Science Fairs

By

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What is a Science Fair Project?

A Science Fair project is an original piece of scientific research completed by the student. It would be unrealistic to expect students to come up with an original investigation that has never been undertaken previously. The project involves some kind of investigation (using the scientific method) into a scientific phenomena which is of interest to the student. It may involve experimentation, observational studies, or demonstration of an event or phenomena. The areas of study can be chosen from any field of science, engineering or technology.

Why do a Science Fair Project?

Science Fair projects:

1. Provide an opportunity for students to take an initiative in their own learning.
2. Develop a sense of personal self-worth among participating students.
3. Develop science knowledge and understanding.
4. Develop skills in using science processes to solve problems.
5. To actively involve students to participate in science.
6. Use skills developed for all subject areas.

The Scientific Method

A Science Fair project is an opportunity to investigate some event or phenomena in the same way a scientist would investigate it.
The Scientific Method is a method of solving problems which involves:

1. Stating the problem - scientists state the problem in the form of a question.
2. Gathering information - research is done to find out what is already known about the problem.
3. Forming hypotheses - a possible answer to the question is formulated.
4. Testing the hypothesis - experimentation is done to test the hypothesis

5. Drawing conclusions - from the data collected, conclusions are made. They may or may not agree with the hypothesis. If they do not, a new hypothesis may need to made, and another experiment formulated to test the new hypothesis.

6. Practical applications of this new knowledge.

Safety Rules

Basically, the safety rules are common sense. Below are listed some specifics:

1. The exhibit is 0.8 m deep, 1.2 m wide and 2.4 m high.
2. No chemicals are on display (all chemicals can be simulated for display).
3. No open flames are on display.
4. No hazardous chemical have been used.
5. Experiments utilizing vertebrates must have the appropriate Ethics Form filled out prior to starting the project.
6. No live animals are on display.
7. Electrical power cords have three-wire grounded connections.
8. Electrical connections are insulated.
9. Any non-current-carrying metal parts are connected to the ground lead.
10. Lasers will not be operated during public display.
11. All microbial cultures have been sealed.
12. No biological toxins are on display.
13. No organisms pathogenic to animals are on display.
14. Projects may be done by only one or two students.
15. Adult supervision is needed for all experiments.

LEVELS OF SCIENCE FAIR PROJECTS

Before beginning the project, it is best to know the levels that projects can be done at. Make sure the project reflects the level that can be satisfactorily completed in the allotted time. (Note: These are arranged from simplest to most complex.)

Level 1 - a diagram, copy, illustration, table, or other display of science information already available in printed or non-printed material.

Level 2 - a chart, illustration, model, collection, specimen, or report based on first-hand investigation by the student.

Level 3 - a working model based on an understanding of a scientific principle.

