

Promoting Scientific Plausibility and Knowledge Shifts Through Modeled Evaluation Activities

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BACKGROUND

- The model evidence link (MEL) project is exploring the effectiveness of scaffolds to promote students' scientific thinking when confronted with controversial and/or complex Earth and space science topics through the pre-constructed MEL (pcMEL) and the Build-a-MEL (BaMEL).
- The pcMEL presents four lines of scientific evidence with two models (scientific and non-scientific alternative).
- The BaMEL presents eight lines of scientific evidence with three models (scientific, scientific alternative and non-scientific alternative). Students will construct their own diagram selecting four evidence lines and two models.

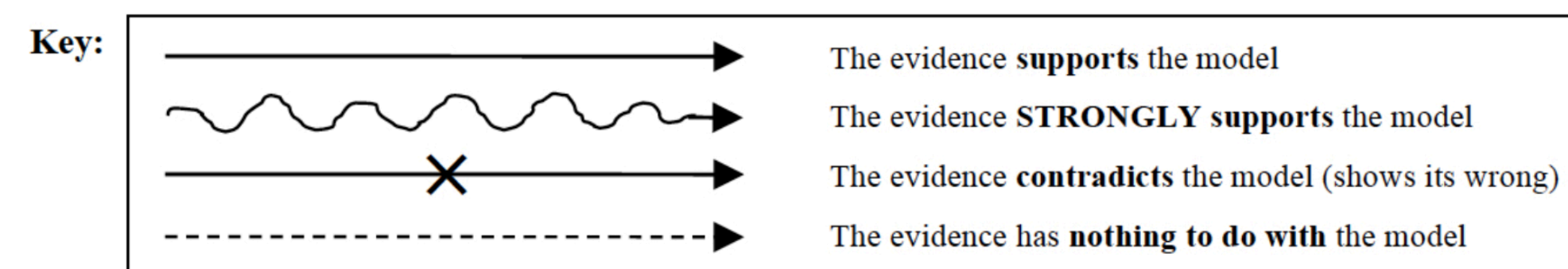
QUESTIONS

- Would the BaMEL increase conceptual agency and reveal deeper evaluations than the pcMEL?
- Would students shift their plausibility judgements towards the scientific and increase their knowledge pre - to post - instruction?
- Would outcomes differ with different classrooms/topics?

METHODS

- N = 86, Participants were enrolled in science classes in 4 schools: 2 middle schools, 1 high school and 1 university
- Tested pcMEL and BaMEL for three different phenomena: climate change, water resource availability, and astronomical origins.
- All students completed 1 pcMEL topic.

Directions: Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.



Evidence #1
 Atmospheric greenhouse gas concentrations have been rising for the past 50 years. Human activities have led to greater releases of greenhouse gases. Temperatures have also been rising during these past 50 years.

Model A
 Our current climate change is caused by increasing amounts of gases released by human activities.

Evidence #3
 Satellites are measuring more of Earth's energy being absorbed by greenhouse gases.

Evidence #2
 Solar activity has decreased since 1970. Lower activity means that Earth has received less of the Sun's energy. But, Earth's temperature has continued to rise.

Model B
 Our current climate change is caused by increasing amounts of energy released from the Sun.

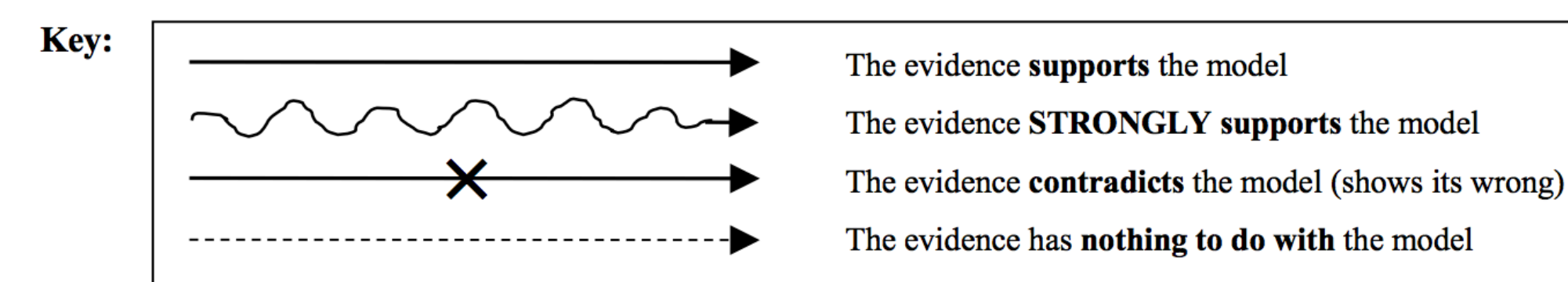
Evidence #4
 Increases and decreases in global temperatures closely matched increases and decreases in solar activity before the industrial revolution.

- All students completed 1 baMEL of the same phenomena as the pcMEL but in a different area (i.e. pcMEL - wetland resources; baMEL - freshwater availability).

Name: _____ Date: _____ Teacher: _____ Period: _____

If you worked with other students, their name(s): _____

Directions: Write the number of each evidence you are using and for each model you have selected in the boxes below. Then draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.



