The Scientific Method

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What is the scientific method?

A series of steps that scientists use to help solve a problem.

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Why do scientists use the scientific method?

To give them a consistent, organized, and orderly methodology to solve problems.

Step 1: State the problem/Ask a Question

1. Problem/Question: **The first step of the scientific method usually begins with someone asking a question based on observations, or someone encountering a problem/curiosity that they want to solve.**

1. State the problem/ Ask a Question

Example: Will a lima bean plant grow larger with soil from an earthworm bed or MiracleGro potting soil?

Step 2. Gather information/ Background Research

2. Gathering Information. A scientist would educate themselves about their topic.

Step 3: Form a hypothesis.

Form a hypothesis: A hypothesis is an educated guess or a possible answer to a question. A hypothesis must be testable.

Step 3: Form a hypothesis.

Example: I think that the lima bean plants grown in earthworm bed soil will grow taller than lima bean plants grown in MiracleGro potting soil.

Step 4: Test the hypothesis/ Conduct the experiment

*The hypothesis is tested by conducting experiments.

*In a controlled experiment, only one *independent variable* is tested at a time. The one factor that the scientist changes is called the ***independent variable***.

Step 4: Test the hypothesis/ Conduct the experiment

Example: Lima bean plants are grown in an area where they get the same sunlight and same amount of water (these are the ***constants***). The only thing that is different is the type of soil that the lima bean plants are grown in. The type of soil is the ***independent variable.***

Step 4: Test the hypothesis/ Conduct the experiment

The amount that the limas grow is called the ***dependent variable***. Plants grown in regular soil found outside would be an example of a *control.*

Step 4: Test the hypothesis/ Conduct the experiment

*A Bigger Sample Size is Always Better!

Ex: You would test 100 lima bean plants in each soil type, not just 1.

Step 4: Test the hypothesis/ Conduct the experiment

*******Cause is to effect as…Independent variable is to dependent variable******

5. Analyze Data/Results

- Scientists organize data so that it can be analyzed. Scientists may organize data into a table or chart during the analyze results step of the scientific method.

5. Analyze Data/Results

Ex: You would graph your data to show much your lima bean plants grew.

Step 6: Draw Conclusions

*During this step, scientists determine if the hypothesis was correct (supported) or incorrect (refuted).
*If the hypothesis is refuted, it does not mean that the experiment was a waste of time.
*Scientists determine what the results actually mean in this step.

Step 6: Draw Conclusions

Scientists also determine what further research could be conducted on this topic. If their hypothesis was proven correct, scientists may need to repeat their research many times to prove their hypothesis valid to other scientists.