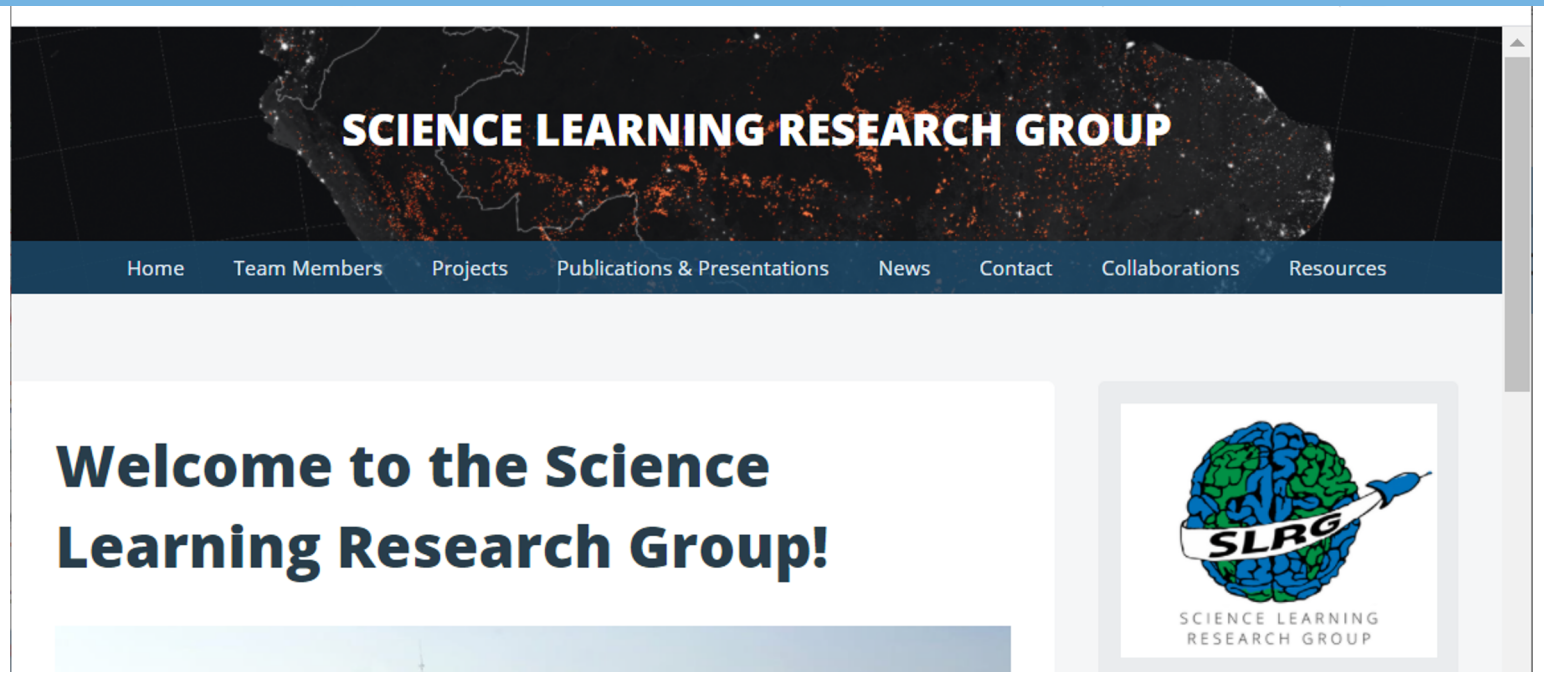
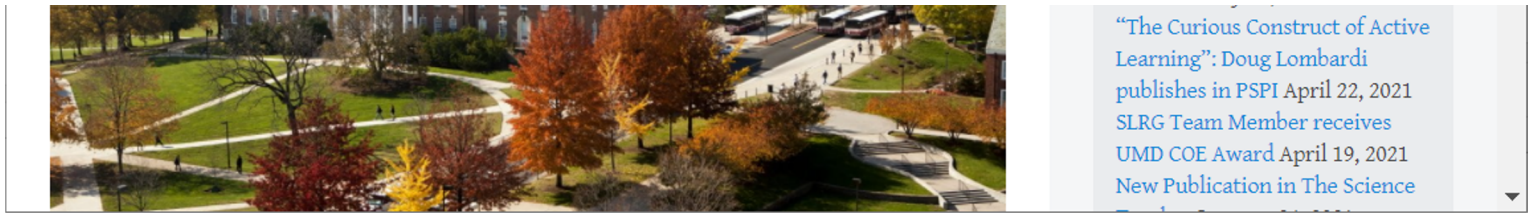
MEL Architecture
Theory to Practice

Our research team (SLRG) consists of faculty and students, working directly with teachers



SLRG is funded, in part, by the US National Science Foundation (Grant Nos. 1316057, 1640800, 1721041, and 2027376).

