Responsive Mini-Lessons: Evidence—Not 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 Not Descriptive Level Make Sense for Your Class?

The suggestion to provide a Responsive Mini-Lesson for the Not 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 do not 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 Not Descriptive level.

Goals

- Provide students with an opportunity to differentiate between evidence offered to support a claim that is based on data—such as observation and measurements—and evidence offered to support a claim that is based solely on opinion.
- Provide students with an opportunity to consider the relevance of the available evidence when connecting it to a given claim.

Responsive Mini-Lesson

Materials and Teaching Considerations

For the class

- Projection: Scientific Argument diagram
- Projection: Examples of Different Kinds of Data
- Projection: An Argument Based on Evidence
- Projection: Examples of Opinions
- Projection: An Argument Based on Opinion
- Copymaster: Broken Vase Argument 1
- Copymaster: Broken Vase Argument 2

For each group of four students

- 1 copy of Broken Vase Argument 1
- 1 copy of Broken Vase Argument 2

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, you will present Scientific Argument diagram, Examples of Different Kinds of Data, An Argument Based on Evidence, Examples of Opinions, and An Argument Based on Opinion. 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. **Make copies of Broken Vase Argument 1 and Broken Vase Argument 2.** Make enough copies so each group of four students gets one copy of each argument.
3. **Write the following on the board:**
    - **Question:** How was the vase in Joe's house broken?
    - **Claim 1:** Joe, the 10-year-old boy who lives in the house, broke the vase.
    - **Claim 2:** An earthquake shook Joe's house and caused the vase to fall and break.

Introduction

1. **Project Scientific Argument diagram.** Review with students that an argument begins with a question, the question is directly addressed with a claim, and the claim is supported by a combination of evidence and reasoning. Say, **"Today, you will focus on understanding what supportive evidence in an argument is."**
2. **Discuss evidence.** Ask students to describe where they've heard the term *evidence* before and what it meant in the contexts they offer. Students will likely discuss evidence as it relates to a mystery or crime. Validate all students' uses of the term—this prior knowledge is valuable because it offers a conception upon which a richer, scientific understanding of the term can be built.
3. **Discuss evidence in science.** Explain that all disciplines—English, history, police work, etc.—use evidence in their work, and all share similar ideas about what evidence is (and isn't). In all cases, evidence is used to make an argument stronger and more convincing. Explain the following points

and record each idea on the board so students can see these terms and concepts in writing as you discuss them.

- In science, evidence has some special characteristics. It includes data (which you will talk more about next).
- Evidence can also come from sources of authority, such as what you read in quality science books or articles or see in videos.
- Evidence should support the claim being offered. (This is true for all arguments, not just those in science.)
- Evidence in science is not based on opinion.

4. **Project Examples of Different Kinds of Data.** Explain that now, you want to look more closely at two kinds of data—observations and measurements. Remind students that data is one kind of evidence that is especially important to scientists. Read over the examples and explain that students will be practicing how to use different kinds of data in order to see how it is used as evidence in scientific arguments.
5. **Project An Argument Based on Evidence.** Explain that scientific arguments that use data—such as measurements and observations—as evidence are more likely to be strong arguments than arguments that don't use this type of evidence. (Note: This argument also contains facts, such as: *Another method when scorpions hunt is to use the poison in their tail stingers to paralyze their prey*. You may want to remind students that facts such as these, which presumably came from an authoritative source, are also a form of evidence. However, this lesson is set up for students to compare things such as measurements and numeric data—concepts that are much easier for students to find and analyze in written form—to opinions in order to start to differentiate opinion-based arguments from data and from evidence-driven arguments.)
6. **Project Examples of Opinions.** Read aloud the examples of opinions and explain that students will also be practicing how to identifying opinions. Opinions that are used as evidence do not provide strong evidence in science.
7. **Project An Argument Based on Opinion.** Discuss why opinion does not constitute strong evidence in scientific arguments. For example, in your own words, explain 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.
8. **Discuss relevant evidence and support for the claim.** Explain that another important role that evidence plays in a strong, convincing argument is that all the evidence offered supports the claim.
    - **Project An Argument Based on Evidence again.** Check with students that all evidence provided supports the claim. Explain that during the activities that follow, they will check for this as well.

