Engaging in Argument from Evidence

| AWARENESS | Science | In Science, reasoning and argument are essential for identifying the strengths and weaknesses of a line of reasoning and for finding the best explanation for a natural phenomenon. Scientists must defend their explanations, formulate evidence based on a solid foundation of data, examine their own understanding in light of the evidence and comments offered by others, and collaborate with peers in searching for the best explanation for the phenomenon being investigated.  

**Engineering**  
In engineering, reasoning and argument are essential for finding the best possible solution to a problem. Engineers collaborate with their peers throughout the design process, with a critical stage being the selection of the most promising solution among a field of competing ideas. Engineers use systematic methods to compare alternatives, formulate evidence based on test data, make arguments from evidence to defend their conclusion, evaluate critically the ideas of others, and revise their designs in order to achieve the best solution to the problem at hand.

From the [A Framework for K-12 Science Education](https://www.nationalacademies.org/k12scienceframework), 2011, p. 71 for entire text. |
| --- | --- |
| AWARENESS QUESTIONS | 1. From the background information, what new awareness do you have about engaging in argumentation?  
2. In a 3-Dimensional classroom, how do you establish a culture of scientific argumentation?  
3. What questions did the background raise for you? |
| EXPOSE BELIEFS | Engaging in Argument [Podcast](https://example.com/podcast)  
Prezi [MPRES](https://example.com/mpres)  
[NGSS @ NSTA](https://example.com/ngss) |
| EXPOSE BELIEF QUESTIONS | 1. What are your current beliefs about this practice?  
|                         | 2. In what ways do you think you are using this practice?  
|                         | 3. What challenges do you see to using this practice? |
| CONFRONT BELIEFS        | Conceptual Change Activities: |
|                         | Any activity that allows learners to draw conclusions and engage in argumentation from evidence are appropriate. |

**Developing Conceptual Understanding of the Engaging in Argumentation Activities Background**

The purpose of the activities is to engage teachers in the practice of argumentation. The emphasis is NOT on the activity itself, but rather the conceptual change related to the practice. Consumers of this Toolkit are reminded to not get wrapped up in the activity, but rather continually reflect on the conceptual nature of the Practice to gain deeper understanding. Three activities have been provided to engage in each Practice.

Since the following activities are NOT lesson plans, in some cases only a brief explanation of the activity has been provided. The facilitator should encourage learners to direct their own investigations and intervene only as needed to redirect.

| RESOLVE BELIEFS | Debrief the activity(ies) by focusing on the conceptual understanding of the Practice using the following prompts: |
| RESOLVE BELIEF QUESTIONS | 1. In what ways did this activity change your beliefs about engaging in argumentation?  
|                         | 2. How difficult was it to engage in argumentation?  
|                         | 3. What clarity was brought to the discussion through argumentation? |
| EXTEND THE CONCEPT QUESTIONS | 1. How do you currently help students to engage in argumentation in your classroom?  
|                         | 2. Review a recent lesson you taught and evaluate the effectiveness of allowing students to engage in argumentation. |
| GO BEYOND QUESTIONS | 1. Share lessons in which you could implement the Practice of engaging in argumentation.  
|                         | 2. Ask a colleague to observe one of your lessons OR video yourself teaching and reflect specifically on defining problems and identifying constraints.  
|                         | 3. Use the EQuiP Rubric for Lessons & Units: Science to evaluate a recent science lesson you taught. |
Learning Progression for Engaging in Argument from Evidence

**Elementary:** Young students can begin by constructing an argument for their own interpretation of the phenomena they observe and of any data they collect. They need instructional support to go beyond simply making claims—that is, to include reasons or references to evidence and to begin to distinguish evidence from opinion.

**Middle School:** As they grow in their ability to construct scientific arguments, students can draw on a wider range of reasons or evidence, so that their arguments become more sophisticated. They should be expected to discern what aspects of the evidence are potentially significant for supporting or refuting a particular argument. Students should begin learning to critique by asking questions about their own findings and those of others. Later, they should be expected to identify possible weaknesses in either data or an argument and explain why their criticism is justified.

**High School:** As they become more adept at arguing and critiquing, they should be introduced to the language needed to talk about argument, such as claim, reason, data, etc. Exploration of historical episodes in science can provide opportunities for students to identify the ideas, evidence, and arguments of professional scientists. They should recognize the criteria used to judge claims for new knowledge and the means by which, scientific ideas are evaluated today. They should see how the practice of peer review and independent verification of claimed experimental results help to maintain objectivity and trust in science.

See p. 13 [Appendix F Science and Engineering Practices in the NGSS](#) for a more thorough grade band progression.

[Return to Table of Contents](#)