The Non-Scientific Parent's
Guide to a Science Project

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Note. Within this document there are 'hyperlinks', which are underlined words that you can click on and be taken to another spot. You may have to hold down the Control key before the link works. The Control keys are located in the bottom left and right of your keyboard, and have CTRL written on them. Hold down the Control key, then click with your mouse.

SCIENCE SAFETY:
Make sure you supervise your child during these experiments! Use extreme caution when working with hot liquids. Safety goggles are recommended for projects with liquids and balloons.

Introduction – Our 25th Science Project - and Counting

One year I decided I would do a science project called "Do Science Projects Cause Maternal Insanity?" That was the year we sent one of our sons to the neighbor's house to do his science experiment. It was one of the years that our four boys all did science projects.

Thirty five years ago, when I was in elementary school, it was easy to do a science project. You made a trip-tik science board out of a cardboard box, hand wrote your topic and procedure, then made a model of a volcano or made an egg squeeze into a bottle. Your teacher had never heard of the scientific method, and your mother never even knew your science project was due.

Those were the good old days. Now, children are expected to choose a science project topic, submit a proposal, form a hypothesis, perform an experiment with three trials, graph and chart the results, develop and present an abstract, give an oral report, and pretend they did all this without help from parents.

It really is enough to drive a mother insane.

But smile, mom! You've discovered a secret weapon to help you conquer the dreaded science project. This is your personal copy of "The Non-Scientist Parent's Guide to Science Fair Projects", a guide that will answer almost every question you have about doing a science project with your child.

We'll help you as you choose the perfect science project, wade through the odd vocabulary, deal with the scientific method, and design an award winning science board.

And the great thing is that you'll find out that your science project really can be done by your child, with you as a teacher and a guide.

Types of Science Projects

There are basically five different types of science projects, a fact that is often overlooked on the little half sheet of paper that tells you when your child's project is due. It's very important that you read the directions from your teacher and/or the science fair, and make sure that the project your child chooses fits into the right category.

1. Investigative projects - Most science fairs require students to submit an investigative (sometimes called investigatory) science project. This project requires an experiment that tests an hypothesis. The experiment must follow the scientific method, and often will require that a control group be established. (Don't worry - we explain these vocabulary words here.)

An example of an investigative project would be "How does salt affect the boiling point of water?" This can easily be tested by our experiment which adds different amounts of salt to water and recording the temperature at which it boils.

If you see the words experiment, scientific method, control and/or variable on the project instructions, you'll probably need an investigative project. For some strange reason, most science project books don't give a lot of projects in this category, which is why we developed the 24 Hour Science Project guides.

2. Demonstration projects - In this type of project a student will actually demonstrate a scientific principal, and lots of time the teacher wants it presented in front of the class as an oral report. There is no true experiment performed, because there won't be a control or different variables.

Our project **The Yeast Beast**, one of our Watch This! Science Projects is an example of a demonstration project. In it, the student adds yeast and sugar to a bottle of warm water, puts a balloon on top, and shows the class what happens. (The balloon blows up!) Other projects could demonstrate static electricity, viscosity, or osmosis.

3. Research project - Years ago, this was called a 'doing a science report'. Students look up information on a topic, and write a paper on what they discovered. Any type of science topic can be used for a research project. The internet has made this process a whole lot easier!

4. Models - For a model project, models are built to explain a scientific principle or structure. Models of rockets, the solar system, and volcanoes are common models. Other models represent a scientific process, such as erosion. Your child may also enjoy models of dinosaurs and fossils.

5. Collections - In this type of project a collection of objects is displayed to give an overview of a topic. An example would be a leaf collection or a display showing many different types of simple machines. HobbyTron is a great starting point for getting ideas and equipment for your project collection!

Every science fair has different requirements for science projects. As you search for a topic, make sure it's the type of project your fair requires.

The Scientific Method Unraveled

Depending on which science book you're reading, there are either four, or five, or six steps to the scientific method. Doesn't sound very scientific, does it?! It's all basically the same general idea, so we've taken the average, and are giving you five steps:

1. Observation - Looking at something in the world. Watching things closely makes you curious about why or when or how something happens. That leads to the next step…

2. Question - Wondering about what you see in the world. The questions that come up during your observations are the second step of the scientific method.

