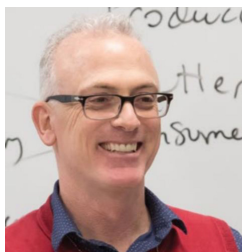




# Teaching Students to Evaluate Sources and Claims

*Pre-Workshop Webinar #2*

# LR-MEL Project Investigators



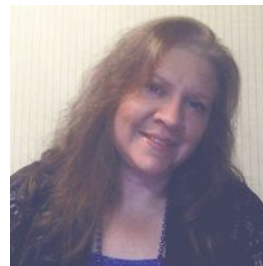
Doug Lombardi  
U Maryland



Sarah McGrew  
U Maryland



Donna Governor  
U North Georgia



Carla McAuliffe  
Institute for Global  
Environmental  
Strategies



Lorraine Ramirez  
Villarin  
U North Georgia



Janelle Bailey  
Temple U



Missy Holzer  
Science Curriculum  
Design Consultant



Gale Sinatra  
U Southern California



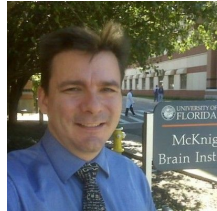
Elizabeth Reynolds  
U Maryland



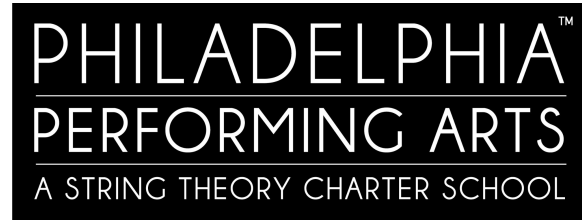
Sanlyn Buxner  
Planetary Science Institute



# LR-MEL Master Teachers



Penny Kline and Derek Piper  
Vickery Creek Middle School (GA)



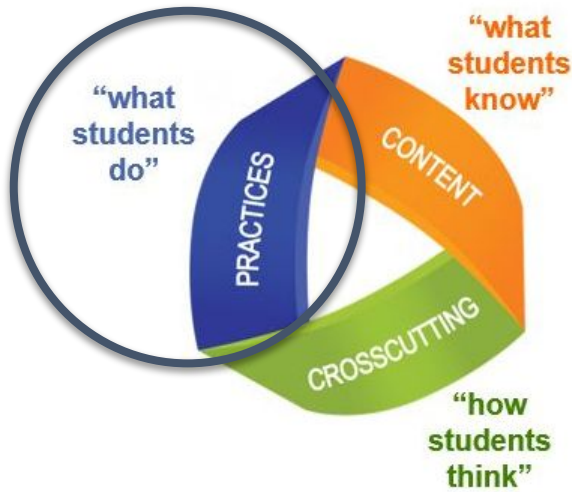
Andrea Johnson and Mike Magnotta  
Philadelphia Performing Arts: A String  
Theory Charter School (PA)

# Webinar Outline

- 3-D Teaching and Learning
- Science and Engineering Practices
- MEL Architecture
- Website Overview
- Next Steps



# Shift in Science Education: 3-Dimensional Science Learning



What does 3-D Teaching and Learning look like?

- Students **DOING** science
- Phenomena based
- Solving problems
- Real-world applications
- Project based learning


# Science & Engineering Practices

## Science and Engineering Practices

- 1 Asking Questions and Defining Problems
- 2 Developing and Using Models
- 3 Planning and Carrying Out Investigations
- 4 Analyzing and Interpreting Data
- 5 Using Mathematics and Computational Thinking
- 6 Constructing Explanations and Designing Solutions
- 7 Engaging in Argument from Evidence
- 8 Obtaining, Evaluating, and Communicating Information

## Science and Engineering Practices

**1** Asking Questions and Defining Problems




I can wonder about the world and write it as a question

**2** Developing and Using Models




I can create ways to model real world situations.

**3** Planning and Carrying Out Investigations




I can plan and carry out investigations.

**4** Analyzing and Interpreting Data




I can understand and explain what data means

**5** Using Mathematics and Computational Thinking




I can use math strategies to explain my thinking.

**6** Constructing Explanations and Designing Solutions



I can come up with solutions and explain why.

**7** Engaging in Argument from Evidence



I can use proof to support my findings.

**8** Obtaining, Evaluating, and Communicating Information



I can collect, understand, and show my information.

