A Guide to Developing Argumentation Practices in Science

Reteaching Loop: Reading Arguments

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 series of Reteaching Loops: reading arguments, writing (basic components, relevant evidence, reasoning), and discourse.

Why provide extra support with this Reteaching Loop? Students often have a difficult time understanding arguments they read in science. In part, this is due to a lack of understanding of the purpose of a scientific argument—to use evidence and present it in a logical way with the intention of being convincing and persuasive about your point of view. For students who find reading a scientific argument to be overwhelming, one first step for engaging them is to provide lessons aimed at thinking about this purpose as they read.

How can I use this strategy guide? This strategy guide is intended to support students who have had some exposure to the basic components of scientific argumentation but who need more support in breaking down and understanding the arguments they read. Use this guide if students are having trouble reading arguments, comprehending what the author is trying to say, and understanding the purpose of an argument (to convince others with evidence).

Addressing Standards

COMMON CORE STATE STANDARDS FOR ELA/LITERACY

Reading Standards for Literacy in Science and Technical Subjects 6–12

RST.6–8.5: Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information: Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

Materials and Teaching Considerations

For the class (projections)

Part 1

- Marked-Up Tree Frog Argument
- Graphic Organizer #1
- Optional: Completed Graphic Organizer #1: Tree Frog Argument
- Forces Argument
- Optional: Marked-Up Forces Argument
- Optional: Completed Graphic Organizer#1: Forces Argument

Part 2

- Mountain Formation Argument
- Optional: Marked-Up Mountain Formation Argument
- Graphic Organizer #1
- Graphic Organizer #2
- Graphic Organizer #3

For teacher reference

- Completed Graphic Organizer #1: Tree Frog Argument (same as projection)

For each student (copymasters)

Part 1

- Forces Argument
- Graphic Organizer #1

Part 2

- Mountain Formation Argument
- Graphic Organizer #1, #2, or #3

Time frame

- Part 1: 30–40 minutes
- Part 2: 20–30 minutes

Teaching Considerations

Both Parts 1 and 2 of this strategy guide can be taught in one day. However, it is probably best to spread out the teaching over two days. Although this strategy guide is intended for whole-class work, it can be adapted for smaller groups as well.

Getting Ready: Part 1

1. Prepare to project the following:
   - Marked-Up Tree Frog Argument
   - Graphic Organizer #1
   - Optional: Completed Graphic Organizer #1: Tree Frog Argument
   - Forces Argument
   - Optional: Marked-Up Forces Argument
   - Optional: Completed Graphic Organizer #1: Forces Argument
2. Make one copy of the following copymasters for each student:
   - Forces Argument
   - Graphic Organizer #1
3. Review and have on hand the following Teacher Reference document to assist you in filling in the projected graphic organizer during class:
   - Completed Graphic Organizer #1: Tree Frog Argument
4. We recommend projecting onto a whiteboard and filling in the graphic organizer on the whiteboard (rather than filling in the graphic organizer itself). However, if you are writing directly on the graphic organizer, you will need to make enough copies for each of your classes. Remember to keep a clean copy for future use.

Part 1 (30–40 minutes)
Whole-Class Introduction to Analyzing Written Arguments

1. **Project the Marked-Up Tree Frog Argument and read aloud the claim.** Remind students that the claim is often the first sentence or two in an argument. For longer texts, it can be buried in the first (or even the second) paragraph or be the whole paragraph.
2. **Explain that the claim is an answer to a question.** For many school assignments and in students' own writing, the question will be apparent and provided to them. For texts that students might read in magazines or in other places, the question might not be as clearly stated. However, students can often figure out the question to which the author is trying to respond as they read the argument itself.
3. **Discuss the Tree Frog Argument as having a two-part claim.** Point out that this claim suggests that tree frogs are both predators and prey. This indicates that the author is likely going

to be trying to prove two different things—one about predators and another about prey.

