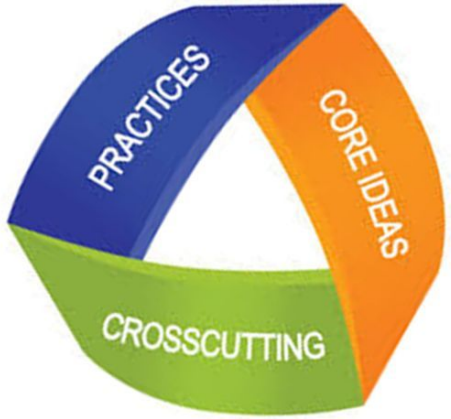
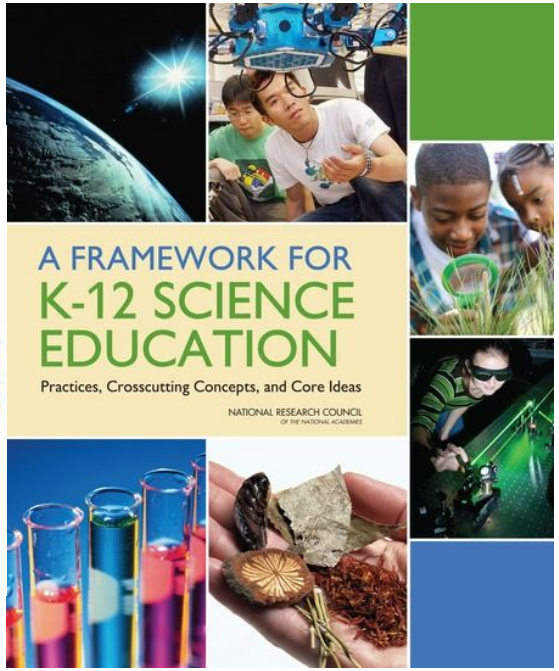
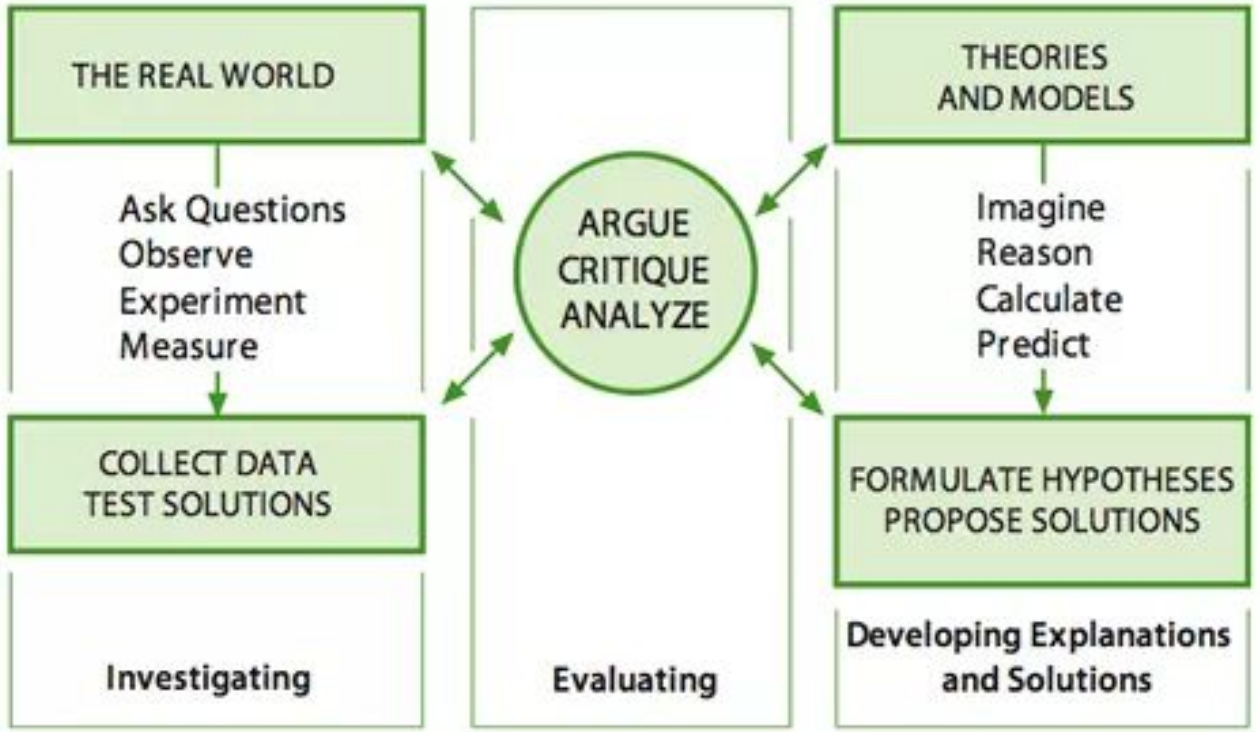
MEL Architecture
Theory to Practice

