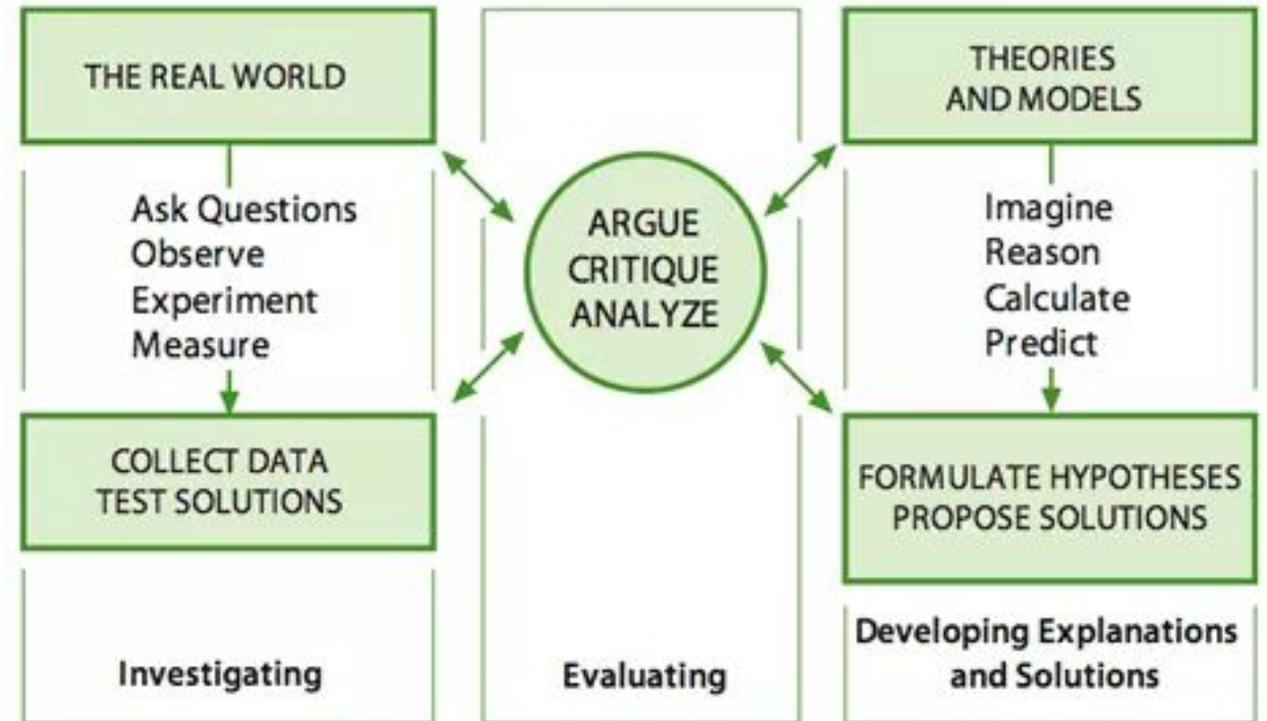
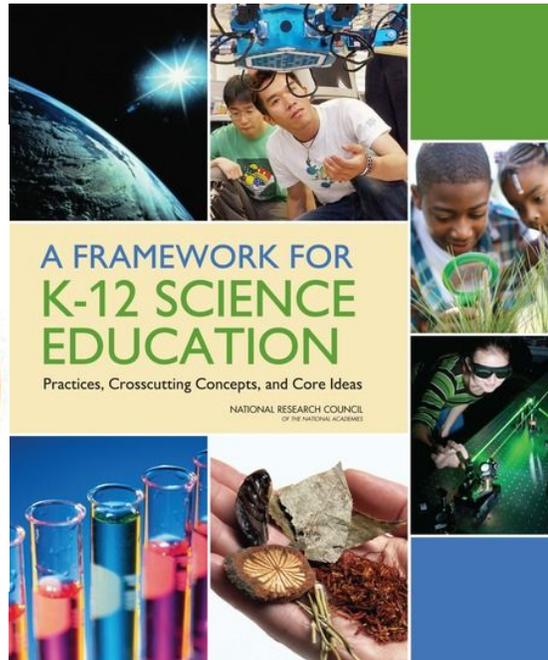
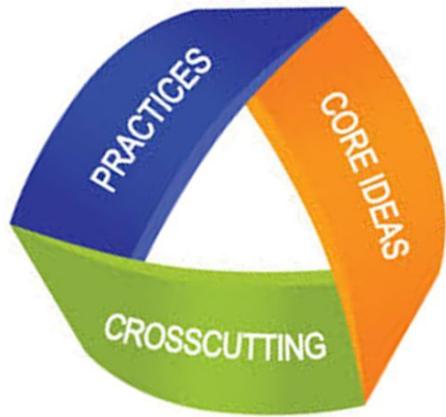




