Today’s Presenters

Michele Cozza, MEd
Manager of Professional Development, STEMscopes
Supporting educational professionals is her true passion! Putting the tools necessary for student success into the hands of educators is her calling. She started her career as a Middle School Science teacher and has been in the educational field for 20 years. She has worked closely with scientists at Argonne and Fermi National Laboratories through grants written with the U.S. Department of Energy. She has worked closely in coaching educators through a National STEM certification process.

Kristy Wheat, EdS
Regional STEMcoach, STEMscopes
A Mississippi Gulf Coast native, Kristy is passionate about empowering teachers to create meaningful learning experiences for students. She has been an educator for 26 years serving as teacher, administrator, and both district and state science content specialist. Kristy believes in promoting authentic collaboration and effective shared practices around STEM, 21st Century Skills, and Inquiry-Based Learning.
Claims Evidence Reasoning: Scientific Explanations to Increase Student Voice

Today’s Goals:

★ Experience Argumentation Strategies
★ Deconstruct the CER Process
★ Provide Equitable Learning Experiences

PLACE THE INVENTIONS IN ORDER BASED ON:

THE MAGNITUDE OF IMPACT ON THE WORLD IN THE YEAR THEY WERE INVENTED.

USE **CONSENSUS** TO PLACE THEM IN ORDER OF IMPACT.

THE WORLD'S 6 BEST INVENTIONS
PROTOCOL FOR ARGUMENTATION

THE PERSON WHO HAS THE LONGEST FIRST NAME CHOOSES A CARD AND PLACES IT IN THE CENTER OF THE SLIDE.

- Make a claim: "This invention had the greatest impact on the world the year it was invented".
- State the evidence to support the claim.
- Team members take turns to provide additional evidence to support the claim or refute the claim with other evidence.

THE PERSON WHO HAS THE NEXT LONGEST FIRST NAME REPEATS THE PROCESS WITH A CARD OF THEIR OWN.

- Repeat the process.

CONTINUE FOR ALL 6 CARDS
Explaining Science: CER Strategy

- **Claim**: Answers a question.
- **Evidence**: Scientific data collected through observations and measurements.
- **Reasoning**: Why your evidence supports your claim.

Would you play in this water?
Clear Expectations

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Feedback</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claim</td>
<td>Answers the Question: Would you play in this water?</td>
<td>/4</td>
</tr>
<tr>
<td>Evidence</td>
<td>Provide at least three pieces of evidence from your observations of the image</td>
<td>/6</td>
</tr>
<tr>
<td>Reasoning</td>
<td>How does your evidence point to the conclusion you are making? Include the terms: ➔ Environment ➔ Contamination ➔ Toxins</td>
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Find three pieces of evidence to answer the question, “Would you play in this water?”
Claim-Evidence-Reasoning (CER): Scientific Explanations to Increase Student Voice, by STEMscopes

April 21, 2021

Michele Cozza and Kristy Wheat

Evidence
- Observations
  - Qualitative
  - Quantitative
- Stick to the Facts!
  - No opinions

Reasoning

Claim

Evidence
- Six people wearing yellow suits and green gloves are around the water.
- Water is brown.
- There is dark brown plant life in the water.
- The water is near a Subway.
- Some type of barrier is on the water’s surface.
- There is a hose/pipe behind the individuals.
- There is a large dumpster and a truck in the area.
- A golf cart is on the grass.

Reasoning

Claim
### Feedback + Score

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<td>Provide at least three pieces of evidence from your observations of the image</td>
<td>Excellent evidence, you are very strong here.</td>
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Would you play in this water?

**Evidence**
- Observations
  - Qualitative
  - Quantitative
- Stick to the Facts!
  - No opinions

**Claim**
- Use the evidence to answer the question.
Claim: I would not play in this water.

Evidence:
- Six people wearing yellow suits and green gloves are around the water.
- Water is brown.
- There is dark brown plant life in the water.
- The water is near a Subway.
- Some type of barrier is on the water's surface.
- There is a hose/pipe behind the individuals.
- There is a large dumpster and a truck in the area.
- A golf cart is on the grass.

Reasoning:

Claim: I would not play in this water.

Hypothesis: “If I played in this water, then I would be exposed to toxins.”

“Prediction”
“Testable Statement”
“Beginning of Exploration”

“Answers a Question”
“Solution to a Problem”
“End of Exploration”

“I would not play in this water.”
### Feedback + Score

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<tr>
<td><strong>Claim</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><em>Would you play in this water?</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I agree, I wouldn't play in this</td>
<td>4 / 4</td>
</tr>
<tr>
<td></td>
<td>water either!</td>
<td></td>
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| **Reasoning**                    | How does your evidence point to the conclusion you are making? Include the terms: | Environment  
|                                  | ➔ Environment  
|                                  | ➔ Contamination  
|                                  | ➔ Toxins | |

### Claim Progression

Adapted from *NRC Framework, 2012, pg. 73*

- **K-2**  
  Make conclusions from investigations.

- **3-5**  
  Make conclusions.

- **MS**  
  Make conclusions.

- **HS**  
  Make conclusions.
How does your evidence point to the conclusion you are making?

Include the terms:
- Contamination
- Toxins
- Environment

Evidence
- Observations
  - Qualitative
  - Quantitative
- Stick to the Facts!
  - No opinions

Claim
- Use the evidence to answer the question.

Reasoning
- Educated Ideas
  - Draw on Experiences
  - Scientific Knowledge
- How does the evidence point to the conclusion you are making?
Claim: I would not play in this water.

