A Guide to Developing Argumentation Practices in Science

Reteaching Loop: Practicing Oral Discourse Skills

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? Oral argumentation is the most efficient and socially immediate way for students to share their thinking and receive feedback about it. It also serves as an opportunity for students to practice argumentation skills without the extra cognitive burden that reading and writing can bring. In addition, many researchers believe that oral practice with ideas—when students get time to first express themselves and their thinking aloud—can be a wonderful scaffold to prepare for writing. This may be especially true for a cognitive activity that is as complex as argumentation. Although oral argumentation has many clear benefits in terms of being more accessible and providing for an easier on-ramp to participation for most students, it is also clear that students do not have all the skills required to participate at a high level of sophistication. They need to be taught appropriate response structures, and they require extensive practice time in order to grow both as speakers and listeners during oral argumentation.

How do I use this strategy guide? This stratey guide provides a context that is immediately engaging for students. The sense of engagement launches students into analysis and, as they interact with their peers, into a mode in which they try to convince one another about their ideas and the connections they are making between the evidence and the claim. As students begin to interact around the provided evidence, circulate and encourage them to use scientific language and to articulate their thinking even more clearly or with more depth and analysis. In later lessons in which you want students to practice good oral argumentation skills, you can use this guide as a touchstone for your class, reminding them of how they worked together to analyze data, link evidence, and explain their thinking. Remind students that this is exactly the kind of work they (and scientists) do when they want to thoroughly convince others through argumentation, whether it is done orally or in writing.

Addressing Standards

COMMON CORE STATE STANDARDS FOR ELA/LITERACY

College and Career Readiness Anchor Standards for Speaking and Listening

SL#4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices

Engaging in Argument from Evidence: Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Materials and Teaching Considerations

For the class

Part 1

- Projection: Scientific Argument Diagram
- Projection: Question: Can Video Games Make You Smarter?
- Projection: Argumentation Sentence Starters for Oral Discourse

Part 2

- Projection: Pompeii #1: city (teacher provided)
- Projection: Pompeii #2: people (teacher provided)
- Projection: Pompeii #3: dog (teacher provided)
- Projection: Question
- Projection: Question and Claim
- Projection: Beginning Setup: Mystery City Card Sort
- Projection: Completed Setup: Mystery City Card Sort
- Projection: Argumentation Sentence Starters for Oral Discourse

For the class (continued)

- 1 large set of Mystery City Claim and Evidence Cards (10 cards/set)
- Paper clips
- Scissors
- Masking tape

For each pair of students

- 1 set of Mystery City Claim and Evidence Cards, clipped together (10 cards/set)

Time frame

- Part 1: 15 minutes
- Part 2: 30 minutes

Teaching Considerations

Although this strategy guide is divided into two parts, both parts should be taught in one day. Students will be working in pairs for part of this lesson. There will also be some whole-class instruction and discussion time.

Getting Ready: Part 1

1. Prepare to project the following:
   - Scientific Argument Diagram
   - Question: Can Video Games Make You Smarter?
   - Argumentation Sentence Starters for Oral Discourse

Part 1 (15 minutes)
Considering Oral Argumentation

1. **Review purpose of argumentation in science.** Hold a brief conversation about why scientists participate in argumentation: to provide others with evidence about new discoveries, to explain their thinking about important ideas concerning the natural world, to open up and hold conversations across the scientific community about these important ideas. As appropriate, offer compelling examples so students will better see and understand these purposes.
2. **Review components of a scientific argument. Optional: Project Scientific Argument Diagram.** As needed, remind students that an argument begins with a claim that answers a question and uses evidence and reasoning to support and build the argument.
3. **Introduce the idea that oral argumentation can be different from written argumentation.** Let students know that today's focus will be on oral argumentation. Explain that although oral argumentation has the same purposes and components as written argumentation, when these components are used in oral argumentation, they are sometimes used and practiced in different ways.
4. **Project Question: Can Video Games Make You Smarter?** Explain that this is a possible scientific question with two claims. Add that although the specific evidence is not presented, students can see that each claim has some evidence that can be used to support it.
5. **Introduce a Think-Pair-Share.** Use the following prompts to guide a partner discussion. After you present each prompt, allow time for partners to share and then for the whole class to share. Record notes on the board during the whole-class share.
   - **"Imagine that a teacher gave you a set of cards: 1 question, 2 claims, and 6 evidence cards. Each evidence card contains information that supports one of the claims. Next, this teacher told you to write an argument, using this**

information. What would you do first? What would you do second? What would you do next? Describe to your partner the process you would go through to complete this assignment so you could begin writing an argument."