MEL Architecture
Theory to Practice

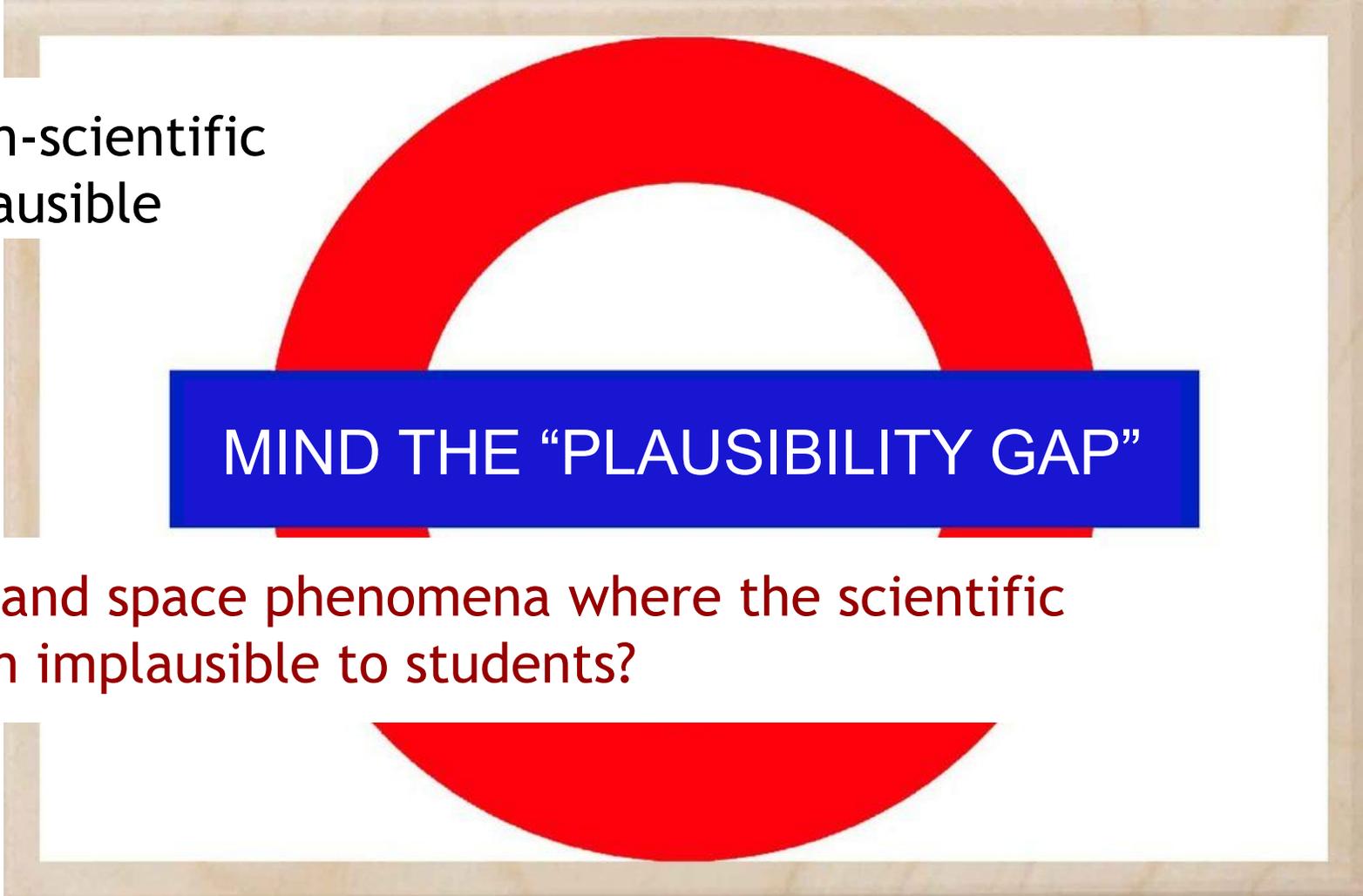
Scientific literacy involves both knowing (1) *what* scientists know and knowing (2) *how* scientists know what they know