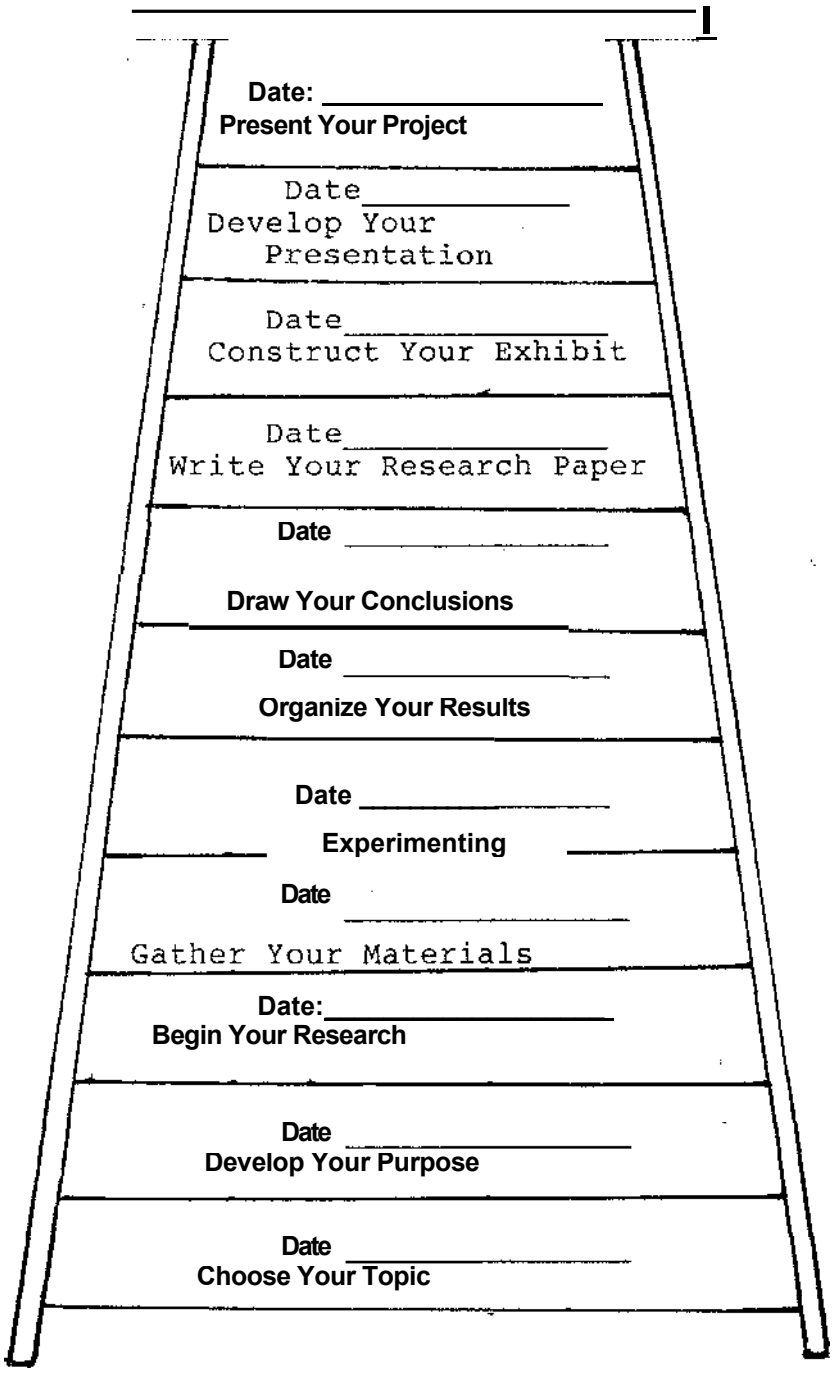
Level 4 - an attempt to answer a question by designing and conducting an experiment or a co-relational study in which one or more variables were tested, but in which circumstances or lack of knowledge prevented adequate control of significant independent variables.

Level 5 - an attempt to answer a question by designing and conducting an experiment or correlation study in which all the important competing variables are controlled.

STEPS TO A SUCCESSFUL SCIENCE FAIR PROJECT

The ladder for success is a brief introduction into the necessary steps to successfully complete a Science Fair project

LADDER FOR SUCCESS

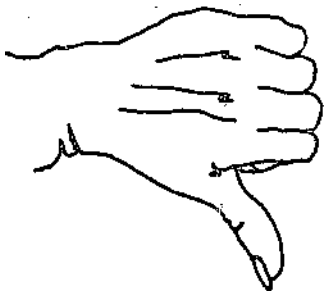


1. Choose Your Topic

This step may be the hardest step of the project. So many possibilities exist that it may be hard to pick a topic.

The topic should have the following characteristics:

a. be specific.
b. be of interest to you.
c. be stated as a question.
d. if possible, be an experiment.
e. be something you can successfully complete

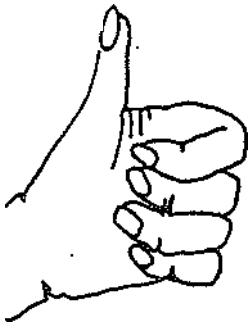


Poor Topic

Fertilizers

- not specific

- not stated as a question



GOOD TOPIC

"What are the effects of fertilizers on bean plants?

