

## ASET Science & Engineering Practice (SEP) Tool: Engaging in Argument from Evidence

**Name or ID:**

**Lesson/Unit Title:**

**Intended Grade:**

### Directions for use

Indicate if a component is present using Y (yes) or N (no) and then, if it is present, fill in the right 2 columns.

A single lesson will most likely not address each of the components below.

The numbering of these components is not meant to indicate they should be used in sequence, they are simply for reference.

<b>SEP 7</b>	<b>Engaging in Argument from Evidence:</b> Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building models, and evaluating claims.			
<b>Components of SEP</b> In this lesson/unit plan, it is clear that students have a structured opportunity to:		Present? Y/N	<b>What teacher actions were taken to facilitate this component for students?</b>	<b>What are the students doing? What sensemaking or intellectual work are students doing?</b>
1) <b>Compare, and critique</b> two arguments based on the supporting evidence				
2) <b>Engage in discourse</b> around a scientific argument with peers				
3) <b>Construct and/or refine</b> an argument using evidence and reasoning to support a claim				
4) [Engineering] <b>Make, defend, and/or evaluate</b> a claim about the <b>effectiveness/ merit</b> of an <b>object or design solution</b> using evidence				

## ASET Grade Band Criteria (Grade Bands: 6-8, 9-12)

<b>Science &amp; Engineering Practices</b>		
<p><b>SEP 7: Engaging in Argument from Evidence:</b> Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). In 9-12 they build on K-8 experiences and progress to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.</p>		
<p>By the end of the grade band <b>students</b> will have had a structured opportunity to develop an understanding of each of these. Individual lessons or units should include opportunities for <b>students</b> to practice one or more of the following components .....</p>		
	6-8 Grade Band	9-12 Grade Band
<p>1) <b>Compare, and critique</b> two arguments based on the supporting evidence</p>	<p>Using <b>two arguments</b> on the same topic developed by students or presented by the instructor:</p> <ol style="list-style-type: none"> <li>a. <b>Identify claims</b> made in each argument</li> <li>b. <b>Distinguish among facts</b> (based on research findings) and speculation or opinion (not supported by objective information) used to support each claim</li> <li>c. <b>Compare and critique</b> claims made by these two arguments on the same topic:                             <ol style="list-style-type: none"> <li>i. by identifying if they <b>emphasize</b> similar or different evidence.</li> <li>ii. and/or by comparing the <b>interpretation</b> of evidence.</li> <li>iii. and/or by considering the <b>ethical issues</b> of each</li> </ol> </li> </ol>	<p>Using <b>competing</b> arguments on the same topic developed by students or presented by the instructor:</p> <ol style="list-style-type: none"> <li>a. <b>Identify claims</b> made in each argument</li> <li>b. <b>Distinguish among facts</b> (based on research findings and scientific consensus) and speculation or opinion (not supported by scientifically-vetted information) used to support each claim</li> <li>c. <b>Compare and critique</b> claims made by these two arguments on the same topic:                             <ol style="list-style-type: none"> <li>i. by identifying if they <b>emphasize</b> similar or different evidence.</li> <li>ii. and/or by comparing the <b>interpretation</b> of evidence.</li> <li>iii. Considering the <b>limitations, constraints, and ethical</b> issues of each</li> <li>iv. In light of currently <b>accepted explanations</b></li> </ol> </li> </ol>
<p>2) <b>Engage in discourse</b> around a scientific argument with peers *</p>	<p>Respectfully provide and receive <b>critiques</b> to/from peers about one's explanations, procedures, models and questions by:</p> <ol style="list-style-type: none"> <li>a. Citing relevant <b>scientific evidence</b> and</li> <li>b. <b>Posing and responding to specific questions</b> that elicit pertinent elaboration and detail.</li> </ol>	<p>Respectfully provide and/or receive <b>critiques</b> to/from peers on scientific arguments by:</p> <ol style="list-style-type: none"> <li>a. <b>Probing reasoning</b> and scientific evidence</li> <li>b. <b>Challenging</b> ideas and conclusions</li> <li>c. Responding thoughtfully to <b>diverse perspectives</b></li> <li>d. Determining what additional information is required to <b>resolve contradictions</b></li> </ol>

<p>3) <b>Construct and/or refine</b> an argument using evidence and reasoning to support a claim</p>	<p>a. Construct, use, and/or present an <b>oral and written argument</b>, to support or refute an explanation or a model for a phenomenon (science), or a solution to a problem (engineering), that is supported by:</p> <ul style="list-style-type: none"> <li>i. A <b>claim</b> or set of claims</li> <li>ii. Relevant <b>empirical evidence</b> (e.g., observations, data, and/or a model) to support the claim and,</li> <li>iii. Scientific reasoning (incorporate scientific principles, theories, and/or ideas) to <b>support evidence linked to claim</b></li> </ul> <p>b. <b>Refine claim or set of claims</b> based on an evaluation of the evidence presented</p>	<p>a. Construct, use, and/or present an <b>oral and written argument</b>, to support or refute an explanation or a model for a phenomenon (science), or a solution to a problem (engineering), that is supported by:</p> <ul style="list-style-type: none"> <li>i. A <b>claim</b> or set of claims</li> <li>ii. Relevant <b>empirical evidence</b> (e.g., observations, data, and/or a model) to support the claim and,</li> <li>iii. Scientific reasoning (incorporate scientific principles, theories, and/or ideas) to <b>support evidence linked to claim</b></li> </ul> <p>b. <b>Refine claim</b> or set of claims based on an evaluation of the data and evidence presented</p>
<p>4) [Engineering] <b>Make, defend, and/or evaluate</b> a claim about the <b>effectiveness/merit</b> of an <b>object or design solution</b> using evidence</p>	<p>a. <b>Make and defend a claim</b> (or set of claims) related to a design solution that:</p> <ul style="list-style-type: none"> <li>i. supports or refutes the advertised <b>performance</b> of a device, process, or system,</li> <li>ii. are based on <b>empirical evidence</b> about the effectiveness of a design solution (whether or not the technology meets relevant criteria and constraints)</li> <li>iii. <b>reflects scientific knowledge</b>, and student-generated evidence.</li> </ul> <p>b. <b>Evaluate competing design solutions</b> based on jointly developed and agreed-upon design criteria</p>	<p>a. <b>Make and defend a claim</b> (or set of claims) related to a design solution that:</p> <ul style="list-style-type: none"> <li>i. supports or refutes the advertised <b>performance</b> of a device, process, or system,</li> <li>ii. are based on <b>empirical evidence</b> about the effectiveness of a design solution (whether or not the technology meets relevant criteria and constraints)</li> <li>iii. <b>are based on</b> scientific knowledge and/ or student-generated evidence about the natural or designed world.</li> </ul> <p>b. <b>Evaluate competing design solutions</b> based on relevant factors such as economic, societal, environmental, and ethical consideration.</p>

\* Teaching methods instructors should consider use of discourse scaffolds or sentence frames to help guide this