- **"Now imagine that this teacher gave you the same question, claims, and evidence cards and told the class that you were going to have an oral argumentation discussion about this. What would happen in this situation? Describe to your partner how you would prepare for this and what the process would look like."**

6. **Have the class vote on the following:**
   - **"Which of these activities (writing or an oral whole-class discussion) would be more fun for you?"** (Optional follow up question: **"Why?"**)
   - **"Which do you think you'd learn more from—written argumentation or oral argumentation?"** (Optional follow up question: **"Why?"**)
7. **Conclude the discussion.** Highlight the following ideas about oral argumentation if they did not come up. If it seems valuable, you may want to record these in a T-chart or Venn diagram to which you can add information over time.

   Oral Argumentation
   - It includes/can include many more people.
   - You can hear many more opinions and ideas.
   - It is much faster paced than written arguments.
   - Often, you can think more about each claim because someone will almost always be representing the other side.
   - You can have mini-debates about a piece of evidence, which helps everyone think more deeply about the arguments.
   - Sometimes, oral argumentation feels more like a conversation than actually doing science or thinking/talking scientifically.
   - It is sometimes difficult to know what points you are working on or trying to make because the conversation is very fluid.
   - Misunderstandings can occur, and it is helpful when you have ways of communicating with one another to fix misunderstandings.
8. **Project Argumentation Sentence Starters for Oral Discourse.** Explain that since oral argumentation can be so exciting and so much like a conversation, it can be easy to forget to do things such as support claims with evidence and explain your reasoning. This is why you are going to introduce students to sentence starters that they can and should use when holding these kinds of discussions in class. Review each prompt and discuss how it might be used.

Getting Ready: Part 2

1. Search the Internet and download the following common images of Pompeii. (Note: These images are widely available. However, due to licensing issues, we cannot provide them in this guide.)
   - ruins of the city, including the mountains in the background
   - museum casts of people who were found in the ruins of Pompeii
   - museum cast of a dog who was found in the ruins of Pompeii
2. Prepare to project the following:
   - Pompeii #1 (city)
   - Pompeii #2 (people)
   - Pompeii #3 (dog)
   - Question
   - Question and Claim
   - Beginning Setup: Mystery City Card Sort
   - Completed Setup: Mystery City Card Sort
   - Argumentation Sentence Starters for Oral Discourse
3. Make enough copies of the Mystery City Claim and Evidence Cards so each pair of students gets one set. The set of 10 cards includes: 1 question, 1 claim, 2 headings (supports the claim, does not support the claim), and 6 evidence cards.
4. Prepare the Mystery City Claim and Evidence Cards. Cut apart the sets of cards and clip each set together with a paper clip.
5. Gather the large set of Mystery City Claim and Evidence Cards. You will use these large cards for demonstration purposes during the whole-class discussion in Part 2, Step 12.

Part 2 (30 minutes)
Practicing Oral Argumentation

1. **Introduce the next activity.** Let students know that they will now think about a mystery that

scientists worked on for many years. Students will work in pairs with a set of claim and evidence cards and talk with their partners, using scientific language. Let students know that you will circulate and listen in on their conversations and that you will expect to hear pairs using scientific language in order to support good oral discourse in their discussions.