## Science

- **S2**: Develop and use models
- **S6**: Construct explanations and design solutions

## Social Studies

- **SS6**: Take informed action

- **SS1/S1**: Develop questions and define problems
- **SS2/S3**: Plan and carry out inquiries and investigations
- **SS4/S7/E5**: Develop claims and arguments using evidence
- **SS5/S8/E3/E4**: Communicate and critique conclusions and information
- **SS5/S8/E2**: Build a strong base of knowledge through content-rich texts
- **SS3/S4/E5/E6**: Value, gather, analyze, and evaluate data and evidence

- **E1**: Demonstrate independence in reading complex texts and writing and speaking about them
- **E7**: Understand other cultures and perspectives through reading, listening, and collaborations

## English/Language Arts

# Engaging in Argument from Evidence

- Compare and evaluate competing arguments in light of currently accepted explanations, new evidence, limitations, constraints, and ethical issues
- Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations to determine the merits of arguments



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# Arguments Evaluate Claims and Evidence

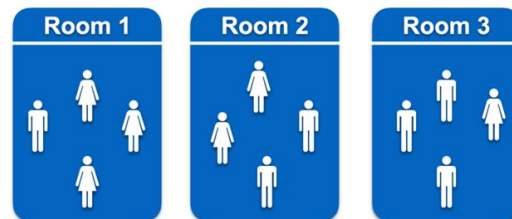
## SS4/S7/E5: Develop claims and arguments using evidence

In Breakout Rooms:

- How does each content area support students to reach this goal?

Regroup:

- What did you discover?
- Where are the overlaps?



# Familiar Instructional Strategies



## Claim-Evidence-Reasoning

- Claims: A proposed answer to a question
- Evidence: The information used in an argument to support the claim
- Reasoning: Justification that links the claim and evidence.

***Scientists construct MODELS to explain evidence***

# Claims vs. Models

## CLAIMS

- An answer to a question
- An assertion based on results of an investigation
- Requires justification to support the claim

