



The Use of Adjunct Questions in Multimedia Learning

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Background & Hypotheses

The benefits of adjunct questions have been studied extensively in the context of text based learning (e.g. Rothkopf, 1966; Hamilton, 1985; Hamaker, 1986) but little research has evaluated their effectiveness for multimedia learning.

Multimedia learning involves the simultaneous presentation of words and pictures (Mayer, 2003). The assumptions outlined in Richard Mayer's Cognitive Theory of Multimedia Learning state that: 1) separate channels are used to process visual and verbal information, 2) each channel is limited in the amount of information it can process at one time, and 3) that active learning (as opposed to passive learning) must take place in order for meaningful learning to occur.

When considering this theory, in conjunction with existing research that demonstrates the positive effects that adjunct questions have on both text based and multimedia learning (Smith et al., 2016 ; Valdez 2013), there is good reason to suspect that incorporating adjunct questions into a video lesson would positively influence learning as well.

In this study, we investigated whether inserting adjunct questions into a video lesson on the muscle stretch reflex can improve retention and transfer of key ideas relative to a video with no adjunct questions. Additionally, we manipulated the question format (multiple choice vs. open response) and placement (immediately before or after the answer is presented in the lesson), to determine whether certain types of adjunct questions are more effective than others.

We hypothesized that the inclusion of adjunct questions (of any type or placement) during the video lesson would lead to improved performance relative to the control condition.

Design and Procedure

This study utilized a 2x2 factorial design, with two levels for question placement (interspersed pre-questions and interspersed post questions), and two levels for question format (multiple choice and free response) There was one additional control condition with no adjunct questions. Participants were randomly assigned to one of the 5 conditions.

		Question Placement	
		Pre-answer	Post-answer
Question Format	Multiple Choice	n = 21	n = 22
	Open Response	n = 22	n = 21

Control: n = 20

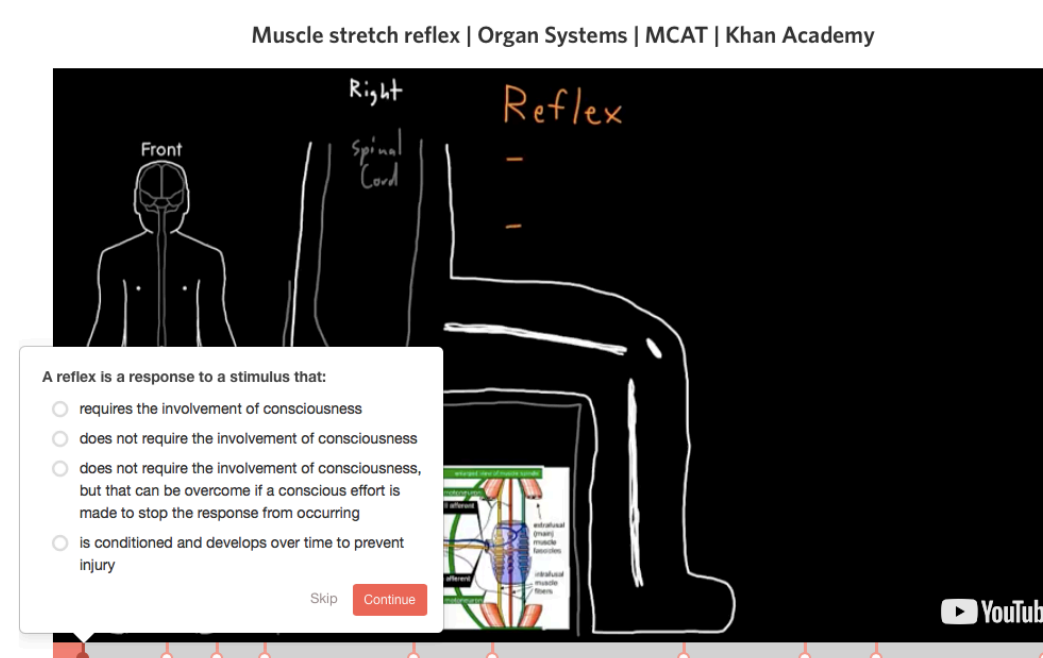
All participants completed the study on desktop iMacs in a laboratory located at the University of California, San Diego. The study was administered via a Qualtrics survey link and adjunct questions were inserted into the video lesson using a free, online platform called Vizia. Following completion of the video, participants were asked to complete a post video learning assessment.