2. **Present mystery.** Use the following script to present the mystery to students. Feel free to enhance the script as you like, although we strongly suggest that you do not mention the name of the city (Pompeii) until after the lesson since some students might already know about Pompeii. Not revealing the name of the city can help enhance the mystery at the center of the activity.
    - **Project Pompeii #1 (the city from a distance with mountains in the background).** Explain that the mystery is about this place. It is a mystery that many scientists tried to solve for hundreds of years. They gathered evidence and made claims until they finally came to the conclusion that they now have the best explanation for what happened. Say, **"This is a mystery about a city that disappeared. In 1749, workers were digging in the countryside of Italy and accidentally uncovered a large object, which turned out to be the walls of a building. Ancient cities are often buried over time, so this wasn't so unusual. What was strange about this city was that much of it was buried under solid rock, not layers of dirt. Also strange was the fact that people were found inside their houses! Over the next 150 years, archaeologists continued to dig in this site, uncovering an entire city."**
    - **Project Pompeii #2 (people in Pompeii doing everyday things).** Say, **"As this image shows, inside the city were the remains of many of the people who had lived there. They were found buried doing normal, everyday things such as sleeping. One man was even found pulling bread out of an oven."**
    - **Project Pompeii #3 (image of dog found in Pompeii).** Say, **"A dog was found lying inside a house."** (If your image shows a cast of a dog, you can add, **"Here you see a cast of a dog, displayed in a museum."**)
    - **Project Question.** Explain that this was the question scientists asked. Read aloud the question, **"What destroyed this city?"**
3. **Students discuss initial ideas about what happened to the city.** Have students talk with a neighbor about the prompt. Then, hold a brief whole-class discussion. Try to ensure that students focus on the question rather than on speculation about what city this might be.
4. **Project Question and Claim.** Acknowledge that there were probably other ideas in students' discussions about what happened to this city, which is great since diverse thinking is encouraged. However, in order to complete the next activity, this is the claim with which students will work. Read aloud the claim, **"The city was destroyed by a sudden volcanic eruption."**
5. **Project Beginning Setup: Mystery City Card Sort.** Explain the activity by saying, **"Each pair of students will get a set of cards. The two largest cards will be the question and the claim. The question card should be placed on your desks at the top, and the claim card should be placed directly under the question card. The two cards that are a bit smaller are the category cards: supports the claim, does not support the claim. You will place each of these cards below the claim so they form two column headings."**
6. **Project Complete Setup: Mystery City Card Sort.** Say, **"You will also receive six smaller cards. These are the evidence statement cards. Your job will be to discuss with your partner and sort these evidence cards under one of the categories: supports the claim or does not support the claim. Notice that this example shows three cards under the 'supports the claim' heading and three cards under the 'does not support the claim' heading. This is just an example—it isn't showing how you should actually sort your evidence statement cards. When you sort, you might end up with two evidence cards under one heading and four cards under the other heading. Or, you might end up with one evidence card under the 'supports the claim'**

heading and five cards under the 'does not support the claim' heading."

7. **Project and review Argumentation Sentence Starters for Oral Discourse.** Explain that since this is an oral argumentation activity, students will use these prompts to discuss each piece of evidence with their partners. The prompts should be helpful in ensuring that students present their thinking clearly and thoroughly to their partners so together they can make a decision about where to place each piece of evidence. Let students know that after pairs have completed the card-sort activity, the class will discuss and practice using these prompts.
8. **Explain what you expect to see and hear.** Let students know that as you walk around, you will listen carefully to make sure that students are discussing and using the prompts as they sort the evidence cards. This is very important. Pairs need to talk to each other about why they feel something is or is not supportive of the evidence. Let students know that you shouldn't see just one student in a pair deciding everything. In fact, a card should not be moved until both partners agree about where it belongs. Partners' discussions should include these projected prompts as needed.
9. **Distribute card sets and have pairs begin sorting evidence.** Distribute one set of Mystery City Claim and Evidence Cards to each pair of students. Have pairs place the question card at the top, the claim card under the question card, and the two category cards underneath the claim card so the category cards form two column headings. Direct pairs to talk with each other as they decide how to sort the evidence statement cards.
10. **Circulate and make note of interesting points you hear.** As you circulate, listen and write notes about points you hear pairs discussing that might be helpful for the whole-class discussion in the next step.
11. **Whole-class discussion of evidence.** When partners have worked through all the evidence, ask for their attention. Explain that you heard many interesting ideas and that you'd like to have the whole class offer their thinking about what you heard. Remind students to use the prompts when discussing.
12. **As a class, sort large cards and discuss.** Quickly post the question, claim, and two headings in a place where all students will be able to see you sort the cards. Choose one piece of evidence on which to focus. For example: *Over 16,000 people were found buried in the city.* Ask students to raise their hands and explain under which heading they sorted this evidence and why. Continue in this way with all pieces of evidence. When appropriate, bring up students' comments that you overheard during their partner discussions (which you recorded). You may want to use the following questions to help guide and prompt the discussion.
    - **"Does this piece of evidence support the claim? Explain your thinking (reasoning) about how or why it is supportive."**
    - **"If you just had this evidence and nothing else, would you be convinced about this claim? Why or why not?"**
    - **"Could you see this evidence being interpreted in such a way that would cause you to think that it WASN'T supportive? Explain your thinking."**
    - **"Does anyone think this evidence is not supportive? Why?"**
    - **"Does anyone think this evidence is supportive? Why?"**
    - **Is there another piece of evidence that you could combine with this piece of evidence that would make you feel even more strongly that the claim is being supported? Explain your thinking."**
13. **Wrap up the activity.** Explain that the kind of thinking that students displayed throughout the discussions today is exactly what scientists do. Emphasize the following points:
    - Scientists weigh evidence against other evidence and against a claim in order to test out the strength of the evidence and the claim.
    - Scientists put evidence together in ways that make sense.
    - Scientists listen to and are influenced by the excellent thinking of their peers.
    - Scientists respect other people's ideas. When they don't agree, they do this in a respectful way.