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



MIND THE "PLAUSIBILITY GAP"

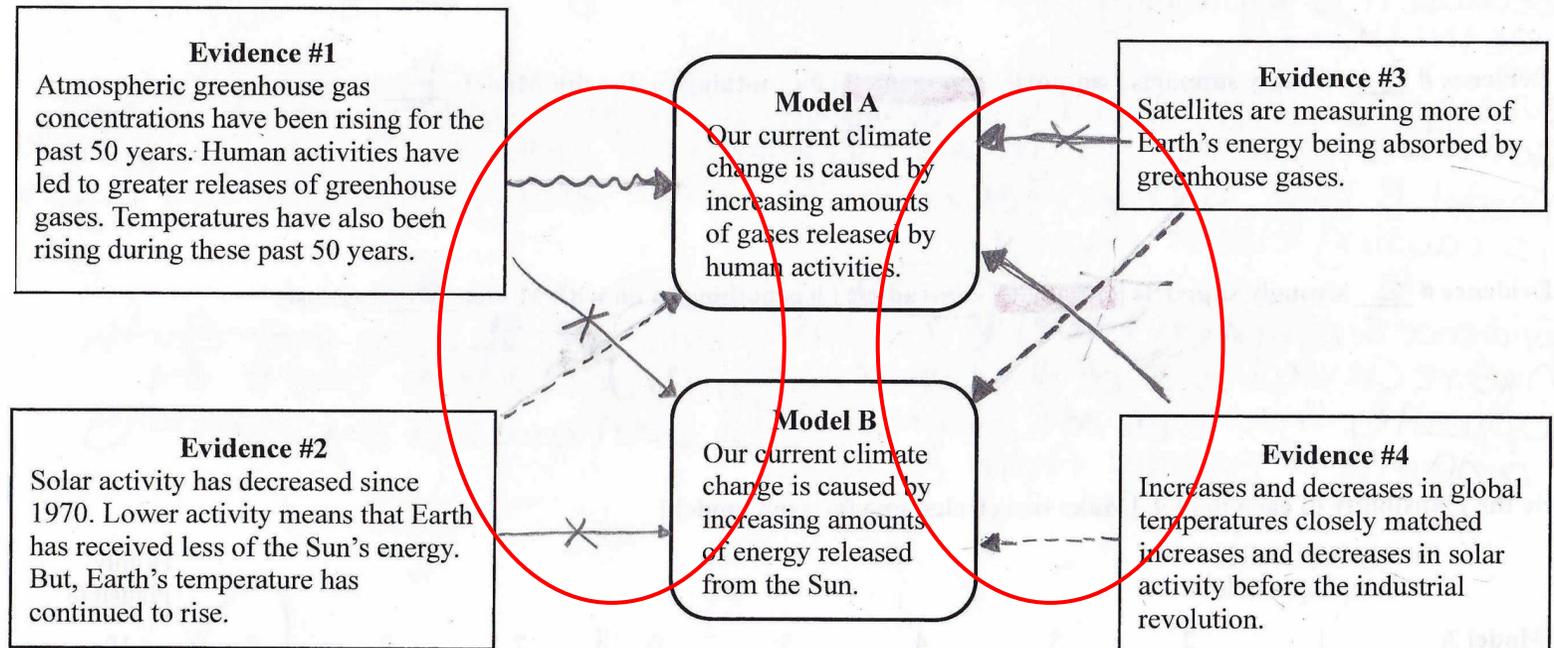
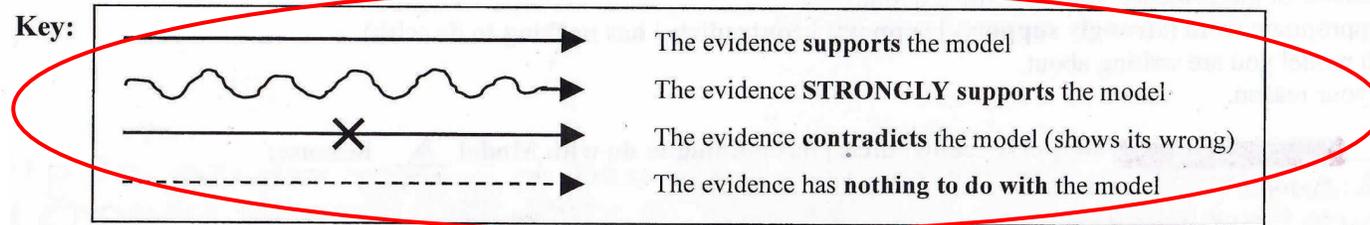
What are some Earth and space phenomena where the scientific explanation may seem implausible to students?