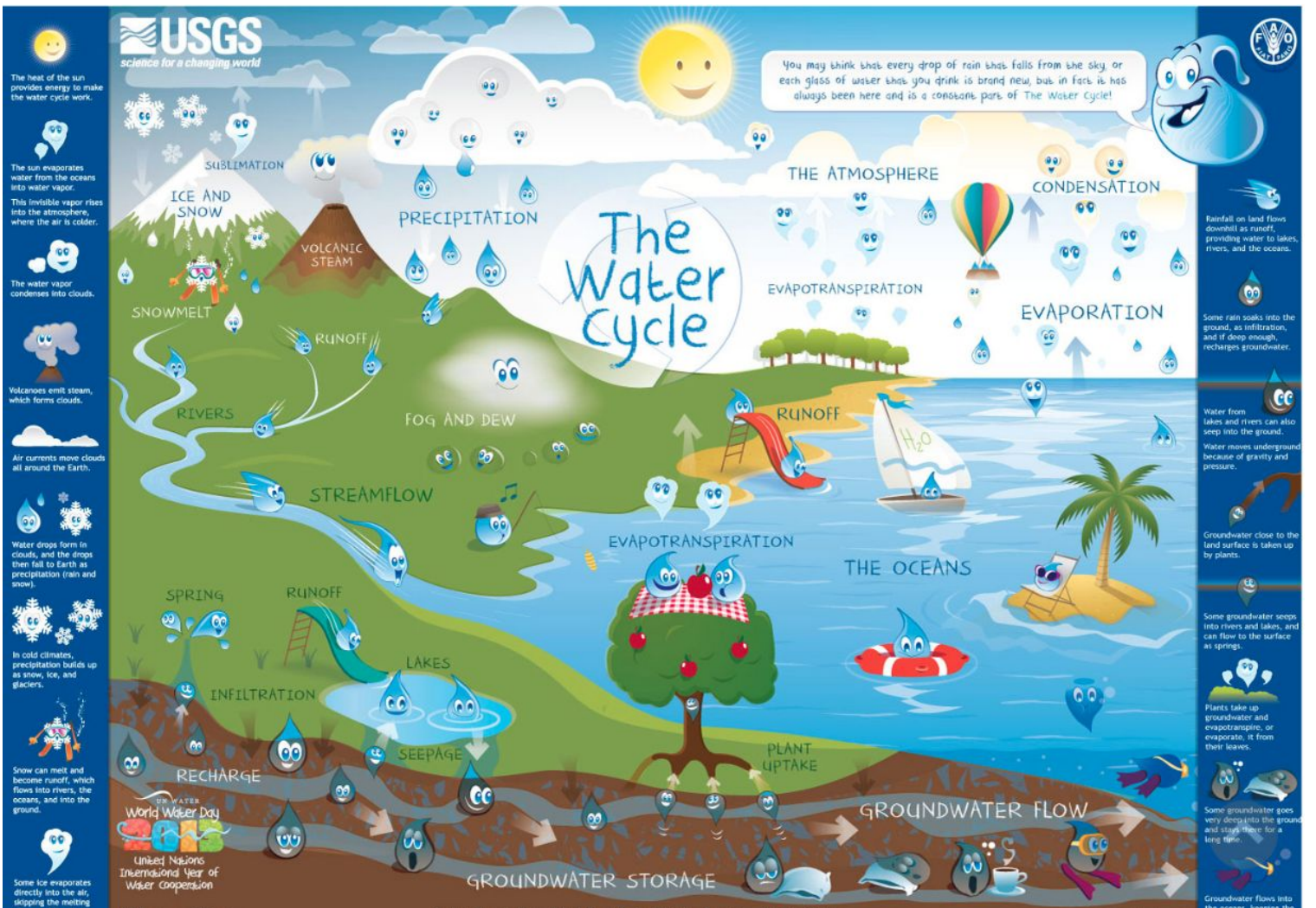
## MODELS

- An explanation of a phenomenon
- A hypothesis that leads to new questions
- Predicts or describes how and why a phenomenon occurs



EVIDENCE is the foundation for both claims and models!

# Model of the Water Cycle



# MEL Architecture: Evaluating Models

When using the Model-Evidence Link (MEL) activities, explanatory models are introduced and students evaluate models using plausibility judgments

*What is Plausibility?*

Chat Box!!!!



**Plausibility of Models Explaining Climate Change**

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

Please work on this individually.

Read the following information carefully.

Humans create *models* to help explain things.

Below are two models. These provide different explanations for why global temperatures have increased over the past 100 years and average sea levels have increased over the past 50 years.

**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 (not certain). You do not have to be committed to that decision.

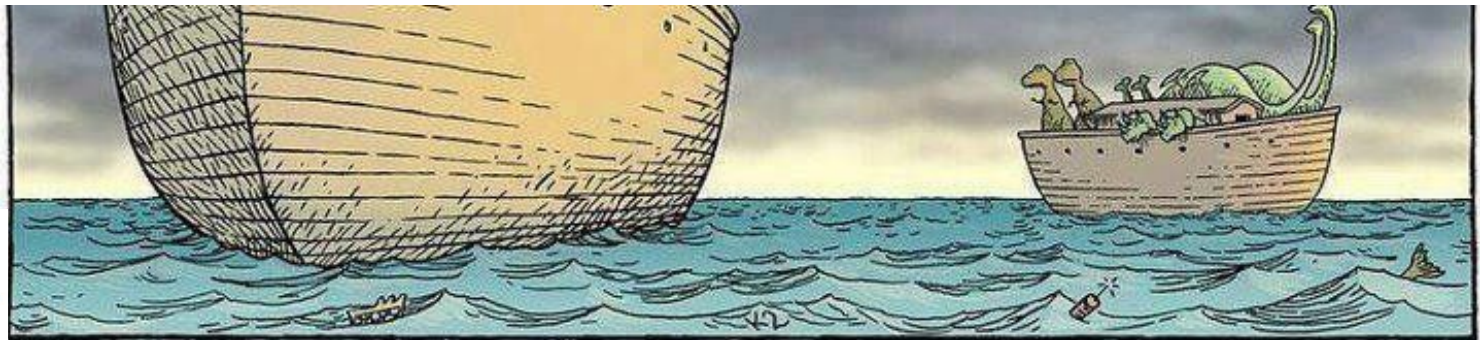
Circle the plausibility of each model. [Make two circles, one for each model.]

