Testing Your Hypothesis

Once you have constructed an effective hypothesis, the next step in the scientific inquiry process is to test the hypothesis through experimentation. This is a great opportunity for students to start a science notebook, if they have not yet started recording their progress.

Steps to Identifying and Conducting an Appropriate Experiment to Test a Hypothesis

1) **Present Hypotheses**
    - Make a list of all potential hypotheses to be tested.
2) **Make Predictions**
    - For each hypothesis, ask what would be true if the hypothesis were true.
3) **Write the Experimental Procedure**
    - The experimental procedure is a step-by-step recipe for the science experiment. A good procedure contains enough detail that someone else could easily duplicate the experiment. Once you have formed a hypothesis, you will need to develop your experimental procedure to test whether your hypothesis is true or false.
4) **Identify the Independent and Dependent Variables**
    - The first step of designing the experimental procedure involves planning how to change the *independent* variable and how to measure the impact that this change has on the *dependent* variable. To guarantee a fair test when conducting the experiment, make sure that the only thing changing is the *independent* variable. All controlled variables must remain constant.
5) **Design the Experiments**
    - How can you identify an appropriate experiment that will effectively test your hypothesis? Begin by asking yourselves, *"What can I do that will give me one result if my hypothesis is true, and a different result if my hypothesis is false?"* Design at least one possible experiment for each hypothesis. Be sure that each experiment tests only one hypothesis.

6) **Experimental Group vs. Control Group**

- Every good experiment **compares** different groups of trials with each other. Such a comparison helps ensure that the changes you see when you modify the independent variable are in fact caused by the independent variable. There are two types of trial groups: experimental groups and control groups.

i. **Experimental group:** Trials where the independent variable is changed. For example, if your question asks whether fertilizer makes a plant grow bigger, then the experimental group consists of all trials in which the plants receive fertilizer.

ii. **Control group**: All those trials where you leave the independent variable in its natural state.

7) **Repeat the Experiment**

- Repeating the science experiment several times is an important step to verify that your results are consistent and not just an accident. For a typical experiment, you should plan to repeat the experiment at least three times. The more you test the experiment, the more valid your results.

The following tips will be helpful when you prepare to create and conduct your experiment:

A. Make sure to review your experimental procedure. Are all of the necessary steps written down? Do you have any questions about how to do any of the steps?

B. Collect and organize all materials, supplies and equipment needed to do the experiment.

C. Think ahead about safety! Are there any safety precautions you should take? Will you need adult supervision? Will you need to wear gloves or protective eyewear? Keep a fire extinguisher nearby, if applicable.

D. Record all observations during your experiments in a science notebook**.**

E. Prepare a data table so you can quickly write down your measurements as you observe them.

F. Follow your experimental procedure exactly. If you need to make changes in the procedure, which often happens, you must write down the changes exactly as you make them.

G. Be consistent, careful and accurate when taking measurements.

H. If possible, take pictures of your experiments along the way; these will help to explain what you did and enhance your Mission Folders.

Testing Your Hypothesis Worksheet

Designing and conducting an experiment is a key occurrence in your project. When conducting your experiment(s), you and your team need to ask yourselves, "What makes a good experimental procedure?"

Step 1. Read the following questions carefully, answering "Yes" or "No" for each.

Have you included a description and size for all experimental and control groups?	Yes / No
Have you included a step-by-step list of all procedures?	Yes / No
Have you described how to change the independent variable and how to measure that change?	Yes / No
Have you explained how to measure the resulting change in the dependent variable or variables?	Yes / No
Have you explained how the controlled variables will be maintained at a constant value?	Yes / No
Have you specified how many times you intend to repeat the experiment, and is that number of repetitions sufficient enough to give you reliable data?	Yes / No
The ultimate test: Can another individual duplicate the experiment based on the experimental procedure you have written?	Yes / No

Every good experiment compares different groups of trials with each other. Such a comparison helps ensure that the changes you see when you modify the independent variable are in fact caused by the independent variable. There are two types of trial groups: experimental groups and control groups.

Step 2. Identify the experimental group(s) for an experiment. Remember, the experimental group consists of the trials where you change the independent variable.

Example Hypothesis: *If I add fertilizer to my plants, then they will grow bigger.*

What is the experimental group? _____

Step 3. Now that you have identified the basis of experimental groups, use the following hypothesis to identify the controlled variables:

Example Hypothesis: *If I add fertilizer to my plants, then they will grow bigger.*

What are the control groups?

1. _____
2. _____
3. _____