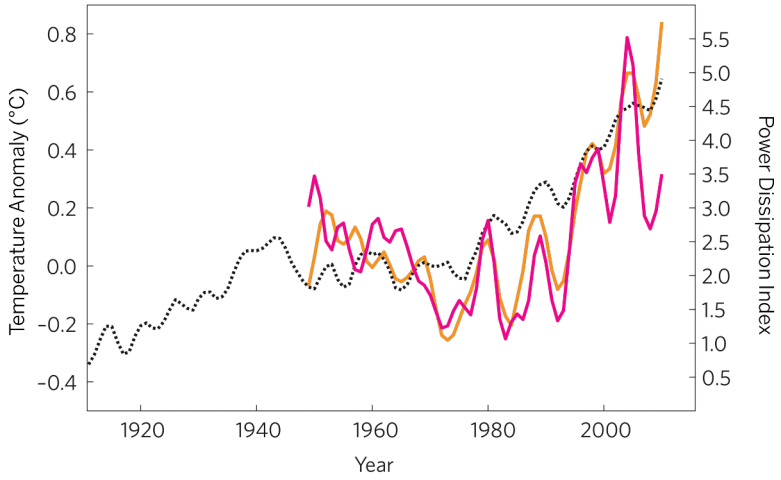


Our projects involve teachers and secondary students (*n* > 1000) in design-based and quasi-experimental research

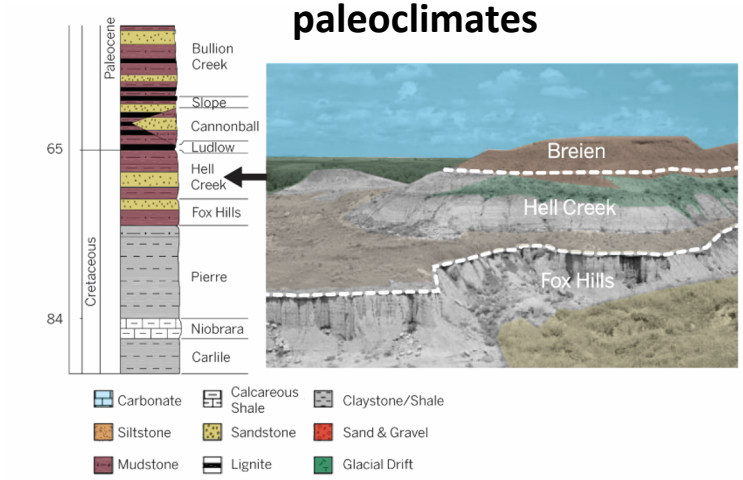
Settings include urban, suburban, and rural classrooms and schools

Our projects examine ways to facilitate teaching of scientific reasoning & deepen knowledge about socio-scientific topics

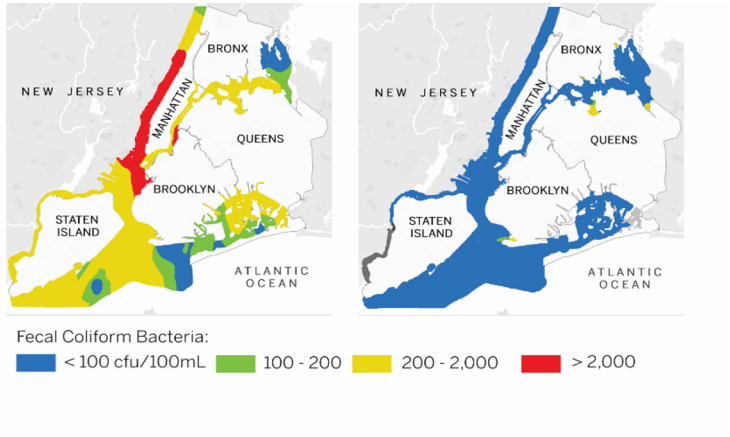
Climate change & extreme weather connections



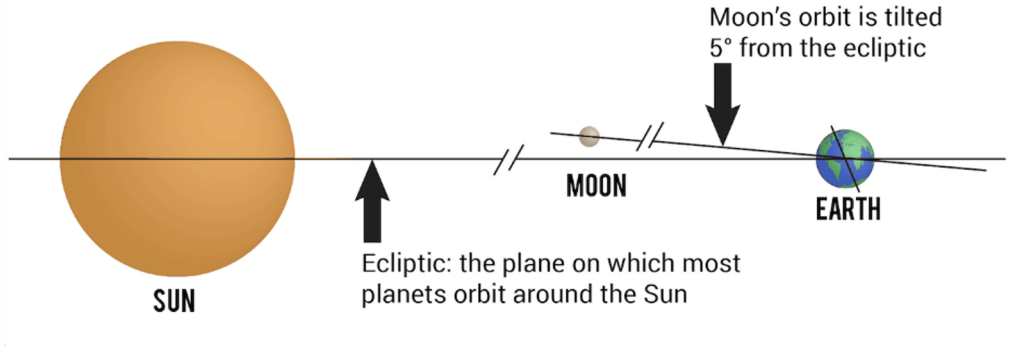
Fracking impacts, earthquakes, fossil evidence, & paleoclimates