4. **Read aloud the first highlighted section about predators.** Stop to discuss how the ideas in this section of the argument work together to support part of the claim—the point the author is making about predators. Draw a line from the section about predators to the section of the claim in which the word *predators* appears in order to emphasize this link (even though it is already called out with blue highlighting).
5. **Read aloud the highlighted section of the text about prey.** Following the same procedure, discuss how the section about prey supports the part of the claim about prey.
6. **Project Graphic Organizer #1.** Discuss how the Tree Frog Argument is structured like this graphic organizer: the claim is supported by two distinct sections, each with its own ideas. Each section supports one aspect of the claim, and each section contains both evidence *and* reasoning. Explain that the graphic organizer is like a map of the "shape" of the argument itself. (Note: The purpose of this guide is to draw students' attention to the generalizable underlying structures that form written arguments. Since this examination of an argument is at a slightly larger grain size than doing such things as finding distinct pieces of evidence or finding examples of reasoning in an argument, little time is devoted in this lesson to directly considering evidence and reasoning as distinct aspects of an argument. Instead, the focus is on finding "chunks" of ideas that work together to support a claim [or part of a claim]—each "chunk" contains evidence and reasoning. Feel free to augment the lesson with a discussion about specific examples of evidence or reasoning in each argument if and when this is helpful.)
7. **Quickly complete the graphic organizer.** In order to show students how the structure of the graphic organizer mirrors the build of the written text for this argument, complete the graphic organizer. In the "First idea" bubble, fill in details about predator; in the "Second idea" bubble, fill in details about prey. (For assistance, see Teacher Reference: Completed Graphic Organizer #1: Tree Frog Argument.)
8. **Discuss reading arguments and finding supporting ideas.** Explain that (most) authors want to try to write convincing arguments that lay out ideas in a clear and logical way. Due to this desire, they usually group ideas together in the ways that you just pointed out: Authors have claims that are clearly stated, each claim might include more than one idea, and each idea in the claim is clearly supported in sections of text that contain evidence and reasoning.
9. **Consider longer, more complex arguments.** Explain that even in longer arguments (those found in magazines, in newspapers, on the Internet, etc.) in which the claim may not be as easily identified, authors try to provide convincing arguments, and one way they do this is by grouping ideas together. Therefore, even with longer arguments, the reader can identify and map those ideas onto a graphic organizer (or another visual representation), just as you did for students earlier. Doing this kind of analysis helps make an author's argument clear, whether it is long or short.

Whole-Class Introduction to Analyzing Written Arguments

1. **Project Forces Argument.** Explain that in a few minutes, you would like students to work with this new argument about forces. (Depending on the needs of your students, you can decide whether it would be best to have them work individually or in pairs.)
2. **Consider the claim.** Read aloud the claim and ask students how many ideas this author seems to be trying to support. [Two. Forces can be pushes, and forces can be pulls.] Explain that claims can present one, two, or many different ideas. This argument about forces, like the Tree Frog Argument, presents two ideas that will be supported with evidence and reasoning.
3. **Distribute one copy of the Forces Argument to each student.** Ask students to circle, underline, highlight, or somehow mark on the page the sections of text in which the author is trying to make the two different points: forces can be pulls, and forces can be pushes.
4. **Students work.** Encourage students to discuss their ideas with their peers while they work. Circulate and offer support as necessary.
5. **Distribute copies of Graphic Organizer #1.** Distribute one copy of the graphic organizer to each student. Explain that as students finish marking up the text, they should fill in the

graphic organizer (independently or with a partner). To assist students, you can project Completed Graphic Organizer #1: Tree Frog Argument and tell them that this is an example of what you expect.

