

A Guide to Developing Argumentation Practices in Science

Reteaching Loop: Understanding the Role of Relevant Evidence in Supporting a Claim

Strategy Guide

The Learning
Design Group



THE LAWRENCE
HALL OF SCIENCE

Grades 6–8

Overview

About the Reteaching Loops collection: Reteaching Loops are instructional sequences that focus on areas in which your students need more support. This collection of strategy guides provides ways for teachers to support deeper and more sophisticated understanding about several foundational aspects of argumentation in science. Each guide assumes that students have been introduced to the basic components of argumentation and that they need more practice and guidance in order to progress further with their skills. The following topics are addressed in this collection of Reteaching Loops: reading arguments, writing (basic components, relevant evidence, reasoning), and discourse.

Why provide extra support with this Reteaching Loop? Writing scientific arguments is often difficult for students. This genre of writing is especially hard to master because it has many essential component parts (claims, evidence, reasoning) that can be difficult to understand on their own. Additionally, the content about which the argument is being constructed is often difficult to comprehend and synthesize. Offering students' guided support and practice in breaking down some of the important aspects of scientific argumentation writing can help build their capacity to write arguments independently. This strategy guide is one of three Reteaching Loops for writing. (The other two are: Reteaching Loop: Identifying Basic Components of Strong Argumentation Writing by Analyzing Student Work and Reteaching Loop: Using the Reasoning Tool to Develop a Strong Written Argument.) In this series of Reteaching Loops for writing, students do very little writing. Instead, they participate in activities that build their capacity to understand the important components of scientific argument writing. The three strategy guides in this Reteaching Loops series will provide students and teachers with shared background experiences to which they can refer as they work on writing throughout the year.

How do I use this strategy guide? Students often have trouble writing arguments that are complete, contain relevant supporting evidence, and contain clearly articulated reasoning. The argumentation card-sort activity in this strategy guide focuses on helping students distinguish between relevant and irrelevant evidence as related to a given claim. In addition, the card-sort activity facilitates students' ability to explain the important connections between the evidence and the claim as they discuss their card sorts with their partners. This guide helps students practice thinking about relevant and irrelevant evidence and articulating reasoning so they will have a common shared experience to refer to as they write later in the year.

Addressing Standards

COMMON CORE STATE STANDARDS FOR ELA/LITERACY

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12

WHST.6–8.1b: Write arguments focused on discipline-specific content. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

Engaging in Argument from Evidence. Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts.

Materials and Teaching Considerations

For the class

- Projection: Scientific Argument Diagram
- Projection: Surface of Mars Before and After
- Projection: Object on the Surface of Mars
- Projection: Claim About Object on Surface of Mars
- Projection: Setup: Object on Mars Claim and Evidence Cards
- Projection: Argumentation Sentence Starters for Partner Discussion
- Paper clips
- Scissors

For each pair of students (copymaster)

- 1 set of Object on Mars Claim and Evidence Cards, clipped together (12 cards/set)

For teacher reference

- Possible Sorted Evidence Cards

Time frame: 35–45 minutes

Teaching Considerations

Students will be working in pairs for the majority of this lesson. There will also be some whole-class instruction and discussion time.

Getting Ready

1. Prepare to project the following:
 - Scientific Argument Diagram
 - Surface of Mars Before and After
 - Object on the Surface of Mars
 - Claim About Object on Surface of Mars
 - Setup: Object on Mars Claim and Evidence Cards
 - Argumentation Sentence Starters for Partner Discussion
2. On the board, write "A strong and convincing argument contains evidence to support the claim."
3. On the board, write "relevant evidence" and "irrelevant evidence."
4. Make enough copies of the Object on Mars Claim and Evidence Cards for each pair of students to get one set. The set of cards includes: 1 question, 1 claim, 2 headings (relevant evidence, irrelevant evidence), and 8 evidence cards.
5. Prepare the Object on Mars Claim and Evidence Cards. Cut apart all card sets and clip each set together with a paper clip. Be sure to keep one set of cards for yourself to use for modeling purposes.
6. Review Teacher Reference: Possible Sorted Evidence Cards. If you find this document helpful, you can refer to it during the debrief in Step 15.

