Science Investigation projects

Choosing Your Question or Hypothesis

Once you've selected a topic and narrowed your search to a single question to investigate, the final steps are making sure that the question is in a testable form.

Is My Question Testable?

Once you have a list of broad questions, think about how you can rephrase the question to make it testable. For example, instead of asking, "What makes a person an adult?" You may want to ask, "How do eighth graders compare to adults?" Little changes like these can make a big difference. Remember to be as specific as you can. These examples below show how to turn your interests into testable questions:

How can plants be protected against pests?	becomes	***Can companion planting protect beans from beetles?***
How does weather change?	becomes	***Can observing cloud formations predict the weather that follows?***
How does sickness affect people?	becomes	***Can taking cold medicine influence the rate of recovery from the common cold?***
How can cars travel faster and farther?	becomes	***Can changing the design and materials of a vehicle influence the speed and distance it can travel?***

Examples of Science Questions:

How does the cool down routine affect how long it takes for the heart to return to normal after exercise?
How does light affect the rate a plant makes starch?
What is the best insulator to keep ice from melting?
Which method of cooking destroys the most bacteria?

Keep in mind that the results of your experiment may not agree with your hypothesis. If your results do not meet your expectations, it may indicate you have discovered something new and unexpected! Whether the results of your experiment agree or disagree with your hypothesis it is always important to think deeply about what other variables that you may not have controlled, which might influence the outcome of your experiment.

The boundaries between science and engineering projects are not always clear. Scientists often engineer tools to do their work, while engineers often use scientific practices to help them design their products. Much of what we often call "computer science" is actually engineering—programmers creating new products. Your project may fall in the gray area between science and engineering, and that's OK. Many projects can and should use science and engineering practices. **However, if the objective of your project is to invent a new device, procedure, computer program, or algorithm, then it makes sense to follow the computer science or engineering design and invention processes.**

Science Investigation Project Checklist

_____**Pick a Topic:** Get an idea of what you want to study or learn about. Ideas should come from things in your areas of interest. A hobby might lead you to a good topic. What is going on in the world that you would like to know more about? Most importantly, pick a question or problem that is not too broad and that can be answered through scientific investigation.

_____**(Optional) Set up and Keep a Project Notebook**: Keep detailed notes of each and every step of your investigation and research in a Project Notebook.

_____**Research Your Topic:** Learn more about your topic. Record your notes in your Project notebook. Keep a list of resources. Use a minimum of 3-5 resources.

_____**Submit Project Proposal:** Submit your project proposal. If safety review is required be sure to indicate so on your project proposal form.

_____**Organize:** Organize everything you have learned about your topic. At this point, you should narrow your thinking by focusing on a particular idea.

_____**Make a Time Line**: Choose a topic that not only interests you, but can be done in the amount of time you have. Based on your background research identify your testable question and hypothesis statement. Develop a time line to manage your time efficiently.

_____**Plan Your Experiment:** Give careful thought to your research plan. This plan should explain how you will do your experiments and exactly what will be involved, and a materials list. Use numbered, logical steps.

- Identify the **controlled variables** (the parts of the investigation that could be made different but that are intentionally being kept the same). There should be many controlled variables.
- **Manipulated/independent variable** (this is the ONE variable changed in the investigation.)
- **Responding/dependent variable** (this is what will be measured or observed.)
- Describe how and when the measurements or observations of the responding variable will take place.
- Number of trials or experimental groups. In most cases, the higher the number, the more evidence or data you will have to support your hypothesis or answer your question.
- Length of time the experiment will last.

_____**Conduct Your Experiment:** During experimentation, keep detailed notes of each and every experiment, measurement and observation in a Project Notebook. Do not rely on memory. Use data tables or charts to record your quantitative data.

_____**Analyze Your Results:** When you complete your experiments, examine and organize your findings. Use appropriate graphs to make 'pictures' of your data. Identify patterns from the graphs. This will help you answer your testable question. Did your experiments give you the expected results? Why or why not? Was your experiment performed with the exact same steps each time? Are there other explanations that you had not considered or observed?

_____**Draw Conclusions:** What patterns do you see? Did you collect enough data? Do you need to conduct more experimentation? Keep an open mind—never alter results to fit a theory. If your results do not fit your hypothesis, that's okay and can even lead to new ideas. Try to explain why you obtained different results than what you expected. Were there sources of error that may have caused these differences? If so, identify them. How could this project be used in the real world? Finally, explain how you would improve the experiment and what would you do differently.

_____**Prepare to Present your Project:** Construct a display board. Practice talking about your project to friends, family, and other supportive adults.

Display Board Example for Science Investigation Projects

Title

Student Name

Purpose and Background Research

Question

Hypothesis

Procedure & Methods

Data & Results

Includes Graphs & Tables

Pictures with captions

Materials & Technology Used

Data Analysis & Conclusions

In Front of Display Board on Table: Project Notebook and any other materials you feel would be useful to explain and show how you ran and/or created your project.