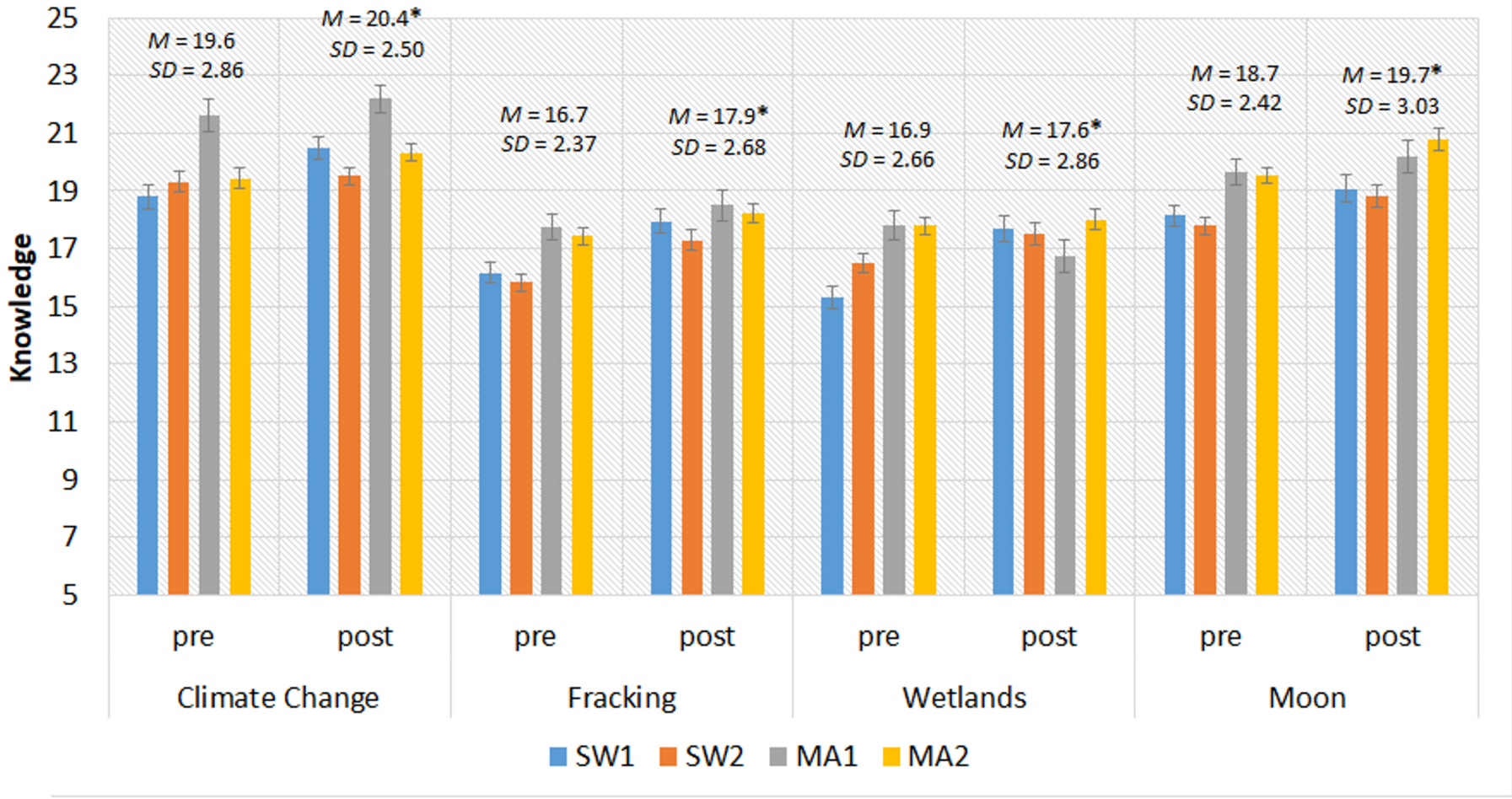
Value of wetlands & availability of freshwater resources



