Responsive Mini-Lessons: Evidence—Somewhat Descriptive

About Responsive Mini-Lessons

Responsive Mini-Lessons (RMLs) provide short, targeted lessons that are responsive to each class's facility with oral argumentation, as assessed with the DiALoG Tool. The DiALoG Tool has eight components. Four are intrapersonal—claims, evidence, reasoning, and relevance; four are interpersonal—listening, co-constructing, critiquing, and regulation. RMLs are aimed at providing more practice with one of the eight components of the DiALoG Tool, so your students are more able to work together to enact rich, thoughtful, and engaging oral argumentation. For each component, the following phrases can be assigned, via the DiALoG Tool, to describe your students' abilities: Not Descriptive, Somewhat Descriptive, or Very Descriptive. An assigned phrase of Not Descriptive or Somewhat Descriptive indicates that your students likely need more support with that particular component of oral argumentation; a lesson is then suggested to help your students strengthen their abilities in that area. If the Not Descriptive phrase is assigned, the lesson provides basic, introductory support; if the Somewhat Descriptive phrase is assigned, the lesson assumes some basic facility with that component and provides an opportunity to practice it with more focus.

For the Evidence RMLs, the Not Descriptive lesson asks students to work with evidence, distinguishing between data and opinions, as they consider an accessible everyday scenario. The Somewhat Descriptive lesson builds on this by having students focus on identifying evidence to support a scientific claim.

Does a Responsive Mini-Lesson for the Somewhat Descriptive Level Make Sense for Your Class?

The suggestion to provide a Responsive Mini-Lesson for the Somewhat Descriptive level indicates that, based on your use of the DiALoG Tool, the following statement best describes your students' use of evidence during oral argumentation: *Students sometimes use evidence to support their ideas.* For more detail about this level and how it compares to other levels, please see the DiALoG Tool User Guide.

There is one Responsive Mini-Lesson provided for the Somewhat Descriptive level.

Goals

- Deepen students' understanding of why evidence is important, how it is essential for argumentation, and how evidence can support a claim.
- Provide students with an opportunity to identify supportive evidence and discuss what makes it supportive of a claim.

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Materials and Teaching Considerations

For the class

- Projection: Scientific Argument diagram
- Projection: Data in Scientific Argumentation
- Projection: Opinion in Scientific Argumentation
- Projection: Mystery Fossil Tooth Argument: Question
- Projection: Mystery Fossil Tooth Argument: Claim
- Copymaster: Evidence Headers
- Copymaster: Evidence Cards
- paper clips, scissors or paper cutter*

*teacher provided

For each pair of students

- 1 set of Evidence Headers (2 cards/set)
- 1 set of Evidence Cards (9 cards/set)

Time frame: 30 minutes

Teaching Considerations

Most lessons will begin with an introduction followed by the lesson itself. The introduction is a brief activity that sets up and supports the lesson that follows. Each introduction is teacher-led, while the lesson that follows is more student-centered.

Getting Ready

1. **Decide how to present arguments.** During the introduction and lesson, you will present Scientific Argument diagram, Data in Scientific Argumentation, Opinion in Scientific Argumentation, Mystery Fossil Tooth Argument: Question, and Mystery Fossil Tooth Argument: Claim. The lesson is written as if these resources will be projected.
    - Alternatively, you can choose to make enough copies so each pair of students receives one copy of each.
2. **Prepare Evidence Headers and Evidence Cards.**
    - **Make copies of Evidence Headers.** Make enough copies so each pair gets one set Evidence Headers. There are two cards/set. Cut apart the cards.
    - **Make copies of Evidence Cards.** Make enough copies so each pair gets one set of Evidence Cards. There are nine cards/set. Cut apart the cards and clip together each set with one set of Evidence Headers.
3. **On the board, write "What kinds of objects can become fossils?"**

Introduction

1. **Project Scientific Argument diagram.** Review that all parts of the diagram are important for making a complete scientific argument. Emphasize that sometimes when conducting oral argumentation, one student might not represent all parts of the diagram by himself—in a group discussion, all group members share responsibility for making the argument together. Say, **"Today you will focus on developing a better understanding of the evidence part of an argument."**
2. **Project Data in Scientific Argumentation.** Read aloud and discuss the examples for numbers and the examples for observations. As needed, include examples

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such as using graphs as data. Or discuss how even with good numeric data, more text would be needed to make it clear why the data is important.

