

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Background

General and organic chemistry are information heavy classes, and the PAL model has shown to improve student performance in these classes, however physical acting may be a good addition to the learning techniques already used.

- Use of 3D models by students while observing instructors use the same 3D models in organic chemistry has shown to be helpful for student performance (Stull, Gainer, & Hegarty, 2018)
- In a PAL study, researchers tested students by having them physically demonstrate electron movement and found it had helped students stay engaged with the material and perform well when tested (Bartholomew et al., 2019)
- Particularly in STEM-fields and careers it is beneficial to develop the ability to use physical representations of concepts as a learning aid (Ferk et al., 2003, Trumbo, 2006)

<u>Literature indicates the potential advantage of implementing physical acting in STEM classrooms.</u>

Methods

In order to determine if physical acting is a learning technique that could be implemented in PAL classrooms; its effect on students' perceived retention, understanding, and confidence in course material was assessed.

- Physical acting (PA) was compared to peer teaching (PT), active recall (AR), and group worksheet (GW) techniques
- Each learning technique was focused on for one 50-minute class period
  - For PA various course relevant kinesthetic learning activities were designed by the research team and implemented
  - For AR, PT, and GW facilitators encouraged students to used the learning techniques throughout the class
- After all learning techniques were emphasized individually in class, the students took a survey with Likert scale and short answer questions
- An ANOVA was run on the data from Likert scale questions to assess if the effect of the different learning techniques were statistically different
- Open ended questions were analyzed for common themes

References

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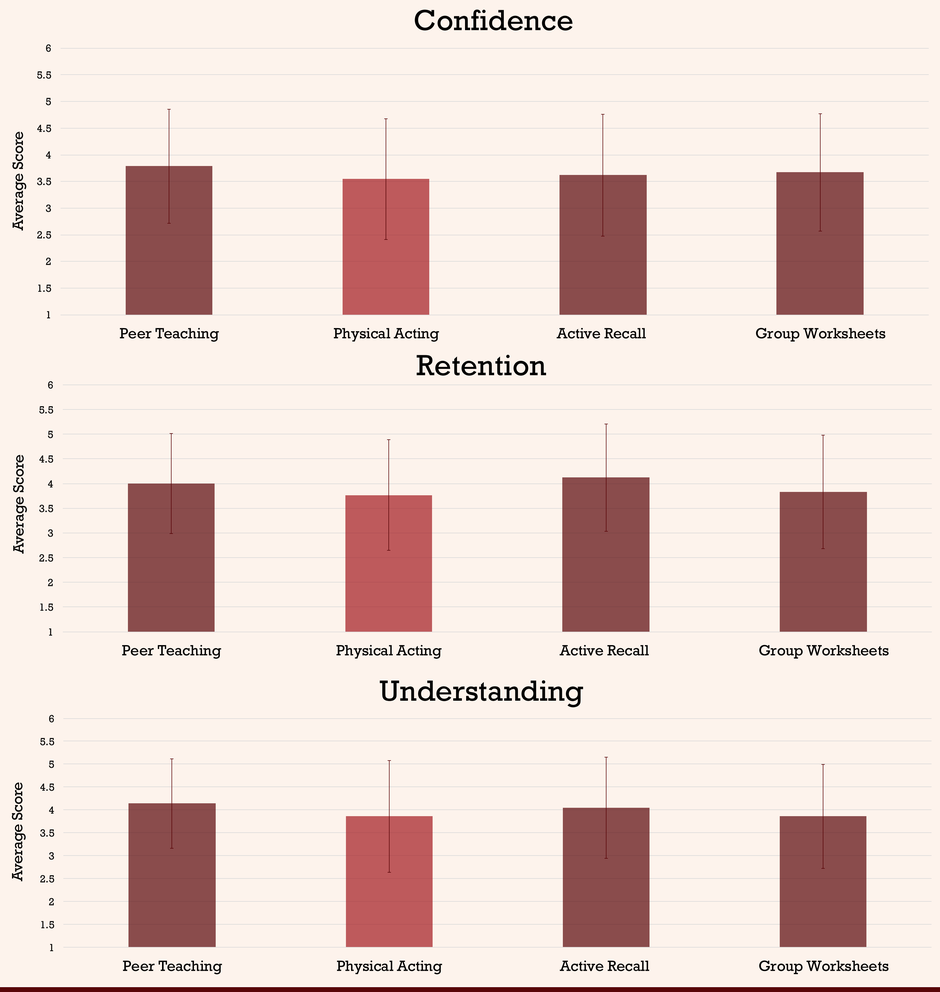
Data & Results



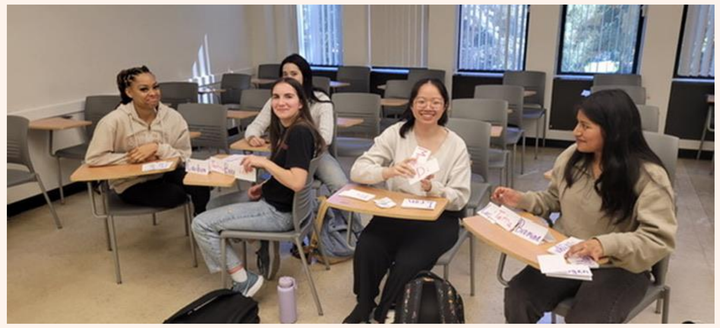
Quotes

"Group worksheets and physical acting were the ones that stood out to me because in the moment, I was thinking more about the solution and collaborating with my team to come up with an answer when I didn't understand the question."

"I really enjoyed the physical activity it was really helpful and I was able to understand so much more of the prefixes and the exceptions."

"[With] physical acting […] I was able to better visualize mechanisms and the act of actually using the magnets like moving them around and placing them on the different atoms and electrons helped me to think about and understand the mechanism more in depth."

The PAL Classroom in Action



Discussion

To better understand the effects of the four PAL learning techniques on student outcomes, our analysis examined students' feelings about the techniques in three different areas: understanding, retention, and confidence.

- We analyzed average scores across all four techniques: Peer Teaching (PT), Physical Acting (PA), Active Recall (AR), and Group Worksheets (GW), in all aspects of their personal understanding.
  - **AR received the highest average scores for understanding (M = 4.05) and retention** (M = 4.12), but PT took the lead in confidence (M = 4.14). PA received the lowest averages across all three domains, though still above the middle of the scale.
- The analysis showed no significant differences between techniques for understanding ($p = 0.559$), confidence ($p = 0.796$), or retention ($p = 0.434$), suggesting all four techniques were equally effective.
- While we were not successful in differentiating PA as a stark learning technique, **all learning techniques were equally beneficial to student learning**.
- Qualitative responses suggest that students valued AR for reinforcing memory, PT for comprehension, and PA for visualizing concepts.
- While our results were not statistically significant, it should be noted that the overall sample size was small, and it is possible that a larger size could yield different statistical outcomes.

We hope this study provides a foundation for future research into improving multimodal learning strategies, including PA, in the PAL learning model.

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