Formation of Earth's Moon & origins of the Universe



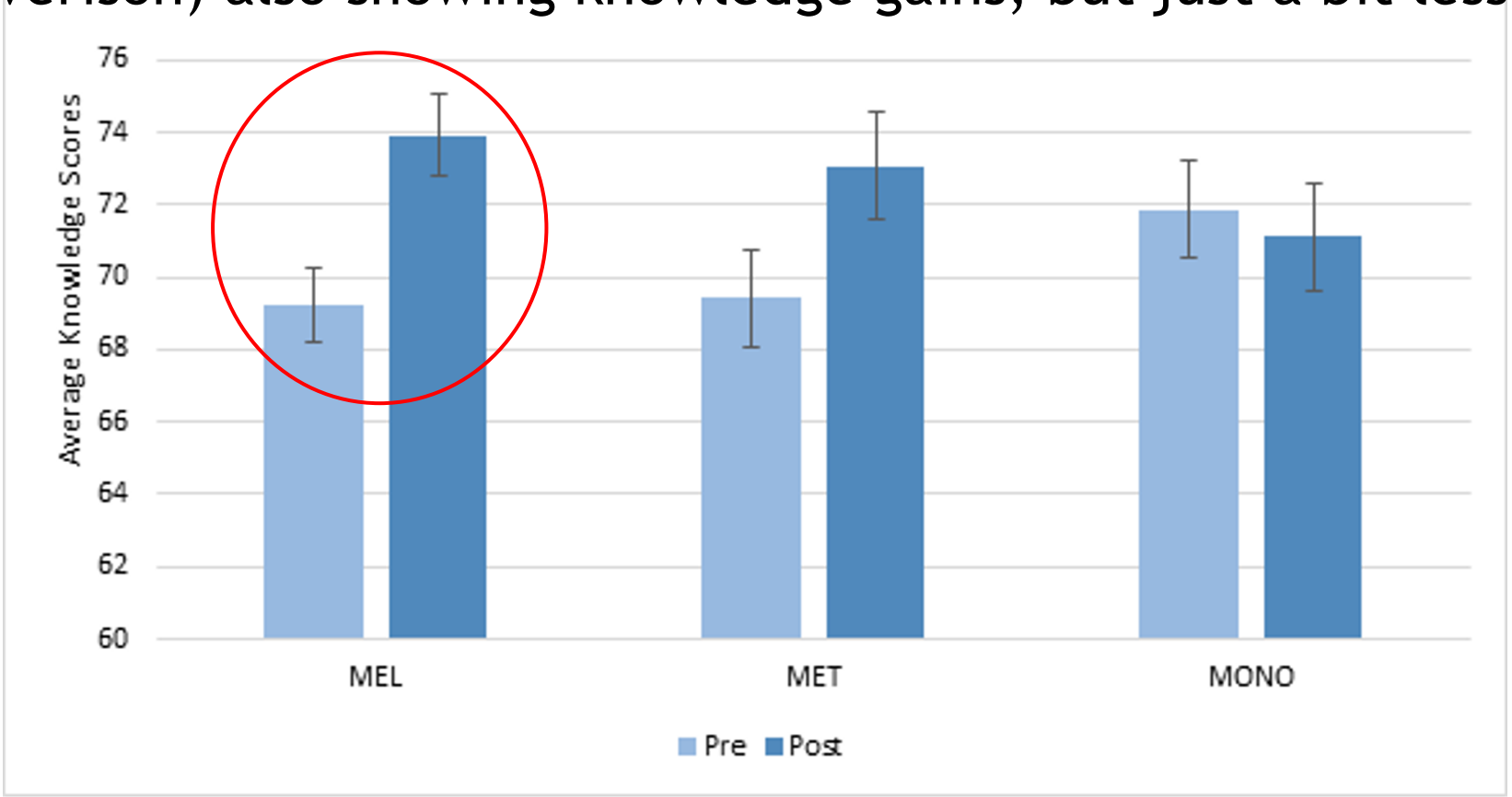
In the MEL project's first phase, students meaningfully increased their reasoning and knowledge



$F(12,546) = 15.1$, $p < .001$, $\eta_p^2 = .251$; Lombardi et al. (2018)

The MEL compared favorably to other types of instruction

The MEL resulted in ~1 letter grade increase in knowledge, with the MET (a table verison) also showing knowledge gains, but just a bit less



Lombardi et al. (2018)

However, beyond the classroom context of the MEL, students' scientific reasoning were not as promising

A person who supports recycling makes the following argument:

Recycling reduces the need for materials obtained through logging, mining, farming, and drilling. Recycling reduces the land needed for waste disposal.

- There are people who read this information one time and think the argument is correct. We call these people "first look" people.
- There are people w… people "second loo…

Your role is to be a "seco… argument again and find…

The more flaws you find, t…

In the space below, write a…

I think there is a problen…

A person who is opposed to recycling makes the following argument.

Recycling of contaminated products endangers public health. Recycling facilities consume energy and are still sources of water and air pollution.

