Claim-Evidence-Reasoning:  
*Scientific Explanations to Increase Student Voice*

Empower students to make informed decisions and speak from evidence with reasoning

Session Goals

Practice using the CER process to:

- Encourage student curiosity and engagement in authentic science and engineering practices
- Engage students in the deeper skills of inquiry they need to be successful not just academically but in the real world
- Empower students to make informed decisions and speak from evidence with reasoning
Is this a healthy snack?

**Nutrition Facts**

10 servings per container

**Serving size**
1 bar (68g)

**Calories per serving**
260

<table>
<thead>
<tr>
<th>Amount/serving</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 7g</td>
<td>9%</td>
</tr>
<tr>
<td>Saturated Fat 1g</td>
<td>6%</td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td></td>
</tr>
<tr>
<td>Polyunsaturated Fat 2.5g</td>
<td></td>
</tr>
<tr>
<td>Monounsaturated Fat 3g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>0%</td>
</tr>
<tr>
<td>Sodium 230mg</td>
<td>10%</td>
</tr>
<tr>
<td>Vitamin D 2mcg</td>
<td>8%</td>
</tr>
<tr>
<td>Calcium 193mg</td>
<td>15%</td>
</tr>
<tr>
<td>Iron 2mg</td>
<td>10%</td>
</tr>
<tr>
<td>Potassium 251mg</td>
<td>6%</td>
</tr>
<tr>
<td>Vitamin A 2%</td>
<td></td>
</tr>
<tr>
<td>Vitamin C 6%</td>
<td></td>
</tr>
<tr>
<td>Vitamin E 10%</td>
<td></td>
</tr>
<tr>
<td>Thiamin (Vit. B1) 15%</td>
<td></td>
</tr>
<tr>
<td>Riboflavin (Vit. B2) 15%</td>
<td></td>
</tr>
<tr>
<td>Niacin 22%</td>
<td></td>
</tr>
<tr>
<td>Vitamin B6 10%</td>
<td></td>
</tr>
<tr>
<td>Vitamin B12 25%</td>
<td></td>
</tr>
<tr>
<td>Phosphorus 20%</td>
<td></td>
</tr>
<tr>
<td>Magnesium 25%</td>
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</table>

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

**INGREDIENTS:**

**Allergen Statement:** Contains Peanuts and Soy. May contain tree nuts, milk, and wheat.

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**STEMscopes - Claim-Evidence-Reasoning (CER)**

Susan Arnette and Maeve Green

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**Claim**
What is a claim?
A statement that answers the question based on your observations.

**Evidence**
What is evidence?
Scientific data collected through observations and measurements.

**Reasoning**
What is reasoning?
Your explanation of why and the evidence that supports your claim.

---

#2

CLAIM

#1

EVIDENCE

#3

REASONING
Would you play in this water?

**Clear Expectations**

<table>
<thead>
<tr>
<th>Specifications</th>
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</tr>
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<tbody>
<tr>
<td><strong>Claim</strong></td>
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<td></td>
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<tr>
<td>Answers the Question: <em>Would you play in this water?</em></td>
<td></td>
<td>/4 :</td>
</tr>
<tr>
<td><strong>Evidence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide at least three pieces of evidence from your observations of the image.</td>
<td></td>
<td>/6 :</td>
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<td><strong>Reasoning</strong></td>
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<td>How does your evidence point to the conclusion you are making? Include the terms: Environment, Contamination, Toxins</td>
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Susan Arnette and Maeve Green
Find three pieces of evidence to answer the question, “Would you play in this water?”

➔ Observations
  ◆ Qualitative
  ◆ Quantitative

➔ Stick to the Facts!
  ◆ No opinions

STEMscopes - Claim-Evidence-Reasoning (CER)

April 14, 2021

Susan Arnette and Maeve Green
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.

Claim
Answers the Question:
Would you play in this water?

Evidence
Provide at least three pieces of evidence from your observations of the image.