Remind students that a strong and convincing scientific argument:

- answers a question about the natural world.
 - begins with a claim that addresses the question. The claim is usually at the start of the argument and is best when it is concise (no more than one or two sentences).
 - contains evidence to support the claim.
 - includes reasoning. The reasoning is used to make the argument clear to your audience.
2. **Focus on evidence.** Let students know that today they will be focusing on evidence. Point out the statement you wrote on the board: *A strong and convincing argument contains evidence to support the claim.* Explain that during today's activities, you will take a closer look at this statement to understand what it means and, specifically, learn more about what it means for evidence to support a claim.
 3. **Introduce *relevant evidence* and *irrelevant evidence*.** Point out the terms *relevant evidence* and *irrelevant evidence* that you've written on the board. Explain that these are important terms in argumentation and that students will be using them today. Knowing what these terms mean will help them to better think about, write, and critique their own arguments as well as arguments that others write.
 - **Provide a definition of *relevant evidence*.** Explain that *relevant* means closely connected. Relevant evidence is evidence that is closely connected and supports the claim you are making. It helps to make your argument strong. On the board next to

Determining Relevance, Using Evidence from a Mystery on Mars

1. **Project Scientific Argument Diagram.** Review the components of a scientific argument.

relevant evidence, write "closely connected to the claim."

- **Provide a definition of *irrelevant evidence*.** Explain that *irrelevant evidence* is evidence that someone added into an argument that does not support the claim and often doesn't actually even have anything to do with the argument at all. If it seems appropriate, you can also explain that the *-ir* prefix means not. Therefore, adding *ir* to the beginning of the word *relevant* creates the word *irrelevant*, which means not relevant. On the board next to *irrelevant evidence*, write "not connected to the claim."
 - **Offer an example of relevant and irrelevant evidence.** Say, "If your claim is that sharks are a type of fish, and you were given a piece of possible evidence that stated that sharks have gills and so do fish, that would be a piece of relevant evidence that supports your claim. What if you were given another piece of possible evidence that stated that birds make nests? Information about birds' nests would be irrelevant to the claim. Therefore, you would want to discard this information and not use it because it isn't useful to making this argument."
4. **Explain the purpose of today's card-sort activity.** Explain that often when you are preparing to write an argument, one of the first things you do is survey your evidence in order to decide which evidence that is available to you actually supports your claim and which does not support your claim. To do this, you can sort out the irrelevant evidence and keep the relevant evidence. If you do this before you write, you are more likely to write a strong argument in which all the evidence that is included is relevant to the claim you are making. Let students know that today, they will practice this kind of thinking and sorting by engaging in a card-sort activity.
 5. **Provide background about the Mars rover to support the card-sort activity.** Let students know that they will evaluate some interesting and puzzling information gathered from the surface of Mars by a Mars rover. Explain that a rover is the name for a kind of vehicle that NASA has been sending to Mars (and other

places, such as the Moon) to explore and collect data from the planet's surface. The rover can move around and do other things, such as take samples of the surface, take photographs, etc. Each rover is given a name; the rover that provided the data from Mars is called *Opportunity*. Let students know that they will use this data in the card-sort activity.

6. **Project Mars' Surface Before and After.** Explain that the rover *Opportunity* took many photos while it was on the surface of Mars. Everyday, people at NASA examined these photos that were sent down to Earth by the rover. Let students know that the data they will be looking at is real data. This same data presented a mystery for scientists and for people around the world. Describe the mysterious object that appeared in *Opportunity's* path. Say, "*Opportunity* took a photograph in one spot on Sol 3528 (a Martian day). This first photograph is shown on the left. *Opportunity* came back 12 Earth days later to take a photograph of the exact same spot. To everyone's surprise, a new object had appeared in this spot. Many scientists and people around the world were curious about this weird object. How did it get there? What was it? Many people thought that it looked like a jelly donut and started calling it the jelly donut object."
7. **Project Object on Surface of Mars and introduce the question about the jelly donut object.** Say, "Scientists immediately began trying to answer the question *What is this object that the rover Opportunity photographed on the surface of Mars and how did it get there?*"
8. **Project Claim About Object on Surface of Mars.** Read aloud, or have a student read aloud, the claim, "*The jelly donut object found on Mars is a rock that was moved by the Mars' rover Opportunity.*" Let students know that after making observations and gathering information about the object and the surface of Mars, scientists decided that the jelly donut object was actually a rock that had been moved from one place to another by one of *Opportunity's* wheels.
9. **Distribute materials for the card-sort activity.** Distribute one set of Object on Mars Claim and Evidence Cards to each pair of students.