6. **Discuss students' work.** As a class, discuss how students analyzed the Forces Argument and filled in the graphic organizer. As needed, project Marked-Up Forces Argument and Completed Graphic Organizer #1: Forces Argument. Alternatively, you can project students' examples.
7. **Wrap up.** Discuss students' thinking about the structure of the argument. Reinforce the idea that the purpose of a scientific argument is to answer a question about the natural world and that scientists are always using evidence to support their claims and convince others in the scientific community. Explain that students can read others' arguments with more confidence if:
   - they know about authors' intended purposes, and
   - they know how to look for the logical sections of text in which the author is supporting one idea at a time. They can do this by identifying the components of an argument through annotation—circling parts, highlighting words and phrases, etc.—*and* by creating a visual representation of the shape (or layout) of each new argument. This can help students read scientific arguments in a more sophisticated way in the future.
8. **Post students' marked-up arguments and completed graphic organizers.** For students' reference in Part 2, you will want to post examples of their marked-up Forces Argument and their accompanying graphic organizers.

Getting Ready: Part 2

1. Prepare to project the following:
   - Mountain Formation Argument
   - Optional: Marked-Up Mountain Formation Argument
   - Graphic Organizer #1
   - Graphic Organizer #2
   - Graphic Organizer #3
2. Make one copy of the following copymaster for each student.
   - Mountain Formation Argument
3. Make copies of the following graphic organizers. Students (or pairs, depending on how you would like students to work) will choose between the three graphic organizers. Therefore, you will need to make enough copies of each of the three graphic organizers so students can choose.
   - Graphic Organizer #1
   - Graphic Organizer #2
   - Graphic Organizer #3

Part 2 (20–30 minutes)
More Practice Analyzing Written Arguments

1. **Project Mountain Formation Argument.** Read the argument aloud. Offer brief background knowledge as necessary. (Collision zones happen when the plates that form Earth's surface push against each other. This plate movement often creates mountain ranges. The student who wrote this argument is describing his experience in class. The description of his experience offers evidence and reasoning about how a mountain range he is studying was formed.)
2. **Consider the claim.** Ask students how many points the author is trying to make with this claim. [One. This is a collision zone.] Remind students that this likely means that all the evidence and reasoning will be presented and will work together to support this one idea—that the mountain range in question was formed at a collision zone.
3. **Distribute copies of the Mountain Formation Argument and have students begin.** Distribute one copy of the text to each student. Point out students' arguments that you posted on the wall and ask students to mark up this new text as they did for the Forces Argument.
4. **Discuss interpretations of the text.** It is possible that some students will want to break down their analyses of the text so each piece of evidence and reasoning is its own separate construction. This is one way of analyzing and understanding this text. Since the goal is for students to deeply read and analyze arguments they read, this can make for an interesting whole-class discussion and can be seen as an acceptable answer. However, what is most important here is that all students understand that this author's intent was to support one consistent claim—the mountains in question were formed by a collision zone—and that he leveraged all his evidence and reasoning to

support this single claim. If you think students will find it helpful, you can project the Marked-Up Mountain Formation Argument. However, if you do choose to project this marked-up argument, make sure students understand that this is only one way to analyze the argument.

5. **Ask students how they might create a graphic organizer to represent the Mountain Formation Argument.** Have a brief discussion about how students might best represent the argument they read. If time allows, you can have a student come up and draw a representative sketch of a possible graphic organizer on the board. You can also show them options by projecting Graphic Organizers #1, #2, and #3 and asking them which one they would choose, if any, to represent the "shape" of the argument they just read. (Note: To reflect the single claim and single idea that supports the claim, Graphic Organizer #2 would best represent the argument. To reflect the single claim and the three ideas from three sources [map, reading, hands-on experience] that support the claim, Graphic Organizer #3 would best represent the argument.)
6. **Distribute Graphic Organizers #1, #2, and #3.** Have students raise their hands to signal which graphic organizer they chose. Distribute one of the three graphic organizers to each student or pair of students (depending on how you would like students to work).
7. **Students work.** Have students record on their graphic organizers the separate ideas that support the claim (evidence and reasoning).
8. **Wrap up the activity by holding a brief discussion about the utility of this kind of analysis.** Explain that one important step in carefully reading and understanding any argument that students read is to first identify the claim and decide what ideas the author wants to support. Remind students that they've seen an example of an argument in which one idea is offered by the claim and then supported with evidence and reasoning (the Mountain Formation Argument). They've also seen two examples of arguments in which more than one idea is offered by the claim and then supported with evidence and reasoning (the Tree Frog Argument and the Forces Argument). Explain that there are many other examples of arguments that students will encounter in the future and that analyzing a written argument in this way can help students better understand arguments. If students don't have a graphic organizer, they can analyze the argument itself by annotating and identifying the claim along with the ideas that are being supported.
9. **Post artifacts from the lesson.** At the end of class, post students' marked-up arguments and accompanying completed graphic organizers so students can reference them in the future.