Reasoning
How does your evidence point to the conclusion you are making?
Include the terms:
→ Environment
→ Contamination
→ Toxins
**Evidence Progression**

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

**K-2**
- Use observations & measurements.

**3-5**
- Use observations & measurements.
- Distinguish between appropriate & inappropriate data.
- Consider sufficiency of evidence.

**MS**
- Use observations & measurements.
- Distinguish between appropriate & inappropriate data.
- Consider sufficiency of evidence.

**HS**
- Use observations & measurements.
- Distinguish between appropriate & inappropriate data.
- Consider sufficiency of evidence.

---

**Would you play in this water?**

---

*Susan Arnette and Maeve Green*
I would not play in this water.

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.
**Claim**

“I would not play in this water.”

- Answers a Question
- Solution to a Problem
- End of Exploration

**Hypothesis**

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

**Feedback & Score**

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Susan Arnette and Maeve Green

8
How does your evidence point to the conclusion you are making?

Include the terms:
- Contamination
- Toxins
- Environment
Use the evidence to answer the question.

Observations
- Qualitative
- Quantitative

Stick to the Facts!
- No opinions

Educated Ideas
- Draw on Experiences
- Scientific Knowledge

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

Evidence
- 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
- 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.

Claim
- I would not play in this water.
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.

**Feedback & Score**

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### 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... and Each piece of evidence may have a different justification.

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

### Grades

<table>
<thead>
<tr>
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<th>Progression of Argumentation Focus</th>
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<tbody>
<tr>
<td>K-2</td>
<td><strong>Claim + Evidence</strong>&lt;br&gt;  - Claim – Make conclusions from investigations.&lt;br&gt;  - Evidence – Use observations from investigations.</td>
</tr>
<tr>
<td>3-5</td>
<td><strong>Claim + Evidence + Reasoning</strong>&lt;br&gt;  - Claim – Make conclusions.&lt;br&gt;  - Evidence – Use observations and measurements.&lt;br&gt;  - 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><strong>Claim + Evidence + Reasoning (greater complexity)</strong>&lt;br&gt;  - Claim – Make conclusions.&lt;br&gt;  - Evidence – Use observations and measurements. Distinguish between appropriate and inappropriate data. Consider sufficiency of evidence.&lt;br&gt;  - Reasoning – Provide a justification for why the evidence supports the claim using scientific principles.</td>
</tr>
<tr>
<td>9-12</td>
<td><strong>Claim + Evidence + Reasoning + Rebuttal</strong>&lt;br&gt;  - Claim – Make conclusions.&lt;br&gt;  - Evidence – Use observations and measurements. Distinguish between appropriate and inappropriate data. Consider sufficiency of evidence.&lt;br&gt;  - Reasoning – Provide a justification for why the evidence supports the claim using scientific principles. Each piece of evidence may have a different justification.&lt;br&gt;  - <strong>Rebuttal</strong> – Describe why a counterclaim is not appropriate by critiquing the alternative evidence and reasoning.</td>
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Adapted from *NRC Framework, 2012, pg. 73
Support Learning

Show me
- Introduce Content
- Model Skills
- Think Alouds
- Engage Students
- Illuminate Ideas

Watch me
- "Chunk" Ideas
- Let Students Lead
- Work Together
- Observe Attempts
- Support + Growth Mindset

Help me
- Reduce Support
- Personalize Learning Feedback
- Diversify Activities
- Provide Authentic Student Choice

Let me
- "Unleash" Students
- Identify Needs
- Coaching
- Reduce/Increase Complexity
- Provide Opportunities for Transfer

Vygotsky's Release of Responsibility

#1
- #2
- #3
- #4

Personalize Learning

Support Learning

Model + Examples
- Explorers
- Plant Cycle
- Claim-Evidence-Reasoning

Anchor Charts
- CLAIM
- EVIDENCE
- REASONING

Graphic Organizers
- Current State
- Comparison
- Data Table

Chunk Information

Students Lead

#1
#2
#3
#4

Susan Arnette and Maeve Green
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!

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STEMscopes - Claim-Evidence-Reasoning (CER)

April 14, 2021

Susan Arnette and Maeve Green