Britannica Expedition:LEARN!

Teacher Toolkit

Claim-Evidence-Reasoning: Grades 6–8

OVERVIEW:

Today's science standards require students to engage with scientific concepts on a deeper level. Integrated within the standards are scientific and engineering practices that highlight the skills students need to develop to engage in the work of the discipline. One of the practices is engaging in argumentation from evidence. Scientific argumentation goes beyond evaluating experiments or testing a solution. Whether testing a design, explaining a phenomena, or constructing a model, students are expected to use argumentation to listen to, compare, and evaluate competing ideas and methods. Using the Claim-Evidence-Reasoning (C-E-R) model can help students hone these skills as it emphasizes using evidence and reasoning to support a claim. The following lessons build on students' elementary school work using the C-E-R model, teaching them to develop more nuanced, sophisticated, and complex scientific arguments.

Mini-Lesson I

Review the Steps of the C-E-R Process

Background: Before students can write sophisticated, nuanced arguments, they need to be proficient in developing scientific arguments, which can be developed using the Claim-Evidence-Reasoning (C-E-R) model. The following lesson reviews the C-E-R process with students, building a common language and structure while they practice using the structure to write a scientific argument. Prior to teaching this mini-lesson, it is suggested that students complete a lesson within Expedition: Learn! that allows them to develop a scientific argument in response to a question or problem presented. While engaging in the lesson, students should use an active reading strategy, such as concept mapping or Cornell note-taking, recording important details and information. The following teaching suggestions are based on the *Expedition: Learn!* lesson "Human Impacts on Earth Systems."

- After students have engaged in the lesson, display the graph on page 2-Build and pose the following question:
    - How do humans change the planet?
- Share with students that they are going to use the C-E-R model and information in the lesson to develop a response to this question.
- Display and distribute the **Claim-Evidence-Reasoning graphic organizer**.
- Work through the steps on the organizer, modeling how to build a scientific argument using information from the lesson. For example:
    - Invite students to record the topic of the lesson on their organizer.
        - Human impact on Earth's systems
    - Reinforce that the first step in the process is to develop an arguable claim that answers the question.

- Invite students to think of a claim in response to the question and record it on their organizer. Consider providing time for students to discuss their claim, either before or after recording it on the organizer, as opportunities to discuss their writing can help develop their cohesion and specificity.
- After students have written their claim, provide the following criteria and ask students to evaluate their claim, revising as necessary:
  - A claim is a belief statement.
  - It answers the question without providing an explanation.
  - It should be written as a complete sentence.
- Share with students that the next step is to consider the evidence. Emphasize that as scientists, their job is to consider all the evidence, not just the evidence that supports their claim.
- Invite students to review their notes from the reading of the lesson, identifying evidence that is relevant to explaining how humans change the planet.
  - To scaffold this step for students, consider providing two or three different claims and having students use different colors to highlight the evidence that supports each claim. This helps them visually organize the information and encourages them to consider all of the relevant evidence, not just the evidence related to their claim.
- Once students have reviewed their notes, invite them to choose the three strongest pieces of evidence and record them on their organizer. As needed, encourage students to revise their claim if they are finding that it is not supported by evidence or that there is stronger evidence for a different claim. Emphasize that this is a key component of scientific thinking—being open to new ideas and evidence. As needed, model the process. For example:
  - *Share your claim: Humans have negatively changed the planet, causing pollution and creating a strain on Earth's natural resources.*
  - *Identify related evidence, considering which most strongly supports the claim. As you model finding evidence, reinforce that while the data and facts need to be restated exactly, the rest of the sentence should be put in students' own words.*
  - *People use large amounts of fresh water for drinking, farming, cooking, and other tasks related to survival.*
  - *The population of Earth has grown over time, which means that people are using more resources.*
  - *Activities like mining are used to get resources. Mining removes materials from the earth, which can lead to erosion, water pollution, and habitat destruction.*
  - *With an increase in population, more houses, schools, and businesses are needed. Trees are cleared to make room for construction. This increases carbon dioxide in the air, which causes global warming.*
- After students have written their evidence, provide the following criteria. Ask them to evaluate the evidence they located to make sure it meets the criteria, revising as necessary. Evidence needs to be:
  - **Appropriate**: The evidence should be related to the question or problem
  - **Sufficient**: The more data and evidence students have, the stronger the claim.
  - **Observation-based:** The evidence should be based on research, articles, interviews, or field notes.
- Share that the last step of the process is to provide the reasoning. Introduce reasoning as:
  - Logical support of the belief or claim
  - Answer the questions "why" or "how."
  - Connect your claim and evidence.
  - Uses scientific rules, principles and reasoning to make your claim strong.
- Model developing a reasoning statement for at least one piece of evidence. For example:
  - *As trees are cleared for houses, business, and schools that are needed to provide for the increase in population, Earth loses a valuable resource to combat global warming. With fewer trees to remove carbon dioxide from the atmosphere, carbon dioxide increases, leading to the greenhouse effect. In this way, humans negatively change and impact Earth's systems.*
- Invite students to develop their reasoning for each of the pieces of evidence they identified.
- After students have completed the reasoning, explain that they can use their organizer to write a scientific argument that answers the question.
- Consider providing opportunities for students to share their responses with peers and use the criteria outlined above to provide feedback and suggestions.

