
“What’s Your Evidence?”

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

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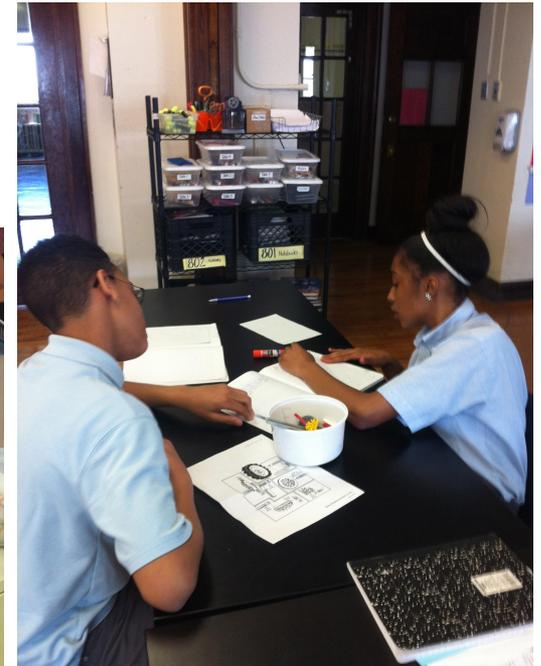
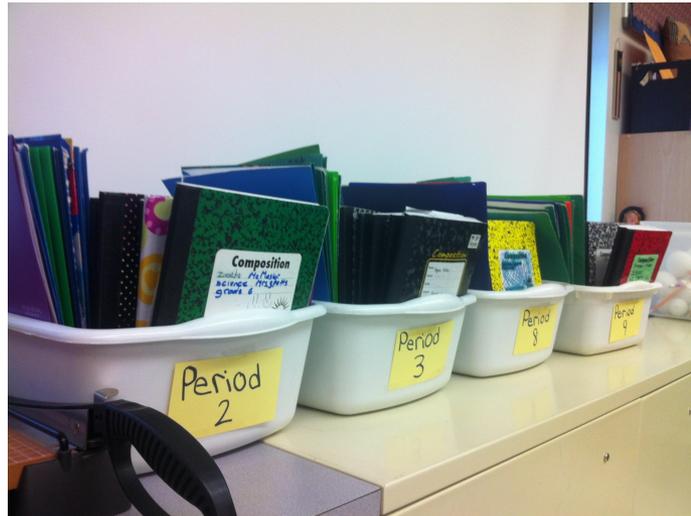
What is it...

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.

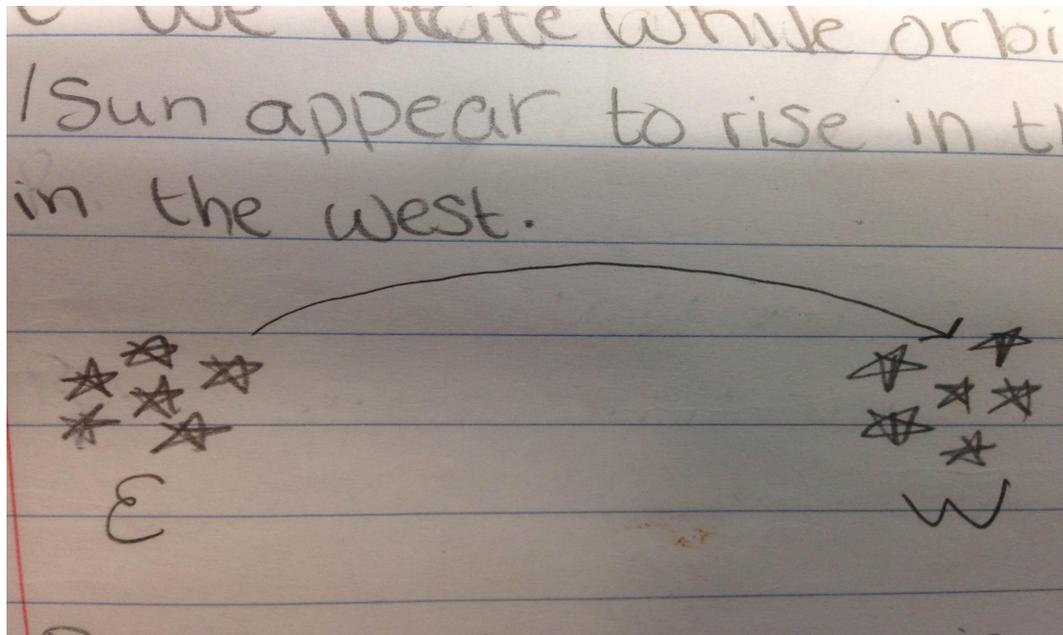
We have night when Earth faces away from the sun.

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.



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.

CER Student Examples

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.

CER Student Examples

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)
 - Transdisciplinary
 - Prepares students with 21st century skills for a globally competitive society
 - HOTS
 - PA Common Core for Reading and Writing (Science) and the NGSS
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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)
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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
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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
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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
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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.

Substance	Litmus Paper Test	Observations
Vinegar	Stays red	clear liquid; strong smell
Vinegar + colored sugar	Stays red	liquid turns green; strong smell
Vinegar + baking soda	Turns blue	Liquid bubbles and fizzes; strong smell; becomes clear with white solid on bottom

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?