Scientific literacy involves both knowing (1) *what* scientists know and knowing (2) *how* scientists know what they know



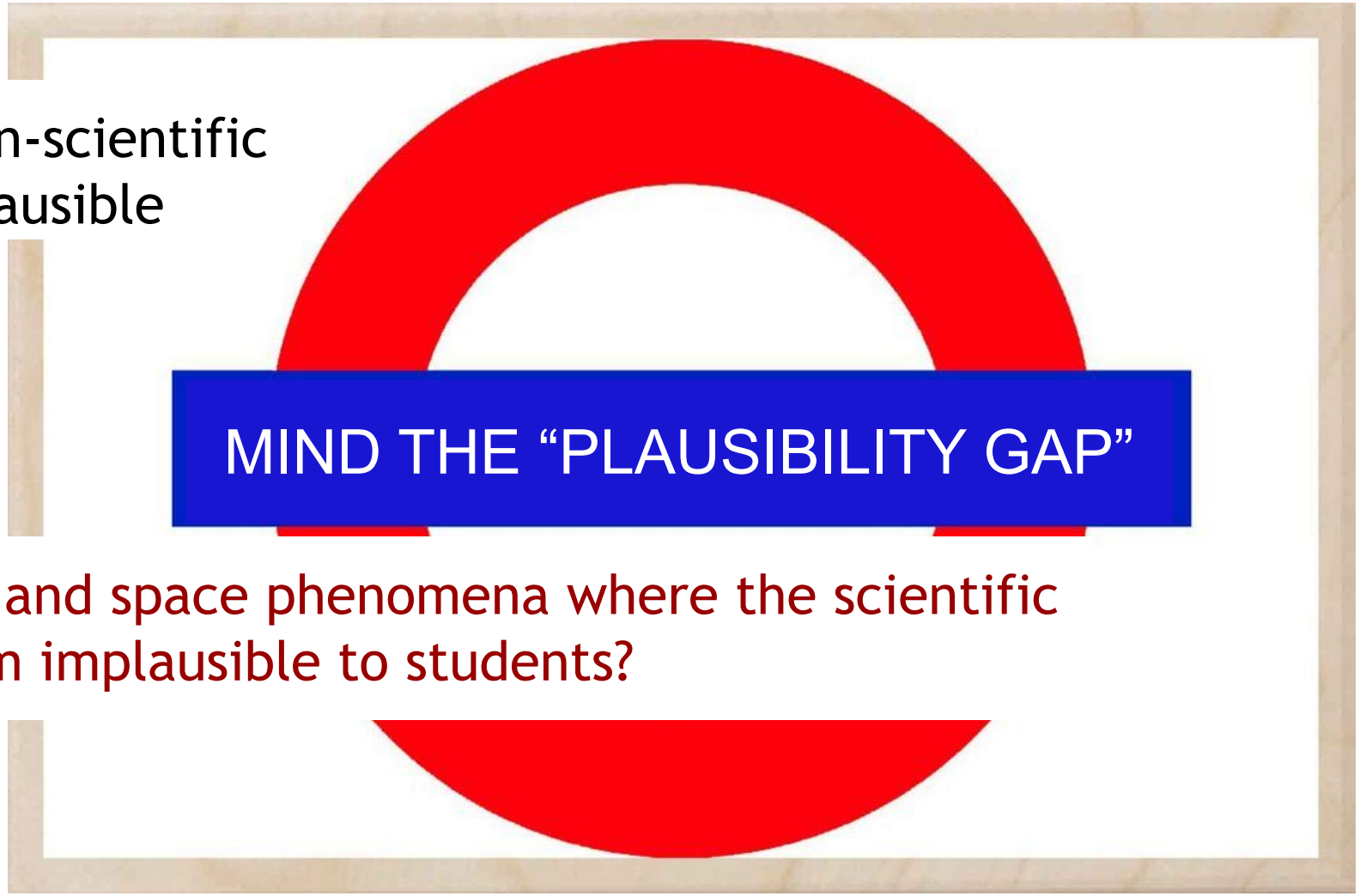




Evaluation as argument, critique, and analysis is central to scientific thinking and knowledge construction

Students may find scientific explanations (hypotheses and theories) about a phenomenon to be implausible...