- specific
- stated as a question -suggests an experiment

Sources of Topics

1. “How to” book of experiments
2. Science textbooks
3. Hobbies
4. Areas of personal interest.
5. Internet research

2. Develop Your Purpose

Now that you have chosen a topic, try to explain the purpose of the project in two or three sentences. A possible way of starting is: "The purpose of this project is to...". Your purpose may include any hypotheses (scientific 'guesses') that you have as to the outcome of your experimentation.

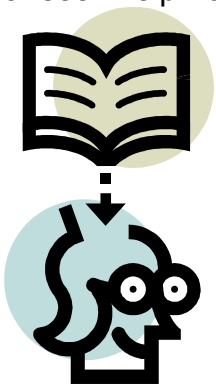
For example: "The purpose of the project is to determine if Brand A fertilizer is better than Brand B fertilizer in causing bean plants to grow as quickly as possible".

If your purpose is well worded, then you should have little difficulty in formulating a title. The title should be descriptive of your purpose without being overly long.

For example: "The Effects of Different Fertilizers on Bean Plant Growth"

3. Begin Your Research

- use the library, internet or seek help from professionals



It does not matter what your topic is, the next step is to begin your research. The starting point might be encyclopedias. It is not sufficient to use only one encyclopedia, it is best to use all of them. You must remember that encyclopedias are not always up-to-date, so it is necessary to check the publication date. If some information contradicts other information, you will have to check carefully to find the correct information. Encyclopedias offer general information about many topics. They may not have very much information on your specific topic.

After you have acquired some background information from encyclopedias, look for books with information specifically about your topic.

This can be done in either school or city libraries. At this point it is a good idea to seek help from the librarian, the librarian can be a valuable help in finding information.

Other sources of Information that are available:

1. Science magazines.
2. Films or large pictures.
3. Scientific periodicals.
4. Internet

Taking Notes

Whenever you get information from any source, you must write it down, otherwise you will forget It. You can write this down in your logbook. A logbook is your daily record of all work done on your project. Remember not to copy directly from your source but put the information in your own words.

All sources of information must be kept track of for your bibliography. You will need to write down the author(s), title, year of publication and the publisher.

Other Sources of Information

Many other sources of information are available, it can be difficult to track them down. For example, government agencies, professional groups, and companies are all sources of valuable information. Another source of information are professionals and scientists within the community you live in

4. Gather Your Materials

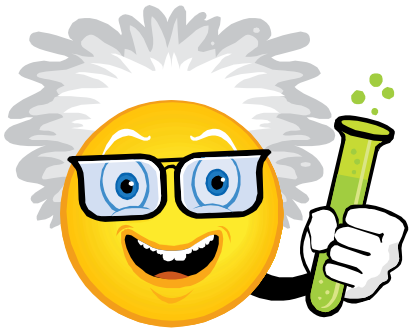
As you begin to outline your experiment, begin listing any materials you will need. Materials do not have to be pieces of scientific equipment but may be some things from around the house or can be purchased at the hardware store. Science does not just take place only in a laboratory!

Some items might need to be ordered in advance. For example, bean seeds might not be available in January!

When performing your experiment, keep accurate records of what, how much, and what kind of materials you used. When you write out your list of materials, be as specific as possible.

For example:

50 bean seeds
1 -125g box of Brand A fertilizer
1- 125g box of Brand B fertilizer 50
Styrofoam cups (plant pots)
4L of sterilized soil
1OL of distilled water



5. Experimenting

Safety

Before you actually begin your experiment, ask an adult to examine your procedure. This will ensure you are following safety guidelines. In almost any experiment, accidents can happen. Be aware of the dangers.

Your project should include controlled experimentation. Your results will be much more reliable if the experiment is well thought out and carefully done. Your experimental design depends upon the experiment that you are doing. Remember to have:

1. An independent variable – something the experimenter changes to observe what will happen.
2. A dependent variable - the experimenter changes something to observe what will happen. These "things" that s/he changes may cause something else to happen. The "something else" is the dependent variable. (This is the response the experimenter measures)
3. A control group - in our example this would be bean plants that do not receive any fertilizer.

It is important to control all variables - in the fertilizer experiment, the experimenter would ensure that the plants are grown in the same size container, receive the same amount of light and water, and the same amounts and type of soil.

