Experiment

Projects of this type involve an original scientific experiment to test a specific hypothesis in which the student recognizes and controls all significant competing variables and demonstrates excellent collection, analysis, and presentation of data. The experimental design is as important as the actual results from the experiment. The process of designing an investigation should have a cyclical progression and not limited to a sequential or a rigid method.

The Experimental Process

1. Select a Topic.

The first and most important step is to select a topic of interest. Choosing a topic is difficult because the possibilities are endless. The topic you choose should represent something that you are <u>really</u> interested in. It is not enough just to go on the internet and select an experiment that has already been done.

2. Formulate the Question.

After a few days of reflection, you need to formulate an open-ended question that can only be answered by doing an experiment. Good questions are specific. That is, they are testing the relationship between only two variables, not three or four. By keeping the question simple and specific, you are preventing your experiment from taking too long or from being too complicated.

3. Research your Topic.

Once you have identified a question, the next step is to learn as much as possible on the subject. Take some time to do research at the library or on the internet. The object is to be prepared to form an intelligent testable hypothesis.

4. Formulate a Hypothesis.

This step allows you to focus on the details of the investigation. You need to formulate a hypothesis that can be easily verified with an experiment. A hypothesis has the following: i) subject identification, ii) what is being measured, iii) identification of the variables and iv) expected results.

Example*: Bean plants grown under a green light 24hrs a day, for a period of 2 weeks, will grow taller than bean plants grown under a natural light over the same period of time.*

i) Subject: Bean plant
ii)) Measurement: Height of the bean plant
iii) Independent variable: Color of the light
Dependent variable: Height of the plant
iv) Result expected: Green light is better than natural light

5. Design the Investigation. (Experimental Design)

The plan needs to include the following:

I. Materials needed
II. Variables involved
III. Detailed procedure
IV. Data collection plan

Before you begin your experimental design, you need to identify the variables and controls. There are three things to identify:

a) ***Independent Variable:*** This is the variable that is manipulated. This is what you purposefully change in the experiment.

b) ***Dependent Variable:*** The purpose of the experiment is to see if this variable will be affected by the changes you make. The dependent variable is what is being measured in the experiment.

c) ***Controlled Variable:*** These are the variables that need to be constant throughout the experiment.

6. Conduct the Investigation.

This is when you actually do the experiment (this can happen at home). During the experiment, you may take pictures, record data and keep detailed notes of observations.

7. Analyze the Results.

When the experiment is over, you need to compare the results with your hypothesis and form a conclusion. You need to establish if your hypothesis was confirmed or not. At this point, you may have found new questions to be answered and suggest new variables, different materials or a procedure for another investigation.

Results:

The results that are collected can occur in two forms:

- If the results can be physically measured, counted and/or if it can be timed… the results are presented in tables and/or graphs.
- If the results are visuals, illustrations, photographs or a video recording maybe more appropriate.

Conclusion:

- Discuss or mention every table, graph, illustration etc...
- Make reference to the hypothesis.
- Indicate whether or not the results support your hypothesis.
- Review the variables.
- Indicate what could be done differently next time to avoid the same mistakes.
- Highlight some practical applications where this knowledge maybe useful.
- Include ideas for future study.

8. Write the Report.

Writing a report about all that was done, how it was done, and what was discovered is an important aspect of a Science Fair Project. Scientists need to communicate their investigation clearly to allow others to conduct the same investigation and arrive at the same conclusions. The written report is a summary of everything you did to investigate your question or problem. It provides information about the extent of the project as well as what you learned through it. The maximum number of pages is 5 plus the bibliography. The contents of the report should include:

Title page: Include first and last name, date, division, category and registration number.

Purpose (Introduction): This should state the objective in only a few lines (less than 8). It is also worth mentioning the main details of the work accomplished.

Question: What do I want to find out? What do I want to understand?

Hypothesis: An educated guess that answers the problem. It is based on what the student already knows and on the research they have done on the topic. What is a possible and measurable explanation to the question?

Materials: Anything used in the project (equipment).

Experimental procedure: Steps taken from beginning to end.

Observation and results: This is the body of the report. Ensure time is taken to explain the results, details and information regarding research.

Conclusion (Discussion): Summarize details of the project and conditions in which the work was done. This is also a good place to write about possible future endeavours for the topic/ project.

Bibliography: Any science fair project should have had some type of resources consulted; everyone **must** cite all sources used for the project.

Acknowledgments: This is where students acknowledge those persons who assisted them in research etc. Remember the importance of not plagiarizing someone else's work.

9. Make a Display.

The display is an important part of attracting people to the student's project. The display must reflect the topic accurately. During public viewings students are encouraged to use demonstrations and hands on materials like models and videos etc. This will aid in attracting people, as well generate interest and questions. However, these demonstrations cannot be used during judging.

The display needs to be neat and organized onto a self-standing background that can be put on a table (see the guide rules and security). It should be self-explanatory and take no more than 5 minutes for an audience to understand from beginning to end.

c) Tips for an effective display that will attract people:

- Have a title that grabs people's attention, use imagination!
- Make things flow from left to right.
- Using bright colors makes the project stand out from others.
- Use a large font, bold writing and limit text.
- Using more pictures, graphs, and diagrams makes the project more interesting and easier to understand. These also can help guide the presentation and emphasize important results and conclusions.

10. Prepare a Presentation.

Prepare a 5 minute oral presentation describing the project. The purpose of the presentation is to share the information and findings with the judges as well as the general audience. Be sure to use language which can be understood by all on- lookers. Ensure that students understand all information being presented, as a question may be asked relating to any aspect of the project. The main goal is to present all information in a clear and understandable way. DO NOT memorize a script. Instead of notes, consider using the display as a guide for the presentation. If notes must be used, use point form notes for important points to discuss. Relax and have fun!