

## **Levels 2-3, Writing Forms of Justification, Relevant Supporting Evidence and Sufficiency of Evidence**

**Goal:** Students will compare and contrast three different arguments in order to determine which is the strongest, most convincing one. They will provide reasons for their choice, based on their burgeoning understanding of forms of justification, relevant supporting evidence, and sufficiency of evidence.

**Pre-Lesson:** The Class Chart that you create with students in the **Level 0, Forms of Justification, Reading lesson** can be used in this lesson and other writing that follow, which is why we are suggesting placing this pre-lesson in this section of the trajectory of lessons for Writing Forms of Justification, Relevant Supporting Evidence and Sufficiency of Evidence, Levels 2-3. If you haven't already taught the **Level 0** lesson from the **Forms of Justification, Reading** section of this website, teach this lesson before starting the lessons below. **Be sure to use the example arguments about aspens only** when you teach this pre-lesson, rather than the example arguments about eels, as the lesson below uses similar arguments about eels as those used in the Reading Lessons. [Note: If you **have** taught using the arguments about eels from the Level 0 Forms of Justification, Reading lesson before, you can still teach the lesson below, just be aware that the arguments in the two lessons are similar to ones students have seen before, but not exactly the same.]

### **Lesson One**

**Teaching Strategy:** Comparing written arguments

**Works Best With:** Pairs

**Details:**

#### **Preparation:**

- Make one copy of the **Comparing Three Arguments** student sheet for each student. Even though students will be working in pairs, each student should have a copy of the arguments to annotate.
- Make one copy of Argumentation Checklist B for each pair of students.
- Make sure the Forms of Justification chart that you completed in previous lessons is posted in a visible place.

#### **Teaching:**

1. Review relevant supporting evidence, sufficiency of evidence and forms of justification with students. You can use the following examples, or provide your own, possibly using anonymous student examples:
  - a. **Sufficiency:** Explain that an argument is often supported by several pieces of evidence, and it is important to explain each piece of evidence completely. Point out that sometimes, students will write an argument and thoroughly explain everything there is to know about one piece of evidence, but forget to include a discussion of the other

- evidence. This means that their argument isn't as strong or as convincing as it could be, because the student didn't provide analysis of all the evidence available to them.
- b. **Relevancy:** Remind students that all ideas in an argument should support the claim. Explain that students will sometimes include ideas that aren't even related to the claim, or that do not support it. This makes their argument weaker and less convincing.
  - c. **Forms of Justification:** Review the Class Chart of Forms of Justification and highlight examples of each kind listed on the chart. Remind students that data and empirical evidence are forms of justification that are valued in science. Point out that it can be tempting to bring personal opinions into an argument, especially when you are trying to make an argument convincing. However, this actually weakens a scientific argument.
2. Summarize by saying that an argument is made stronger and more convincing to a potential audience if
    - a. all the evidence that is included in the argument is relevant;
    - b. the argument accounts for and explains all of the available evidence;
    - c. the forms of justification used are those that are considered to be more valuable in science.
  3. Project the **Comparing Three Arguments** student sheet. Explain that these three arguments all address the same claim: **The American Eel population along the coast of the United States was shrinking, but now it is coming back.** However, all three arguments are different – they are written by different authors, use different forms of justification, may or may not include irrelevant evidence, etc.
  4. Project and present **Argumentation Checklist B.** Tell students that they will use this checklist to analyze three arguments and decide which is the strongest.
  5. Explain how to analyze the arguments.
    - a. Read and annotate the first argument. Tell students that they will work in pairs and read each argument. As they read, they should feel free to annotate each argument, highlighting anything they notice (a piece of irrelevant evidence, or a poor justification, for example).
    - b. Complete the checklist for each argument. After reading one argument, they will complete the Argumentation Checklist for it and discuss why they have selected "yes" or "no." For any category where they mark 'No,' students should be prepared to share an example with the class. They can write notes about the example in the Notes column of the Checklist if this is helpful.
    - c. Repeat for each of the three arguments. They should follow the same procedure for each argument.
  6. Students work. Allow time for pairs to read and analyze each argument. Circulate and offer support as needed.
  7. Discuss results as a class. Ask students to explain any categories for which they marked 'no' on their Checklists and provide examples from the arguments.