Educative Notes

Going Further: Extending the Use of Annotations and Graphic Organizers to Analyze Other Arguments

As students read arguments throughout the year, you can have them use the strategies embedded in this guide. First, have students read a provided argument, identify the claim, and identify what the claim intends to draw support for in the body of the argument. Next, have students break down and identify the parts of the claim that are being supported and where in the text the support is to be found. Students can do this by marking the text with highlights, underlining, circling, numbering, etc. Finally, have students choose the graphic organizer they feel best represents the structure of the argument and complete those graphic organizers with the important points from the argument. This process will help all students deeply analyze each argument they read.

If the component parts aren't easily found in a given argument, you may want to discuss with students why this argument is not as strong as it could be (e.g., the necessary supports are weak or absent) and work through how they might improve the argument. You can also have students analyze their own arguments or the arguments of their peers in a similar way. This offers students a useful technique for providing meaningful suggestions to their peers for writing improvement. Analysis like this becomes habitual over time. Practicing this kind of analysis with different and more complex arguments allows students to become more and more capable of reading and analyzing difficult science texts.

Supporting English Learners: Transition Words

Transition words can provide helpful markers for some ELs who are struggling to find obvious delineations between one group of evidence and another. It can be helpful to directly instruct ELs and other students to look out for these words as they read. Transition words can alert the reader to places in the text where evidence is grouped in an argument. For example, when students read words such as *additionally*, *another example*, and *also*, the author is likely adding new evidence. Authors do this intentionally to help group evidence, and readers can use these transition words to better understand the arguments they read.

Marked-Up Tree Frog Argument

evidence and reasoning
(about predator)

One Student's Argument:

QUESTION: In this pond, are the tree frogs predators or prey?

claim

In this pond, the tree frogs are both predators and prey. We observed the tree frogs eating the flying insects, like damselflies, that live around the pond. Over two days, we observed 7 flying organisms being eaten. We also observed the tree frogs eating two tadpoles. In addition, we read in the field guide that tree frogs eat these kinds of organisms. All of this evidence offers examples to show that the tree frogs in this pond are predators. However, we also observed one larger fish eating a frog, and we read in the handbook that organisms like raccoons and hawks eat tree frogs. These are examples showing that tree frogs can also be prey for other organisms. Tree frogs in this pond are both predators and prey.

evidence and reasoning
(about prey)

Graphic Organizer #1

Scientific Argument

Question:

Claim:

First idea:

Second idea:

Projection

Completed Graphic Organizer #1: Tree Frog Argument

Question: In this pond, are the tree frogs predators or prey?

Claim: They are both predators and prey.

First idea:
They are predators

- damselflies
- tadpoles
- book: insects

Second idea:
They are prey

- fish ate frog
- book: racoons and hawks

Forces Argument

Question: Is a force a push or a pull?

There are examples everywhere of forces that are pushes and pulls. There are many examples of pulling forces, such as gravity. Gravity attracts objects together all across the universe. Another example is found with magnets. As we saw in class, when you put the positive end of one magnet near the negative end of another magnet, the two magnets pull toward each other. However, there are also many examples everywhere of pushing forces. Using the example of magnets again, if you put the positive end of one magnet near the positive end of another magnet, these two magnets will push away from each other. In an everyday example, you can observe a pushing force when you push someone on a swing.

