

Introductory Module on Scientific Argumentation

This introductory module on scientific argumentation can be executed as four sessions that are each 45-minutes, or fewer sessions that are longer (e.g. one 3-hour session). If held as four sessions, the agenda includes a “Try it with your students!” section to encourage teachers to implement some argumentation aspect before the next session. The following session then begins with time for teachers to share their experiences, as well as artifacts of their students’ argumentation (e.g. writing, video). These sections are optional.

The agenda below contains descriptions about the various activities that make up the module, as well as estimated lengths of time for each activity.

The goals for this introductory module include:

- Teachers will be introduced to four areas of argumentation in which students need extra support: 1) Evidence, 2) Reasoning, 3) Student Interaction and 4) Competing Claims.
- Teachers will develop an understanding of argumentation as a social process in which students build, question and critique claims using evidence and reasoning.
- Teachers will be introduced to a Card Sort as an instructional activity that encourages students to think about what evidence does and does not support a claim.
- Teachers will be introduced to a Card Sort as an instructional activity that promotes students use of evidence to evaluate multiple claims.
- Teachers will be introduced to the Reasoning Tool as an instructional activity that supports students in articulating the link between their evidence reasoning.
- Teachers will design a new lesson or revise an existing lesson to integrate argumentation into their science instruction.*
- Teachers will identify areas of argumentation that are challenging for their students.*

*Note: These final two goals are only applicable if the module is implemented as multiple sessions

Materials:

- Card Sort 1 (Session #1)
- Card Sort 2 (Session #2)
- Reasoning Tool (Session #3)
- Sample Student Writing (Session #3)
- Argumentation Elements (Session #4)
- Study Results (Session #4)

Session #1: What is the role of evidence in a scientific argument?

Activity	Description	Time
Video: Introduction to module	<ul style="list-style-type: none">• Introduce teachers to the module by watching the video Argumentation Toolkit Overview - http://www.argumentationtoolkit.org/introduction.html	10 min.

	<ul style="list-style-type: none"> • Discuss the four areas of argumentation in which students need extra support (evidence, reasoning, student interactions, and competing claims). Explain that this first session is going to focus on the role of evidence 	
<p>Activity: Mystery fossil card sort 1</p>	<ul style="list-style-type: none"> • Describe the purpose of a card sort, and provide the context for this activity. Have teachers work in pairs or small groups to engage in Card Sort 1. This activity entails categorizing evidence cards as supporting, maybe supporting, or not supporting the claim – The fossil tooth came from a prehistoric lion, which is related to mountain lions that live today. <ul style="list-style-type: none"> ○ Encourage teachers to articulate <i>why</i> they sort cards as they do • After the card sort, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What did you talk about when you were discussing the evidence? 2. What types of questions did you ask? 3. How can you envision your students engaging in this activity? What would work well? What challenges would they have? • Key Points to highlight after the activity and discussion: <ul style="list-style-type: none"> ○ Evidence is observations or data about the natural world that is used to support claims ○ Evidence can be used in different ways and we use our understandings of the science concepts (reasoning) to make sense of that evidence. ○ Some pieces of evidence can be stronger than others in support of a claim <p><i>Materials: Card Sort 1</i></p>	<p>20 min.</p>
<p>Video & Discussion: Encouraging talk about evidence</p>	<ul style="list-style-type: none"> • Transition into the idea that it is important for students to talk about evidence by watching the video Strategy: Creating a culture of argumentation – http://www.argumentationtoolkit.org/student-interaction.html • Following the video, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. How do the card sort and other types of activities encourage students to talk to each other and develop their ideas? 2. How can students use evidence not only to support claims but also to question and build on the ideas of their peers? 	<p>10 min.</p>

	<ul style="list-style-type: none"> • Key points to highlight during the discussion: <ul style="list-style-type: none"> ○ The teacher steps back ○ The students lead the discussion in order to think critically as they share their ideas. 	
Session Takeaways	<ul style="list-style-type: none"> • Reiterate the key points from this session: <ul style="list-style-type: none"> ○ Evidence is observations or data about the natural world that is used to support claims ○ Evidence can be used in different ways, and we use our understandings of the science concepts (reasoning) to make sense of that evidence. ○ Some pieces of evidence can be stronger than others in support of a claim ○ Encouraging talk about evidence supports students in thinking critically and building understandings of the science concept 	5 min.
Extension: Try it with your students! *If the module is held as multiple sessions	<ul style="list-style-type: none"> • Before the next session, ask teachers to develop or revise a lesson to encourage students to talk about evidence. This lesson could be a card sort or it could be another type of activity, such as making sense of data from an investigation. • Have teachers bring to the next meeting the lesson that they developed, as well as potentially student artifacts (such as writing) or a video clip of students engaged in this. 	Optional

Session #2: How does considering competing claims support students’ use of evidence and reasoning?

