**Levels 0-1,** Writing Forms of Justification, Relevant Supporting Evidence and Sufficiency of Evidence:

**Goal:** Students will practice thinking about relevancy and sufficiency of evidence as they sort evidence cards. They will then practice writing a short, simple argument based on the cards they sorted. In Lesson Two, students will think about forms of justification as well.

**Teaching Strategy:** Card sort and writing an argument

**Works Best With:** Pairs

**Details:**

**Preparation:**

* Use the “Cards for Sort One” and “Claim for Sort One” for the first lesson. You will need to make enough copies for pairs of students to consider the evidence. In the follow up lesson, use “Cards for Sort Two” and “Claims for Sort Two.” Both lessons will follow the same basic format, as outlined below for the first lesson.

**Teaching:**

**Lesson One:**

1. Project the Visual Representation of an Argument and review with students the basic components of an argument.
2. Explain:
   1. *A good written argument is clear and convincing.  One way to write this kind of argument is to think about your****evidence, or support for your argument****.  Does it relate to your claim?  Is it enough?  Have you covered all the evidence you can think of?*
3. If you haven’t done so in past lessons, write the terms you are discussing (claim, relevant evidence, etc.) on the board, or on chart paper so students can see and consider these ideas]
4. Project the Visual Representation of an Argument and review with students the basic components of an argument. Remind students that a goal for a good written argument is to be as clear and convincing as possible. One way to do this is to think carefully about the evidence you provide in your argument. You should strive to include only evidence that is relevant to the claim. The evidence should also be sufficient, so that you include all evidence available to you that is supportive of your claim. [ If you haven’t done so in past lessons, write the terms you are discussing (claim, relevant evidence, etc.) on the board, or on chart paper so students can see and consider these ideas].
5. Explain to students that they will think about relevancy and sufficiency today by first participating in a card sort activity, which will be followed by writing a short argument.
6. Introduce the activity by explaining that this is a Fossil Mystery. It is based on actual work that scientists like geologists (scientists who study the Earth and its formation) and paleontologists (scientists who study ancient life on Earth) do every day.
7. Project the following text, or explain these ideas on your own: *When sedimentary rocks form, sometimes evidence from living things get preserved in the rock. These are called fossils. Fossils can be bones, footprints, shells, teeth and leaves. Fossils can be from prehistoric animals that lived thousands or millions of years ago. These animals are related to animals that live now, but also different from them in some ways.*
8. If possible, offer students visuals illustrating these key ideas above (photos of actual fossils, of scientists at work, etc.), in order to better provide background knowledge.
9. Project the Fossil Tooth Photo and ask students to discuss, in pairs, their initial thoughts about what kind of animal might have once had this tooth. Share out as a whole class.
10. Accept all student ideas about the fossil tooth **and jot this information down somewhere**. It will become important for Lesson Two, because many of these initial thoughts are conjectures that are not based on evidence. You can use this information later to highlight how much stronger and more convincing arguments are when they are supported by evidence.
11. Tell students that one scientist who found this fossil made the following claim (project if possible): *Claim #1: This fossil tooth is from a kind of prehistoric lion, which is related to mountain lions that live today.*
12. Explain that they will now get a set of evidence cards and this claim. They will place the claim at the top of their desk, and the evidence cards underneath. Each card has one piece of evidence on it. Some evidence is relevant to the claim, and supports it. Other evidence is not relevant or doesn’t support the claim. Their job will be to discuss with their partner and choose which evidence is supportive of the claim and which isn’t. They will place evidence that they feel is supportive under the claim. Evidence that is not supportive will be placed in a nearby pile.
13. Explain that it is very important that student pairs discuss why they think a certain piece of evidence is or is not supportive of the claim. They shouldn’t move a piece anywhere until they’ve discussed it. Model how you might do this with a volunteer student as needed.
14. Have students sort evidence. Some evidence is not as clear as other evidence as to relevancy – some students may interpret a piece of evidence differently from their peers. This is fine, since it helps to evoke interesting and important discussions with the whole class after the sort.
15. As students work, try to pick up on which pieces of evidence seems to cause the most discussion. Debrief student sorts with students. Ask students to share out as a class their thoughts about the controversial pieces of evidence. Next, focus on irrelevant or non-supporting evidence. Ask students to explain why they put particular pieces in this pile.
16. After the whole class discussion, ask student pairs to go back and re-sort. Explain that after hearing their peers, they might think that a piece of evidence that wasn't relevant or important now seems to be relevant. Remind them that one way to write a strong, convincing argument is to make sure you have sufficient and relevant evidence – so they should recheck to make sure they aren’t leaving any important evidence out.
17. Explain that students will now use the evidence they sorted to write a sort argument supporting the claim that this tooth came from a prehistoric mountain lion. They will use the provided claim and then explain how the evidence they sorted as relevant supports this claim. Emphasize that even if they don’t agree that this is the case, this activity will help them to practice writing arguments with relevant and sufficient evidence.