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

# A more scientific way to think about claims, evidence, and reasoning



Simultaneously evaluating how well scientific evidence supports competing claims and rendering a plausibility judgment on each claim



# The Plausibility Ranking Task

## How do scientists change their plausibility judgments?

Plausibility is a judgment we make about the potential truthfulness of one model compared to another. The judgment may be tentative (not certain). You do not have to be committed to that decision.

Scientists may change their plausibility judgments about scientific ideas.

They do this by looking at the connections between evidence and the idea. Evidence may:

1. *Support* an idea
2. *Strongly* support an idea
3. *Contradict* (oppose) an idea
4. Have *nothing to do* with the idea

**Which type of evidence do you think is most important to a scientist's plausibility judgment? Use numbers 1 to 4 to rank each evidence. (1 = most important and 4 = least important). Use each number only once.**

Type of evidence	Your ranking
Evidence supports the idea	
Evidence strongly supports the idea	
Evidence contradicts (opposes) the idea	
Evidence has nothing to do with the idea	

When instructed, flip over to Page 2

Prior to this webinar  
we asked you to take a  
survey....

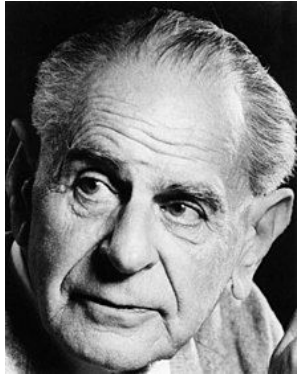
# The Plausibility Ranking Task

↓	● 1	↓	● 2	↓	● 3	↓	● 4
Evidence supports the idea	20.00% 8		45.00% 18		35.00% 14		0% 0
Evidence strongly supports the idea	50.00% 20		37.50% 15		5.00% 2		7.50% 3
Evidence contradicts (opposes) the idea	22.50% 9	...	17.50% 7		52.50% 21		7.50% 3
Evidence has nothing to do with the idea	7.50% 3		0% 0		7.50% 3		85.00% 34



Here are the results of the survey as of 6:20 pm today....

# What About Contradictory Evidence?



**Falsifiability** makes explanations scientific, that is, scientific explanations must be open to be able to be proven wrong (i.e., false)  
--Karl Popper

*“Theories can never be proven, only disproven”*



**Falsifiability**

# The Plausibility Ranking Task

- Now that you've heard a bit more about plausibility and falsifiability, let's re-rank the four types of evidence.
- Go to <https://www.surveymonkey.com/r/2026PRT2>

Carefully read the following paragraph.