Activity	Description	Time
Extension Discussion: Try it with your students! *If the module is held as multiple sessions	<ul style="list-style-type: none"> • If the “Try out With Your Students!” was completed, encourage teachers to share the lessons they developed, as well as any student artifacts they may have. Lead a discussion around the questions: <ol style="list-style-type: none"> 1. What went well with the lesson? Why do you think this went well? 2. What was challenging with the lesson? Why do you think it was challenging? 	Optional
Video: Using evidence to consider competing	<ul style="list-style-type: none"> • Transition into the role of evidence in argumentation, particularly in terms of how it is used to evaluate multiple claims by watching the video Approach: Evidence – http://www.argumentationtoolkit.org/evidence.html 	10 min.

claims	<ul style="list-style-type: none"> This video discusses in more depth what counts as evidence as well as shows different types of classroom activities that include evidence. At the end it shows another way to engage in a card sort, which we will then try out as a group. 	
Activity: Mystery fossil card sort 2	<ul style="list-style-type: none"> Describe how a card sort could also be a means for students to use evidence to determine which of two competing claims is strongest. Have teachers work in pairs or small groups to engage in Card Sort 2. This activity entails categorizing evidence cards as supporting either 1) Claim 1: The fossil tooth is from a prehistoric lion, which is related to mountain lions that live today; 2) Claim 2: The fossil tooth is from a prehistoric shark, which is related to sharks that live today; or 3) Other: does not strongly support either Claim 1 or Claim 2 <ul style="list-style-type: none"> Encourage teachers to articulate <i>why</i> they sort cards as they do Have teachers first sort the cards from Group #1 (i.e. cards A – G) that focus on evidence about teeth sharpness and size. After the initial card sort, ask teachers which claim they think is best supported given the existing evidence. Afterwards, discuss how scientists are constantly making observations and gathering data, which can become new evidence. Have teachers now sort all the cards, including those from Group #2 (i.e. cards H – L), which focus on evidence about rock layers and other fossils. After the card sort, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> How were your discussions similar/different when you engaged in this card sort from when you sorted evidence cards for one claim? What did you talk about when you were discussing the evidence? Did your conversations change once you received the cards from Group 2? Key Points to highlight after the activity and discussion: <ul style="list-style-type: none"> Often scientists develop competing claims about a particular phenomenon. They use evidence to decide which claim is stronger. Weighing multiple claims can encourage students to think about why the evidence supports the claim and refine their understanding of the science concepts. 	20 min.

	<ul style="list-style-type: none"> ○ As new evidence emerges, scientists re-evaluate the strength of claims <p><i>Materials: Card Sort 2</i></p>	
Video & Discussion: Arguing about competing claims	<ul style="list-style-type: none"> ● Transition into engaging students in arguing about competing claims by watching the video Approach: Competing Claims – http://www.argumentationtoolkit.org/competing-claims.html ● Following the video, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What are the benefits to having your students engage in competing claims? 2. What challenges do you think your students might have when engaged in this work? 3. What types of activities (e.g. card sort, evidence from text, science seminar, other) can you envision incorporating into your science instruction? Why? ● Key points to highlight during the discussion: <ul style="list-style-type: none"> ○ Competing claims are different explanations for the same phenomenon ○ Competing claims provide students with an authentic reason to argue 	10 min.
Session Takeaways	<ul style="list-style-type: none"> ● Reiterate the key points from this session: <ul style="list-style-type: none"> ○ Often scientists develop competing claims about a particular phenomenon. They use evidence to decide which claim is stronger. ○ As new evidence emerges, scientists re-evaluate the strength of claims ○ Competing claims provide students with an authentic reason to argue ○ Weighing multiple claims can encourage students to think about why the evidence supports the claim and refine their understanding of the science concepts. 	5 min.
Extension: Try it with your students! *If the module is held as multiple sessions	<ul style="list-style-type: none"> ● Before the next session, ask teachers to develop or revise a lesson to include the consideration of competing claims. This lesson could be a card sort, making sense of data from an investigation, using evidence from text, a science seminar or another type of activity. ● Have teachers bring to the next meeting the lesson that they developed, as well as potentially student artifacts (such as writing) or a video clip of students engaged in this. 	Optional

Session #3: What is the role of reasoning in a scientific argument?

