Lesson 2: The Scientific Method

Scientific and Engineering Research Methods

Overview

- The Scientific Method is a systematic procedure for doing scientific research
- It is usually applied to projects involving experimentation
- It consists of five basic steps
- It makes use of statistical analysis to quantify the results

Step 1: State the Problem

Explanation:

Provide a statement of the problem you are trying to solve

Example:

Find the cause of the disease that broke out in South Transistan last month

Step 2: Research the Problem

Explanation:

Learn what is already known about the problem

Example:

Look up what other research has been done on the disease. Look at research on similar diseases

Step 3: Form a Hypothesis

Explanation:

Make a statement about the solution that you can test experimentally

Example:

The virus pacillus studiae is the cause of the disease

Step 4: Test the Hypothesis

Explanation:

Do an experiment to test whether or not the hypothesis is true

Example:

Conduct experiments on animals to see whether or not the virus causes the disease

More on Step 4

- When conducting experiments
  - Have a fixed set of experimental conditions with which all runs of the experiment are to be compared. This is called a *control*
  - 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. Simple statistical analysis will tell you how many times to repeat an experiment
  - Ensure that the way you do your experiments does not bias the results

More on Step 5

- You want to either accept or reject your hypothesis based on the data you collected
  - A simple statistical analysis allows you to draw a conclusion and to quantify it
  - Whether you accept or reject the hypothesis, you have learned something

Main Points

- The Scientific Method is a procedure for doing experimental research
- It consists of five basic steps:
  - State the Problem
  - Research the Problem
  - Form a Hypothesis
  - Test the Hypothesis (through experimentation and data collection)
  - Draw Conclusions From the Data
- Statistical Analysis is used to help design the experiment and to analyze the results