Materials

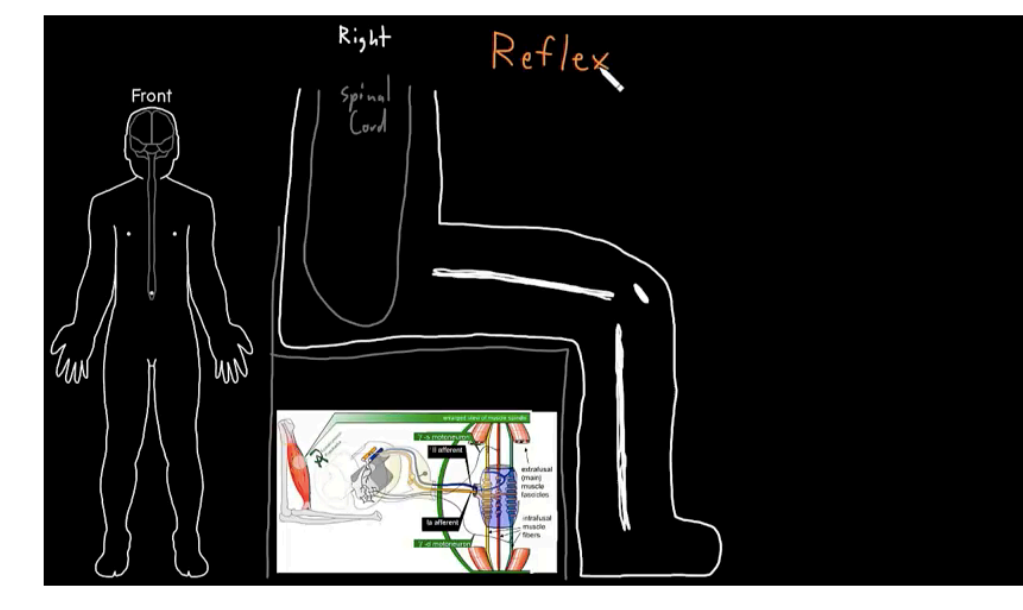
Video Lesson and Inserted Adjunct Questions:

A Khan Academy video on the Muscle Stretch Reflex was used for the video lesson portion of the experiment. The video was 9 minutes and 34 seconds long and discussed the neural components of the stretch reflex and knee jerk reflex circuits. Adjunct questions were inserted throughout the video using an online tool called Vizia.