Marked-Up Forces Argument

claim

Question: Is a force a push or a pull?

There are examples everywhere of forces that are pushes and pulls. There are many examples of pulling forces, such as gravity. Gravity attracts objects together all across the universe. Another example is found with magnets. As we saw in class, when you put the positive end of one magnet near the negative end of another magnet, the two magnets pull toward each other. However, there are also many examples everywhere of pushing forces. Using the magnets example again, if you put the positive side of one magnet near the positive side of another magnet, these two magnets will push away from each other. In an everyday example, you can observe a pushing force when you push someone on a swing.

evidence of pulling forces

evidence of pushing forces

Completed Graphic Organizer #1: Forces Argument

Question: Is a force a push or a pull?

Claim: There are examples everywhere of forces that are pushes and pulls.

First idea:
A force is a pull
- gravity
- magnet positive to negative

Second idea:
A force is a push
- magnet positive to positive
- swing

Mountain Formation Argument

Question: How was this mountain range formed?

This mountain range was formed by collision-plate movement. The map shows that right next to this mountain range, two plates are pushing against each other. When plates push against each other, scientists call it a collision zone. We read that when the plates push very hard against each other, mountains are formed. We also saw this in the demonstration we did in class in which we used two towels to represent two plates. We pushed the two towels toward each other, just like at a collision zone, and the towels wrinkled up. The wrinkles are like the mountains because the mountains were pushed up when the plates collided.

Marked-Up Mountain Formation Argument

claim

Question: How was this mountain range formed?

This mountain range was formed by collision-plate movement. The map shows that right next to this mountain range, two plates are pushing against each other. When plates push against each other, scientists call it a collision zone. We read that when the plates push very hard against each other, mountains are formed. We also saw this in the demonstration we did in class in which we used two towels to represent two plates. We pushed the two towels toward each other, just like at a collision zone, and the towels wrinkled up. The wrinkles are like the mountains because they were pushed up when the plates collided.

evidence (from several different sources) and reasoning about mountain formation

Graphic Organizer #1

Scientific Argument

Question:

Claim:

First idea:

Second idea:

Graphic Organizer #2

Scientific Argument

Question:

Claim:

One idea:

Graphic Organizer #3

Scientific Argument

Question:

Claim:

First idea:

Second idea:

Third idea:

Name: ______________________________ **Date:** ______________

Forces Argument

Question: Is a force a push or a pull?

There are examples everywhere of forces that are pushes and pulls. There are many examples of pulling forces—such as gravity, which attracts objects together all across the universe. Another example is found with magnets. As we saw in class, when you put the positive end of a magnet near the negative end of another magnet, the two magnets pull toward each other. However, there are also many examples everywhere of pushing forces. Using the example of magnets again, if you put the positive end of a magnet near the positive end of another magnet, these two magnets will push away from each other. In everyday examples, you can observe a pushing force when you push someone on a swing.

Name: ________________________________ Date: ________________

Mountain Formation Argument

Question: How was this mountain range formed?

This mountain range was formed by collision-plate movement. The map shows that right next to this mountain range, two plates are pushing against each other. When plates push against each other, scientists call it a collision zone. We read that when the plates push very hard against each other, mountains are formed. We also saw this in the demonstration we did in class in which we used two towels to represent two plates. We pushed the two towels toward each other, just like at a collision zone, and the towels wrinkled up. The wrinkles are like the mountains because the mountains were pushed up when the plates collided.

Names: ______________________________ Date: ______________

Graphic Organizer #1

Scientific Argument

Question:

Claim:

First idea:

Second idea:

Names: ______________________________ Date: ______________

Graphic Organizer #2

Scientific Argument

Question:

Claim:

One idea:

Names: ______________________________ Date: ______________

Graphic Organizer #3

Scientific Argument

Question:

Claim:

First idea:

Second idea:

Third idea:

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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THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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