3. Hypothesis - A guess at the answer to the question. An hypothesis is an "educated guess". You take what you already know about the subject and use it to guess the answer to your question. You could be right. You could be wrong. It doesn't matter, because you're going to find out in the next step…

4. Experimentation - Testing your hypothesis. You come up with an experiment to find out the answer to your question. This is the trickiest part of the scientific method, because an experiment has to be designed with controls and variables in place. (Keep reading - we're getting to the definitions!)

5. Results - The answer to the question. When the experiment is complete, your question will be answered, and you'll have your results!

It looks complicated, but it is really a simple process that we use every day to understand and solve problems in the world around us.

Use this example with your child: Suppose you observe that your DS isn't working. You'll ask yourself the question "What's wrong with my DS!?" Then you'll come up with a couple of ideas, or hypotheses: "The battery could be dead, the game could be dirty, or maybe the baby dropped it into the toilet." So you'll check the battery, take out the game and blow out the dust, then check for signs of dried Cheerios and wet spots. These experiments will hopefully lead you to the result, and you'll know why your DS wasn't working.

Kid (and Parent) Friendly Definitions to Scientific Terms

You'll probably run across a lot of new vocabulary while doing a science project. Some of the things below will be required for your science project, and others will not. We recommend you print these pages and highlight the things your teacher wants you to do.

To help explain some of the unfamiliar terms, we're going to refer to the following experiment, and note specific reference to it in blue font.

"What type of fertilizer produces the most plant growth?"

Project summary: A group of plants of the exact same height is divided into five groups. Each of four groups is given a different type of fertilizer. The fifth group is given only water. At the end of one month, plants are measured.

Science Project Proposal - This is a short description of your science project. It needs to include your purpose, hypothesis, materials, and procedure. Your teacher may also want you to list the variables, and give places where you will do research. Turn it in as early as you can, in case it is rejected.

Purpose (Problem) - The purpose is what your project hopes to find out or prove. It's the 'big question'. What is your goal? What are you trying to test? That's your purpose, sometimes stated as a problem. The purpose of our science project is to find out, "What type of fertilizer produces the most plant growth?"

Hypothesis - An hypothesis is simply an educated guess about what will happen in your experiment. To form your hypothesis, take all the information you know about your science project question, and use it to predict what you think will happen. It doesn't matter if you're right or wrong; that's what the experiment will tell you! In our experiment, the hypothesis will be, "I think that …. will make plants grow the highest." Use what you know about fertilizer, advertisements, comments from a gardener you know, or personal experience to formulate your hypothesis.

Procedure - A step by step description of how to do your experiment. Another person should be able to do your experiment again, just by following your procedure.

Materials - This is a detailed list of exactly what you used (or plan to use) in your experiment:

Four types of liquid houseplant fertilizer -Peters Professional® All Purpose Plant Food, Spectrum® Colorburst Plant Food, Osmocote® Indoor Outdoor Plant Food, and Miracle-Gro® All Purpose Plant Food
20 identical terra cotta pots filled with potting soil
20 bush bean plants of identical height
Water
Ruler

Variables - When doing a science experiment, there are things that you, as the scientist, control to make sure your test results are dependable:

> **Independent Variable** - The independent variable is the thing that you change in the experiment. All the other things in your experiment should stay the same. For example, in our experiment the independent variable is the type of fertilizer. We'll use the same kind of pot, soil, and plant. We'll have the plants get the same amount of light and stay in the same room at the same temperature. We'll add the same amount of water. The only thing that will change is the kind of fertilizer.
>
> **Dependent Variable** - The dependent variable is the thing that changes because of the independent variable. For us, that would be the height of the plant. The height of the plant changed because we changed the type of fertilizer.

Control - The Control is the group in which nothing changes at all. In the fertilizer experiment, that would be the group of plants that only was given water with no fertilizer.

Metric Measurements - Sometimes teachers require students to do all measurements in metrics, which is a decimal system of measurement based on:

The Meter - measures length. The English system uses yards, feet, and inches. One meter equals 39.37 inches.

The Kilogram - measures mass, or the amount of matter present. It's not the same thing, but you can relate mass to weight. The English system measures mass in pounds and ounces. A pound is 2.2 kilograms.

The Liter - measures capacity or volume. The English system uses gallons, quarts, teaspoons, tablespoons, ounces - and 2 liter bottles! An American gallon is 3.8 liters.