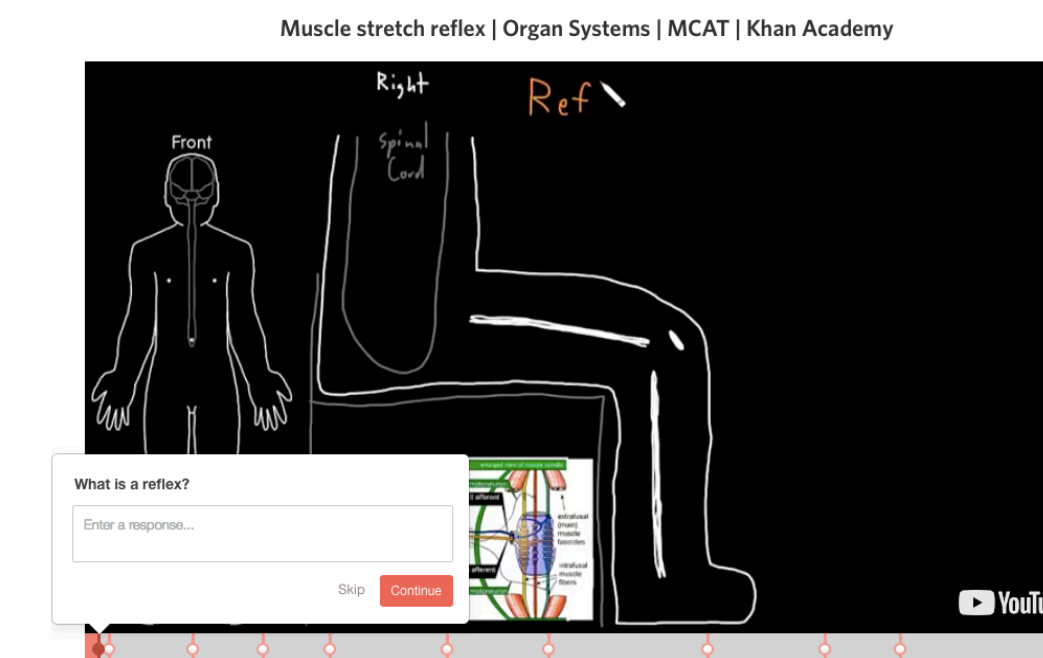
Multiple Choice Questions



Control (no questions)



