How to Do a Science Experiment

This sheet contains instructions and information that will hopefully assist your students in creating fun, interesting, successful science experiment. Science experiments should be one of the most fun activities of the entire school year because they give the children a chance to use their hands, imagination, and creativity, all of which are the learning tools they most utilize. The following outline is designed to help plan and perform a science experiment.

I. What Should an Experiment Be?

An **experiment** requires the following elements (commonly called **The Scientific Method**):

1. **Question** (What happens if? Which is better/more/bigger/faster? Why does? How long? Can this animal learn to do such-and-such? Where can I research for more information?)

2. **Hypothesis** (My best guess for what the answer to my question will be.)

3. **Plan Experiment** (How will I perform my experiment? Which variables are important? What materials do I need? How much time will this take? What will be my step-by-step procedure?)

4. **Perform and Observe** (Take data, write down observations, perform more than once to check validity of the data, change the experiment if it can be easily improved.)

5. **Results** (Plot data on a graph and compare results. Compare written observations. Describe what you think happened in words, pictures (sketches, diagrams), graphs, equations.)

6. **Conclusions** (What happened, and why? How does it answer your question? How does it compare to your hypothesis? How could you improve the experiment?)

A science fair experiment should answer a question to which you do not already know the answer. Building a model of a volcano or of the solar system is not an experiment because it does not answer a question that you do not already know. Models are useful tools, and building a good model can develop some problem-solving skills, but models of familiar things do not develop new scientific knowledge. On the other hand, doing some experiments to determine which kind of ground-up volcanic rock might make the best soil for growing plants would be a good idea for a project. Real scientific work involves asking questions, forming hypotheses, and trying an experiment to test your hypotheses.

II. Picking a Topic for the Science Fair Project

Picking a topic for a science fair project is often an intimidating thing for children, but it does not have to be. The best way to pick a topic is to start off by asking a bunch of questions (**1. Question**) and finding a question that is interesting. One way to generate ideas would be to let the kids "brainstorm" ideas in class. The teacher can write down every idea on the blackboard. It is important to write down every idea, even if they start to get silly, because sometimes silly ideas from one head can trigger a good idea in another. The three rules for picking a science fair topic are:

1. **Interesting.** What kinds of things does the student enjoy doing? What area of science or engineering does the student find interesting? What kinds of books does the student like to read? Does the student have any special skills or talents?

2. **Do-able.** Is the student familiar with the topic or is it new? Will the student need to gather lots of information? Are there books in the library? How much involvement will be required from parents? Can the appropriate materials be bought or borrowed? How much time will this project take?

3. **Safe.** Will there be any danger from the equipment or materials used in this project? Will there be any danger to the student or to the subjects of the experiment?

III. Plan the Experiment

Once the topic has been chosen, the student will need to plan how to do the experiment. He will first need to make an educated guess, based on his current knowledge, what the answer to his question will be (**2. Hypothesis**). The student may need to do some research in the library to see what information about his topic is available. To plan the experiment (**3. Plan Experiment**), he will want to

determine what variables are important to the problem, and which are not. He will also need to make a list of materials needed for the experiment, and plan a schedule for completing the experiment on time.

IV. Perform the Experiment and Record Observations

Once the research is completed, the experiment has been planned, and the materials obtained, it is time to perform the experiment and record observations (**4. Perform and Observe**). There are two types of observations that can be made during an experiment:

1. **Quantitative.** Measure variables such as time, distance, volume, temperature, etc. Make an XY graph or a bar graph of the data. Compare the data (Does the temperature increase as time goes on? Or does the temperature level off? Does variable A have a greater effect on temperature than variable B?)

2. **Qualitative.** Write down in words what you observed. What effect did changing variable C have on the color of the liquid in the beaker? Did the leaves look healthier on plant P with tap water or on plant Q with grapefruit juice added to the soil? Can you draw a picture to explain what you observed?

All good experimenters keep a notebook or journal in which to record all the events regarding the experiment, such as what steps she followed, what data she measured, and what results she observed. Sometimes the student will need graph paper to plot out her results.

V. Report the Conclusions

After the experiment has been completed, the data and observations must be analyzed to determine the results of the experiment (**5. Results**). The results may support the original hypothesis, or they may disprove it. The experiment ends when the student can draw conclusions about what happened and why (**6. Conclusions**).

VI. Prepare the Experiment for Presentation

- **Build the Display Board** -- Use cardboard box, poster board, peg board, or whatever is appropriate.

- **Display Experiment** -- Use experimental equipment, photos, graphs, sketches, etc. to show what you did.
- **Report** -- Summarize the procedure, results, and conclusion in a written report.

VII. Prepare the Oral Presentation

The other thing about science fair projects that intimates, and sometimes terrifies, children is having to describe their projects to adults (such as judges). Just like any other kind of public speaking (like plays), it helps to prepare and practice beforehand. The student should first write down what she wants to say. Another helpful activity would be to let students interview each other, or for the teacher or parent to interview the child. Typical judge questions include:

1. Describe to me your experiment -- what did you do?
2. Why did you choose this topic?
3. How did you come up with your hypothesis?
4. Did you go to the library to find out about your topic?
5. Did your experiment go as you planned?
6. What data did you measure? What happened when you did such-and-such?
7. What were your results?
8. What happened, and why?
9. Were your conclusions the same as your hypothesis? Why, or why not?
10. How could you improve this experiment?

11. What did you learn?

12. What do you think would happen if you did such-and such differently?