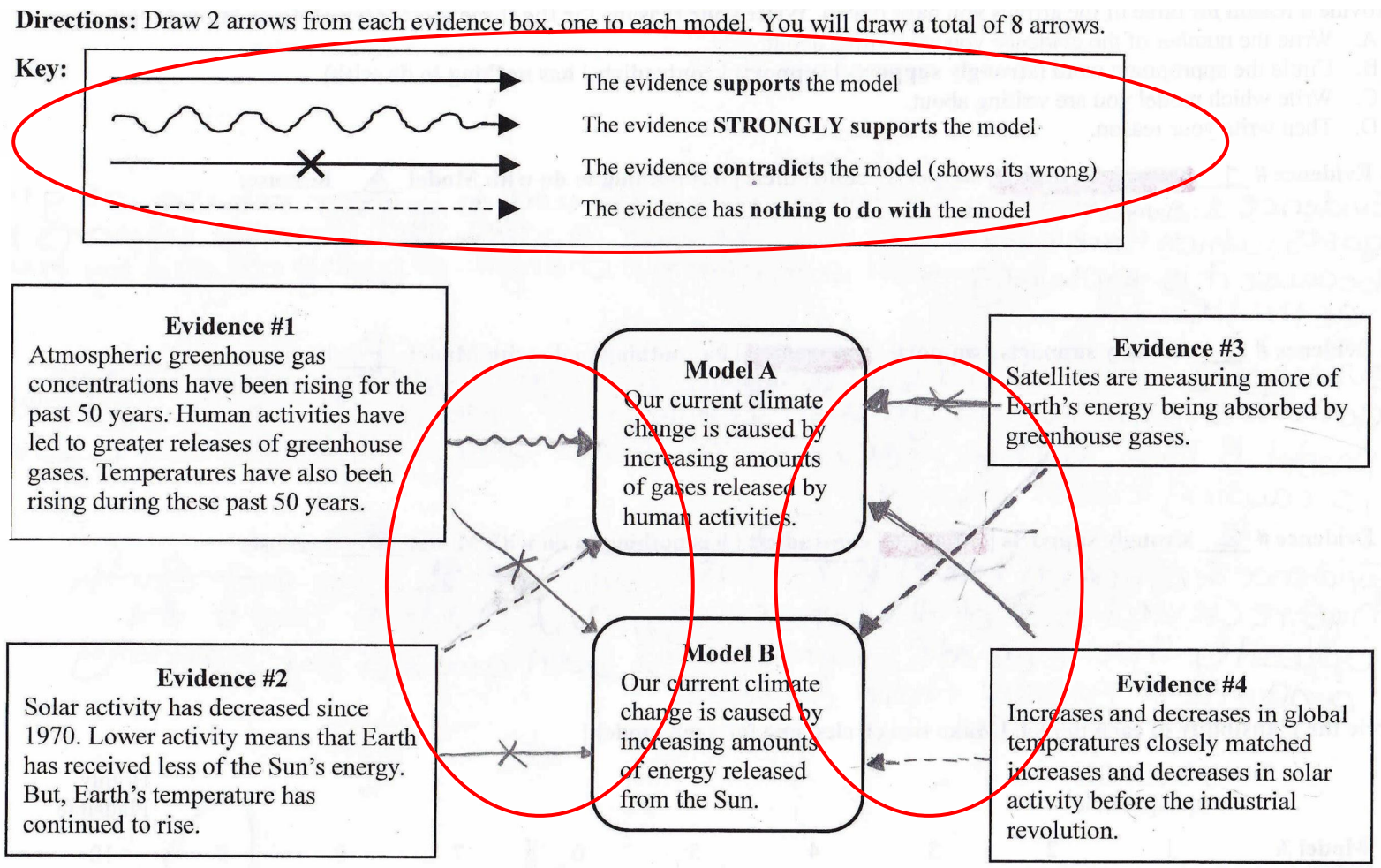
...and competing, non-scientific explanations to be plausible



What are some Earth and space phenomena where the scientific explanation may seem implausible to students?