Free Response Questions



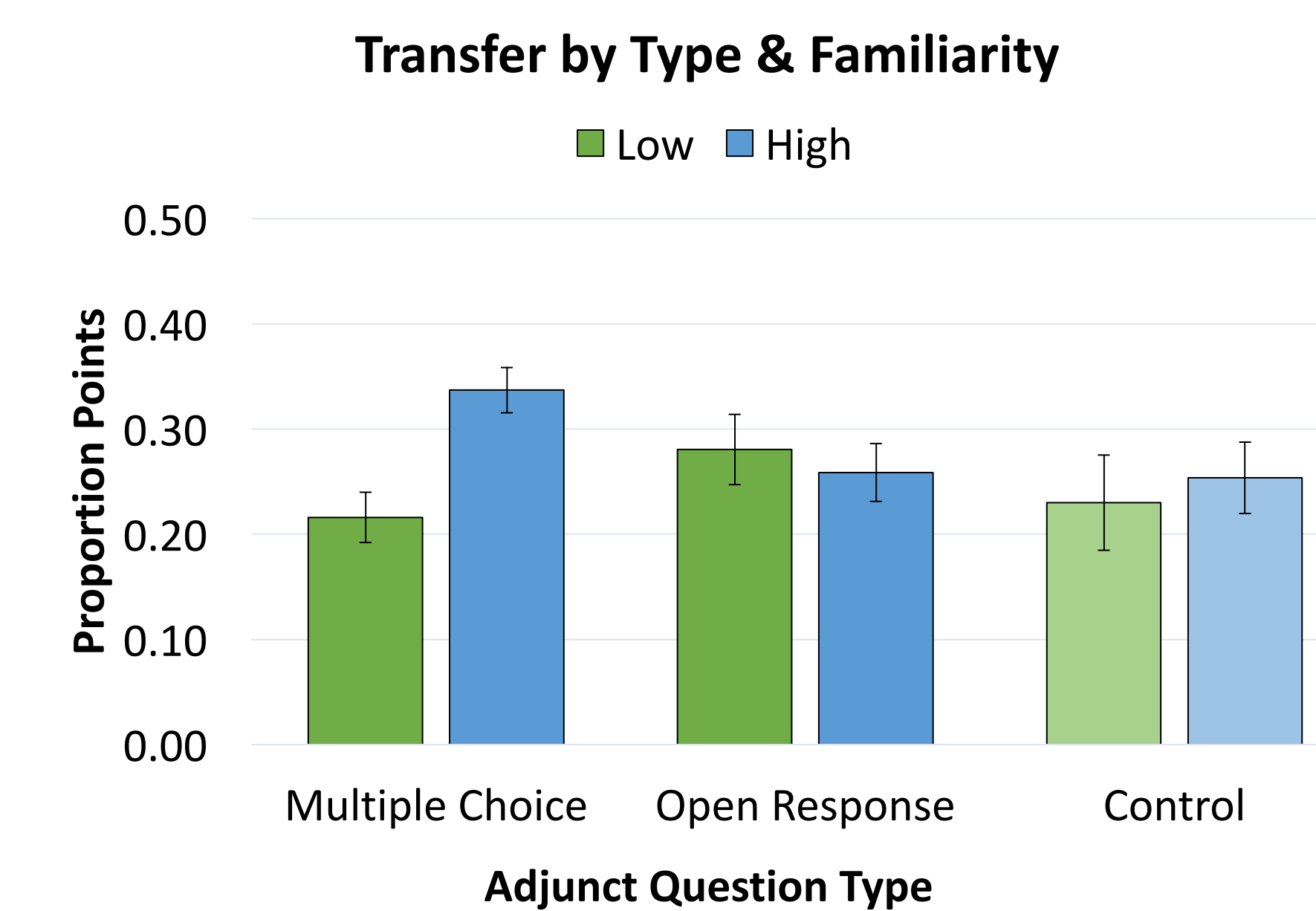
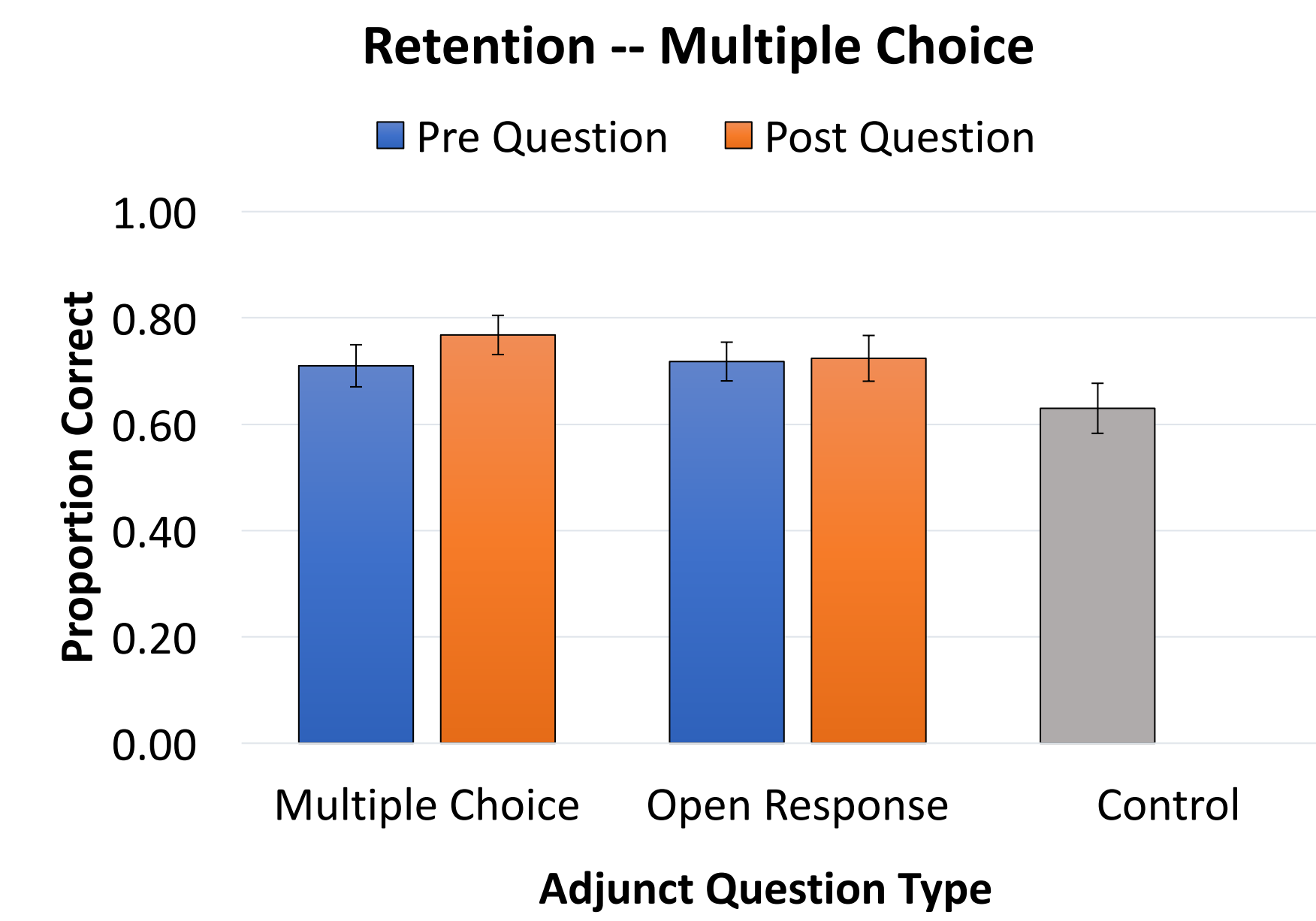