- 10. Project Setup: Object on Mars Claim and Evidence Cards.** Explain how students will set up the card sort on their desks. Hold up the question and claim cards and have students find these in their card sets. On the projection, point out that the question should go at the very top and the claim below it. Then, hold up the two headings: "relevant evidence" and "irrelevant evidence" and have students find these cards. Point out that these two headings go below the claim and that pairs will sort their evidence cards under one of these two headings.
- 11. Explain how students will sort cards.** First, students will read the information on the evidence cards. Partners should read them quietly aloud to each other. Next, partners will decide whether or not each piece of evidence supports the claim or does not support the claim—in other words, whether each piece of evidence is relevant to the claim (and, therefore, relevant to the argument) or irrelevant. Once partners decide, students will place the evidence under the appropriate headings.
- 12. Project Argumentation Sentence Starters for Partner Discussion and set expectations for student talk.** Say, "As you sort the evidence cards, I'd like you to practice using the language of argumentation. These sentence starters (and the question) will help you describe your ideas just as a scientist who is engaged in argumentation would. As you discuss the information presented on the evidence cards with your partners, use these sentence starters to explain your ideas about how the information on the cards is relevant or irrelevant to the claim."
- 13. Model expectations for student talk.** Select an evidence card from your demonstration set. Read aloud the information on the card. Choose one of the sentence starters to describe your thinking about the connections between this piece of evidence and the claim. Let students know that this is how you expect to hear them discuss as they engage in the activity. Also let students know that you will keep these sentence starters projected so students can reference them during the activity.
- 14. Students begin card sort.** Have students begin sorting the evidence cards. Circulate and offer feedback as students work. Try to listen for interesting discussions so you can reference this information during the class debrief after the card sort.
- 15. Debrief argumentation activity.** When students appear finished with the card sort, conduct a short whole-class discussion. Let students know that there are no right or wrong answers for this activity—if they can make a strong case for why certain evidence is relevant (or irrelevant), then that is what is important, even if others disagree. You can prompt students with the following questions:
- "Which evidence did you and your partner decide was definitely relevant? Explain why you thought this."
 - "Which evidence did you and your partner decide was definitely irrelevant? Explain why you thought this."
 - "Was there any evidence about which you and your partner had trouble deciding how to sort? Which evidence? Why was it so difficult to sort?"
- 16. Wrap up.** Say, "In this activity, you practiced using information as evidence to support a claim. You thought about how each piece of evidence could work to support or not support the claim, and you saw that you can and should get rid of irrelevant evidence if you want to make the strongest argument possible. You also used reasoning to explain connections between the claim and the evidence as you discussed with your partner. The process you went through is similar to how scientists build their understanding of the natural world. The strongest and most convincing arguments contain relevant evidence about how the natural world works and are accepted by the scientific community until new information is presented that challenges older ideas."

Educative Notes

More Support: Understanding the Concept of Evidence

If you feel that your students do not have a strong familiarity with the concept of evidence and its role in supporting claims, you might want to take a few extra minutes to discuss their initial understanding of the word *evidence* in order to draw on their background knowledge to help support the new understanding that you are trying to develop with them in a science context. Many students know about the word *evidence* from television or books that describe mysteries or crimes. You can draw on this everyday knowledge to offer analogous examples that will help make students' experiences with scientific evidence, claims, and argumentation more accessible.

Support for English Learners: Establishing Connections Between English and ELs' Native Languages

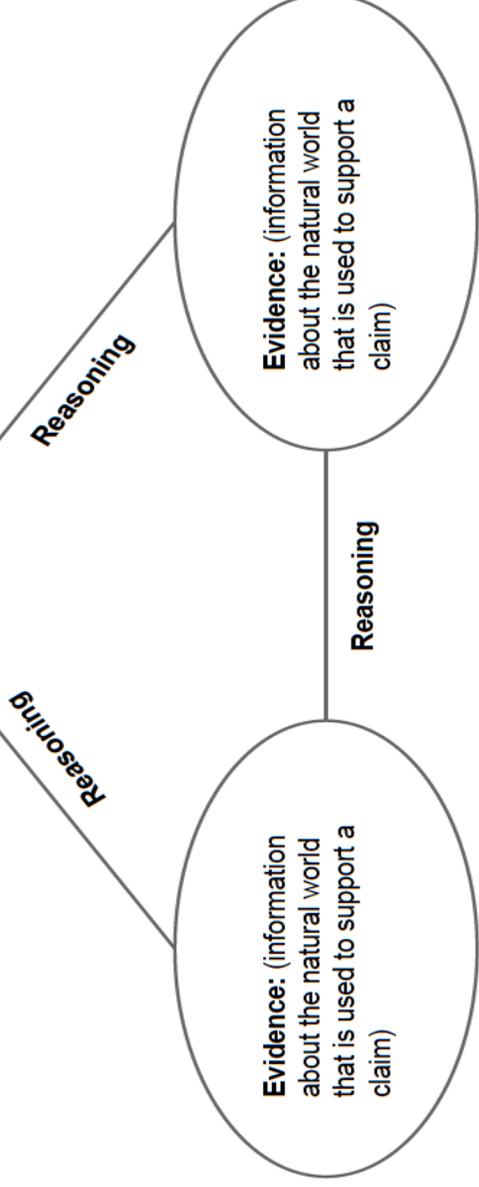
In this strategy guide, students use many words that are cognates: *convincing/convinciente, evidence/evidencia, relevant/relevante para, irrelevant/irrelevante*. Display and add to a cognates chart to help ELs who speak Latin-based languages use newly learned English words to improve their academic science vocabulary in their native languages. In addition, cognates present a good opportunity for ELs to share their linguistic expertise by teaching science words in their native languages to English-only speakers.