- Scientists use normative ways of talking and thinking about evidence and claims to arrive at better ideas, better thinking, and better solutions than they likely could have on their own.

This is the kind of talking and thinking that you will be supporting in this class throughout the year. (Note: See the Educative Notes on page 7—Argumentation: About Supportive Evidence in This Activity and Argumentation: About Reasoning in This Activity—for other considerations and things to discuss with your students.)

Educative Notes

Instructional Rationale: Why Compare Oral and Written Argumentation?

In many cases, students are more familiar with what constitutes a written argument or a piece of writing that is written to convince others of something. Students sometimes tend to think about oral argumentation as less valuable or less useful because of its very nature nature. It doesn't produce a product and is not as easy to follow. (There can be many subarguments in a whole-class argumentation discussion, and sometimes it is not easy to know when a claim is being made versus an accounting of evidence, versus reasoning, etc. During oral argumentation, since it isn't useful to keep track of these components, some students don't see oral argumentation as a legitimate form of argumentation.) Using writing as a contrasting mode of argumentation helps students understand how oral argumentation is both the same as and different from written argumentation. It also allows students to begin to appreciate the purposes for engaging in oral argumentation in class.

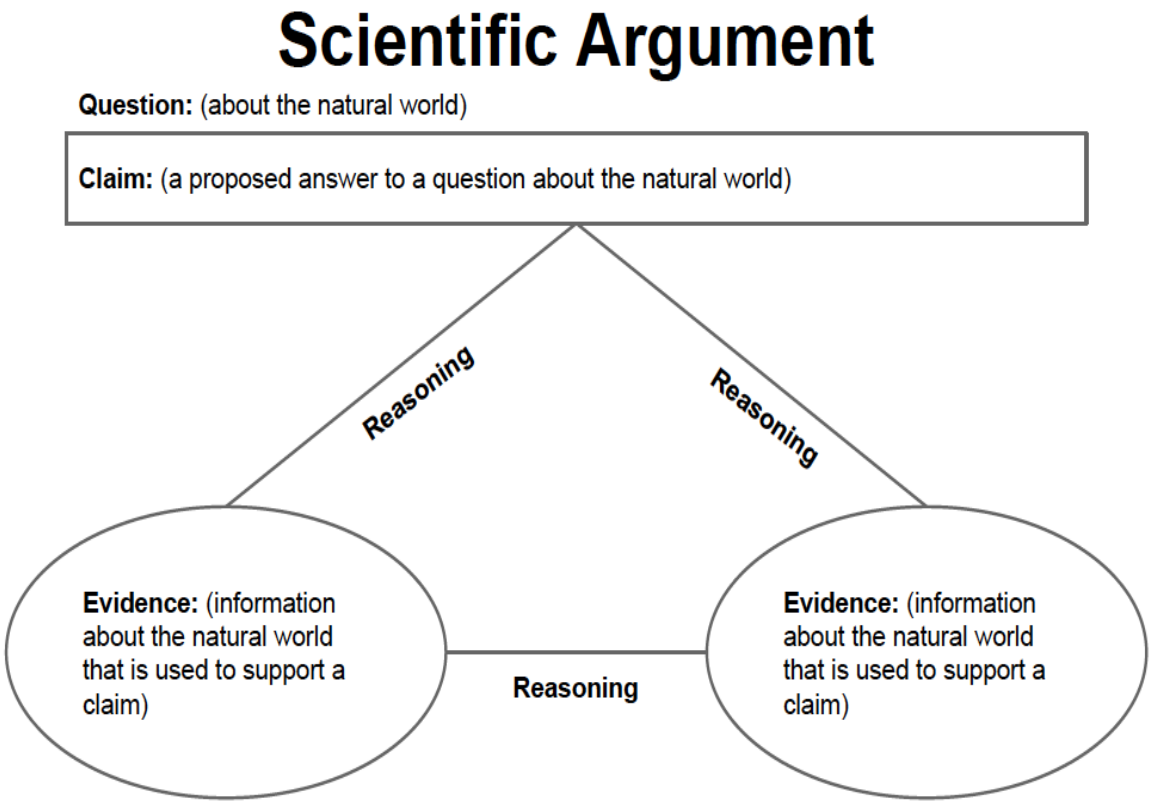
Argumentation: About Supportive Evidence in This Activity