**Lesson Two:**

**Preparation:**

* Find the notes you took about students’ initial ideas about the fossil tooth during lesson one. These will be used to reflect on relative strengths and weaknesses of using different kinds of evidence later in this lesson.

**Teaching:**

1. Review components of an argument, and the purpose of an argument (to be convincing) as needed. The definitions you have displayed from lesson one should be referenced here.
2. Project the fossil tooth photo and review the lesson one activity (one scientist claimed that this tooth came from a prehistoric mountain lion; students sorted evidence to find the evidence that supported this claim; they then wrote a short argument).
3. Explain that a competing claim was then introduced by another scientist. This is a common way of communicating and thinking in science – scientists introduce claims and arguments; their claims and arguments are then often challenged or supported by other scientists. This is not seen as a negative or cruel aspect of science. In fact, this is one way that scientists ensure that the best evidence and ideas are always being presented, based on the available evidence at that time.
4. Project or read the competing claim: Claim #2: *This fossil tooth is from a kind of prehistoric shark, related to sharks that live today*.
5. Explain that today they will get a new set of evidence. The evidence will be a *combination of evidence* that supports one or the other claim. Students will sort according to which claim the evidence supports. Students will again work in pairs. They will place both claims at the top of the desk/table, then sort in the same way they did last time, discussing each piece of evidence carefully before moving it. If there is a piece of evidence that supports neither claim they can pile it on the side.
6. Distribute materials and circulate. Listen for points of contention, as these will likely make for rich discussion after the activity.
7. Once all pairs have sorted, ask for the students’ attention and debrief the paired sort activity. First, quickly discuss evidence that was easy to sort and ask students what made these pieces especially easy for everyone (often this is because these pieces were so clearly supportive of the claim that inferences weren’t necessary to see the tie). Next, focus on evidence that was difficult to sort and ask students how they sorted this evidence. It is fine if students have different ideas about this evidence, as long as they back their ideas up.
8. After some discussion time, ask students to share which claim they think, on the whole, is better supported and why. As students orally explain their thinking, try to highlight moments when students thinking is especially clear and convincing and use this as a model for good argumentation.
9. Project or put up the notes you took about students’ initial thoughts about the fossil tooth from Lesson One. These represent general thoughts brought up when students first considered the fossil tooth. Explain that you are using these to illustrate a point – when you don’t have actual evidence to support a claim, often you just give opinions or speculation. If this was the only ‘evidence’ you used, you wouldn’t be able to make a very strong argument. Arguments based on what scientists call ‘empirical evidence’ are stronger and more convincing.
10. Ask students to write a short argument based on whichever claim they feel is strongest. Some may choose to write about the mountain lion again. If so, they can use the new evidence and try to write an even more convincing argument explaining why this is a stronger claim than the shark claim.Remind students to avoid opinion and speculation as part of their evidence; instead they should try to use the evidence and ideas offered on the cards to write their arguments.

**Resources:**

* **Visual Representation of an Argument**
* **Fossil Tooth Photo**
* **Cards for Lesson One**
* **Claim for Lesson One**
* **Cards for Lesson Two**
* **Claim for Lesson Two**

**Why This Matters:** Students struggling with writing arguments often have an unclear understanding of the purpose of an argument and a lack of knowledge about how to strengthen a scientific 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). Teaching these aspects independent of the context of a complete argument is difficult to do, since the nature of an argument is 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 in unison. 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 and realistic way.