The MEL diagram is a scaffold designed to help students think scientifically by...

...(1) promoting students' evaluations about the connections between evidence and alternative explanations about a phenomenon



The MEL diagram is a scaffold designed to help students think scientifically by...

...and (2) explicitly appraising & re-appraising the plausibility of both alternative explanations

Model A: Climate change is caused by humans who are releasing gases into the atmosphere.

A person who supports this model makes the following argument:

A few gases in Earth's atmosphere prevent some of Earth's energy from escaping out into space. Human activities are increasing the amount of these gases in the atmosphere. Therefore, humans are causing climate change.

Model B: Climate change is caused by increasing amounts of energy released from the Sun.

A person who supports this model makes the following argument:

The Sun is the main source of energy for planet Earth. Scientists have shown that for thousands of years Earth's average temperature increases when the Sun releases more energy. Therefore, the Sun is causing climate change.

Plausibility is a judgment we make about the potential truthfulness of one model compared to another. The judgment may be tentative, and you do not have to be committed to that decision.
Circle the plausibility of each model. [Make two circles, one for each model.]

	Greatly implausible (or even impossible)									Highly plausible
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

1. Evidence # 1 strongly supports | supports | contradicts | has nothing to do with Model A because:
Evidence 1 says that human activities have lead to greater releases of gr gases, which have been rising for the past 50 years. This strongly supports because it is explaining that our climate change is being caused by hu activities.

2. Evidence # 1 strongly supports | supports | contradicts | has nothing to do with Model B because:
Evidence 1 contradict Model B, because evidence one says that human activities have lead to greater releases of greenhouse gases, while model B says that increasing amounts of energy from the sun is wh is causing climate change.

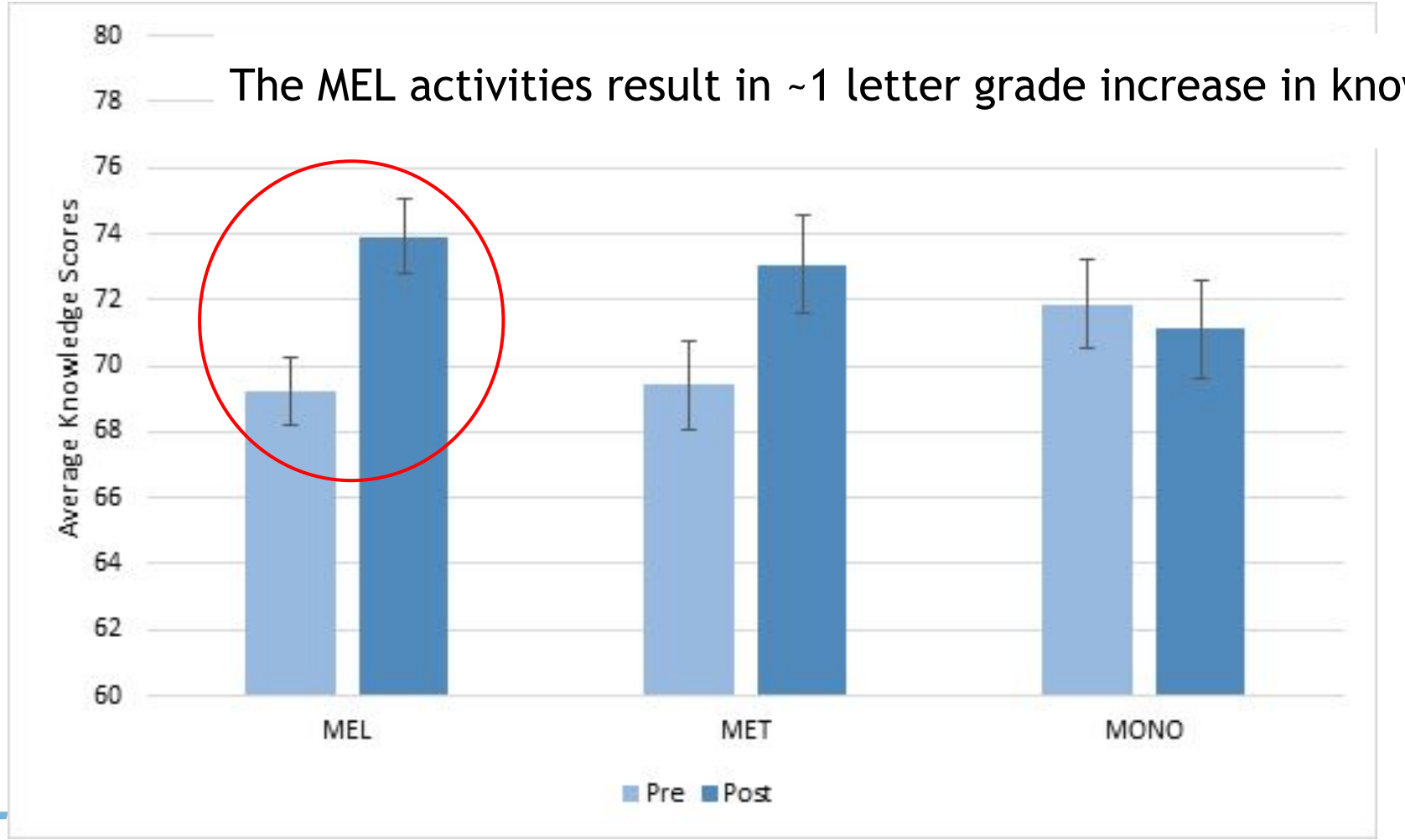
3. Evidence # 2 strongly supports | supports | contradicts | has nothing to do with Model B because:
Evidence 2 contradicts Model B because evidence 2 says that Earth has recieved less of the suns energy, and mode B says the opposite, that climate change has been caused by increasing amounts of energy from the sun.