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

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

Key:



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.]**

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

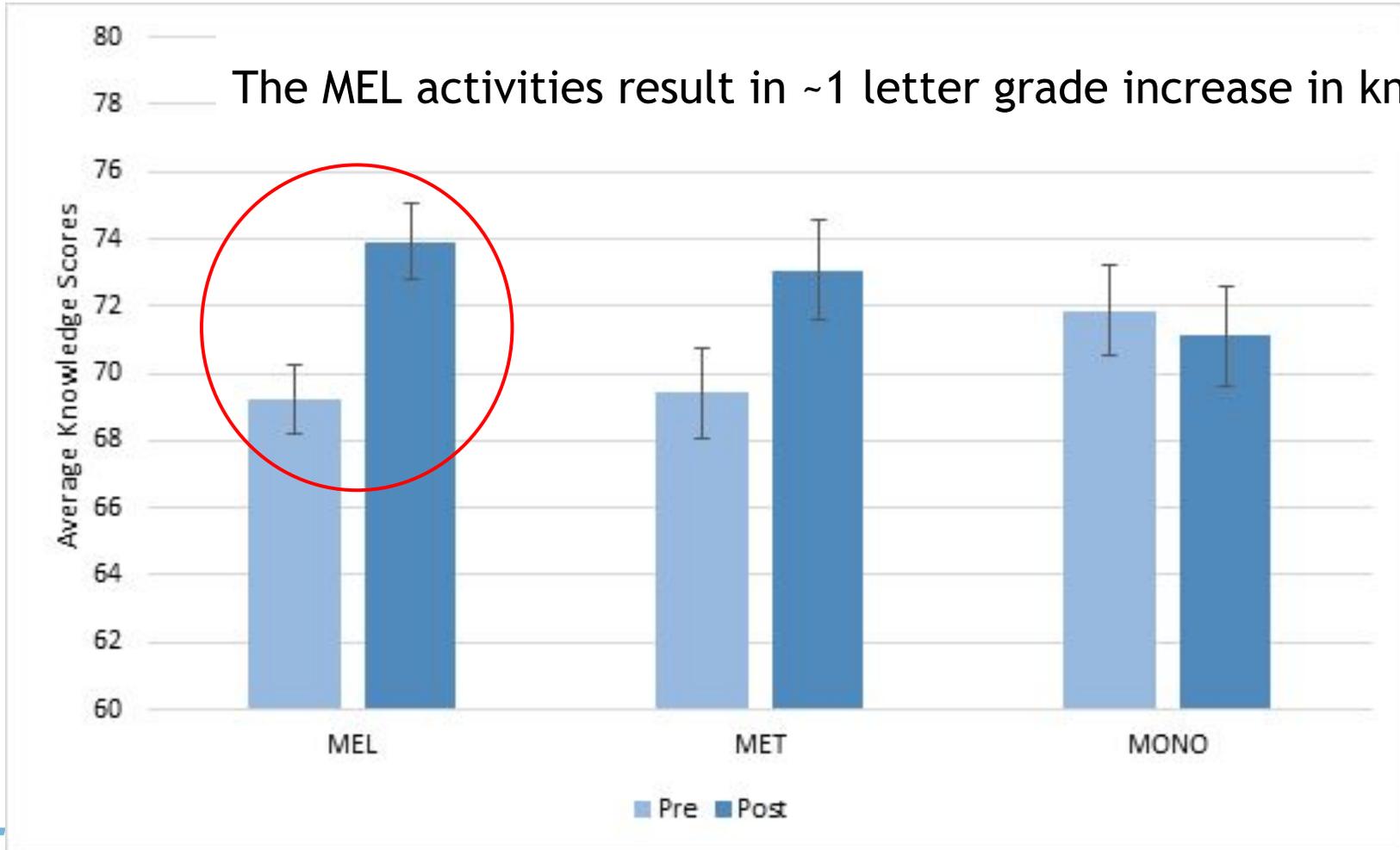
- Evidence # 1 **strongly supports** | supports | **contradicts** | has nothing to do with Model A because: Evidence 1 says that human activities have led to greater releases of greenhouse gases, which have been rising for the past 50 years. This strongly supports, because it is explaining that our climate change is being caused by human activities.
- Evidence # 1 **strongly supports** | supports | **contradicts** | has nothing to do with Model B because: Evidence 1 contradicts Model B, because evidence one says that human activities have led to greater releases of greenhouse gases, while model B says that increasing amounts of energy from the sun is what is causing climate change.
- 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 received less of the sun's energy, and model 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.]

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



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



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)



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

Freshwater build-a-MEL

Evidence #1 Land use changes have generated large pressures on fresh water resources. These changes are affecting both water quality and
