Science Fair Project Design

Your task is to conduct an experiment using the scientific method. This document outlines the steps to complete this.

Project Steps

There are several steps to this project: use this as a guide to make sure you haven't forgotten anything.

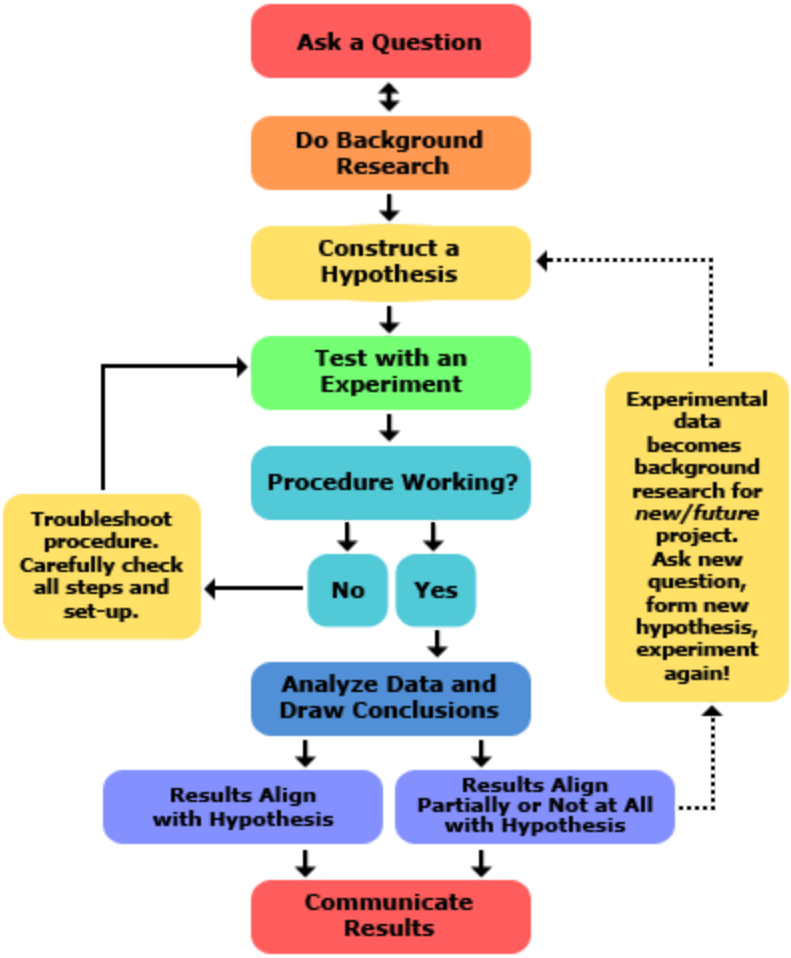
1) Use the Google Chrome extension Kami to edit the document titled 'Name's Science Fair Project Design'. Here is a video on how to download and use Kami https://youtu.be/VhIWR-aCGY0
2) Watch YouTube video 'How to rename the PDF document' https://youtu.be/3Va3p2JAeds
3) Watch YouTube video 'Make changes to document in Kami' https://youtu.be/ZW7gZfyXJ8s
4) Read the section 'What is the Scientific Method' and watch the YouTube video provided.
5) Next read the section 'Pick an Experiment' and start brainstorming an experiment that you would like to conduct.
6) Complete the section 'Project Question'.
7) Read the section 'Dependent and Independent Variables'.
8) STOP and email Ms. Jadams. Send Ms. Jadams an email that includes:
    - A web link to the experiment. This could be a website or video.
    - Your project question.
    - A description of your independent and dependent variables
9) Wait for approval from Ms. Jadams.
10) Complete the section 'Project Research'. Before you conduct your experiment you need to learn as much about the topic as possible. As always you should be using reliable sources and keeping track of where your information is coming from. You will be expected to include a Works Cited portion to your project using APA style. MAKE SURE YOU KNOW WHERE YOUR INFORMATION IS COMING FROM, KEEP IT ORGANIZED, remember to use (Author, year) at the end of each sentence or section.
11) Complete the section 'Project Hypothesis'.
12) Complete the section 'Project Experiment'. It is in this stage that you will conduct the experiment and record the results. Take pictures of your experiment, be sure

to include at least one picture with you in it. These pictures will be added to your final Project Presentation.