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

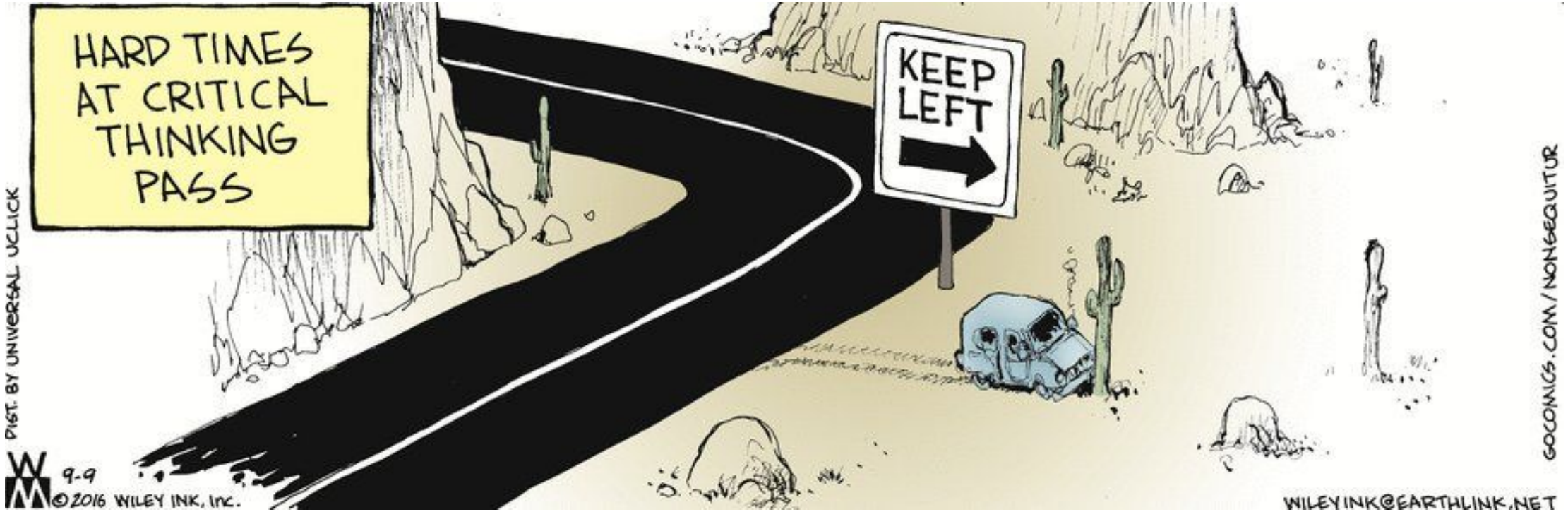
	Greatly implausible or even impossible									Highly Plausible
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

Good news...evaluation & plausibility reappraisal of alternative explanations deepen student learning!