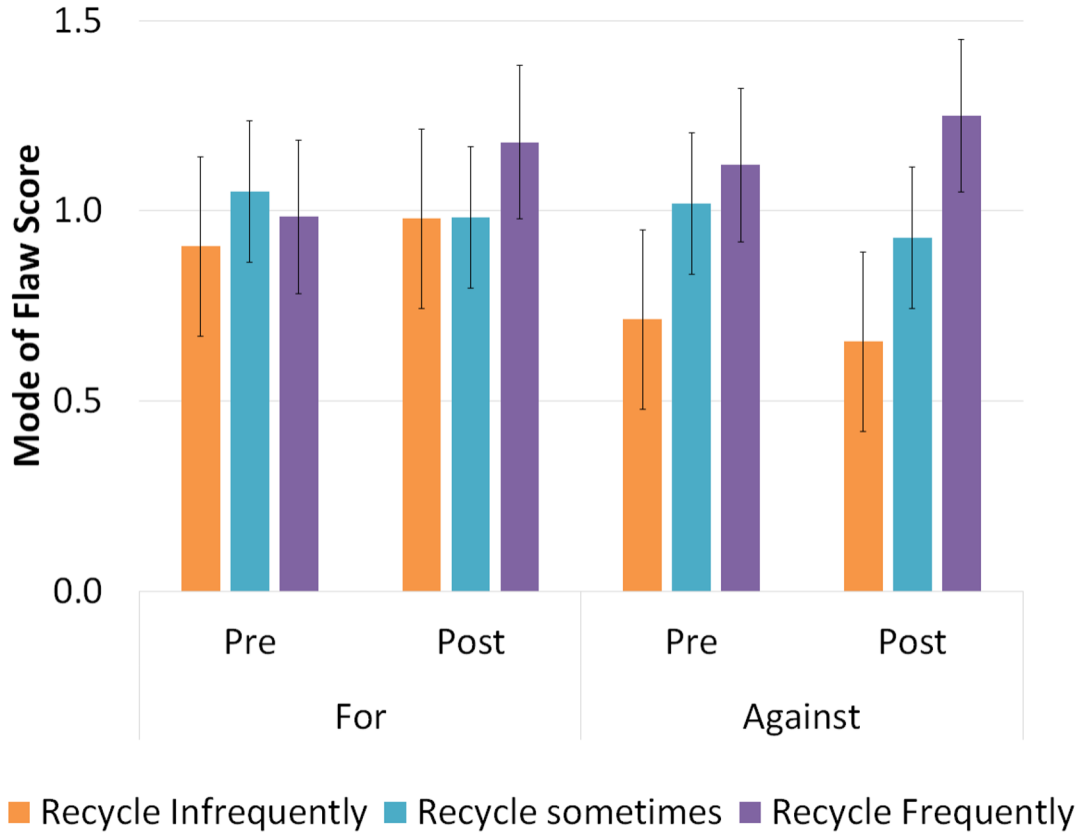
- There are people who read this information one time and think the argument is correct. We call these people "first look" people.
- There are people who after reading this again find flaws in this argument. We call these people "second look" people.

Your role is to be a "second look" person and find flaws in the argument. Read the framed argument again and find as many different flaws as you can.

The more flaws you find, the better debater you are!

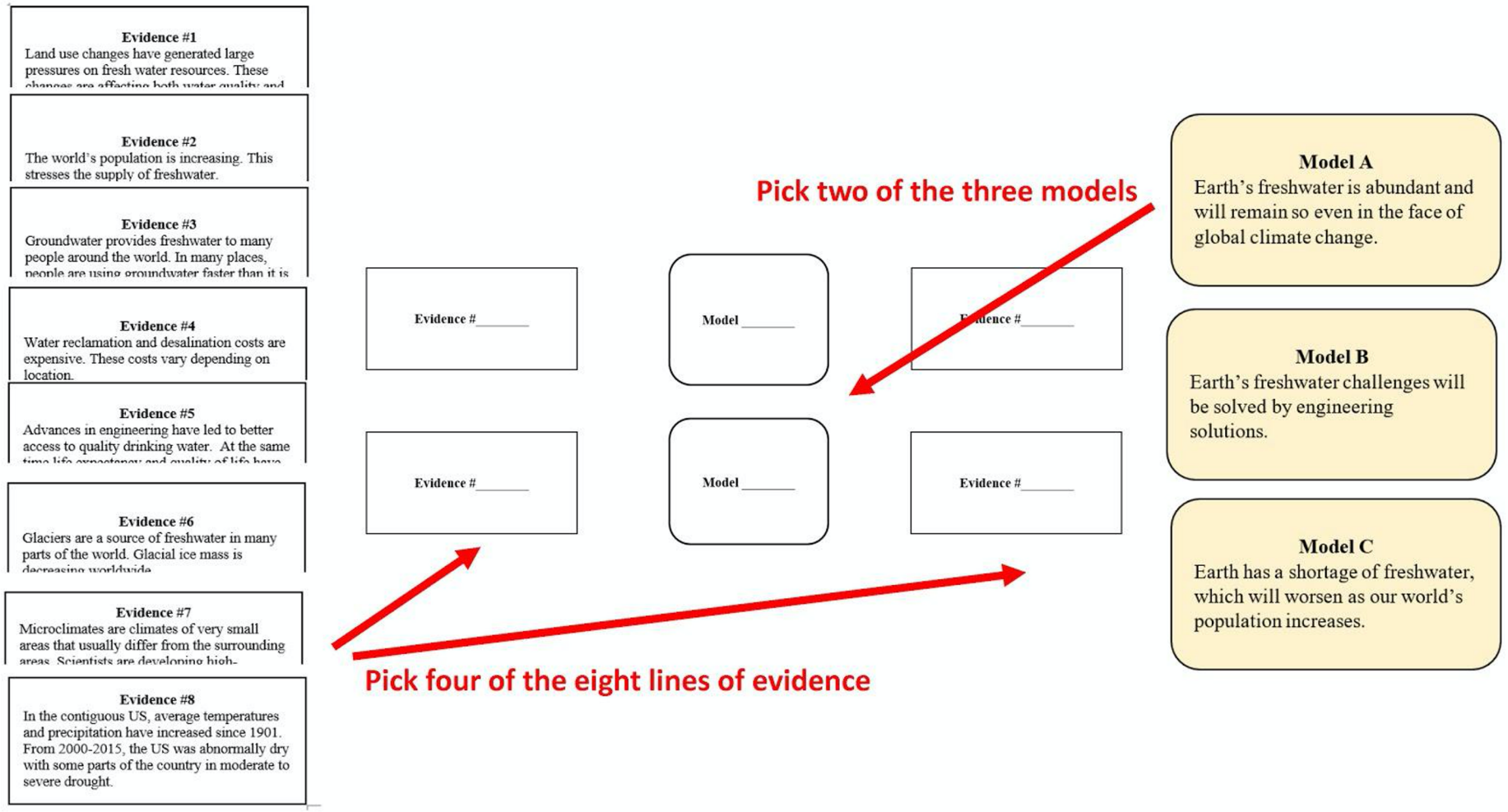
In the space below, write as many different flaws as you can.