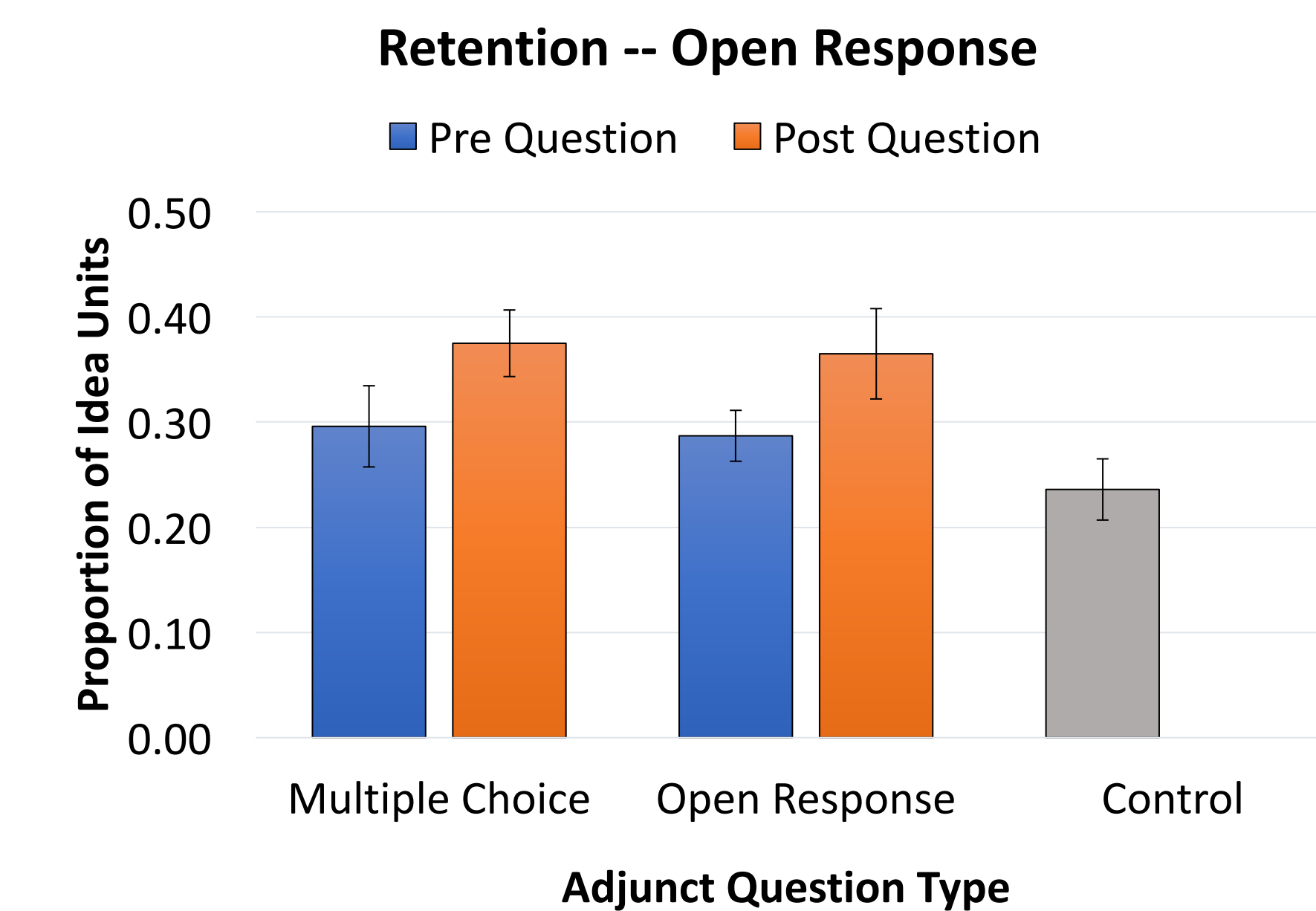
Post Video Learning Assessment (15 total questions)