Observations

A science project requires careful observing of objects, events and phenomena. Seeing is one way of observing, but if you use all of your senses, they will help you to observe even more. Instruments can be used to extend your senses, for example, microscopes, thermometers, balances or clocks.

Two types of observation can be made: qualitative and quantitative. Qualitative observations are made without the use of measuring devices. For example: “plant #5 looks healthier”. Quantitative observations use a measuring device and are more accurate.

6. Organize Your Results

Written observations should be organized in neat log or charts. If your data consists of numbers, organize the data in tables or graphs. There are many ways to construct tables and graphs. Certain types will show your data off the best. Your teacher can help you decide on what types of tables and graphs to use.

7. Draw Your Conclusions

Now that you have completed your experimentation and have collected data, what have you discovered?

Scientists use statistics to analyze the data collected in an experiment. A statistical treatment of data allows them to predict, or generalize, about larger populations. If you can find someone trained in statistical methods, ask for help in analyzing your data. For example, with the bean plants the average total growth of the fertilized plants versus the average total growth for the unfertilized plants would be a useful statistic.

Your data will either support your original hypothesis or it will not. You must state this in your conclusion. If it does not then you could form a new hypothesis and test it.

8. Write Your Research Paper

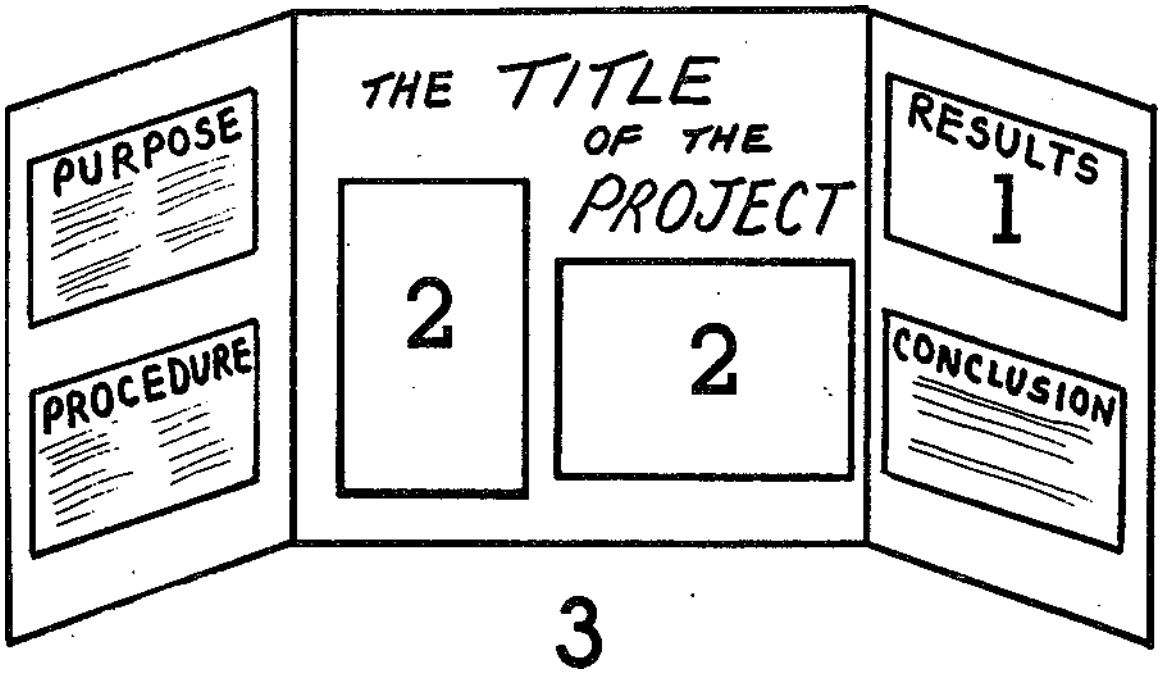
The value of a scientific investigation would be lost if it were not reported to others.

