ASET Science & Engineering Practices (SEP) Tool: Analyzing & Interpreting Data

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 4	**Analyzing and Interpreting Data:** Scientific investigations produce data that must be analyzed in order to derive meaning. Scientists use a range of tools-including tabulation, graphical interpretation, visualization, and statistical analysis- to identify sources of error in investigations and calculate the degree of certainty in the results. Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria. Like scientists, engineers require a range of tools to identify patterns within data and interpret results.

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) Clearly **organize** and **display** data to represent phenomena.			
2) Identify and describe relevant and meaningful **patterns** and **relationship**s in data.			
3) Use statistical techniques to analyze data to address a **scientific question** or design solution			
4) Interpret data to provide evidence for, predict, and/or draw conclusions **about phenomena**.			
5) Analyze and interpret **large data sets**.*			
6) Identify and address **variation and uncertainty** in data sets.*			

* This component is not required in K-2 or 3-5 grade bands

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

Science & Engineering Practices		
SEP 4: Analyzing and Interpreting Data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlations and causation, and basic statistical techniques of data and error analysis. In 9-12 they build on K-8 experiences and progress to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.		
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 ……		
	6-8 Grade Band	**9-12 Grade Band**
1) Clearly **organize** and **display** data to represent phenomena.	Students will: a. **Organize data** in a clear way that i. facilitates analysis and interpretation of relationships. ii. highlights patterns and relationships that are relevant and meaningful to a scientific question. b. **Generate visual display**s (e.g. tables, graphs, charts, images) that are i. Interpretable and clear ii. Appropriate to the data. iii. Connected to the phenomenon c. Clearly **describe how** the visual displays represent each data set.	Students will: a. **Organize data** in a clear way that i. facilitates analysis and interpretation of relationships. ii. highlights patterns and relationships that are relevant and meaningful to a scientific question. b. **Generate visual displays** (e.g. tables, graphs, charts, images) that are i. Interpretable and clear ii. Appropriate to the data. iii. Connected to the phenomenon c. Students clearly **describe how** the visual displays represent each data set.
2) Identify and describe relevant and meaningful **patterns** and **relationships** in data.	Students will: a. Identify and describe **patterns and relationships** (similarities and differences, causal and correlational, linear and nonlinear) that i. Are relevant and meaningful ii. Address a natural phenomenon. b. Distinguish between **causal and correlational** relationships in data. c. [Engineering] Analyze data to define an **optimal operational range** for a proposed object, tool, process, or system that best meets criteria for success	Students will: a. Identify and describe **patterns and relationships** (similarities and differences, causal and correlational, linear and nonlinear) that i. are relevant and meaningful ii. address a natural phenomenon. b. Distinguish between **causal and correlational** relationships in data. c. [Engineering] Analyze data to identify design features or characteristics of the components of a proposed process or system to **optimize its relative to criteria for success**
3) Use statistical techniques to analyze data to address a **scientific question** or design solution	Students will: a. Use appropriate **descriptive statistics** to summarize data in a way that addresses a scientific question. b. Apply concepts of **statistics and probability** (including mean, median, mode, minimum/maximum values, and variability) to analyze and characterize data, using digital tools when feasible.	Students will: a. Use appropriate **descriptive statistics** to summarize data in a way that addresses a scientific question. b. Apply concepts of **statistics and probability** (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to analyze and characterize data, using digital tools when feasible

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4) Interpret data to provide evidence for, predict, and/or draw conclusions **about phenomena.**	Students will: a. Make predictions based on **evidence**. b. Make a claim about a **phenomenon** based on relevant and sufficient evidence. c. Determine, describe, and provide **evidence for phenomen**a. d. Draw **conclusions** about phenomena.	Students will: a. Make predictions based on **evidence.** b. Make a valid and reliable claim about a **phenomenon.** c. Determine, describe, and provide **evidence for phenomena**. d. Draw **conclusions** about phenomena.
5) Analyze and interpret **large data sets.***	Students will: a. Use **graphical displays** (e.g., maps, charts, graphs, or tables) of large data sets to identify and describe temporal and spatial relationships. b. **Construct, analyze, and/or interpre**t graphical displays of large data sets to identify linear and nonlinear relationships.	Students will: a. Use **graphical displays** (e.g., maps, charts, graphs, or tables) of large data sets to identify and describe temporal and spatial relationships. b. **Construct, analyze, and/or interpret** graphical displays of large data sets to identify linear and nonlinear relationships.
6) Identify and address **variation and uncertainty** in data sets.*	Students will: a. **Compare results** from different trials and/or different groups and describe variations in findings b. Identify **relevant sources** of measurement variation and determine how to address them. c. Seek to **improve precision and accuracy** of data with better technological tools and methods (e.g., multiple trials). d. Identify relevant sources of **measurement error** and describe how they limit interpretations of the data. e. Apply basic **statistical techniques** of error analysis.	Students will: a. **Compare results** from different trials and/or different groups and describe variations in findings b. Identify **relevant sources** of measurement variation and determine how to address them. c. Seek to **improve precision and accuracy** of data with better technological tools and methods (e.g., multiple trials). d. Identify relevant sources of **measurement error** or sample selection bias and describe how they limit interpretations of the data. e. Apply basic **statistical techniques** of error analysis. f. Compare and contrast various **types of data sets** (self-generated, archival, etc.) to examine consistency of measurements and observations g. Evaluate the **impact of new data** on a working explanation and/or model of a proposed process or system

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