

The Scientific Method

The Scientific Method is a systematic procedure for doing scientific research. It can be adapted to solve problems in many different fields of science. It has been claimed that it could be used to solve any problem. The basic steps of the Scientific Method are outlined below.

Steps in the Scientific Method	Explanation	Example - Epidemiology
1. State the Problem.		Determine the cause of a new disease that has recently broken out.
2. Research the Problem.	Learn what other people have already done on the subject.	Look up what other research has been done on the disease. Look at research done on similar diseases. Find out what all victims had in common.
3. Form a Hypothesis.	Make a statement about the solution to the problem that you can test experimentally.	The virus <i>pacillus studiae</i> is the cause of the disease.
4. Test the Hypothesis.	<p>Do an experiment to test whether or not the hypothesis is true.</p> <ul style="list-style-type: none"> • You need to have one fixed set of experimental conditions with which all runs of the experiment are to be compared. This is called a <i>control</i>. • Each run of an experiment should vary only one factor. • Each experiment should be repeated enough times so that you can be sure that the results are reliable. Statistical methods are often used to determine how many times an experiment needs to be repeated. • You need to ensure that the way you do your experiment does not bias the results. 	<ul style="list-style-type: none"> • Conduct experiments with animals to see whether the virus will cause the disease • Examine human patients with and without the disease for evidence of the virus • Do you assessments on large numbers of subjects
5. Draw Conclusions from the Data.	Examine your data to see whether your hypothesis was true, partially true, or false. Often statistical analysis is used to determine if data confirms a hypothesis. Note that even if you prove your hypothesis false, if you've done your research correctly, you've learned something.	You want to determine whether the percentage of subjects with the <i>pacillus studiae</i> virus that got the disease is significant enough that we can conclude mathematically that the virus causes the disease. Or, conversely, that it is small enough that we can conclude that it does not cause the disease.

The Engineering Method

The Engineering Method is a systematic procedure for completing an engineering project. It can be adapted to solve many types of problems. The basic steps of the Engineering Method are outlined below.

Steps in the Engineering Method	Explanation	Example - PACE P2
1. State the Problem.		Design a consumer vehicle for today's market.
2. Determine the Requirements of the project.	Determine what conditions the product or service has to satisfy.	<ul style="list-style-type: none"> • The PACE P2 must have a large storage capacity. • The PACE P2 must get at least 28 mpg. • The PACE P2 must sell for under \$32,000. • The vehicle must have a high safety rating.
3. Research the project. <ul style="list-style-type: none"> • Look up what research has been done in the field. • Evaluate alternative approaches to completing the project. 	You may need to look at pure research results as well as evaluate established engineering procedures for similar projects.	Look at what techniques exists to reduce gas mileage. Has any new ideas come along? Are there promising approaches that our engineering team can develop?
4. Do an Initial Design.	Design the product and test it against the requirements.	Make a prototype of the car. Measure it's storage capacity, mpg, and determine how it has to be priced to make a profit.
5. Refine the Design.	Change the design to improve it. This is especially important if previous designs failed to meet all the requirements.	Experiment with different parts, configurations, or different designs. Continue to refine the vehicle until all requirements are met.