Evidence # _____ Model _____ Evidence # _____

Evidence # _____ Model _____ Evidence # _____

- Students completed knowledge surveys (5- 12 questions) pre - and post - instruction

Below are statements about freshwater resources. Rate the degree to which you think that hydrologists agree with these statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Water reclamation makes contaminated water safe for humans to use.	A	B	C	D	E
2. Engineers will solve current shortages of freshwater.	A	B	C	D	E

- Students completed plausibility ranking on a scale of 1 (completely implausible) to 10 (greatly plausible) pre - and post - Instruction.

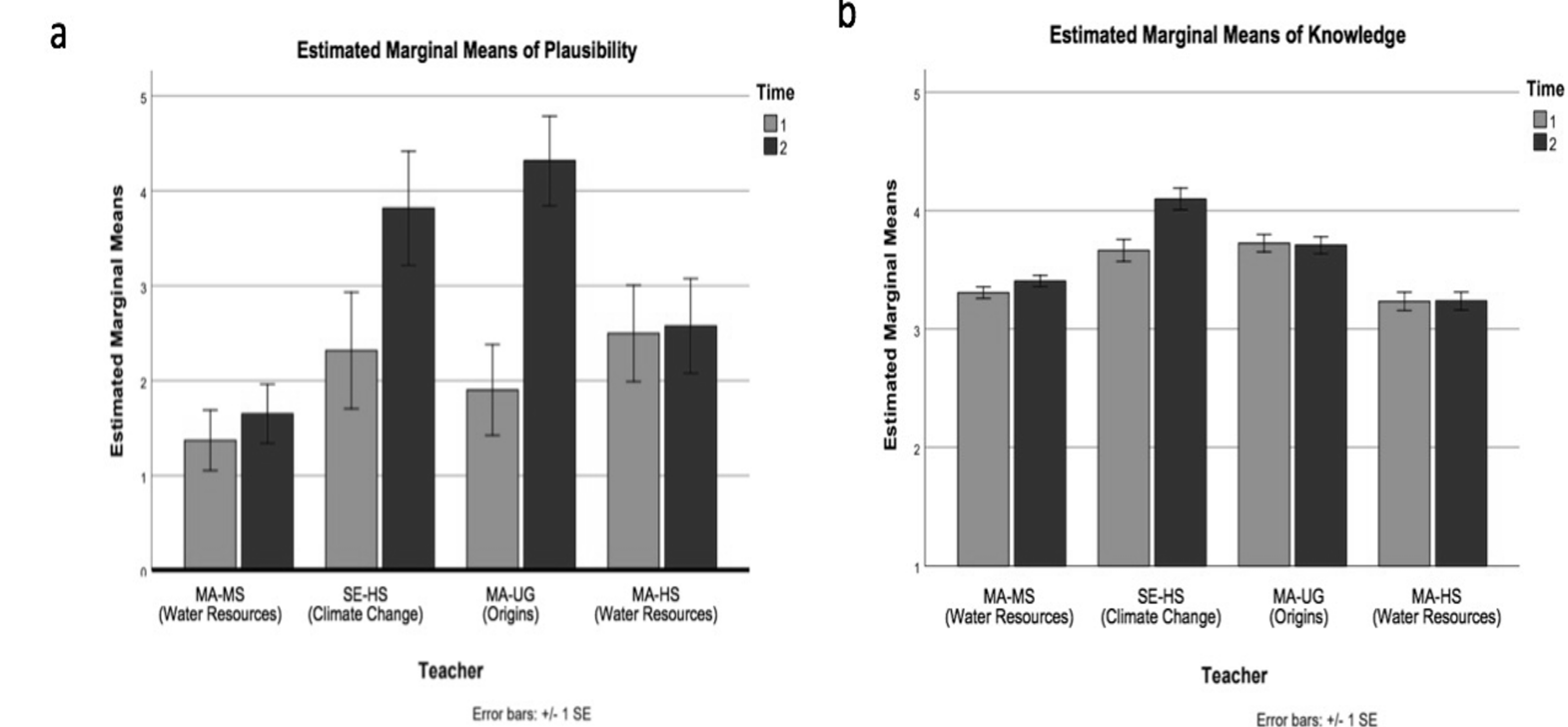
Circle the plausibility of each model. [Make two circles, one for each model.]

	1	2	3	4	5	6	7	8	9	10
Model A										
Model B										

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RESULTS

	Scaffold	Mean (Plausibility -9-+9 Knowledge 1-4)	Standard Deviation
Evaluation	pcMEL	2.23	0.80
	BaMEL	2.45	.81
Plausibility Pre	pcMEL	1.44	3.36
	BaMEL	2.19	2.29
Plausibility Post	pcMEL	2.22	3.60
	BaMEL	3.10	2.28
Knowledge Pre	pcMEL	3.45	0.66
	BaMEL	3.40	0.40
Knowledge Post	pcMEL	3.45	0.43
	BaMEL	3.60	0.55



CONCLUSIONS

- BaMEL did not result in greater evaluation scores compared to pcMEL
- BaMEL resulted in increased knowledge scores with both scaffolds shifting students plausibility toward the scientific.
- We found differences between the different classrooms/topics
 - Origins resulted in greatest plausibility shifts
 - Climate change resulted in largest knowledge changes.



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