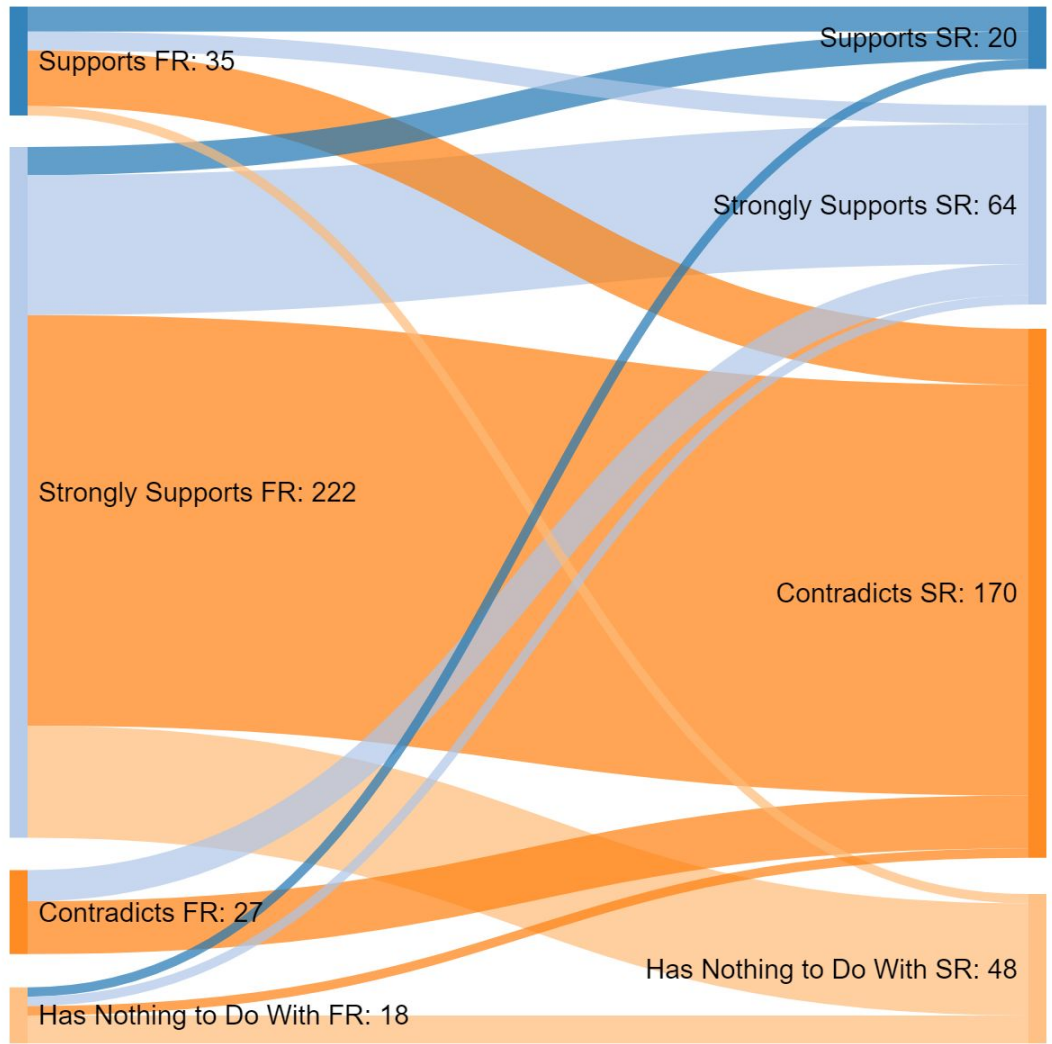
Scientific ideas must be *falsifiable*. In other words, scientific ideas can never be proven. But, ideas can be disproven by opposing evidence. When this happens, scientists must revise the idea or come up with another explanation. *Falsifiability* is a very important principle when evaluating scientific knowledge.

As a reminder, scientists may change their plausibility judgments about scientific ideas and they do this by looking at the connections between evidence and the idea. Evidence may:

1. *Support* an idea
2. *Strongly support* an idea
3. *Contradict* (oppose) an idea
4. Have *nothing to do* with the idea

With *falsifiability* in mind, *re-rank* each evidence from 1 to 4. (1 = most important and 4 = least important). Use each number only once.

Type of evidence	Your ranking
Evidence supports the idea	
Evidence strongly supports the idea	
Evidence contradicts (opposes) the idea	
Evidence has nothing to do with the idea	



Contradictory evidence promotes shifts in plausibility judgments about explanations, demonstrates the process of scientific evaluation, & deepens students' knowledge



# The Plausibility Ranking Task (p2)--*your new responses*

↓	● 1	↓	● 2	↓	● 3	↓	● 4	Total ↓
Evidence supports the idea	11.43% 4		14.29% 5		71.43% 25		2.86% 1	35
Evidence strongly supports the idea	17.14% 6		57.14% 20		14.29% 5		11.43% 4	35
Evidence contradicts (opposes) the idea	71.43% 25		20.00% 7		8.57% 3		0% 0	35
Evidence has nothing to do with the idea	0% 0		8.57% 3		5.71% 2		85.71% 30	35

# MEL Architecture

## Step 1: Evaluating Models

Students are asked to evaluate competing scientific models

### Plausibility of Models Explaining Climate Change

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

Please work on this individually.

Read the following information carefully.

Humans create *models* to help explain things.

Below are two models. These provide different explanations for why global temperatures have increased over the past 100 years and average sea levels have increased over the past 50 years.

**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.*

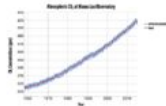
Plausibility is a judgment we make about the potential truthfulness of one model compared to another. The judgment may be tentative (not certain). You do not have to be committed to that decision.

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

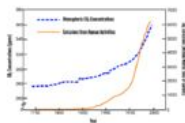
	1	2	3	4	5	6	7	8	9	10
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

# MEL Step 2: Examining the Evidence

**Evidence #1:** Atmospheric greenhouse gas concentrations have been rising for the past 80 years. Human activities have led to greater releases of greenhouse gases. Temperatures have also been rising during these past 80 years.

