Lab Report Primer

Each lab experiment investigates the relationship between two variables: the independent, which is changed on purpose, and the dependent, which changes as a result of changes to the independent. The independent can be thought of as the cause while the dependent can be thought of as the effect. The relationship of these two variables drives the entire lab.

Experimental question takes the form "What is the effect of (independent variable) on (dependent variable.) This format always works when the actual variables from the lab are substituted into the ( ).

What is the effect of (*the amount of light received*) **on** (*the growth of a bean plant*?)

Here, the independent is the amount of light received and the dependent is the growth of the bean plant. The lab will specify later how the light and growth will be measured. Alternately, the question could be more specific:

What is the effect of (*the hours of light received by a plant*) **on** (*its height*?)

Hypothesis is a predicted answer to the experimental question. To be clear and complete, it must contain both variables. It can be phrased as an "if- then" statement.

a) Giving bean plants more light will make them grow more while giving bean plants less light will make them grow less.
b) If bean plants receive different amounts of light, then the ones that get more light will grow more while the ones that get less light will grow less.
c) The more light bean plants get, the taller they will grow.

Constants or variables held constant are things that *could* change, or vary, from trial to trial. They are deliberately held constant so that they don't change. There are always several, and sometimes there are many. Not all constants are equally important. The more likely that a variable is to change the dependent variable, the more important it is to hold it constant.

For example, testing the effect of light on bean plant growth, other variables like soil, watering, and fertilizer would be held constant. Otherwise, it would be impossible to know if differences in growth were caused by the light or by one of those other variables. The color of the watering can used, on the other hand, is not a very important constant when compared to soil, watering, or fertilizer.

Control is a trial in which the independent variable is removed completely. In the case of the plant experiment, we would give one plant or group of plants no light at all.

Materials are resources need to do the experiment listed down the page without numbering.

Procedures are a numbered list of steps necessary to complete the experiment. Procedure steps are brief, clear, and specific, and each one leads with the verb that best describes the action that the step is indicating. Procedures make a lab replicable or repeatable by explaining how to hold important constants constant, how to change the independent variable, and how to observe or measure the dependent variable.

Observations and data are where the results of the experiment are recorded. Qualitative (non-number) observations may be written in sentences or may be in a table. Data will often be organized in ordered pairs of the independent and dependent variables and will be in a table or tables. For example, in the bean plant case, there might be columns of different bulb wattages with bean heights or masses filled into the columns. Tables are labeled with the names of the independent and dependent variable, and numbers are labeled with units.

Conclusion is a two part section of the lab that summarizes the results of the lab.

In the first part of the conclusion, experimental data and observations are used to answer the experimental question. For example, "The more light bean plants get, the taller they grow." The general answer to the question is then supported by data, either specific examples or measures of central tendency like mean or median. Analysis of data, including comparing and contrasting and creating ratios and percents, is also used as support the answer. For example, "The bean plant that was exposed to a 60 watt bulb grew 1.35 times taller than the bean plant that was exposed to a 40 watt bulb."

In the second part of the conclusion, called **"validity and error,"** the experimenter tells how confident (s)he is in the conclusion. "We are very/mostly/somewhat/not confident in our results." The general statement of validity is then supported by evidence of validity or errors that take away from validity.

For example: We know we controlled the amount of water and fertilizer that the plants got very carefully by measuring and recording it. We are not sure that we were able to hold constant the amount of light coming from outside sources, though, because some of the light may have leaked in around our shades or blinds. That could mean that we weren't really able to accurately measure how much light the plants received.

A validity statement is a clear, simple sentence or two, but must be elaborated and supported with specific evidence from the lab.

Things to consider in the validity section of your lab report:

a. Measurement: were measurements independent and checked?

b. Constants: were all important constants identified and keep constant? Identify constants and how they were kept constant or how they were not kept constant.

c. Trials: were enough identical and non-identical trials completed to make the data valid or are more trials needed?

d. Data: Is data from identical trials similar? If data from identical trials is similar, it may be used as evidence of validity because it indicates that important constant variables have been kept constant. If data from identical trials is different, it may be used as evidence of invalidity because it indicates failure to keep important variables constant.

Graphs are visual representations of experimental data.

A graph title takes the form: The Effect of (IV) on (DV). It can be your experimental question with "What is" removed.

Bar graphs are useful for comparing numbers and are typically used when the independent variable (x axis) **is not** numbers and **cannot** be used to produce a scale. Bar graphs are used to compare categories.

Line graphs or **scatter plots** are useful for showing how two sets of numbers change together and are typically used when the independent variable (x axis) is numbers and can be used to produce a scale. Line graphs are used to show continuous change.

The independent variable goes on the x axis and the dependent variable goes on the y axis. Each axis is labeled with the variable name, which must be specific, and the units if applicable.

When an axis is scaled, the scale interval must be constant.