1 Free Response Retention Question : "Please Describe in as much detail as you can, everything you now know about the muscle stretch reflex and the knee jerk reflex. Include any information directly from the video and/or any questions you were asked during the video. Feel free to write in full sentences/paragraphs or write it down in bullet points. Do your best to identify any terms, ideas, processes, or other information that you learned during the video and questions."

10 Multiple Choice Retention Questions yoked to adjunct questions in the video

4 Free Response Transfer Questions one explanation, one troubleshooting, one prediction, and one redesign question

Results



For the retention score, we found a significant main effect of question placement ($F(1,77) = 4.28, p = 0.042$) for the open response score but not for the multiple choice score. No other main effects or interactions reached statistical significance ($p > 0.05$).

For the transfer score, we found a significant main effect of familiarity ($F(1,77) = 6.76, p = 0.011$) and a significant interaction between familiarity and question type ($F(1,77) = 7.96, p = 0.006$), but there was no significant effect of question placement ($F(1,77) = 1.96, p > 0.05$) and no other significant interactions (all $p > 0.05$).

Conclusion and Discussion

Overall, we found that post questions improved learning relative to pre-questions, and that there was no effect of question type on retention. However, multiple choice questions did improve transfer performance, but only for those who had some familiarity with the subject.

These results suggest that:

- 1) Using adjunct questions (regardless of placement or type) is more beneficial to learning than not using questions
- 2) Post questions are more helpful than pre questions overall
- 3) The most beneficial type of question to ask (multiple choice or free response) may depend on prior knowledge and familiarity

Future Directions

Explore the use of massed pre questions and massed post questions on multimedia learning.

Further investigate the specific relationship between topic familiarity and question type.

Assess the use of adjunct questions in multimedia learning for a variety of topics (math, science, etc.)

References

Hamaker, C. (1986). The effects of adjunct questions on prose learning. *Review of Educational Research, 56*(2), 212-242.

Hamilton, R. J. (1985). A framework for the evaluation of the effectiveness of adjunct questions and objectives. *Review of Educational Research, 55*(1), 47-85.

Mayer, R. E. (2003). The promise of multimedia learning: using the same instructional design methods across different media. *Learning and Instruction, 13*(2), 125-139.

Rothkopf, E. Z. (1966). Learning from written instructive materials: An exploration of the control of inspection behavior by test-like events. *American Educational Research Journal, 3*(4), 241-249.

Smith, M. A., Blunt, J. R., Whiffen, J. W., & Karpicke, J. D. (2016). Does Providing Prompts During Retrieval Practice Improve Learning? *Applied Cognitive Psychology, 30*(4), 544-553.

Valdez, A. (2013). Multimedia learning from PowerPoint: Use of adjunct questions. *Psychology Journal, 10*(1), 35-44