You and your students will likely note through discussion that any single piece of evidence is not in and of itself supportive of the claim. However, when added together with other ideas or evidence, that piece of evidence does (or can) become relevant and supportive. This is an important subgoal of this activity that you can highlight, depending on how the discussion is going. If students are discussing well and using the prompts with ease, you may want to also focus their attention on the fact that one single piece of evidence by itself (e.g., over 16,000 people were found buried in the city) may not offer much support for the claim that it was a volcano that caused the burial. However, when added to the idea that there is an active volcano nearby and that the people who were buried were doing normal, everyday things, it makes a much stronger case for a sudden volcanic eruption. If your students are having difficulty discussing, you may want to use this as a way to wrap up the activity and focus instead on supporting their efforts to speak and discuss with one another.

Argumentation: About Reasoning in This Activity

When students are discussing and making a case for why one piece of evidence is or is not supportive of the claim, they are actually engaging in reasoning. If you feel that your students would benefit from having this pointed out to them directly, you can make it a more distinct part of the lesson. If your students are struggling with discussion, we suggest treating this with a lighter touch, either mentioning it a few times throughout so they hear the term reasoning or saving this point for the wrap up.

Scientific Argument Diagram



Question: Can video games make you smarter?

Claim 1: Video games can make you smarter.

evidence

evidence

evidence

Claim 2: Video games cannot make you smarter.

evidence

evidence

evidence

Argumentation Sentence Starters for Oral Discourse

- 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?

Question

Question: What destroyed this city?

Question and Claim

Question: What destroyed this city?

Claim: The city was destroyed by a sudden volcanic eruption.

Beginning Setup: Mystery City Card Sort

Question: What destroyed this city?

Claim: The city was destroyed by a sudden volcanic eruption.

supports the claim

does not support the claim

Complete Setup: Mystery City Card Sort

Question: What destroyed this city?

Claim: The city was destroyed by a sudden volcanic eruption.

supports the claim	does not support the claim

Mystery City Claim and Evidence Cards

Question: What destroyed this city?

Question: What destroyed this city?

Claim: The city was destroyed by a sudden volcanic eruption.

Claim: The city was destroyed by a sudden volcanic eruption.

supports the evidence	**does not support the evidence**
supports the evidence	**does not support the evidence**

Mystery City Claim and Evidence Cards

There are active volcanoes near where the city was found.	The city was buried under layers of ash and rock.
Many bodies were found in the middle of doing everyday actions. For instance, one man was found pulling bread out of the oven.	There were over 16,000 people found buried in the city.
A new island was formed in 2006 by a volcanic eruption in the Pacific Ocean over 3,000 miles away.	Many people still live near Mt. Vesuvius today because the land is very good for growing crops.
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Question: What destroyed this city?

Claim: The city was destroyed by a sudden volcanic eruption.

supports the claim	does not support the claim

There are active volcanoes near where the city was found.

The city was buried under layers of ash and rock.

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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://scienceaguments.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.

Support for this project was provided by a grant from Carnegie Corporation of New York.

Additional support was provided by the Bill & Melinda Gates Foundation.

This material is based upon work supported by the National Science Foundation under Grant No. 1119584.
Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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