ASET Science & Engineering Practice (SEP) Tool: Using Mathematics and Computational Thinking

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.

SEP 5	**Using Mathematics and Computational Thinking:** In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of predictions.		
Components of SEP **In this lesson/unit plan, it is clear that** students **have a structured opportunity to:**	Present? **Y/N**	**What teacher actions were taken to facilitate this component for students?**	**What are the students doing?** **What sensemaking or intellectual work are students doing?**
1) **Identify** mathematical and/or computational representation(s) that can be used to interpret and make sense of phenomena or assess solutions to design problems			
2) **Apply** mathematical and/or computational representation(s) of the phenomenon to identify relationships in the data and/or simulations			
3) **Use analysis** of the mathematical and/or computational representation(s) as evidence to explain phenomena or assess solutions to design problems			

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ASET Grade Band Criteria (Grade Band: 6-8)

<table>
<tr><th colspan="2">Science & Engineering Practices</th></tr>
<tr><td colspan="2">SEP 5: Using Mathematics and Computational Thinking: Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets, using simple statistical features, and using mathematical concepts to support explanations and arguments.</td></tr>
<tr><td colspan="2">By the end of the grade band students will have had a structured opportunity to develop an understanding of each of these. Individual lessons or units should include opportunities for students to practice one or more of the following components ……</td></tr>
<tr><td>1) Identify mathematical and/or computational representation(s) that can be used to interpret and make sense of phenomena or assess solutions to design problems</td><td>Students will investigate a phenomenon and generate/apply mathematical representations to make sense of phenomena or to test and compare proposed solutions to an engineering design problem.

To do this students will:
a. decide when to use qualitative vs. quantitative data
b. identify and select mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) that represent the phenomena or design problems
c. create or utilize a series of ordered steps (algorithms) to solve a problem or represent a phenomenon.
d. identify the relevant components/characteristics from given mathematical and/or computational representations of phenomena</td></tr>
<tr><td>2) Apply mathematical and/or computational representation(s) of the phenomenon to identify relationships in the data and/or simulations</td><td>Students will model phenomena or solutions to engineering design problems using mathematical concepts and/or processes. To do this students will:

a. apply mathematical concepts and/or processes (as identified in 1.b or given by the instructor) to model scientific and engineering questions and/ or problems.
b. use digital tools (e.g., computers) to analyze very large data sets for patterns and trends and transform data between various tabular and graphical forms
c. use digital tools and/or mathematical concepts and arguments to represent phenomena and relationships among data and/or underlying mechanism(s), or to compare solutions to an engineering design problem

These include identifying relationships within data and/or simulations or correlations with physical observations.</td></tr>
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3) **Use analysis** of the mathematical and/or computational representation(s) as evidence to explain phenomena or assess solutions to design problems	Students will: a. use mathematical representations to describe and/or **support scientific conclusions** and design solutions. b. **identify relationship**s or explanations for phenomena that they will support The analysis of data includes consideration of: a. **Patterns** in data b. **Predicting the effect of change** in parameters**.** or inform changes in an initial testing phase c. **Synthesis of analysis** with related scientific information

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