

Scientific Method (Scientific Methodology) describes all of the techniques, processes and logical routes used by scientists for exploring nature and investigating questions about the natural world. There is no single specific series of steps used by all scientists at all times (often called “*the*” scientific method).

For many years, philosophers of science including Feyerabend (1975), Bauer (1994) and Gjertsen (1989) have asked the question “is there a scientific method?” The answer is “yes” and “no.” Yes, because there are things that most scientists do most of the time so these might be called scientific methods or methodology. No, because there is no formula or plan that all scientists follow all of the time as in the case of some single scientific method.

The key to understanding scientific methodology is to recognize that scientists use many techniques and logical processes to gain knowledge about the natural world. Scientists communicate with each other. Scientists generally review the literature to learn about past discoveries, take measurements and maintain careful records. Scientists apply creative thinking, develop and engage mathematical models, use the process of induction to evaluate data and look for patterns, and apply deduction to test their ideas. It would be impractical to list all of the things that scientists do as they explore and explain nature, but those things that scientists do routinely are very likely part of the methods of science.

Many science textbooks talk about *the* scientific method as if all scientists use the same process regularly. Often, this version of scientific method contains 6 to 9 steps beginning with “ask a question,” continuing with “collect data” “analyze results” and ending with “communicate results.” In many classrooms students are taught this step-by-step method directly and even assessed on their ability to memorize and report the steps.

Perhaps because scientists share their findings in scientific journals, using a standard reporting form, some may think that all scientists follow the same method to gain evidence and answer questions (Medawar, 1963). However, studies of scientists at work reveal many idiosyncratic [distinct and personal] ways of approaching research” and answering questions (McComas, 2004, p. 25).

If a student has no idea where to begin a scientific investigation, the step-by-step “scientific method” found in many science textbooks has value in providing a framework for such work but it should not be called *the* scientific method. There are many tools used by scientists to investigate nature and reach conclusions and such tools are the methods of science. (WM)

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