Climate Crisis Learning Through Scaffolded Instructional Tools

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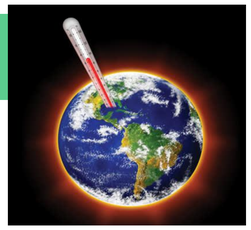

Background

- Autonomy-supportive may promote students' learning and agency about socioscientific topics (Patall, 2019; Zangori et al., 2017).
- Yet, learning about socioscientific issues may be challenging for students because they are often controversial and complex (Sinatra & Lombardi, 2020).
- Instructional scaffolding may facilitate students' learning about controversial and complex socioscientific topics and help them to think more scientifically (Bailey et al., 2018).

Purpose and Research Questions

- **Model-Evidence Link** (**MEL**) scaffolds can facilitate students' scientific evaluations about the connection between evidence and alternative explanatory models (Lombardi et al., 2018).
- More critical evaluations can shift students toward more scientific judgments and deeper learning (Lombardi et al., 2016).
- The purpose of the present study was to compare the effectiveness of two types of MEL scaffolds:
  a) build-a-MEL (baMEL; more autonomy supportive), and
  b) preconstructed MEL (pcMEL; less autonomy supportive).
- **Research Question:**
  How do students' plausibility judgments and knowledge change over the course of these two instructional treatments (pcMEL and baMEL)?

Methods

- Participants ($N = 171$) were mostly White (71%) secondary students from two school districts in the U.S.
- Procedures
  - We measured model plausibility pre and post activity per the procedures outlines in Medrano et al. (2020).
  - Scientific topics: climate change (pcMEL) & extreme weather (baMEL)

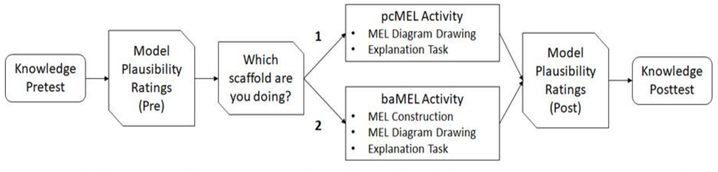

Figure 1. Schematic of the study procedures. Plausibility judgements were measured pre and post activity, and we embedded within the instructional tasks. Knowledge was surveyed just prior to beginning the activities and immediately after the activities. Instruction took ~90 minutes for each activity.

Materials

- The **Climate Change pcMEL** is about causes of current climate change, where students are presented 4 lines of scientific evidence and 2 explanatory models (scientific and a non-scientific alternative).

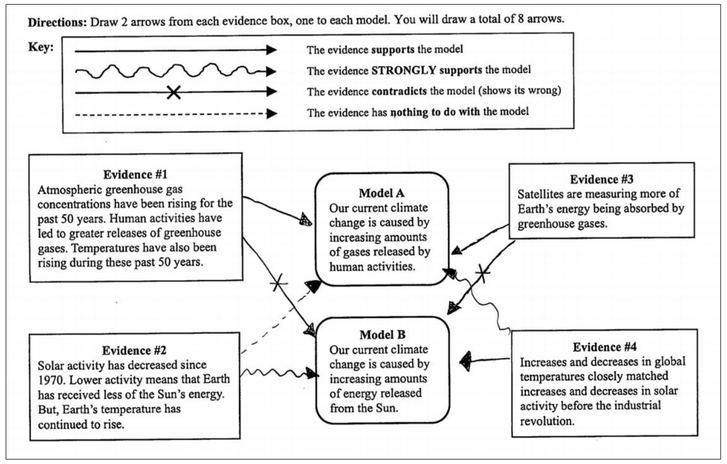

Figure 2. Student example of the Climate Change pcMEL.

- The **Extreme Weather baMEL** is about extreme weather events and climate change, where students constructed their own diagram selecting 4 lines of scientific evidence (from 8 possible choices) and 2 explanatory models (from 3 possible choices).

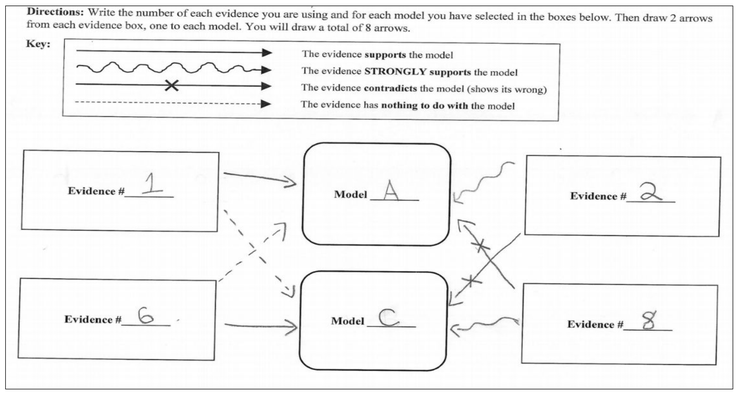

Figure 3. Student example of the Extreme Weather baMEL.

Acknowledgements

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Results

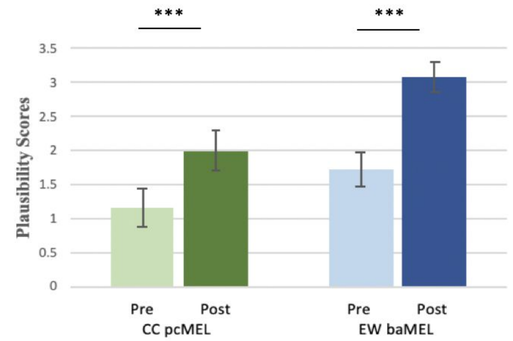

Figure 4. Plausibility scores for each instructional treatment. Range 1 (highly implausible) – 9 (highly plausible). Errors bars indicate ±1 standard error. Asterisks indicate a statistically significant difference between pre- and post-instruction, ***$p < 0.01$.

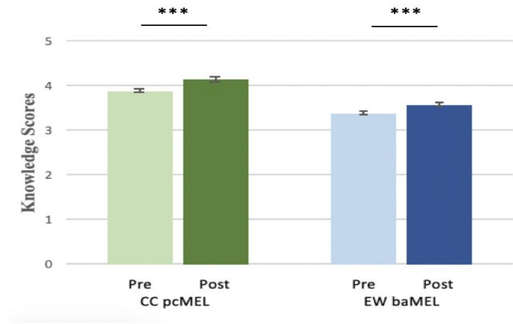

Figure 5. Knowledge scores for each instructional treatment. Range 1 (strongly non-scientific) – 5 (strongly scientific). Error bars indicate ±1 standard error. Asterisk indicates a statistically significant difference between pre- and post-instruction, ***$p < 0.001$.

Conclusion

- Both MEL scaffolds promoted plausibility shifts toward the scientific model and deepened students' knowledge.
  - Scientific shifts had a stronger effect size for the baMEL.
- The Climate Change pcMEL may have reached "ceiling" effect, with wider acceptance of human-inducement.

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For further questions about the study and reference list, please refer to this manuscript.