Responsive Mini-Lesson

Lesson

1. **Explain the activity.** Let students know that they will work in groups of four and will arrange themselves into two sets of pairs within these groups of four. Also let them know that this is the first part of a two-part activity.
    - Call students' attention to the question and two claims you wrote on the board before class. Explain that each pair will be given a sheet with this question on it, but that one pair will consider Claim 1, and the other pair will consider Claim 2. Each sheet provides a list of possible evidence that might be used to support the claim. Each pair will read their list of possible evidence together and check boxes for evidence that should be included to support their claim.
    - Encourage students to consider whether each piece of possible evidence offers facts, data—such as measurements or observations—or whether it is opinion.
2. **Distribute one copy of Broken Vase Argument 1 and one copy of Broken Vase Argument 2 to each group of four.** Let each pair choose one argument to work with.
3. **Students work on the first part of the activity.** Give pairs approximately five minutes to choose the possible evidence they think supports the claim.
4. **Explain the second part of the activity.** Pairs will now rejoin the other pair in their group.
    - One pair will start by reading aloud their claim, followed by each piece of evidence they thought supported the claim. Then, they will read aloud each piece of possible evidence they didn't choose and explain why they thought it shouldn't be included.
    - Pairs switch roles. The other pair will read aloud their claim, followed by each piece of evidence they thought supported the claim. Then, they will read aloud each piece of possible evidence they didn't choose and explain why they thought it shouldn't be included.
5. **Students work on the second part of the activity.** Give groups approximately five minutes to share.
6. **Debrief the activity.** Ask pairs to discuss which possible evidence they left out of Broken Vase Argument 1 and Broken Vase Argument 2.
    - Focus students on evidence about earthquakes and ask why this evidence was appropriate for Argument 2 but not for Argument 1.
    - Ask students about the opinion "evidence" and discuss why this is not appropriate evidence for any scientific argument. [Argument 1: The sister's thoughts about Joe breaking the vase. Argument 2: The dad's and the aunt's evidence about Joe breaking the vase.]

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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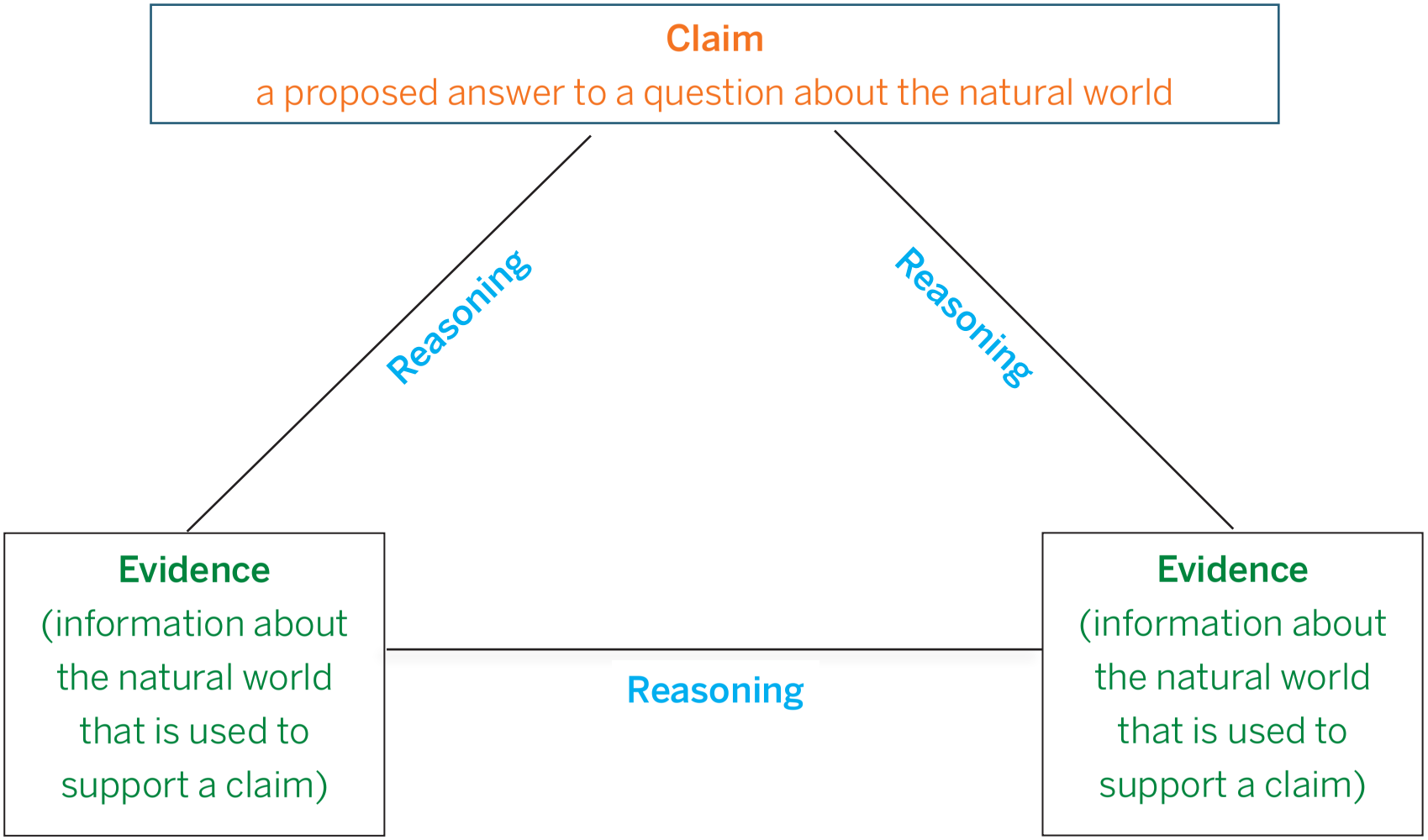
Scientific Argument

Question about the natural world



Examples of Different Kinds of Data

Observations

- Most of the plants on the south side of the hill were dead, while most of the plants on the north side of the hill were living.
- When a hammerhead shark swims toward them, all the small fish quickly hide in the small holes and crevices of the reef.

