Lab Report Primer

Each lab experiment investigates the relationship between two variables: the independent, which you change on purpose, and the dependent, which changes as a result of changes to the independent. The relationship of these two variables drives the entire lab.

Question: The question is where you state what you will be investigating. You *always* investigate the relationship between the independent and dependent variables. There are many ways to phrase a single question as shown below.

    a) How does giving bean plants different amounts of light affect their rate of growth?
    b) If I give bean plants different amounts of light, then how will it affect their rate of growth?
    c) What is the relationship between the amount of light and the growth of bean plants?

Here, the independent is the amount of light and the dependent is the growth of the bean plant. You'll need to specify later how you will measure or quantify the amounts of light and growth. Alternately, you could make your question more specific: What is the relationship between the amount of time that a bean plant is exposed to light and its height?

Hypothesis: The hypothesis is a proposed answer to the question. The hypothesis is sometimes called an "educated guess." It is educated because you should have done some research about the topic and should have some ideas about the answer before you do the lab. It is a guess because you haven't done the lab yet to find the answer. The hypothesis should take its form from the question.

    d) Giving bean plants more light will make them grow more while giving bean plants less light will make them grow less.
    e) If I give bean plants different amounts of light, then the ones that get more light will grow more while the ones that get less light will grow less.
    f) The more light bean plants get the more they will grow.

Independent Variable: This is the thing that you change on purpose. It is buried in your question and hypothesis if you have written them correctly. In the bean plant case, the independent variable is the amount of light, which you change on purpose. It could also be more specific, like the wattage of the bulb, or the number of lumens, or the hours of light per day.

Dependent Variable: This is the thing that you observe or measure. It changes because you changed the independent variable. It is also buried in your question and hypothesis. In the bean plant case, your dependent variable is the growth or size of the plant, which you observe. It could also be more specific, like the mass or height of the plan.

Constant Variables: These are the things that *could* change, or vary, from trial to trial. You keep them constant so that they don't change. There are always several, and sometimes there are many. For example, if you were testing the affect of light on bean plant growth, you would need to keep other variables like soil, watering, and fertilizer constant.

Materials: In this section, you simply list down the page any materials needed to conduct the experiment. Don't number them.

Procedures: In this section, you list the steps necessary to complete the experiment. You should strive to make your explanations brief, clear, and specific, and each one should lead with a verb. Chose the verb that best describes the action that the step is indicating. Procedures should be numbered.

Data Table and Observations: This is where you record any data that you have collected. Data will often be organized in ordered pairs of the independent and dependent variables, and it is helpful to make a table or tables. For example, in the bean plant case, you might have columns of different bulb wattages with bean heights or masses filled into the columns. Tables should always be labeled, and numbers should be labeled with units. This section will often include qualitative observations (those without numbers) as well.

Conclusion: This is where you use your experimental data and observations from #5 to answer your question in #1. For example, "The bean plant plants that got more light grew taller." You should also analyze data here, including **comparing and contrasting**, noting **differences**, and creating **ratios** or **percents**. 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, or, the bean plant that was exposed to the 60 watt bulb grew 4 cm taller than the bean plant that was exposed to the 40 watt bulb. You should make generalizations about your data. You must also cite data here, either by giving specific examples or measures of central tendency, e.g., mean/average. Don't restate all of your data here.

Difference between two numbers x 100% = "What percent larger is the larger than the smaller"
Smaller number

Larger number   = "How many times larger is the larger than the smaller"
small number

---**Validity and Error:** The validity statement is where you tell how confident you are in your conclusion. "We are very/mostly/somewhat/not confident in our results." The error statement is where you explain errors that you know you made, that you might have made, or that you know you avoided. The validity statement is the main idea while the error analysis is the supporting detail. For example: We know we held constant the amount of water and fertilizer that the plants got by measuring and recording it. We are not sure that we were able to hold constant 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.

You can make your validity statement with clear, simple sentence or two, but you must elaborate in the error section. The Error section is not only about errors; it is where you support your validity statement with specific detail about your lab.

1. Measurement: Did you measure independently and check with each other?

2. Constants: Did you identify and keep constant all the necessary variables? You need to say what the constants are and how you know you kept them constant or how you know you did not keep them constant.

3. Trials: Did you complete enough identical and non-identical trials to make your data valid or do you need to do more trials?

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

1. Question and Hypothesis

What two parts does the experimental question always contain?

Give one example of a question here:

What is a hypothesis?

Give a hypothetical answer to the question you wrote above:

2. Variables: Independent, Dependent, and Constant

Using everyday language, define the following:

Independent variable:

Dependent variable:

Constant variable:

Why must constant variables be kept constant?

3. Materials, Procedures, and Data

Which gets numbered, materials or procedures?

Which part of speech is the most important in a procedure step?

What must you do to make tables easy to read and understand?

4. Conclusion

What is the point of the conclusion?

How is mathematical analysis used in the conclusion?

How is data used in the conclusion?

5. Validity and Error

What do you tell in your validity statement?

What do you tell in the error portion?

Give two examples of details that might be used in an error statement.

1.

2.