

Science & Engineering Practices
Analyzing and
Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis. 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—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.



| K–2 Condensed Practices | 3–5 Condensed Practices | 6–8 Condensed Practices | 9–12 Condensed Practices |
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| Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. | Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. | Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. | Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. |
| <ul style="list-style-type: none"> Record information (observations, thoughts, and ideas). Use and share pictures, drawings, and/or writings of observations. Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems. Compare predictions (based on prior experiences) to what occurred (observable events). | <ul style="list-style-type: none"> Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. | <ul style="list-style-type: none"> Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. Distinguish between causal and correlational relationships in data. Analyze and interpret data to provide evidence for phenomena. | <ul style="list-style-type: none"> Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. |
| | <ul style="list-style-type: none"> Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. | <ul style="list-style-type: none"> Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. | <ul style="list-style-type: none"> Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. |
| | | <ul style="list-style-type: none"> Consider limitations of data analysis (e.g., measurement error), and/or seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). | <ul style="list-style-type: none"> Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. |
| | <ul style="list-style-type: none"> Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. | <ul style="list-style-type: none"> Analyze and interpret data to determine similarities and differences in findings. | <ul style="list-style-type: none"> Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations. |
| <ul style="list-style-type: none"> Analyze data from tests of an object or tool to determine if it works as intended. | <ul style="list-style-type: none"> Analyze data to refine a problem statement or the design of a proposed object, tool, or process. Use data to evaluate and refine design solutions. | <ul style="list-style-type: none"> Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success. | <ul style="list-style-type: none"> Evaluate the impact of new data on a working explanation and/or model of a proposed process or system. Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success. |