Evidence:
- Six people wearing yellow suits and green gloves are around the water.
- Water is brown.
- There is dark brown plant life in the water.
- The water is near a Subway.
- Some type of barrier is on the water's surface.
- There is a hose/pipe behind the individuals.
- There is a large dumpster and a truck in the area.
- A golf cart is on the grass.
- Hazmat suits indicate the clean-up of toxic waste. The group is going to pump the contaminated water to remove toxic waste.
- The individuals have placed a barrier in the stream to stop the toxic waste in the water from spreading.
- The dark brown plants may be dead due to the toxins.
- People might be at risk of being exposed to the contaminants in the water.

Reasoning:
- Hazmat suits indicate the clean-up of toxic waste.
- The group is going to pump the contaminated water to remove toxic waste.
- The individuals have placed a barrier in the stream to stop the toxic waste in the water from spreading.
- The dark brown plants may be dead due to the toxins.
- People might be at risk of being exposed to the contaminants in the water.

Specifications Feedback Score

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<td>Reasoning</td>
<td>How does your evidence point to the conclusion you are making? Include the terms: Environment, Contamination, Toxins</td>
<td>Great use of the terms contamination and environment. What causes the contamination? What are ways in which the environment will be affected?</td>
</tr>
</tbody>
</table>
### Reasoning Progression

Adapted from *NRC Framework, 2012, pg. 73

- **3-5**
  - Provide a simple connection between claim and evidence using the big ideas they have learned in science.

- **MS**
  - Provide a justification for why the evidence supports the claim using scientific principles.

- **HS**
  - Provide a justification for why the evidence supports the claim using scientific principles. Each piece of evidence may have a different justification.

- **Rebuttal**
  - Describe why a counterclaim is not appropriate by critiquing the alternative evidence and reasoning.

### Progression of Argumentation Focus

<table>
<thead>
<tr>
<th>Grades</th>
<th>Focus</th>
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<tbody>
<tr>
<td>K-2</td>
<td>Claim + Evidence</td>
</tr>
<tr>
<td></td>
<td>• Claim – Make conclusions from investigations.</td>
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<tr>
<td></td>
<td>• Evidence – Use observations from investigations.</td>
</tr>
<tr>
<td>3-5</td>
<td>Claim + Evidence + Reasoning</td>
</tr>
<tr>
<td></td>
<td>• Claim – Make conclusions.</td>
</tr>
<tr>
<td></td>
<td>• Evidence – Use observations and measurements.</td>
</tr>
<tr>
<td></td>
<td>• Reasoning – Provide a simple connection between claim and evidence using the big ideas they have learned in science.</td>
</tr>
<tr>
<td>6-8</td>
<td>Claim + Evidence + Reasoning (greater complexity)</td>
</tr>
<tr>
<td></td>
<td>• Claim – Make conclusions.</td>
</tr>
<tr>
<td></td>
<td>• Evidence – Use observations and measurements. Distinguish between appropriate and inappropriate data. Consider sufficiency of evidence.</td>
</tr>
<tr>
<td></td>
<td>• Reasoning – Provide a justification for why the evidence supports the claim using scientific principles.</td>
</tr>
<tr>
<td>9-12</td>
<td>Claim + Evidence + Reasoning + Rebuttal</td>
</tr>
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Adapted from *NRC Framework, 2012, pg. 73
Personalize Learning

More Support

Less Support

Exceeds

Meets

Level 4

Level 3

Level 2

Level 1

Expectations

Specifications

Feedback

Score

Claim

Answers the question, “Would you play in this water?”

1/4

Evidence

Includes at least three pieces of evidence from the image.

3/6

Reasoning

How does your evidence point to the conclusion you are making?

Use the terms:

Contamination
Toxins
Environment

3/6

Exceeds

Level 4

Meets

Level 3

More Support

Less Support

Specifications

Feedback

Score

Claim

Answers the question, “Would you play in this water?”

1/4

Evidence

Includes at least three pieces of evidence from the image.

3/6

Reasoning

How does your evidence point to the conclusion you are making?

Use the terms:

Contamination
Toxins
Environment

3/6

Evidence:

I see...

I notice...

I observe...

Claim: Would you play in this water? Circle your choice.

I would play in this water.

I would not play in this water.

Reasoning: Choose the choice that best connects the evidence to your claim:

The yellow suits are helping to protect the workers from the toxic river.

It is a rainy day and the river is overflowing, so workers are making sure the river doesn’t overflow and hurt the environment. Some toxins may have come from the rain.

Willow suits mean the workers are protecting themselves from the water because it may be contaminated with toxins. The workers are using a pump and safety gear to clean the river environment of the toxins. The environment may be affected as indicated by the brown plants, meaning they may have died because of the contamination of harmful toxins.
Claim: Would you play in this water?

Evidence:
1. 
2. 
3. 

Reasoning:
Exceeds

Expected Score:
Level 1: 31
Level 2: 
Level 3: 
Level 4: 32

Meets

Exceeds

Exceeds
**Why do we do this?**

Asking **students to demonstrate** their own understanding of the implications of a scientific idea by developing their own explanations of phenomena, whether based on observations they have made or models they have developed, **engages them in an essential part of the process by which conceptual change can occur.**

~NRC Framework, 2012, p. 68-69
Thank you!

Shared Resources
https://padlet.com/pobrien12/n56vf9s7te6j1p49

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