Scientific Argument Diagram

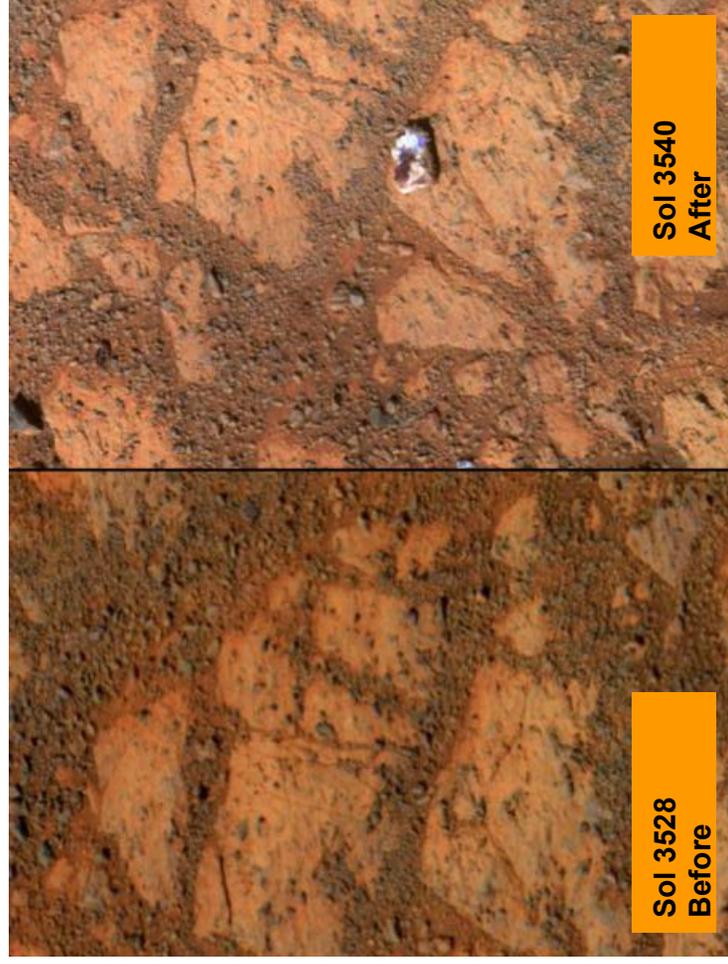
Scientific Argument

Question: (about the natural world)

Claim: (a proposed answer to a question about the natural world)



Surface of Mars Before and After



Object on the Surface of Mars



Claim About Object on Surface of Mars

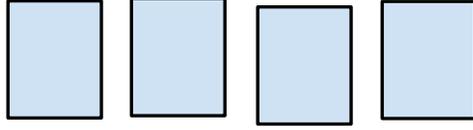
**Claim: The jelly donut object found on Mars
is a rock that was moved by the Mars'
rover *Opportunity*.**

Setup: Object on Mars Claim and Evidence Cards

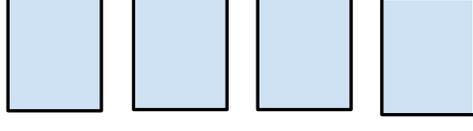
Question: What is this object that the *Opportunity* rover photographed on the surface of Mars and how did it get there?

Claim: The jelly donut object found on Mars is a rock that was moved by the Mars' rover *Opportunity*.

relevant evidence



irrelevant evidence



Argumentation Sentence Starters for Partner Discussion

- I think this piece of evidence supports this claim because
- I don't think this piece of evidence supports this claim because
- I agree because
- I disagree because
- Why do you think that?

Possible Sorted Evidence Cards

Relevant evidence

Opportunity tested the jelly donut object with scientific equipment. The tests showed that the object was made of the exact same chemicals as a nearby rock.