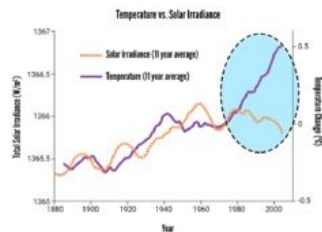


**Figure 1:** Carbon dioxide levels in the atmosphere. Credit: Wright team.  
The symbol for carbon dioxide is CO<sub>2</sub>. These levels have been increasing (Figure 1). CO<sub>2</sub> in the atmosphere absorbs infrared energy emitted by Earth. People call CO<sub>2</sub> a greenhouse gas because it keeps some of Earth's energy from escaping to space.



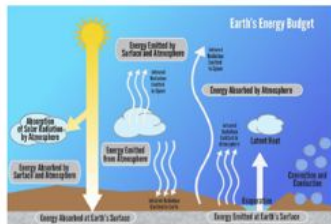
**Figure 2:** CO<sub>2</sub> released by human activities. Credit: Wright team.  
Figure 2 shows increasing releases of CO<sub>2</sub> by the human activity of burning fossil fuels, including coal, gasoline, natural gas, and wood. Burning fossil fuels releases CO<sub>2</sub> into the atmosphere.

**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.



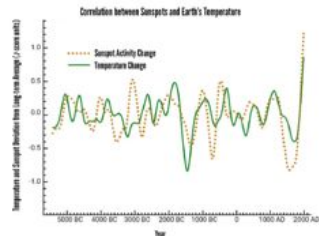
**Figure 3:** Solar activity levels over time. Credit: Wright team.  
The Sun's brightness is one way to measure solar activity. In Figure 3, the dashed line shows the Sun's brightness. Since 1970, the Sun's brightness has been decreasing. The solid line on the graph shows Earth's temperature. The graph shows that temperatures are increasing while solar activity is decreasing. The region outlined by the dash-dot oval shows where solar activity is decreasing and temperature is increasing.

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



**Figure 1:** Earth's energy budget. Credit: Wright team.  
Figure 1 shows Earth's energy budget. Earth absorbs about half of the Sun's energy. Most of the Sun's energy comes to Earth as visible light. Earth re-emits this absorbed energy as invisible light called infrared. Some of this infrared energy is absorbed by the atmosphere and sent back to Earth. Some escapes into space. Over time, NASA satellites orbiting Earth have recorded less infrared energy leaving Earth's atmosphere.

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



**Figure 1:** Sunspot activity and temperature over time. Credit: Wright team.  
In Figure 1, sunspot activity is the dashed line. Solar activity increases when the Sun has more sunspots. The solid line shows temperature. The shapes of the sunspot and temperature curves match closely. Peaks in the temperature are near peaks in sunspot activity. Dips in temperature are near dips in sunspot activity.

These data show sunspot activity and temperature for the past 9000 years. These data are based on evidence collected from tree rings. Some of the tree rings are from trees that are still living. Some of the tree rings are from ancient trees that have died.

# MEL Step 3: Connecting Evidence to Models

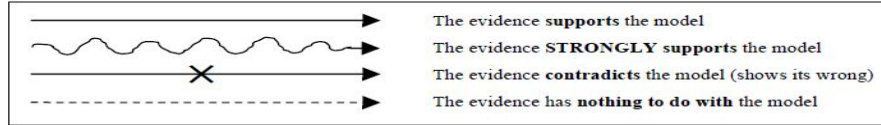
Complete the  
MEL diagram  
using the  
evidence texts  
as a resource

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

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

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

**Key:**



#### **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.

## Types of Arrows

**Supports**



**Strongly Supports**



**Contradicts**



**Has nothing to do with**



### 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

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

### 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.

***Break Out Rooms!***

Click [here](#) for evidence texts

# MEL Step 4: Model Re-Evaluation & Explanation

**Explain your  
reasoning**

**Re-evaluate the  
Models using  
Evidence-based  
reasoning**

Name \_\_\_\_\_ Date \_\_\_\_\_ Teacher \_\_\_\_\_ Period \_\_\_\_\_ Topic \_\_\_\_\_

Please work on this part individually after you complete your diagram.

