

1.2: Designing Experiments - What's Being Tested?

An **experiment** is a controlled method of testing a hypothesis. Experiments are designed to provide an opportunity to make observation that will help test a hypothesis. Experiments are best understood in term of three types of variables: independent variables, dependent variables, and controlled variables. A **variable** is some kind of parameter that is either directly recorded, set as constant, or something that affects a change in another parameter.

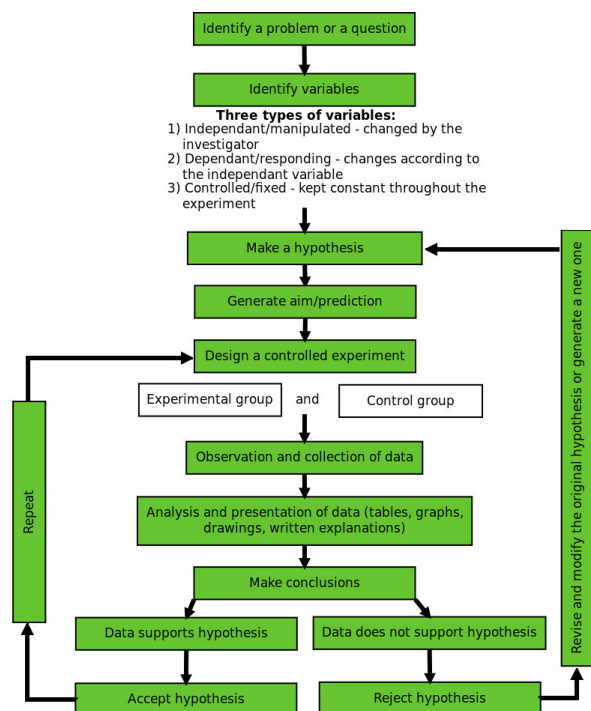


Figure 1.2.1: A recap of The Scientific Method that shows how a hypothesis is tested through experiments that have clearly defined experimental variables (measurements).

Experimental Variables

Most experiments are repeated multiple times with slight variations. These repetitions are often called trials. A variable that is purposely altered between trials is called an **independent variable**. Usually, it is a best practice to have a single independent variable in an experiment. It may be helpful to think of the independent variable as the "input" of the experiment.

If the independent variable is the "input" of an experiment, than the **dependent variable** is the "output." Dependent variables change in response to the independent variable (their name comes from the fact that they depend on the independent variable).

Finally, some variables, called **controlled variables**, are kept constant through all of the trials. Controlled variables are kept constant so that their fluctuations do not alter the dependent variable and cloud its relationship with the independent variable.

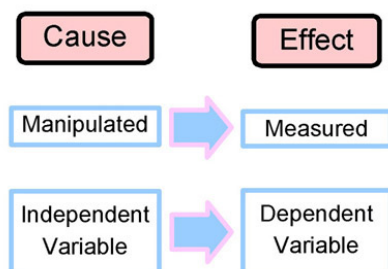


Figure 1.2.2: Experiments are designed such that the directly measured result (or something that can be used to calculate a desired result) is the dependent variable. Since hypotheses are inductive statements, i.e. statements that aim to predict or explain, the

dependent variable must be treated as an affected outcome that results from changes in specific causes of that outcome.

Example Experiment

Below is an example of an experiment that involves measuring plant growth by determining the height of the plant. In this experiment, the objective is to test a hypothesis that relates the amount of water (independent variable) to the height of the plant (dependent variable), specifically, "If little water is given to a plant, then the plant height will be lesser." If only those two variables are to be related, then all other factors that affect plant height must remain unchanged throughout the experiment. Can you design an experiment that will test this hypothesis?

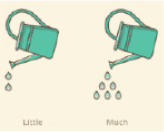

Independent variable	Amount of water
Value of amount of water	
Dependent variable	Height of plant
Effect/result (Measure height of plant growth)	
Controlled variable	Location of pots, Type of plant, Water plants at the same time

Figure 1.2.3: Experimental variables involved in a plant growth experiment.

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