SCIENCE FAIR

THE SCIENTIFIC METHOD

Establishing the Process

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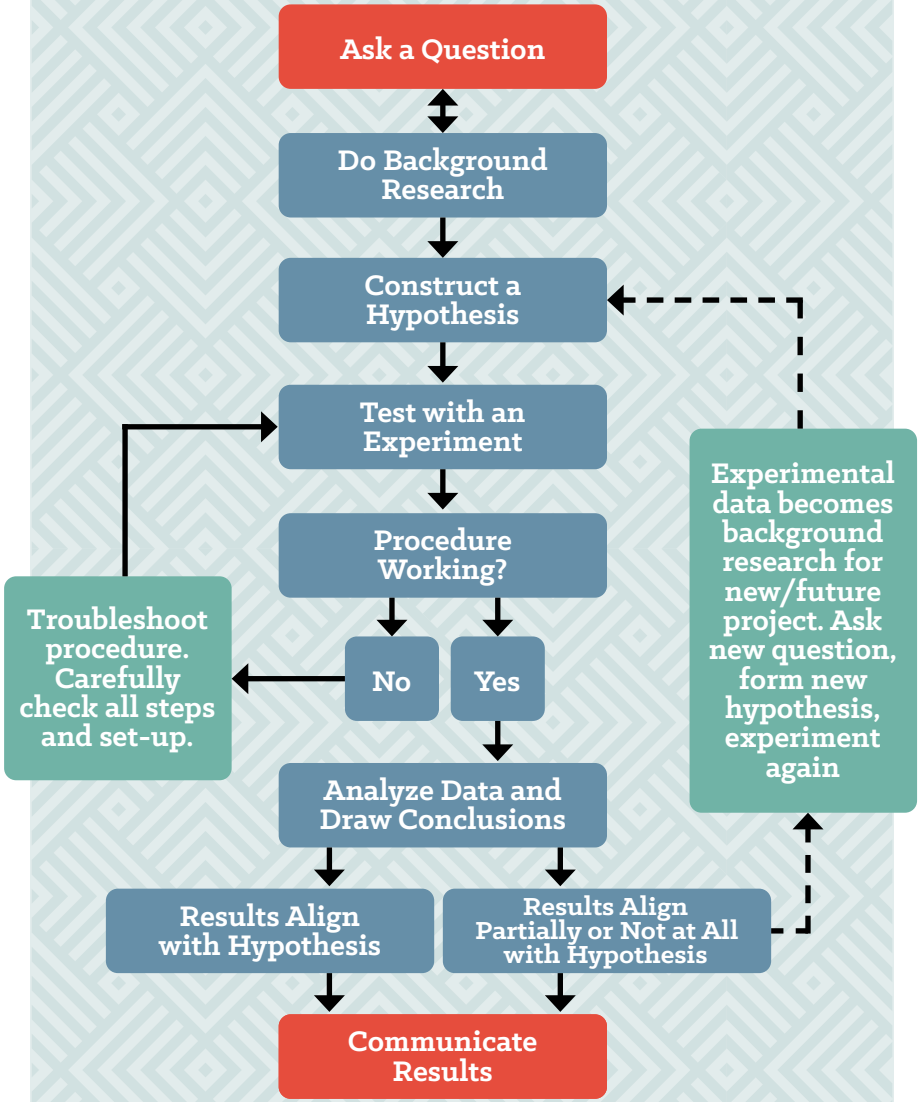
The scientific method is a tool used by scientists (and the rest of us) to solve problems and answer questions in a logical format. It provides step-by-step, general directions to help us work through a problem.

Steps of the scientific method:

- Make an observation
- Ask a question
- Conduct research
- Form a hypothesis
- Test your hypothesis
- Do an experiment
- Collect data
- Analyze the results
- Draw conclusions
- Communicate the results

The Scientific Method



Observation

An observation is noticing the world around us by using our senses or recording information using scientific tools. There are two different types of observations:

Qualitative

- Descriptive
- Uses your five senses

Quantitative

- Measurable; uses numbers
- Made with tools like rulers, scales, thermometers, etc.

Hypothesis

A hypothesis is an educated guess that:

- Is based on research and prior knowledge
- Allows you to make a prediction that can be measured
- Can be tested
- Is often written as "If…(I do this), then…(this will happen)." Example: If I add sugar to the water, then the cut flowers will live longer.

Experiment

In order to determine if the hypothesis is supported or not, an experiment is conducted.

A scientific experiment must be a fair test. To make sure that your experiment is a fair test, you must change only one factor at a time and keep all other factors the same. The factors that affect an experiment are called variables. The main variables are the independent variable, dependent variable, constants, and control.

To ensure that the results of the experiment are reliable, and not an accident, the experiment should be repeated several times.

Variables

Independent Variable (IV):

- What is changed by the scientist
- The 'I control' variable
- What you are testing

Dependent Variable (DV):

- The result, usually something that is measured.
- "Depends" on the independent variable.

Hint: Your hypothesis can TELL you what your variables are!

If ___IV_____ , then _____DV_____.

Ex. If I drink Mountain Dew before bed, then I will not sleep very much.

IV: Drinking Mountain Dew

DV: The amount of sleep

Practice: Use the following hypotheses to identify the variables:

- If I leave all the lights on all day, then my electric bill will be expensive.

  IV: _____

  DV: _____
- If I brush my cat more, then there will be less fur on my furniture.

  IV: _____

  DV: _____

Constants:
Constants are variables that must remain the same throughout the experiment. For example, watering the plants the same amount of water, using the same type of plant, or using the same measuring tool every time. *To have a fair test, the only variable that should be different is the independent variable.*

Control:
The control is the part of the experiment that the scientist doesn't change or add the independent variable to. *This is considered the "normal" circumstance. Why do we need a control? The control is a standard to which we can compare our results.*

An example of a fair test: I want to see if different colors of light help plants grow better. I am going to take four plants (all the same type) and set them up underneath different lights. One will be a white light, one will be red, one will be blue, and one will be green. Every day, I will water the plants the same amount at the same time. I will also record how high each plant grows for two weeks and then look at my results.

- Independent variable: different colors of lights
- Dependent variable: the height of the plants
- The constants:
  - each plant gets the same amount of water
  - all of the plants are the same type
  - all plants get the same amount of light
- The control group: the plant that gets white light; normal sunlight is white light.

Results

- While conducting your experiment, it is important to make quantitative and qualitative observations and record them.
- These recorded observations are known as data.
- Once multiple trials of the experiment have been conducted, the data can be arranged in tables and graphs so that it can be analyzed.

**You can learn more about data analysis and graphing in the library's Data & Analysis brochure.*

Conclusion

Your conclusion should summarize how your results support or contradict your original hypothesis.

- Summarize your project results in a few sentences.
- State whether your results support or contradict your hypothesis. (Engineering projects should state whether they met their design criteria.)
- Evaluate your experiment. Was it successful?
  Be sure to support your conclusion by including key facts from your background research and data from your experiment to help explain your results.
- Suggest changes in the experimental procedure (or design) and/or possibilities for further study.

Be sure to visit our website at
clermontlibrary.org/science-fair
for more resources and information on this and other components of creating a Science Fair project.

All Science Fair project proposals must be submitted through the registration form on the website by the deadline stated on the form to be considered for inclusion in the Library Science Fair.

Questions? Email us at:
sciencefair@clermontlibrary.org

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CED 10-2022