1. Now that you have completed the diagram, reconsider the plausibility of Models A and B (and C, if there is one). Circle the plausibility of each model. [Make one circle 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
Model C (if there is one)	1	2	3	4	5	6	7	8	9	10

2. For the model you selected as most plausible, explain why you think so.

# Evaluating the Explanation Task

**3. Which arrows changed your plausibility judgments about the models? If your plausibility judgment did not change, which arrows supported your original plausibility judgments? Consider 2 lines of evidence. For each line, does it support, strongly support, or contradict one of the models? Why? When writing your explanation, consider the following:**

- Use the specific information from the evidence text and figures to support your response. Ex: when looking at graphs or figures, be sure to describe the patterns in the data.
- Describe any cause and effect relationships found in the text.

Evidence # \_\_\_\_ strongly supports | supports | contradicts | has nothing to do with Model \_\_\_\_ *because:*

Evidence # \_\_\_\_ strongly supports | supports | contradicts | has nothing to do with Model \_\_\_\_ *because:*

***Evaluate students claims using evidence-based reasoning***

# Project Website: <https://serc.carleton.edu/mel/index.html>



The screenshot shows a web browser displaying the website <https://serc.carleton.edu/mel/index.html>. The page features a blue header with the title "Evaluating Sources and Claims" and the "THE LR MEL PROJECT" logo. A left sidebar contains navigation links: "Teach the Earth Portal", "Model-Evidence Link Diagrams Project" (highlighted), "About", "Teaching Resources", and "Professional Development". The main content area is titled "Lateral Reading-Model-Evidence Link Diagrams (LR-MEL) Project" and includes a text box describing the project's purpose. Below this is a line graph showing atmospheric carbon dioxide levels from 400,000 years ago to the present. The graph shows a relatively stable level around 280 ppm until the Industrial Revolution, after which it rises sharply to over 400 ppm. A horizontal line is drawn at approximately 280 ppm, labeled "For centuries, atmospheric carbon dioxide had never been above this line". Two vertical arrows on the right side of the graph indicate the "1950 level" and the "current level".

**Evaluating Sources and Claims**

Teach the Earth Portal

**Model-Evidence Link Diagrams Project**

About

Teaching Resources

Professional Development

## Lateral Reading-Model-Evidence Link Diagrams (LR-MEL) Project

The purpose of our project is to promote students' civic and scientific evaluations of sources and alternative claims when confronted with controversial and/or complex socioscientific issues in the Earth and environmental sciences. We do this by integrating English Language Arts (ELA) and social studies classrooms—focused on *source evaluation*—with science classrooms—focused on *evaluating connectors between lines of evidence and alternative explanatory claims*. We are developing, implementing, and testing complementary Lateral Reading (LR) and Model-Evidence Link (MEL) scaffolds that include instructional materials and methods in both social studies and science classrooms. Issues students explore range from climate change and extreme weather to freshwater availability and food security along with many others.



carbon dioxide level (parts per million)

For centuries, atmospheric carbon dioxide had never been above this line

current level

1950 level

years before today (0 = 1950)

Climate Change: Increases in atmospheric carbon dioxide since the Industrial Revolution

## Project Overview

The Lateral Reading-Model-Evidence Link Diagrams (LR-MEL) project is investigating how deeper evaluations might promote changes in students' epistemic judgments, including source trustworthiness, and claim plausibility, toward a more civically-minded and scientific stance. We are also developing and implementing three-day summer institutes and follow-on professional development to help middle and high school ELA, social studies, and science teacher teams use LR (in ELA and social studies) and MEL (in science) scaffolds to facilitate students' critical-analytic thinking, evidence-based reasoning, and core disciplinary knowledge.

## Lateral Reading - Source Evaluation



# Webinar Evaluation Survey

Please fill out a Webinar Evaluation Survey at:

<https://www.surveymonkey.com/r/ZCMGF72>

(this will also be emailed out)

Please fill out this survey by Friday May 22, 9pm EDT



# Questions?

For general questions, use the Chat Box to ask them.

For specific questions, email us at [MEL2institutes@gmail.com](mailto:MEL2institutes@gmail.com)

**DON'T LEAVE!**

*We need you in our Institute groups for some last minute business items!*

Thank you - We look forward to seeing you at the institutes!



# ACKNOWLEDGEMENTS



This research project is supported by the US National Science Foundation (NSF) under Grant Nos. 2201012, 2201015, 2201016, 2201017, 2201018, and 2346657. Any opinions, findings, conclusions, or recommendations expressed are those of the authors and do not necessarily reflect the NSF's views.