Activity	Description	Time
<p>Extension Discussion: Try it with your students!</p> <p>*If the module is held as multiple sessions</p>	<ul style="list-style-type: none"> • If the “Try out With Your Students!” was completed, encourage teachers to share the lessons they developed, as well as any student artifacts they may have. Lead a discussion around the questions: <ol style="list-style-type: none"> 1. What went well with the lesson? Why do you think this went well? 2. What was challenging with the lesson? Why do you think it was challenging? 	Optional
<p>Video & Discussion: Using the Reasoning Tool</p>	<ul style="list-style-type: none"> • Transition into the role of reasoning in argumentation by watching the video Activity: Reasoning Tool – http://www.argumentationtoolkit.org/reasoning.html • Following the video, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What challenges have you experienced, or could you imagine experiencing, supporting your students in articulating their reasoning? 2. What different ways could you envision using the reasoning tool to encourage students to explain the link between their evidence and claim? • Key points to highlight during the discussion: <ul style="list-style-type: none"> ○ Reasoning explains how evidence supports a claim, often incorporating science ideas and concepts ○ Including reasoning makes an argument more convincing ○ Students often experience challenges articulating reasoning ○ The reasoning tool is a versatile scaffold that prompts students to consider how their evidence connects to the claim 	10 min.
<p>Activity: Writing with the Reasoning Tool</p>	<ul style="list-style-type: none"> • Reiterate the purpose of using a reasoning tool, and provide the context for this activity. Have teachers work individually to complete the reasoning tool template. This activity, which builds off the arguments teachers have been working with in Session #'s 1 and 2, entails using the reasoning tool template to explain how two pieces of evidence support the claim that the fossil tooth came from a prehistoric shark. <ul style="list-style-type: none"> ○ Once teachers have completed the task, ask them to share their work with another person ○ After everyone has had an opportunity to give and receive 	15 min.

	<p>feedback, share and discuss the sample reasoning tool that has been filled in</p> <ul style="list-style-type: none"> • After the activity, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What was your experience using the reasoning tool? What did you find helpful? What did you find challenging? 2. How can you envision your students engaging in this activity? What would work well? What challenges would they have? • Key Points to highlight after the activity and discussion: <ul style="list-style-type: none"> ○ The reasoning tool is one resource for supporting students in articulating their reasoning in writing ○ It can be challenging for students to include and explain science ideas in their arguments <p><i>Materials: Reasoning Tool</i></p>	
<p>Activity: Analyzing Student Writing</p>	<ul style="list-style-type: none"> • Explain to teachers that they will now have an opportunity to examine students' written arguments, focusing on reasoning. The context of the sample work is the same as what the teachers wrote about in the previous activity. However, these students wrote arguments <u>without</u> using the reasoning tool. Have teachers individually: <ul style="list-style-type: none"> ○ Read through the students' writing and underline the reasoning in each argument ○ Rank the sample student writing from strongest (1) to weakest (4) ○ After everyone has had an opportunity to complete the task, encourage teachers to share their ranking with another person • After the activity, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. How did people rank the student writing? Why? 2. What were some of the strengths and weaknesses of the student work? 3. How might the reasoning tool help students with this task? • Key Points to highlight after the activity and discussion: <ul style="list-style-type: none"> ○ These examples highlight four different ways that students write arguments with respect to reasoning. These include arguments that are: absent of reasoning (i.e. Student A), appropriately incorporate reasoning (i.e. Student B), repeat evidence as reasoning (e.g. Student C), and mention and define a science concept, without explaining the link 	<p>15 min.</p>

	<p>between the evidence presented and the claim being made (i.e. Student D).</p> <p><i>Materials: Sample Student Writing</i></p>	
Session Takeaways	<ul style="list-style-type: none"> ● Reiterate the key points from this session: <ul style="list-style-type: none"> ○ Reasoning explains how evidence supports a claim, often incorporating science ideas and concepts ○ Including reasoning makes an argument more convincing ○ Encouraging students to write and talk about reasoning supports them in building understandings of the science ideas 	5 min.
<p>Extension: Try it with your students!</p> <p>*If the module is held as multiple sessions</p>	<ul style="list-style-type: none"> ● Before the next session, ask teachers to develop or revise a lesson to encourage students to write about reasoning. This lesson could incorporate the reasoning tool, or it could be another type of activity, such as encouraging students to explain <i>why</i> they sort cards as they do during an evidence card sort. ● Have teachers bring to the next meeting the lesson that they developed, as well as potentially student artifacts (such as writing) or a video clip of students engaged in this. 	Optional

Session #4: How do we support students in interacting with their peers during argumentation?

