

The Scientific Method

The simplest accurate definition of Science is: [Science is a Process](#).

The Scientific Method is the heart of Science. The goal of this method (process) is to discover the relationships between cause and effect in various technical situations.

Webster's dictionary defines an overview of the [Scientific Method](#) as:

Principles and procedures for the systematic pursuit of knowledge involving:

- 1) the recognition and articulation of a problem,
- 2) the collection of data through observation and experiment, *and*
- 3) the formulation and testing of hypotheses.

In other words, the **Scientific Method** is a **step-by-step problem-solving process**.

Below is an outline. It is not a rigid, linear method, but rather one that is as flexible and creative as the user is. The typical steps (e.g., from [here](#), [here](#), [here](#), and [here](#)) are:

1. **Make an observation.** This involves monitoring and gathering information from a certain aspect of the natural world.
2. **Ask a question.** Form relevant and testable queries based on the individual's observations.
3. **Gather background information.** Do reasonable research into what is claimed to be known about the topic.
4. **Create a hypothesis.** A [hypothesis](#) is a possible answer to a question. If proven later, it can become a fact or theory.
5. **Make a prediction.** Create a testable prediction based on the hypothesis.
6. **Perform a test.** The test should establish a change that can be measured or observed using empirical analysis. It is important to control for other [variables](#) during the test
7. **Analyze the results and draw a conclusion.** Use the [metrics](#) established before the test see if the results match the prediction. Determine whether the hypothesis was validated or not.
8. **Share the conclusion and decide what to do next:** Document the results of the experiment. By sharing the results with others, the total body of knowledge available is increased. This experiment may have led to other questions, or if the hypothesis is disproven, a new one may need to be created and tested.

The Faddish Alternative

The PreK thru 12 [Next Generation Science Standards](#) (NGSS) (and [here](#)) never mention the phrase *Scientific Method*. Instead they are advocating a snobbish substitute.

Who are “they”? They are a variety of institutions, but likely the most influential is the [National Academy of Sciences](#) (NAS) and their division [National Research Council](#) (NRC). For examples of their NGSS involvement see [here](#) and [here](#).

The new alternative proposed by these parties is: “[Science and Engineering Practices](#).” Here is their description:

Science and Engineering Practices describes: (a) the major practices that scientists employ as they investigate and build models and theories about the world, and (b) a key set of engineering practices that engineers use as they design and build systems.

Listed below are the eight NGSS *Science and Engineering Practices*:

1. Asking questions and defining problems
2. *Developing and using models*
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. *Using mathematics and computational thinking*
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

The two most significant differences between the NGSS/NAS alternative and the Scientific Method are italicized. Basically, they are advocating that we use **computer models** instead of **Critical Thinking** by humans.

A good example of this routine in everyday life, is their heavy reliance on computer models to justify Global Warming assertions. [Here](#) are some slides that examine the multiple weaknesses in this approach, for anything of that complexity.

The bottom line is that reliance on computer models is fraught with major concerns, scientific and otherwise. Replacing the Scientific Method and Critical Thinking is not in the interest of Science or of our society. If and when we have some Science-oriented national leaders, they should establish an *Einstein Commission*, along the lines of the [1776 Commission](#) as Science is being pillaged, just as US history is.