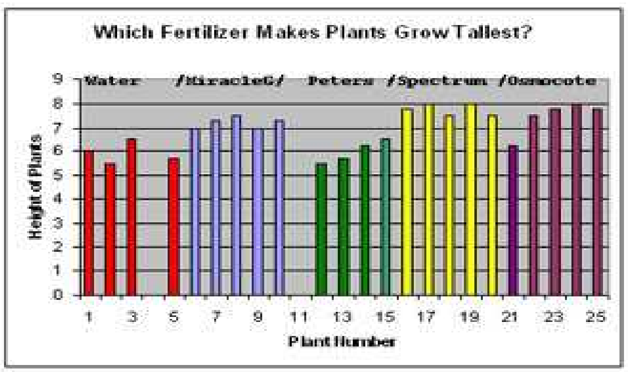
HINT! If you have to convert English measurements to Metrics, go to Google and type in "convert 2 inches to meters", or whatever you need to convert. Sometimes, you don't even have to think!

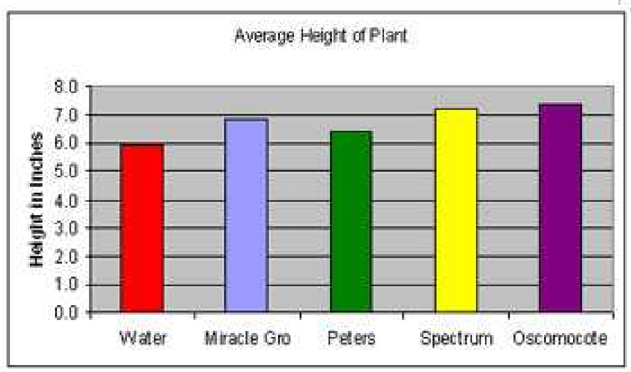
Science Log - A journal of what happened in your experiment, from day to day or minute to minute. In our experiment, an entry might read, "On day five, we noticed that the plants with fertilizer had really started getting taller than the control that was only getting water." Or..."On day seven, we noticed that the plants getting ... brand fertilizer had started to wilt a bit." If you are doing one of our 24 Hour Science Projects, your log will record changes at much more frequent intervals. You will often need to keep a graph of data in your log. In our experiment, the graph might look like the one at the right. Obviously, the graph would extend to include all the days. You would measure and fill in the height of each plant daily.

		Height in Inches			
Additive	Plant #	Day One	Day Two	Day Three	Day Four
Water	1	4	4	4 1/4	
Water	2	4	4	4 1/4	
Water	3	4	4	4 1/4	
Water	4	4	4 1/4	4 1/4	
Water	5	4	4	4 1/4	
Fertilizer 1	6	4	4 1/2	4 1/2	
Fertilizer 1	7	4	4 1/4	4 1/2	
Fertilizer 1	8	4	4 1/4	4 1/2	
Fertilizer 1	9	4	4 1/2	4 1/2	
Fertilizer 1	10	4	4 1/2	4 3/4	
Fertilizer 2	11	4	4 1/2	4 1/2	
Fertilizer 2	12	4	4	4 1/4	
Fertilizer 2	13	4	4 1/2	4 1/4	
Fertilizer 2	14	4	4	4 1/2	
Fertilizer 2	15	4	4 1/2	4 3/4	
Fertilizer 3	16	4	4 1/2	4 3/4	
Fertilizer 3	17	4	4 1/2	4 3/4	
Fertilizer 3	18	4	4	4 3/4	
Fertilizer 3	19	4	4 3/4	5 1/4	
Fertilizer 3	20	4	4 1/2	4 3/4	
Fertilizer 4	21	4	4 1/2	4 1/2	
Fertilizer 4	22	4	4	4 1/2	
Fertilizer 4	23	4	4 1/2	4 3/4	
Fertilizer 4	24	4	4 1/2	4 1/2	
Fertilizer 4	25	4	4 1/2	4 3/4	

Graph - The words chart and graph are used interchangeably. We use the word "graph" for a numbers placed on a grid (or spreadsheet) like the one at the right. And a chart...

Chart - A chart arranges the information (data) from your experiment visually, so you can see it. Look at the charts below. The one on the left gives all the heights of the plants on the last day. The chart on the right gives the average height.





Abstract - Some science fairs require an abstract, which is a brief but complete summary of your project. It probably should not be more than 250 words.

Data - Data means information. It's plural, so the absolute correct usage would be "The data show us that..." (Actually, one piece of data is datum, which you really don't need to know unless you're taking Latin or have an extremely pedantic teacher.) Your data will most often be in numbers, although if you were a zoologist, your data might be observations about the feeding habits of anteaters. The measurements of the plant height (the numbers in the graph) give the data for our experiment.