3. **Project Opinion in Scientific Argumentation.** Read aloud and discuss each example. As needed, review and discuss why opinion does not constitute strong evidence in a scientific argument. For example, explain in your own words the idea that, in science, one important standard is the ability to replicate data. Therefore, basing arguments on evidence that comes from data, for example, allows other scientists to try the same investigation or experiment. In addition, there are agreed-upon methods for collecting data that scientists share and that provide standards for their work and their conclusions. Opinions don't have these built-in safeguards.
4. **Introduce context for today's argumentation work.** Say, **"You will consider a fossil that was found by scientists. Then, you will review evidence to support a claim about the kind of animal the fossil came from. You will learn more about the fossil in a few minutes."**
5. **Discuss the question written on the board.** Explain that first you'd like students to think about what a fossil is.
   - Have each student turn to a partner and discuss their ideas about what a fossil is.
   - Have students share their ideas with the class.
   - Confirm that fossils can be from bones, teeth, or droppings; fossils can even be imprints. Fossils are evidence from the bodies of organisms living long ago, and many have been mineralized.

Lesson

1. **Project Mystery Fossil Tooth Argument: Question.** Let students know that this is the fossil that was found and that they will be thinking about and discussing possible evidence about this fossil tooth. They will use evidence to support a claim that answers the question *From what kind of animal did this fossil tooth come?*
2. **Project Mystery Fossil Tooth Argument: Claim.** Read aloud the claim and explain that students will be working to support this claim. Remind students that this claim is only one possible answer to the question *From what kind of animal did this fossil tooth come?*
3. **Review the importance of evidence in argumentation.**
   - Point out that this claim—*This fossil tooth is from a prehistoric shark, which is related to sharks that live today.*—is not very convincing all by itself. It needs to be supported with strong evidence in order to be convincing.
   - Say, **"In science, it is important to think carefully about all the available evidence in order to determine how well each piece of evidence supports a claim. Using better and stronger evidence makes your argument more convincing."**
   - Explain that some characteristics of strong evidence are that it includes data, such as observations or numeric descriptions, and that it is not simply someone's opinion.
   - Review accessible examples of data and opinion as needed.

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- Discuss the importance of evidence being relevant and supportive of the claim to which it is connected. Remind students that in argumentation, the goal is to always try to make as convincing an argument as possible. One important way to do this is to make sure that all evidence used actually supports the claim. Provide counterexamples of this as needed to illustrate this point (e.g., If the claim is *This fossil is from a prehistoric whale.*, it would likely be unhelpful to include evidence such as *People have found bird fossils before.*).

4. **Hold up a set of Evidence Headers and introduce the activity.** Explain that students will work in pairs to sort evidence cards under these two categories.
   - Each pair will receive one set of these Evidence Headers and one set of Evidence Cards.
   - Pairs will place the two headers across the tops of their desks or tables.
   - Pairs will review the evidence cards and discuss the possible evidence that supports the claim.
   - Pairs will decide together under which category to place each evidence card.
5. **Distribute card sets and have partners sort and discuss.** Allow time for partners to sort each evidence card and decide under which of the two headers it should be placed. Circulate and encourage students to articulate their reasoning about where they are placing the evidence.
6. **Explain next steps.** When students have finished sorting the Evidence Cards, regain their attention. Explain that students will now have a chance to discuss with the whole class the evidence and under which header they sorted each card.
7. **Discuss evidence as a class.** Lead a discussion in which students discuss where they placed each piece of evidence and why.
   - Try to allow students to respond directly to one another as much as possible.
   - As students discuss, ask them to explain why one piece of evidence is stronger.