The *Opportunity* rover has a broken front wheel. Scientists think the wheel might have caught an object in its wheel and dragged it along the surface of Mars, causing the wheel to break.

Some rocks that the *Opportunity* rover found are round.

The jelly donut object found on Mars is round.

Irrelevant evidence

The jelly donut object is red, pink, and white in color.

Donuts are usually round.

Mars is a planet in our Solar System.

Jelly donuts are sweet and filled with jelly.

Object on Mars Claim and Evidence Cards

Question: What is this object that the *Opportunity* rover photographed on the surface of Mars and how did it get there?

Question: What is this object that the *Opportunity* rover photographed on the surface of Mars and how did it get there?

Claim: The jelly donut object found on Mars is a rock that was moved by the Mars' rover *Opportunity*.

Claim: The jelly donut object found on Mars is a rock that was moved by the Mars' rover *Opportunity*.

relevant evidence

irrelevant evidence

relevant evidence

irrelevant evidence

Object on Mars Claim and Evidence Cards

<p>The jelly donut object is red, pink, and white in color.</p>	<p>Some rocks that the <i>Opportunity</i> rover found are round.</p>
<p>Donuts are usually round.</p>	<p>Jelly donuts are sweet and filled with jelly.</p>
<p><i>Opportunity</i> tested the jelly donut object with scientific equipment. The tests showed that the object was made of the exact same chemicals as a nearby rock.</p>	<p>The <i>Opportunity</i> rover has a broken front wheel. Scientists think the wheel might have caught an object in its wheel and dragged it along the surface of Mars, causing the wheel to break.</p>
<p>The jelly donut object found on Mars is round.</p>	<p>Mars is a planet in our Solar System.</p>
<p>The jelly donut object is red, pink, and white in color.</p>	<p>Some rocks that the <i>Opportunity</i> rover found are round.</p>
<p>Donuts are usually round.</p>	<p>Jelly donuts are sweet and filled with jelly.</p>
<p><i>Opportunity</i> tested the jelly donut object with scientific equipment. The tests showed that the object was made of the exact same chemicals as a nearby rock.</p>	<p>The <i>Opportunity</i> rover has a broken front wheel. Scientists think the wheel might have caught an object in its wheel and dragged it along the surface of Mars, causing the wheel to break.</p>
<p>The jelly donut object found on Mars is round.</p>	<p>Mars is a planet in our Solar System.</p>

About Argumentation in the Science Classroom

Recently, in both science education research and the new Next Generation Science Standards (NGSS), argumentation has been increasingly emphasized as an important practice for students to learn. The NGSS give argumentation a central role as the way that scientific knowledge is developed and refined within the scientific community and, therefore, a fundamental way for students to both learn about science and develop scientific knowledge themselves. In addition, the Common Core State Standards–English Language Arts/Literacy (CCSS–ELA/Literacy) have placed the role of argumentation at the forefront in core disciplinary subjects such as science and history. Clearly, many associated with education—teachers, researchers, and policy makers—are converging on the importance of ensuring that our students can think about and represent their thinking in the clear, logical ways that the practice of argumentation represents. By providing students with a collection of lessons aimed at breaking apart and understanding the basic components of argumentation—reading, writing, and speaking—teachers can make it much more likely that students will have and feel success participating in this central scientific practice of argumentation, even when content becomes more and more complex.

Resources

- **Scientific Argument Assessments for Middle School Students.** A collaborative project between the Lawrence Hall of Science at the University of California, Berkeley and Katherine McNeill and colleagues at Boston College. Funding from Carnegie Corporation of New York. One product of this grant is a series of formative assessments along with corresponding teaching suggestions. These products can be found on the team's website (<http://sciencearguments.weebly.com>).
- **Constructing and Critiquing Arguments in Middle School Science Classrooms: Supporting Teachers with Multimedia Educative Curriculum Materials (MECMs).** A collaborative project between the Lawrence Hall of Science at the University of California, Berkeley and Katherine McNeill and colleagues at Boston College. Funding from the National Science Foundation. Products for this grant include professional-development videos, podcasts, and short animations that support teacher growth in understanding and teaching argumentation in the classroom. These products will be available in late 2015. Check the website for updates (<http://learningdesigngroup.org>).

About Us

The Learning Design Group, led by Jacqueline Barber, is a curriculum design and research group at the Lawrence Hall of Science at the University of California, Berkeley. Our mission is to create high-quality, next-generation science curriculum with explicit emphasis on disciplinary literacy and to bring these programs to schools nationwide. Our collaborative team includes researchers, curriculum designers, and former teachers as well as science, literacy, assessment, and curriculum-implementation experts.

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