

SCIENCE AND ENGINEERING PRACTICES

The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term practices instead of a term like “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Part of the NRC’s intent is to better explain and extend what is meant by “inquiry” in science and the range of cognitive, social, and physical practices that it requires. Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design. Strengthening the engineering aspects of the *Next Generation Science Standards* will clarify for students the relevance of science, technology, engineering, and mathematics (the four STEM fields) to everyday life.

- [Asking Questions and Defining Problems](#)
A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.
- [Developing and Using Models](#)
A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.
- [Planning and Carrying Out Investigations](#)
Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.
- [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.

- **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; statistically analyzing data; and recognizing, expressing, and applying quantitative relationships.
- **Constructing Explanations and Designing Solutions**
The products of science are explanations and the products of engineering are solutions.
- **Engaging in Argument from Evidence**
Argumentation is the process by which explanations and solutions are reached.
- **Obtaining, Evaluating, and Communicating Information**
Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.