   If students do not mention the following ideas, point them out:
   - Evidence that contains data and is not opinion-driven is stronger.
   - Some evidence is made stronger when it is coupled with other evidence.
8. **Conclude the discussion.** Wrap up the class discussion by pointing out that students have just engaged in argumentation as they discussed the evidence. Say, **"Argumentation can include writing or expressing an entire argument, but it can also focus on smaller aspects of an argument, such as discussing why one piece of evidence is strong or weak. As you were discussing your thinking about the evidence for each Evidence Card, you were making mini-arguments to convince one another of your thinking."**
9. **Students write short arguments supporting the claim.** If there is time, have students write short arguments, using the claim *The fossil tooth is from a prehistoric shark, which is related to sharks that are living today.* Have students use the evidence they decided was strong to complete their arguments. Encourage students to avoid including any opinions in their arguments.

Why This Mini-Lesson Matters

This mini-lesson supports students in distinguishing between opinion and scientific data and in grasping the idea that scientific data provide stronger evidence than opinions for evaluating scientific claims. Without prior support or instruction, many students have difficulty citing quality evidence to support their ideas or claims during class discussion (Jimenez-Aleixandre, Rodriguez, and Duschl 2000). When working with evidence, students can have difficulty evaluating the quality of evidence according to scientific criteria and may judge arguments based on what intuitively makes sense; they do not necessarily privilege data over opinion or carefully collected measurements over personal observations (Zeidler 1997; Driver, Newton, and Osborne 2000). This can relate to the finding that students tend to interpret information in a biased way according to how it supports pre-existing beliefs and opinions. Thus, this mini-lesson seeks to support students in evaluating the type and quality of evidence used in scientific argumentation.

Resources

Driver, R., Newton, P., and Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education* 84(3): 287–312.

Jimenez-Aleixandre, M. P., Rodriguez, A. B., and Duschl, R. A. (2000). "Doing the lesson" or "doing science": Argument in high school genetics. *Science Education* 84(6): 757–792.

Zeidler, D. L. (1997). The central role of fallacious thinking in science education. *Science Education* 81(4) 483–496.

