“What’s Your Evidence?”

Pushing students toward stronger scientific explanations using the Claims-Evidence-Reasoning framework

Lauren Beal  AMY Northwest Middle School

Heather Spotts  Bellefonte Area Middle School
What is it...

A framework for shaping a scientific explanation

- **Claim**: a statement that answers a question
- **Evidence**: quantitative or qualitative data/observations; must support the claim
- **Reasoning**: scientific concept or explanation that links the evidence to the claim

*Krajik and McNeill, 2012*
Organizational Methods
CER Student Examples

**Question** (6th grade):
Why do we have day and night?

**Question** (8th grade):
What type of movement is occurring at the boundary between ______ and ______ plates?
CER Student Examples

**Claim** (6th grade): When the Earth faces the sun, we have day. We have night when Earth faces away from the sun.

**Claim** (8th grade): The Antarctic and Australian plates are moving apart from each other at their boundary.
CER Student Examples

**Evidence** (6th grade):
The sun and stars appear to rise in the east and set in the west.

![Handwritten Evidence](image)
CER Student Examples

**Evidence** (8th grade):
The geochronology map shows new seafloor at the boundary.
The geography map shows slightly higher elevation at the boundary.
The volcanology map shows only one volcano at the boundary.
The seismology map shows earthquakes occurring all along the boundary.
Reasoning (6th grade):
The Earth rotates on an axis every 24 hours. As we rotate counterclockwise, the sun rises in the East every morning. Throughout the day, the sun rises to its highest point around mid-day and sets in the West each evening. The sun continues to light the other half of the world at one time. Although it appears as though the sun and stars move, the Earth is actually what is rotating.
Reasoning (8th grade):

The convection currents in the mantle cause warmer, less dense magma to rise from the mantle and form new crust or seafloor. As this new crust is being formed the plates are pushed apart. This type of boundary is called divergent and it usually has new seafloor, higher elevation at a ridge and earthquakes and sometimes volcanoes.
Importance of CER

- Memorization to Internalization (Habits of Mind)
- Transdiscipline
- Prepares students with 21st century skills for a globally competitive society
- HOTS
- PA Common Core for Reading and Writing (Science) and the NGSS
How Can We Improve?

- Clear introduction of framework
- Multiple opportunities to practice formulating CERs
- Deliberate focus on questioning (parking lot, inquiry chart)
- Specific strategies to encourage peer feedback and target areas of weakness
  (peer review, gallery walk, class meetings)
Methods of Introduction

Nature of Science Unit to Introduce CER Framework

Using Non-Science examples to Introduce CER Framework

Parking Lot/Inquiry Chart for questions
Parking Lot

More than 700 questions ‘Parked’ over the course of one unit.
Peer Review

- Whole class review of CER
- Model constructive feedback
- Students work in pairs to provide feedback for written CERs
- Whole class discussion of patterns, areas of strength and weakness
- Revision of group CER
Gallery Walk

- Whole class review of CER
- Model constructive feedback
- Students use sticky notes to provide feedback to peer CERs posted around room
- Class discussion of patterns, areas of strength and weakness
- Revision of group CER
Class Meetings

- Whole class review of CER
- May take place after a Gallery Walk
- Whole class discussion of patterns, areas of strength and weakness
You Try It

1. Use the data chart provided to write a CER with your group on chart paper.
   (5 minutes)

2. Gallery Walk: Constructive feedback on each poster
   (5-10 minutes)

3. Group discussion: Strengths and weaknesses of CERs

4. Group discussion: Process; where to go from here
**You Try It**

**Scenario:** Students are learning about physical and chemical changes. Vinegar is tested with red litmus paper. It is combined with colored sugar and tested with red litmus paper. It is then combined with baking soda and tested with red litmus paper.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Litmus Paper Test</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinegar</td>
<td>Stays red</td>
<td>clear liquid; strong smell</td>
</tr>
<tr>
<td>Vinegar + colored sugar</td>
<td>Stays red</td>
<td>liquid turns green; strong smell</td>
</tr>
<tr>
<td>Vinegar + baking soda</td>
<td>Turns blue</td>
<td>Liquid bubbles and fizzes; strong smell; becomes clear with white solid on bottom</td>
</tr>
</tbody>
</table>

**Question:** What type of change is occurring with the vinegar and baking soda reaction?
Final Thoughts?

How do you envision using CER in your classrooms?

What other strategies do you use to target areas of weakness?