I think there is a problem with this argument because:



Only students who recycle frequently were more scientific in their evaluations and reasoning (Burrell et al., 2016)

Would an autonomy-supportive instructional form of the MEL scaffold increase students' agency and learning?



The build-a-MEL (baMEL)

Time to pause...what questions do you have?

Any questions or comments: Please put these in the chat window

Over the past few years, we have developed the baMELs and and are observing students using them in classrooms

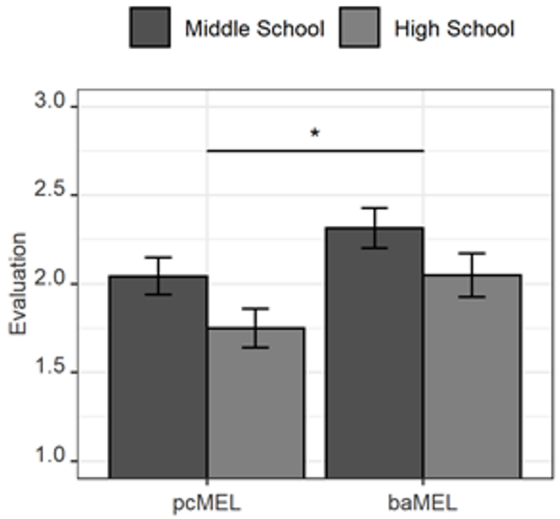
Activity	Year 1 Fall Spr Sum	Year 2 Fall Spr Sum	Year ~~3~~ Fall Spr Sum	Year ~~4~~ Fall Spr Sum
Plan & initially develop 4 new baMEL activities				
Bench & pilot testing of materials & activities				
Collect & analyze classroom artifacts & instruments from bench & pilot testing				
Summer institute GA & NJ				
Meeting of advisory panel & external evaluator to review year				
Revise 4 baMEL activities based on test data results				
Conduct 5 observations each in 10 classrooms (5 in GA & 5 in NJ)				
Follow on PD (webinars + in person meeting)				
Quasi-experimental phase of comparative effectiveness				
Collect & analyze classroom artifacts & instruments from quasi-experimental phase				
Dissemination of results, materials, & activities				