Measurements

- A count done last week showed that 360 out of the approximately 520 coyotes in the park had the illness.
- Measurements of the water in our local river showed that it contained 10% sodium.

An Argument Based on Evidence

Scorpions are excellent predators. The first option when scorpions hunt is for scorpions to grab and bite their prey with their strong front "arms." We observed the scorpion in our classroom doing this to a cricket last week. In one study, scientists observed scorpions using this method 6 out of 10 times when they were hunting. Another method when scorpions hunt is to use the poison in their tail stingers to paralyze their prey. Analysis of the venom in their stingers shows that it is a combination of chemicals that can paralyze the victim and other chemicals that can slow down a victim's heart rate. In the United States, scorpion stings rarely kill humans. It is estimated that around the world, 1.2 million people a year are stung by scorpions, and approximately 3,250 people a year die from these stings. Scorpions are excellent predators, partly because of their strong bodies and partly because their venom can be so deadly.

Examples of Opinions

- The fish in the reef don't like hammerheads, but they like other kinds of fish.
- Basalt is the best kind of rock. It is beautiful, which is why people like to use it in their homes.
- The river water tastes worse now than it did five years ago.

An Argument Based on Opinion

Scorpions are excellent predators. They look vicious. They are really mean and seem angry when they chase down their prey. Scorpions eat a lot, which means that they are really good at catching their prey. They also look very strong, and strong animals are always great predators. I think that scorpions are the best predators around!

Names: _____ Date: _____

Broken Vase Argument 1

1. With your partner, read the question and claim below.
2. Read the list of possible evidence together.
3. Check all the boxes for possible evidence that should be included to support Claim 1.
   - The evidence you choose should contain data (such as measurements or observations) and/or be based on facts. It should also support the claim, and it should not be someone's opinion.

Question: How was the vase in Joe's house broken?

Claim 1: Joe, the 10-year-old boy who lives in the house, broke the vase.

Possible Evidence

- ☐ Joe has a large cut on his finger.
- ☐ Joe's mom observed Joe picking up pieces of the vase. While he was doing this, Joe told his mom that he had cut his finger as he was picking up the sharp pieces of the vase.
- ☐ Joe's mom observed him playing with a baseball in the living room earlier that morning. In fact, she remembers seeing him playing baseball in the living room three other times before that week.
- ☐ An earthquake was recorded on the same day that the vase was broken.
- ☐ Pieces of the vase were spread all over the floor, and there was a baseball on the floor nearby. When Joe's mom picked up the pieces, she counted 32 separate pieces.
- ☐ There was a baseball lying near the vase.
- ☐ Kids were playing with a soccer ball outside the house at the same time the vase was broken. Joe said he thought that one of the kids probably kicked the soccer ball against the wall of the house and broke the vase.
- ☐ Joe's sister thinks he broke the vase because she says that Joe really likes to break things.

Names: _____ Date: _____

Broken Vase Argument 2

1. With your partner, read the question and claim below.
2. Read the list of possible evidence together.
3. Check all the boxes for possible evidence that should be included to support Claim 2.
   - The evidence you choose should contain data (such as measurements or observations) and/or be based on facts. It should also support the claim, and it should not be someone's opinion.

Question: How was the vase in Joe's house broken?

Claim 2: An earthquake shook Joe's house and caused the vase to fall and break.

Possible Evidence

☐ Joe has a large cut on his finger.

☐ Joe's mom observed Joe picking up pieces of the vase. While he was doing this, Joe told his mom that he had cut his finger as he was picking up the sharp pieces of the vase.

☐ An earthquake was recorded on the same day that the vase was broken.

☐ Several neighbors observed that they found that things in their houses had fallen down and broken on the same day.

☐ Joe's mom felt the earthquake and then ran into the living room where the vase was broken. That is when she found the broken vase and observed Joe picking up pieces of the vase.

☐ The earthquake measured 3.0 on the Richter scale in strength. This is strong enough to be felt by some and to cause minor damage.

☐ Joe's father thinks the vase is ugly, so he is glad it is broken. He thinks Joe broke the vase because he probably thinks it is ugly, too.

☐ Joe's aunt didn't feel the earthquake, but she thinks that an earthquake must have broken the vase because Joe is too nice to have broken it.