Evidence #2 The world's population is increasing. This stresses the supply of freshwater.
Evidence #3 Groundwater provides freshwater to many people around the world. In many places, people are using groundwater faster than it is
Evidence #4 Water reclamation and desalination costs are expensive. These costs vary depending on location.
Evidence #5 Advances in engineering have led to better access to quality drinking water. At the same time, life expectancy and quality of life have
Evidence #6 Glaciers are a source of freshwater in many parts of the world. Glacial ice mass is decreasing worldwide.
Evidence #7 Microclimates are climates of very small areas that usually differ from the surrounding areas. Scientists are developing high-
Evidence #8 In the contiguous US, average temperatures and precipitation have increased since 1901. From 2000-2015, the US was abnormally dry with some parts of the country in moderate to severe drought.

Evidence # _____

Model _____

Evidence # _____

Evidence # _____

Model _____

Evidence # _____

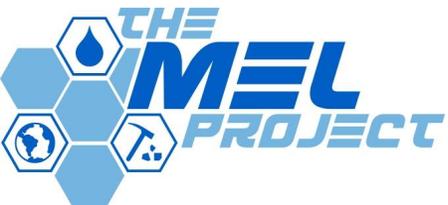
Pick two of the three models

Model A
Earth's freshwater is abundant and will remain so even in the face of global climate change.

Model B
Earth's freshwater challenges will be solved by engineering solutions.

Model C
Earth has a shortage of freshwater, which will worsen as our world's population increases.

Pick four of the eight lines of evidence



ACKNOWLEDGEMENTS



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