13) Complete the section 'Project Results'. In this section you will write a paragraph explaining what happened in your experiment and why you think this is.
14) Complete the section 'Project Conclusions'.
15) Complete the section 'Project Abstract'.
16) Complete the section 'Project Presentation'. Since we are completing school online, I would like you to do the final presentation portion in Google Slides instead. This means typing up the sections you completed in this document as final drafts in this order: Abstract, Question, Hypothesis, Key Words and Research, Procedure and Materials, Results and Conclusion. Make the Google Slides interesting by adding photographs. I would like to see real photographs of you doing the experiment, but you may also use photographs from the Internet (remember to source) to enhance the presentation.
17) Upload this document named appropriately (ex. Anika's Science Fair Project Design) to Google Classroom. Watch this YouTube video 'How to upload assignment to Google Classroom' https://youtu.be/7bv3Wae0N-s
18) Upload your Google Slides Project Presentation to Google Classroom.
19) Celebrate, you are done!!

What is the Scientific Method

WATCH this YouTube video that explains the Scientific Method: https://youtu.be/yi0hwFDQTSQ



The scientific method is a process for experimentation that is used to explore observations and answer questions. Does this mean all scientists follow *exactly* this process? No. Some areas of science can be more easily tested than others. For example, scientists studying how stars change as they age or how dinosaurs digested their food cannot fast-forward a star's life by a million years or run medical exams on feeding dinosaurs to test their hypotheses. When direct experimentation is not possible, scientists modify the scientific method. In fact, there are probably as many versions of the scientific method as there are scientists! But even when modified, the goal remains the same: to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be combined into a logical answer.

Even though we show the scientific method as a series of steps, keep in mind that new information or thinking might cause a scientist to back up and repeat steps at any point during the process. A process like the scientific method that involves such backing up and repeating is called an iterative process.

Whether you are doing a science fair project, a classroom science activity, independent research, or any other hands-on science inquiry understanding the steps of the scientific method will help you focus your scientific question and work through your observations and data to answer the question as well as possible.

[Text source: https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method]

Pick an Experiment

Pick an experiment that you are able to conduct at home with supplies that you already have. There are many experiment ideas that can be found online, BUT you will need to change the experiment to answer a question. Here is a few examples:

1) Check out this link on how to conduct the 'Explode-A-Bag' experiment. http://www.sciencefun.org/kidszone/experiments/9727-2/
    - This is a fun experiment to do, but it's not following the scientific method. First we would need to ask a question such as "Does it explode sooner if I put more chemicals in the bag?" This type of question could lead you to designing an experiment in which you change the levels of each chemical and record the results.
2) Check out this link on how to conduct the Cool Off Volcanoes' experiment. http://www.sciencefun.org/kidszone/experiments/cool-off-volcanoes/
    - For this experiment you could ask questions like "Does the size of the bowl affect the eruption?" or "Does the shape of the container affect the eruption?" These types of questions could lead you to designing an experiment in which you test out different container sizes and shapes then recording the results.

Here are a variety of sources that you can review to find an experiment. Remember you will NOT simply be repeating the experiment, but rather you'll be asking a question and designing a way to answer that question. When picking your experiment also keep in mind the materials required, make sure that you already have everything you would need at home.

- http://www.sciencefun.org/kidszone/experiments/
- https://sciencebob.com/category/experiments/
- http://www.sciencekids.co.nz/experiments.html
- https://mommypoppins.com/kids/50-easy-science-experiments-for-kids-fun-educational-activities-using-household-stuff
- https://www.kidspot.com.au/things-to-do/collection/science-experiments
- https://redtri.com/classic-science-experiments/slide/4

Project Question

Think of a Question

Your question will drive your entire project. Make sure that your question is something that can be measured and answered by following the scientific process. You may use the project question for your project title.