8. Discuss which argument is the strongest, and why. Note that students may have reasons to think any of the arguments are appealing, and this is important to acknowledge. Try to encourage students to use the criteria related to scientific argumentation (relevant supporting evidence and accepted forms of justification) to choose the strongest, most convincing argument.

#### **Resources:**

- **Comparing Three Arguments**
- **Class Chart: Forms of Justification**
- **Argumentation Checklist B**

## **Lesson Two**

**Teaching Strategy:** Sorting evidence to create the most convincing argument

#### **Preparation:**

- This lesson is based on a basic understanding of what happens when you combine baking soda and vinegar. If your students have not experienced this before, we recommend that you either show this experiment as a demonstration for the class or to show the experiment being done in a video. In particular, it could be difficult for students to visualize a balloon filling with gas, so be sure to describe what this looks like as you read about the investigation during the lesson. Note that extensive knowledge of chemical reactions is not required for students to engage in this activity.
- Make one copy of **Argument about the Vinegar and Baking Soda Investigation** for each pair of students. Cut apart the statements that appear in boxes. Place each set of paper strips, as well as the top of the page that lists the question and the claim, in an envelope.

#### **Teaching:**

1. Project and read the **Description of an Investigation with Vinegar and Baking Soda** with the class. As you do, stop to fill in any information that you feel your students would need in order to understand the basic ideas of the investigation.
2. Project the **Argument about the Vinegar and Baking Soda Investigation** sheet. Explain that this argument was written by a student trying to support a claim about the investigation.
3. Focus on the question and claim. Discuss how the (fictitious) student is trying to support the claim that a chemical reaction occurred when vinegar and baking soda were added together.
4. Focus on the parts of the argument. Explain that some parts of this student's argument help make the argument stronger, while others should not have been included. Some of the are strong and convincing evidence, or support when they are included in an argument. Other ideas are irrelevant or weak sources of evidence.

5. Explain the activity. Explain that students will receive a copy of this argument, but with the statements cut apart. Pairs should read over the ideas on these strips of paper with their partner. They should discuss which evidence is supportive of the claim and which is not, and which ideas are related and convincing enough to make up a good argument. They will then arrange these strips into an argument that is convincing and strong. They should remove any ideas they feel do not belong in the argument and set them to the side.
6. Project the **Description of an Investigation with Vinegar and Baking Soda** again so students can refer to it as they work.
7. Students work. Distribute an envelope containing the paper strips to each pair of students. Allow time for students to discuss the statements, select the ones they believe belong in the argument, and arrange the remaining statements into an argument. Circulate and offer support as needed.
8. Rewrite the argument. Ask students to rewrite the argument with the evidence that they selected as strongest included and placed in a logical order. They can also revise the statements to make them sound more fluent in the context of the argument they are writing. They should try to write the strongest argument they can.

**Resources:**

1. **Description of an Investigation with Vinegar and Baking Soda**
2. **Argument about the Vinegar and Baking Soda Investigation**

**Why This Matters:** Students struggling with writing arguments often have an unclear understanding of the purpose of a scientific argument and a lack of knowledge about how to strengthen an argument. They may not be aware that an argument is stronger when the evidence provided comes from a more highly regarded source, is relevant to the claim it is linked to, and is sufficient (in that it includes all relevant, available evidence). Although it is difficult to coordinate all of these aspects simultaneously, teaching these aspects independent of each other is difficult to do, since the strengths and weaknesses of an argument can most easily be seen when all of the component parts are considered. For this reason, we've chosen to offer a series of lessons that are intended to address all of these aspects simultaneously. Some lessons might highlight one concern over another, but practicing with an eye for all three -- forms of justification, relevancy and sufficiency of evidence – helps students to internalize these important aspects of argumentation in a more holistic way.