Potential instructional activities for Engaging in Argument from Evidence

1. Introduce students to the argumentation framework of claim, evidence, and reasoning (CER). A claim answers a question or problem, which could be an explanation or model. Evidence is data that supports the claim, such as observations and measurements. Reasoning explains why the evidence supports the claim using scientific ideas or principles.

2. Provide students with scaffolds such as a graphic organizer, sentence starters, or questions that highlight the CER components to help them craft their arguments.

3. Revise argumentation questions in lessons or the curriculum to ensure that there is more than one possible claim that students could potentially support with evidence. When students have multiple competing claims, there is more opportunity for critique.

4. Facilitate a discussion about the norms for argumentation. Explain to students that they should be talking directly to each other and not through the teacher. In addition, they should be questioning and critiquing each other's ideas. However, it is also important for students to be willing to change their minds if new ideas or evidence are presented by their peers that convince students of the strength of a competing claim.

5. Create a poster in the classroom that supports the CER structure as well as students critiquing different ideas. It could include sentence starters such as, "My evidence is …" and "I disagree because ...," as well as questions such as "What are some other possible claims? Do we have support for those claims?" and "Why did you decide to use that evidence to support your claim? Could the data be interpreted in a different way?"

6. Model for students what it looks like to question or critique another person's idea. For example, "I disagree with Maria's claim, because I interpreted the data in a different way. I think the data show that lunch capacity is important for …"

7. Limit teacher talk during argumentation by physically removing yourself from the discussion (e.g., sit in the corner of the room) or telling students that you have a specific task during the discussion. For example, you can tell the class that your job is to record the different evidence that comes up during the conversation and that you will not be actively talking during the discussion.

Potential instructional activities for constructing explanations

1. Discuss key features of explanations in science: explanatory account, science ideas, and evidence. An *explanatory account* describes how or why a phenomenon occurs. *Science ideas* are key concepts or principles students apply to make sense of a specific phenomenon. *Evidence* is scientific data such as measurements and observations.

2. Create a poster with the key features for a scientific explanation, such as that it shows how or why something occurs.

3. Revise explanation questions in the curriculum or lessons to ensure that students need to answer with more than a simple "yes" or "no"; rather, they require an explanatory account.

4. Provide examples of strong and weak explanations (e.g., describes a phenomenon instead of explaining it). Critique the examples as a class.

5. Provide students with scaffolds such as sentence starters, questions, or graphic organizers that highlight the key features. For example, a graphic organizer could include three sections labeled: (1) Your explanation: the how or why?, (2) Big science ideas that support your explanation, and (3) Evidence that supports your explanation.

6. Ask students to highlight the key features of an explanation (explanatory account, science ideas, and evidence) in their own or a peer's writing.

7. Ask students to give feedback to each other about written explanations. Provide sentence starters to students to help them make specific statements about the explanations. Examples of sentences starters can include, "I have a question about your evidence …," "I am not sure that your writing explains why _____ occurs. Can you explain that to me?", or "How can we use our big science ideas to help explain _____?"

NGSS connections for the two examples of argument and explanation

Standards
MS-ESS1: History of Earth
MS-LS4: Natural Selection and Adaptations

www.nextgenscience.org/msess-he-history-earth

www.nextgenscience.org/msls-nsa-natural-selection-adaptations

Performance Expectation
The materials/lessons/activities outlined in this article are just one step toward reaching the performance expectations listed below.

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variation of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Dimension	**Name or *NGSS* code/citation**	**Matching student task or question taken directly from the activity**
Science and Engineering Practice	Engaging in argument from evidence	After analyzing data, including maps, students write their own arguments using evidence and reasoning to support their claims. Students participate in a Science Seminar,

		which is a discussion in which they should be building on, questioning, and critiquing each others' arguments.
Disciplinary Core Ideas	ESS2.B: Plate Tectonics and Large-Scale System Interactions • Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	How will the Indian plate be different in 50 million years? Students use evidence from maps about the movement of the plates in the past to make claims about whether the Indian plate will get smaller, remain the same, or get larger in 50 million years.
Crosscutting Concepts	Patterns	Students use patterns from past movements to make predictions of future movement.
Science and Engineering Practice	Constructing explanations and designing solutions	After analyzing data, students use evidence to construct an explanation addressing how the pollution affects the population of bugs. Students develop explanatory accounts using evidence and science ideas.
Disciplinary Core Ideas	LS4.B: Natural Selection • Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	Did the pollution affect the bugs? Students use evidence from the color of the bug population, the pollution, and pictures of the environment to examine how natural selection resulted in a change in the color of the bugs over time.
Crosscutting Concepts	Cause and Effect	Students determine the cause of the changes in the bug populations.

Connections to the *Common Core State Standards* (NGAC and CCSSO 2010)

CCSS.ELA-Literacy.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-Literacy. WHST. 6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

CCSS.ELA-Literacy. SL.8.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade topics, texts, and issues building on others' ideas and expressing their own clearly.

CCSS. ELA-Literacy. SL.8.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

CCSS.Math.Content.6.SP.B.5: Summarize numerical data sets in relation to the context.