Experimental Design
Types of Data
Levels of Testing
Trials

Data are information collected in an experiment. There are two types of data collection; **qualitative** and **quantitative**.

Most quantitative data are collected using a standard measuring instrument. (Some examples are: thermometer, ruler graduated cylinder, weight or mass balance.) Scientists use the Metric System, so quantitative data have units attached to them. (Some examples are millimeter, meter, liter, gram, degrees Celsius. Quantitative data may also be collected by counting. Some examples include the number of seeds that sprouted or the number of flowers produced.

Some data result from not using a standard measuring device or counting. Simple **evaluations or observations** made against a personal standard result in **qualitative data**. Examples include: the color of a leaf to assume its state of health-dark green = very healthy, brown, dead or dying and those colors in-between are defined by the scientist. Determining that one person is "taller" than a group of persons simply by observing them standing back to back is an example of qualitative data. You cannot find the mean when using this type of data. This is the time to use the most frequent observation called the mode.

Levels of testing are used when testing the Independent Variable. When changing the Independent Variable, the experimenter must make the decision about the number of levels and the amount of change for each level. For example:

- raising a ramp from 2 inches to 12 inches by two inch intervals for each trial
- increasing soaking time from 5 minutes to 30 minutes by five minute intervals for each trial
- increasing fertilizer used from 2 grams to 30 grams by 2 gram intervals for each trial

These are examples of the decisions that the experimenter must make for the levels of testing. The change in each level AND the number of levels can be too small or too large. Prior experience with variables will help experiments choose an appropriate number of levels and the change between levels. Also, when determining level of testing, the experimenter should think about the control or comparison group. (See information link about designing a control.)

Repeated trials are the number of times each level of the independent variable is tested. Repeated trials are made because errors in measurements, counts etc. that are too high will be mathematically balanced (averaged) by measurements that are too low. How many trials are needed? This depends on the experiment. In general, the more variables to be controlled and the more difficult the variables are to control, the more repeated trials (data) are necessary to prove or disprove a hypothesis. For this reason, in general, experiments involving plants and animals require more repeated trials than do other experiments.

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