Parts of the Research Project:

1. Title page - title of the project, name of student, name of teacher and grade.
2. Purpose - the purpose is stated, it should be three sentences or less.
3. Acknowledgements - be sure to thank anybody who helped with your project.
4. Materials and Methods - list the materials you used. Use drawings if they will help to explain the experiment. Explain any materials you made.
5. Results - this section is organized into charts, tables and graphs.
6. Conclusions - here is where you state your conclusion. If your findings did not support your hypothesis, then say so.
7. Further Study - give ideas you have to further explore your topic.
8. Application(s) - science has an impact on our lives. How might your result(s) be used?
9. Bibliography - a list of any source of materials you used while researching your paper.

9. Construct Your Exhibit

A 3-Sided display



Your own creativity will determine how you make your display. This diagram is an example of a basic 3-sided display (note that some sections described above have not been included) .

1. Graphs and Charts

2. Materials and Methods (include drawings or photographs of your experimental set-up

3. Equipment, logbook, specimens, etc can be placed on the table

10. Develop Your Presentation

Materials

The backboard must be made from sturdy non-flammable material. Remember that it should stand by itself on the table.

Colour

Before you go any further, decide on what colours you will use. If your backboard needs painting, an enamel paint works best. Choose contrasting colours for lettering.

Lettering

Your title and headings should be l a r g e a n d e a s y t o r e a d .

Drawings

Drawings and sketches should always be drawn in pencil first and then retraced.

Photos

Photographs (preferably 5" x 7" or 8" x 10") can be used if they are good quality pictures. Before gluing or taping anything on your backboard, lay it on the backboard and stand back to look at it. This will ensure you have a pleasing layout with everything in the right place.

Remember: Your display's purpose is to effectively communicate the results of your project.

11. Present Your Project!

Here is a step-by-step approach to preparing your presentation:

1. Introduce yourself.
2. Give the title of your project.
3. Explain the purpose of your project.
4. Tell the judges how you got interested in this topic.
5. Explain your procedure.
6. Show your results.
7. List your conclusions.
8. Tell the judges what you might do in the future to continue your experimentation.
9. Explain applications of your project.
10. Ask the judges if they have any questions. If they ask a question you do not know the answer to say, "Sorry I do not know the answer to that question".
11. Thank the judges.

Other Tips for Presenting

1. Dress neatly.
2. Stand up straight on both feet. Don't sway from foot to foot.
3. Look straight into the eyes of the judges.
4. Stand to the side of your exhibit.
5. Get the judges involved in your project. Let them hold your research paper, notebook or apparatus. Point out charts and graphs.
6. Speak loudly enough to be heard by all of your judges.
7. Smile and be polite

<u>SCIENCE FAIR PROJECT CHECKLIST FOR EXPERIMENTS:</u>

TOPIC:

a. Did you ask a question that can be answered only by **experimentation?**

b. Were you specific rather than general?

PROJECT TITLE:

a. Does the title sound descriptive?

b. Does the title catch your interest?

PURPOSE/HYPOTHESIS:

a. Does the purpose explain what you are trying to answer in the **experiment?**
b. Does the hypothesis state what you think will **happen?**
c. Can you test your hypothesis to prove it true or false?

RESEARCH:

a. Did you use at least THREE different sources of information?
b. Did you include your resources in a bibliography?
c. Is your research paper written neatly or typed, if possible.
d. Is the grammar and spelling corrrect in your research paper?

EXPERIMENTATION:

a. Did you follow the scientific method and use the following headings? i.e.:
- PURPOSE
- MATERIALS AND METHODS
- PROCEDURES
- OBSERVATIONS
- CONCLUSIONS

b. Do you have controls in your experiment?
c. Did you keep accurate records of your results?
d. Did you repeat the **experimentation** to test the results?

CONCLUSIONS:

a. Do you have **dates, samples** and pictures to support your conclusions?

PROJECT DISPLAY

a. Is your backboard within regulation **size?**
b. Is your backboard neat?
c. Is your backboard **eye catching?** Does the backboard include the **TITLE**, **PURPOSE, PROCEDURE, RESULTS**, and **CONCLUSION**?

PRESENTATION

a. **Are** you **prepared?**

b. **Have you practised?**

Everyone who completes a project is a winner!