Mini-Lesson II

Strengthen Your Argument With a Rebuttal (20 minutes)

Background: One of the drawbacks to the C-E-R model is that students are asked to develop a claim first in response to a question. For some students, this can be problematic as they may only look for evidence to support their claim, ignoring evidence for a possible alternate explanation. It is important to emphasize that scientists consider all evidence even if it contradicts what they initially believed, as this enhances the strength of their claim and increases scientific advancements. In the fourth component of the C-E-R model, "rebuttal," students are asked to describe evidence counter to their claim, which ensures that they pay attention to all the evidence. For this lesson, it is suggested that students have completed C-E-R for a lesson from *Expedition: Learn!* or a lesson aligned to the topic being studied in class. The following lesson builds off the work in Mini-Lesson I and the *Expedition: Learn!* lesson "Human Impacts on Earth Systems."

- After students have engaged with the C-E-R process in a previous lesson, share that this lesson will focus on strengthening their argument.
- Explain that sometimes when students are developing an argument using the C-E-R model, they can encounter something called *confirmation bias*. Share that confirmation bias occurs when we only look for the evidence that supports our claim, ignoring other pieces of evidence that might provide an alternate explanation.
- Share with students that scientists' goal is not to just prove their opinions and claims, but rather to be open to all the evidence and consider which explanation is best supported by the evidence. Share that some of the most significant scientific discoveries arose from times when an explanation ran counter to what was believed at the onset.
- Introduce the term *rebuttal*, sharing that students will add a rebuttal to the C-E-R process to ensure they are considering all the evidence and to strengthen their claims. Define *rebuttal* for students:
    - *rebuttal*: a description of alternative explanations, providing counter evidence and reasoning for why the explanation is not appropriate.
- Share with students that to develop their rebuttal, they will complete a C-E-R organizer for a counterclaim (or a claim opposite of theirs).
- Provide students with time to complete the C-E-R organizer.
- Emphasize to students that while planning a rebuttal, we might find that we change our thinking, and that is okay. Allow time for students to develop a new argument if they decide the counterclaim is stronger than their original claim.
- Model how to develop a rebuttal to add to your argument, emphasizing that the rebuttal includes:
    - What the counterclaim is
    - Evidence that might support the counterclaim
    - Reasoning as to why the evidence and counterclaim are disproven.
    - For example:
        - ➢ *Some might argue that humans don't impact Earth, and the changes we see are not because of human activity but rather the natural systems on Earth. For example, throughout history there have been examples of Earth warming and natural resources dying off. However, the evidence shows that this now occurs at a much faster rate than ever before, which can only be explained by human causes.*
- Invite students to add their rebuttal to their argument and share with the class.

Check for Understanding

If you observe …	Then try …
students struggling to develop the reasoning	redefine reasoning as "explaining what the evidence means." Once students are able to explain what it means, ask them to identify a connecting scientific rule or principle. This will strengthen students' reasoning and scaffold them in understanding how to connect their evidence to their claim.
students struggling to develop a rebuttal	presenting students with two or more potential explanations related to a topic or phenomena being studied. Ask students to verbally support each explanation, which strengthens their ability to see multiple explanations.

Claim-Evidence-Reasoning

Topic/Title of Lesson: _____

Claim

Evidence

Sentence Stems:
For example...
Evidence that supports my claim is...
According to...

Reasoning

Sentence Stems:
This confirms...
Since...
In conclusion...