Brainstorm some possible questions that you are interested in learning more about.

Once you have decided on your project question, write it on the lines below and then get approval from your teacher to begin your project.

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_____

_____

Dependent and Independent Variables

WATCH the YouTube video on Scientific Variables: https://youtu.be/nzfDvfoBv_g

Scientists try to figure out how the natural world works. In doing so, they use experiments to search for cause and effect relationships. Cause and effect relationships explain why things happen and allow you to reliably predict what will happen if you do something. In other words, scientists design an experiment so that they can observe or measure if changes to one thing cause something else to vary in a repeatable way.

The things that are changing in an experiment are called variables. A variable is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

The independent variable is the one that is changed by the scientist. Why just one? Well, if you changed more than one variable it would be hard to figure out which change is causing what you observe. For example, what if our scientific question was: "How does the size of a dog affect how much food it eats?"; then, during your feeding experiments you changed both the size of the dog and the time of day the dogs were fed. The data might get a bit confusing— did the larger dog eat less food than the smaller dog because of his size or because it was the middle of the day and dogs prefer to eat more in the morning? Sometimes it is impossible to just change one variable, and in those cases, scientists rely on more-complicated mathematical analysis and additional experiments to try to figure out what is going on. Older students are invited to read more about that in our Experimental Design for Advanced Science Projects page. To be clear though, for a science fair, it is usually wise to have only one independent variable at a time. If you are new to doing science projects and want to know the effect of changing multiple variables, do multiple tests where you focus on one independent variable at a time.

The dependent variables are the things that the scientist focuses his or her observations on to see how they respond to the change made to the independent variable. In our dog example, the dependent variable is how much the dogs eat. This is what we are observing and measuring. It is called the "dependent" variable because we are trying to figure out whether its value depends on the value of the independent variable. If there is a direct link between the two types of variables (independent and dependent) then you may be uncovering a cause and effect relationship. The number of dependent variables in an experiment varies, but there can be more than one.

Experiments also have controlled variables. Controlled variables are quantities that a scientist wants to remain constant, and she or he must observe them as carefully as the dependent variables. For example, in the dog experiment example, you would need to control how hungry the dogs are at the start of the experiment, the type of food you are feeding them, and whether the food was a type that they liked. Why? If you did not, then other explanations could be given for differences you observe in how much they eat. For instance, maybe the little dog eats more because it is hungrier that day, maybe the big dog does not like the dog food offered, or maybe all dogs will eat more wet dog food than dry dog food. So, you should keep all the other variables the same (you control them) so that you can see only the effect of the one variable (the independent variable) that you are trying to test. Similar to our example, most experiments have more than one controlled variable. Some people refer to controlled variables as "constant variables."

In the best experiments, the scientist must be able to measure the values for each variable. Weight or mass is an example of a variable that is very easy to measure. However, imagine trying to do an experiment where one of the variables is love. There is no such thing as a "love-meter." You might have a belief that someone is in love, but you cannot really be sure, and you would probably have friends that do not agree with you. So, love is not measurable in a scientific sense; therefore, it would be a poor variable to use in an experiment.

[Text source: https://www.sciencebuddies.org/science-fair-projects/science-fair/variables]

Project Research

Research Your Topic

Spend some time learning more about your topic. Use reliable Internet sources, books from the library, your science book, or other resources. Not only do you want to be an expert on your topic, but you want to teach others about your topic.

Science Terms - locate at least 3 key science words related to your topic. Your science book is an excellent place to find these. Make sure that the words you choose are directly related to your topic. Provide a definition of each key word IN YOUR OWN WORDS.

Term	Definition

Project Research

A paragraph describing the science behind your project - after you have completed your research give us, your audience, some background information on your topic in a complete and well-written paragraph. Give us specific, rather than general information. Use the space provided to write a draft. You will edit a final copy to place on your display board.