Activity	Description	Time
<p>Extension Discussion: Try it with your students!</p> <p>*If the module is held as multiple sessions</p>	<ul style="list-style-type: none"> ● If the “Try out With Your Students!” was completed, encourage teachers to share the lessons they developed, as well as any student artifacts they may have. Lead a discussion around the questions: <ol style="list-style-type: none"> 1. What went well with the lesson? Why do you think this went well? 2. What was challenging with the lesson? Why do you think it was challenging? 	Optional
<p>Video & Discussion: Encouraging student interactions</p>	<ul style="list-style-type: none"> ● Transition into the interactive nature of argumentation by watching the video Approach: Argument is Interactive – http://www.argumentationtoolkit.org/student-interaction.html ● Following the video, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What are the benefits to having your students interact with peers during argumentation tasks? 2. What challenges do you think your students might have 	10 min.

	<p>when engaged in this work?</p> <p>3. What types of activities (e.g. writing arguments, science seminar) can you envision incorporating into your science instruction to encourage student-to-student interaction? Why?</p> <ul style="list-style-type: none"> • Key points to highlight during the discussion: <ul style="list-style-type: none"> ○ Argumentation entails students questioning, critiquing and building off of their peers’ ideas ○ Persuading others of the strength of a claim is an authentic goal of argumentation ○ Evidence and reasoning can be used to convince others of the strength of a particular claim ○ Students can convince an audience of an argument through both writing and speaking tasks 	
<p>Activity: Analyzing data with peers</p>	<ul style="list-style-type: none"> • Explain to teachers that they will now have an opportunity to engage in an argumentation task in which they will examine results from three studies to develop the strongest argument in response to the question – <i>When a person trains to become an athlete, how does her body change to become better at releasing energy?</i> • Before engaging in this activity, review the background science content about how the human body creates energy: <ul style="list-style-type: none"> ○ When the human body exercises, cells need more energy. ○ The mitochondria in cells need both glucose and oxygen to release energy. ○ The body systems work together to deliver glucose and oxygen to the cells in the body. • Have teachers work together as they complete this task, encouraging them to: <ul style="list-style-type: none"> ○ Listen to one another ○ Ask each other questions ○ Build off other’s ideas ○ Critique ideas that you do not agree with ○ Be convincing • After the activity, conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. What did you talk about when you engaged in this task? 2. How did interacting with others influence the argument you developed? 3. What types of supports do you think your students might need to engage in this element of argumentation? 	<p>25 min.</p>

	<ul style="list-style-type: none"> • Key Points to highlight after the activity and discussion: <ul style="list-style-type: none"> ○ Interacting with peers can help students develop stronger arguments ○ Working with peers can support the consideration of multiple claims <p><i>Materials: Study Results</i></p>	
Discussion: Connections between argumentation elements	<ul style="list-style-type: none"> • Have teachers look through the Argumentation Elements handout, and conduct a whole group discussion around the questions: <ol style="list-style-type: none"> 1. How do you see these elements working together? 2. What strengths do you see in using these argumentation elements in your classroom? 3. What challenges do you think your students will have engaging in these argumentation elements? 4. What questions do you still have about these elements? <p><i>Materials: Argumentation Elements</i></p>	5 min.
Session Takeaways	<ul style="list-style-type: none"> • Reiterate the key points from this session: <ul style="list-style-type: none"> ○ Argumentation entails students questioning, critiquing and building off of their peer’s ideas ○ Persuading others of the strength of a claim is an authentic goal of argumentation ○ Interacting with peers can help students develop stronger arguments ○ Students can convince others of the strength of a argument through both writing and speaking tasks 	5 min.
Extension: Try it with your students! *If the module is held as multiple sessions	<ul style="list-style-type: none"> • Ask teachers to develop or revise a lesson to encourage students to interact with their peers during an argumentation task. This lesson could be a science seminar, making sense of data from an investigation, writing a persuasive argument, or another activity. • Encourage teachers to meet with colleagues to share the lesson that they developed, as well as potentially student artifacts (such as a video clip) of students engaged in this. 	Optional