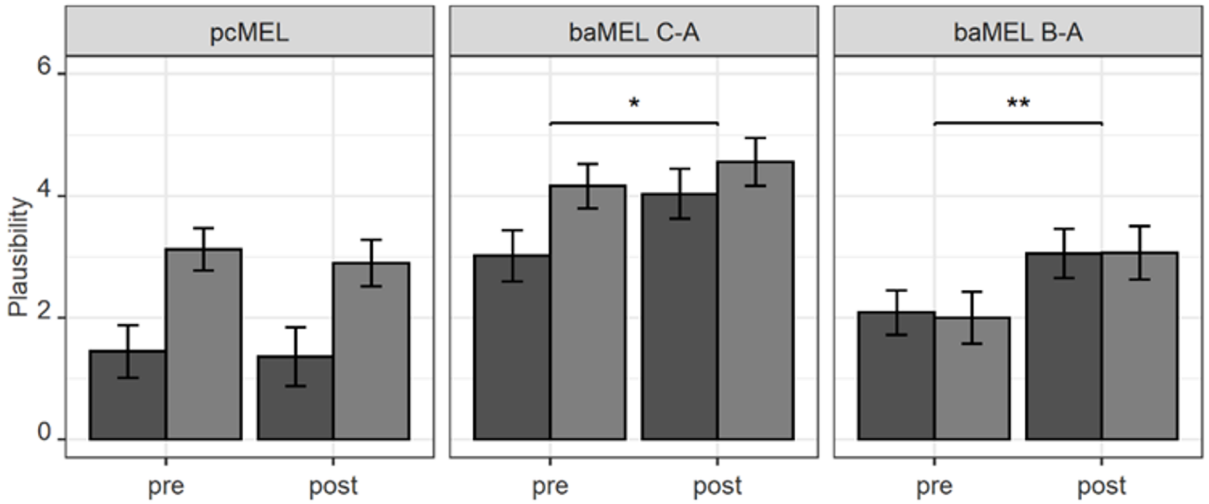
3 and 4

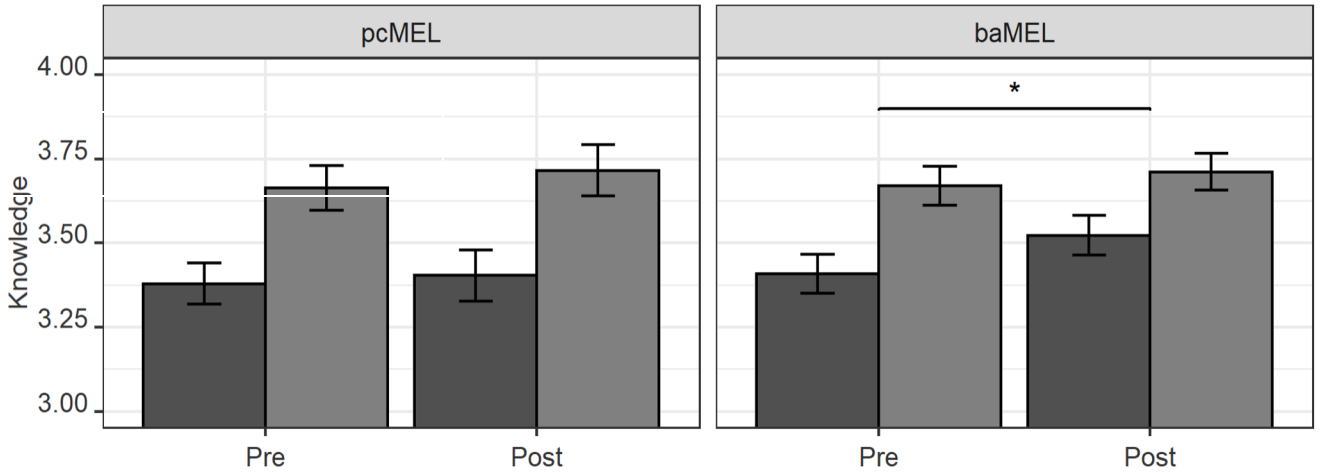
5

You Are Here!

Years 2-4 studies showed advantages for the baMEL vs. the pre-constructed MEL in scientific reasoning shifts and knowledge gains