Project Hypothesis

State Your Hypothesis

Based on your research, decide what you think the outcome of the project will be and make a good guess as to what you think the answer to your question will be. **Also explain WHY you think that will be the outcome.** Remember, it is ok if you don't have the right answer; that is how scientists make discoveries. Make sure that your hypothesis is written in a complete sentence.

Start by listing some possible outcomes or answers to your question.

Decide which outcome is most likely. This will be your hypothesis. Clearly write your hypothesis in complete sentences.

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Project Experiment

Design Your Experiment

Clearly write out the procedure you are going to follow. Remember that your experiment needs to follow the scientific process and that you need to have one variable that you are going to change (independent variable). There are three variables in a scientific experiment: independent, dependent, and controlled.

The *independent variable* is the one, and only one, variable you will change.

The *dependent variables* are those being observed and measured throughout the experiment.

The *controlled variables* are those that remain constant and allows you, the scientist, to understand how the experiment would react under normal circumstances.

Independent Variable:

_____

Dependent Variables:

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Controlled Variables:

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_____

Project Experiment

Materials

List *all* materials needed to complete the experiment. Be specific about type, size, brand, etc.

Project Experiment

Procedure

Write out each step of your experiment. Remember to number each step and clearly explain what to do. Other scientists should be able to follow the same steps and get similar results.

Project Experiment

Conduct experiment

Scientists conduct an experiment many times in order to get the most accurate data, so make sure you also conduct your experiment multiple times. During your experiment you need to collect data and make observations. You will record these in your Experiment Log. After you have completed the experiment use your log to write down the data and observations below. In your log you will need to:

Collect Data - you will need to collect numerical data; that means you need to take measurements during the experiment. Measurements can be temperature, distance, height, etc. Creating a chart is a helpful way to organize your data. You will analyze the data later to determine the results of your experiment.

Make Observations - as you conduct your experiment you will use your senses (sight, smell, touch, etc.) and write down any observations you make during the process.

Observations

Project Experiment

Data

Project Results

Determine the Results

Now it is time to review your data and observations to find out what happened during the experiment. Think about the best way to show your data: bar graph, line graph, chart, etc. and then create a table or a graph below. This visual will help you analyze your data for trends.

Results

Use this space, or a separate sheet in your notebook, to sketch 1 or more tables, charts, or graphs to analyze your data.

Project Results

Determine the Results

You will also write out the results of each test in the experiment in paragraph form using complete sentences. Make sure that you include the numerical data (measurements) as well as any other important observations that you made.

Project Conclusions

Draw Conclusions

Analyze the results and determine how the results helps you answer your project question. Write your answer in a complete sentence using the question to begin your answer. You also need to tell whether your hypothesis was supported or if the results contradict the hypothesis. If it was not supported, explain why you think so. End this paragraph by saying how you would change or improve your experiment in the future.

Answer to your project question: _____

_____

_____

_____

Did the results support or contradict the hypothesis? Explain. _____

_____

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_____

How would you improve or change the experiment? _____

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Project Abstract

Abstract

The abstract is a short version of your science fair final report. It should be no more than 250 words. Most of the information you will put in your abstract is already written, you will just need to copy it over. You must have the following five components in your abstract:

Introduction
Project Question
Procedures
Results
Conclusions

The only new thing you will need to write is the **Introduction**. This is where you describe the purpose for doing this experiment or project. Tell why people should care about the work you did. How does your experiment give us new science information? Can this information be used to improve our lives? If so, how? This is where you want to interest the reader in your project and motivate them to read the rest of it.

Project Presentation

Display board

Now that you have completed your experiment you will begin setting up your display board to communicate the results of your experiment to others. Remember, the board is graded on the information you present, not how colorful or pretty it looks. Your display board must have ALL of the following components located in the same places.

Other board guidelines:

- Font should be easy to read and at least a size of 16pt or greater.
- Photos should not include faces of students.
- Information on the board can be typed or written neatly by hand.

Hypothesis	Question/Title	Results
Key Words and Research	**Photos or Drawings**	
		Conclusion
Procedure and Materials	**Graphs**