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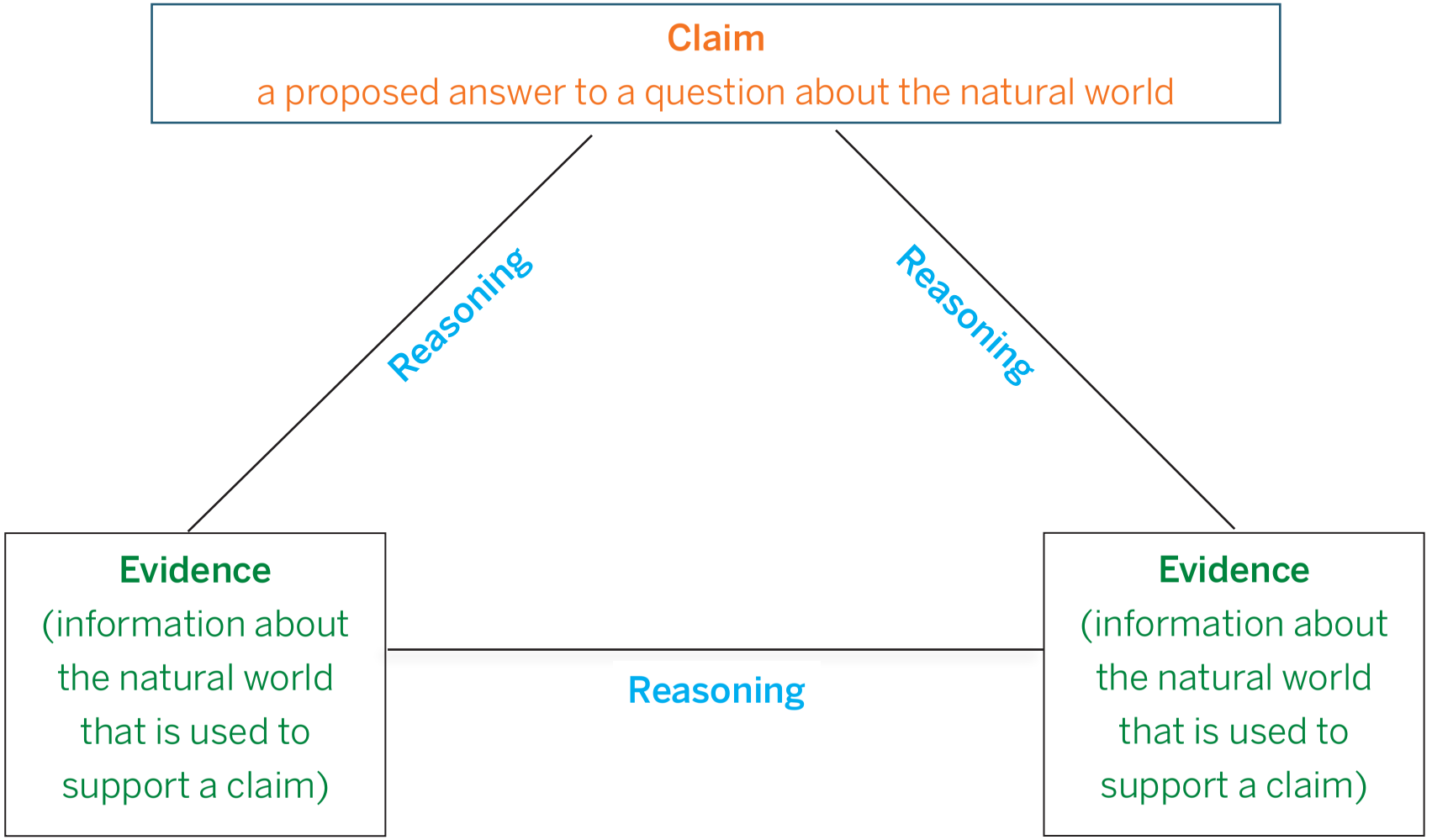
Scientific Argument

Question about the natural world



Data in Scientific Argumentation

Examples of Data: Numbers

- Scientists estimate that 1.2 million people a year are stung by scorpions and that approximately 3,250 people a year die from these stings.
- The birds' beaks are between 2–3 cm long.
- We used 10 drops of red food coloring for each experiment.

Examples of Data: Observations

- We observed scorpions using the hunting method of grabbing its prey 6 out of 10 times when they were hunting.
- The birds were observed to fly in circles over their nests and to screech loudly whenever they were disturbed by hawks.

Opinion in Scientific Argumentation

Examples of Opinion

- Scorpions are really mean and angry.
- I don't think birds are very smart.
- I thought the red food coloring made the water very pretty.

Mystery Fossil Tooth Argument

Question: From what kind of animal did this fossil tooth come?

Mystery Fossil Tooth Argument

Claim: This fossil tooth is from a prehistoric shark, which is related to sharks that live today.

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Strong Evidence

Weak Evidence

Strong Evidence

Weak Evidence

Strong Evidence

Weak Evidence

Strong Evidence

Weak Evidence

Copymaster: Evidence Headers

Evidence Cards

The fossil tooth is sharp and is about 5 cm long.

Evidence Cards

Sharks have many sharp teeth. Some teeth are a few centimeters long, and some teeth from prehistoric sharks are 15–17 cm long.

Evidence Cards

I think it is a great choice to say that the animal that had this tooth is a lot like a shark.

Evidence Cards

The people who found this tooth must have been happy when they found it. They were probably scientists who were studying rocks.

Evidence Cards

Sharks have been on Earth for about 400 million years.

Evidence Cards

The fossil is definitely a tooth.

Evidence Cards

The rock layer in which the shark's tooth was found is approximately 250 million years old.

Evidence Cards

The fossil tooth was found inside a rock formation that is about 2,000 meters high. It is in the mountains of Utah, which is in the middle of the United States.

Evidence Cards

When scientists made closer observations of the rock in which the tooth was found, they discovered that there were many marine fossils in the rock.