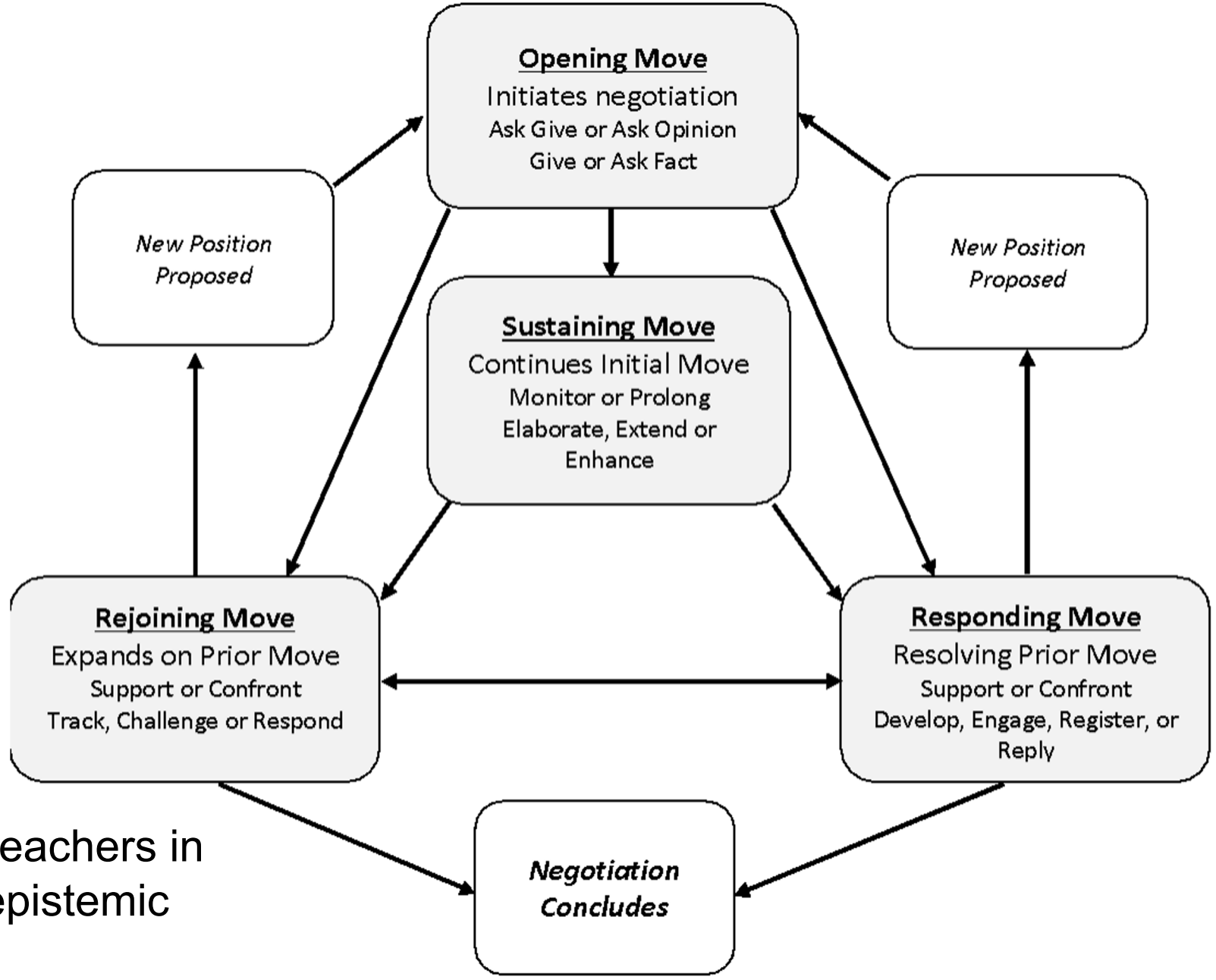
Medrano et al., 2020

Analysis of student group discussions (audio/video recordings) allow us to understand how they evaluate connections

Argumentation Sequence Excerpt		
Student	**Dialogue Turn**	**Move**
1	Well, it could contradict it by saying…	Rejoin: Confront: Challenge: Rebound
	Because to say, our current climate change is….um... caused by the Sun	Sustain: Continue: Prolong: Enhance
2	You could be saying that humans have nothing to do with it.	Respond: Confront: Challenge: Rebound
1	Yeah, that could be.	Respond: Support: Reply: Agree
	If you're taking that as almost like an absolute.	Sustain: Continue: Prolong: Enhance

Discourse analysis revealed how student group discussions led to more more scientific judgments...

…but only when consensus was reached via negotiation (Governor et al., 2021)



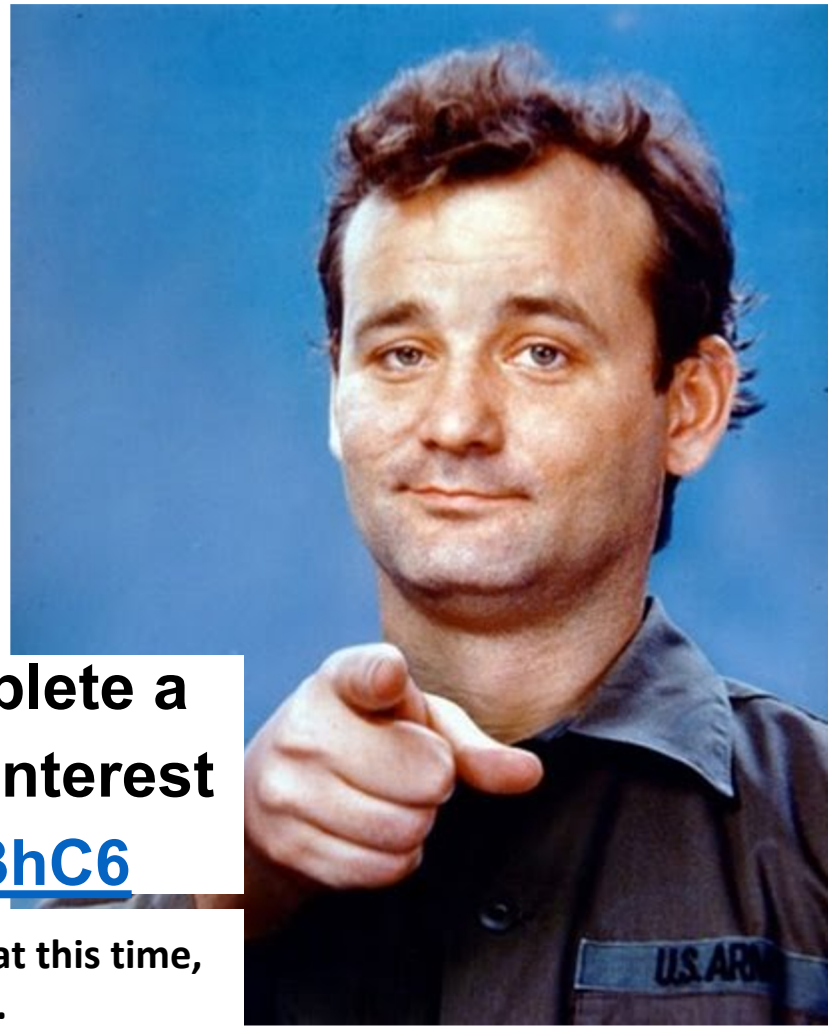
These results helped us guide teachers in how to develop their students' epistemic agency

Are you interested in you & your students being a part of next year's study?

We hope to work with a few teachers each in GA and NJ, and would visit these classrooms ~ 4 times in 2021-2022

We would collect student work after obtaining assent & consent

We would offer an extra stipend to teachers involved in the study



We would like to have all of you complete a quick survey to gauge your research interest

https://forms.gle/VbxyDWqbdh1Dr3hC6

Please note, your interest does not commit either you or us at this time, but rather helps us be more focused in our selection process.

ACKNOWLEDGEMENTS

This research project is supported by the US National Science Foundation (NSF) under Grant Nos. 1316057, 1721041, and 2027376. Any opinions, findings, conclusions, or recommendations expressed are those of the authors and do not necessarily reflect the NSF's views.