The MEL activities result in ~1 letter grade increase in knowledge



But, some bad news...students did not reflect scientific thinking outside the context of the MEL activities



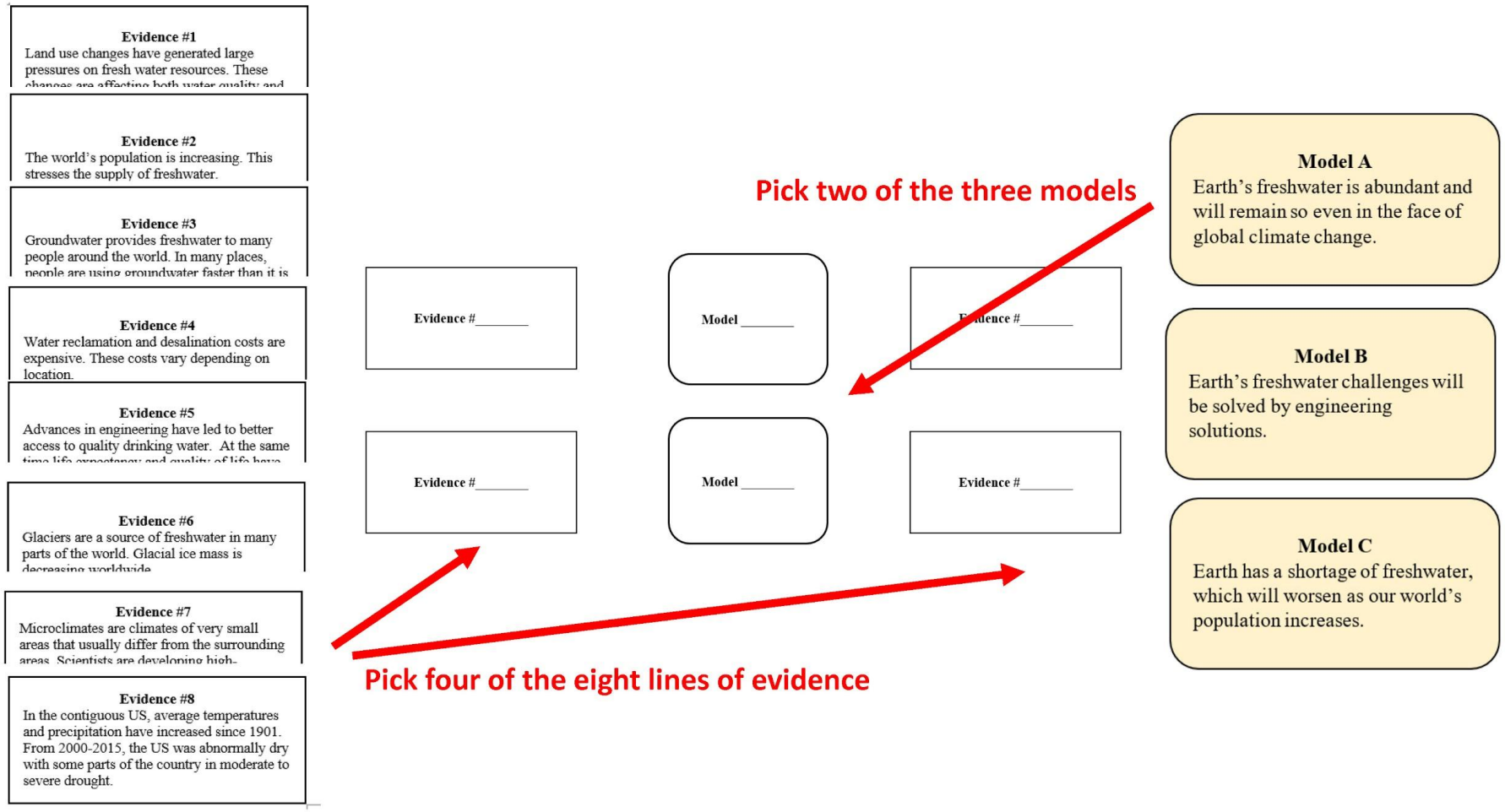
Enter the idea of “conceptual agency,” where students construct and evaluate their own MEL diagram

Students who exercise conceptual agency are authors of their own contributions, accountable to the classroom learning community, & have the authority to think about and solve issues (Nussbaum & Asterhan, 2016)

THE MEL PROJECT

We hypothesize that the Build-a-MEL (aka the baMEL) will increase students' conceptual agency

Freshwater build-a-MEL



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