Analysis - When you explain your data and observations, you are giving an analysis. What have you learned? Why did you get the results you did? What did the experiment prove? And, most important, was your hypothesis correct? The analysis for the fertilizer experiment would begin "We discovered that the Miracle Gro produced the most plant growth. While water produced the least growth overall, it is worth noting that two of the plants died after having been added Peters fertilizer. Our hypothesis was disproved, as we thought the Peters fertilizer would produce the tallest plants.

Conclusion - Answer your problem/purpose statement. What does it all add up to? What did you learn from your project?

Application - What questions come up as a result of your experiment? What else would you like to know? If you did this project again, what would you change? How can this project help in real life? While we discovered which plants grew tallest, we didn't test which plants had the most flowers, and would give the most fruit. This would be what we would like to see answered in our next experiment. We have learned, however, that it is important to use a fertilizer, and we have learned some of the best brands.

A Science Board That Isn't Boring

After the science project is finished, you want it to look it's very best for the science fair! You want the project to reflect how hard your child has worked on it.

ORGANIZING YOUR SCIENCE BOARD

A science board is usually a three fold display divided into several sections. Each section can be headed by an identifying title. The section title at the right is an example of how you can add color and style to your project.

Title, Purpose and Hypothesis - Every science board has to display the project title and purpose - and they aren't necessarily the same thing. For example, we sell the guide to a project called, "EGG-XPERIMENTING!" The purpose of the project, however, is to discover "Does water move through the membrane of an egg?" The title will usually be displayed in the center panel at the top or on an extra board fastened across the top of your project. Have a separate section for your hypothesis.

Materials and Procedure - These two sections list what you used in your experiment, and what steps you took to accomplish to perform it. It always looks nice to use bullets (little dots or marks) or numbers in your list. Remember, the information in these sections should read like a recipe, and give instructions for your project to be repeated by someone else! You'll want to be as clear as possible. If you can, get another adult to read over your procedures to see if they can follow what you have done.

MATERIALS

- Four types of liquid houseplant fertilizer:
  - Peters ® All Purpose Plant Food
  - Spectrum® Colorburst Plant Food
  - Osmocote® Indoor Outdoor Plant Food
  - Miracle-Gro All Purpose Plant Food
- 20 identical terra cotta pots
- Potting soil
- 20 bush bean plants of identical height
- Water
- Ruler

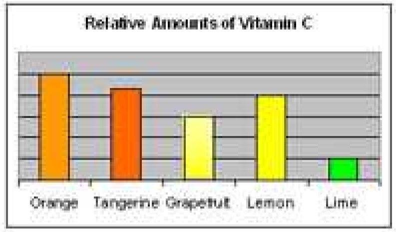
Data and Results - The format of your data and results section will depend on the experiment you have done. You will probably include your graph and chart in this section. You may also give a paragraph summarizing your results. Graphs and charts should be colorful and clear. Of course, with 24 Hour Science Projects, we provide a spreadsheet that creates the graphs and charts for you automatically. Instead of taking an hour - or two, your chart can be finished in about five minutes!

CHANGE IN	EGG'S	WEIGHT
	Actual	% Change
Initial	40	200
After vinegar	20	40
After syrup	40	200
After water	60	50

Conclusion, Analysis, Applications, References - These sections will not always be required. Check with your teacher to see if you need to include them.

NOTE: Many science fairs do NOT want a child's name on a project board; your child will be assigned an anonymous number. Read your fair guidelines to make sure!

MAKING YOUR DISPLAY LOOK GREAT



Using Color - Office Depot offers display boards in many colors. You can use different colors of paper, borders, and fonts. It's fun to have the colors on your display reflect some aspect of your project. When we did our project Vitamin "C"itrus, we used citrus colors for our paper, and used the same colors on the graph. You can also print your material on white paper, but mount it on colored paper, so it looks framed. Don't use so many colors that your project looks too flashy or gaudy - you want the colors to draw attention to your work, not be a distraction.

Display Hints - We've found that printing on card stock produces a neater board. We've also had great results with a full sheet of labels, in other words, one 8 1/2 x 11 sticker that you simply stick onto your board. Be creative with your printing. Once, when we were doing A Slice of Ice we printed on overhead transparencies cut in the shape of dripping ice.

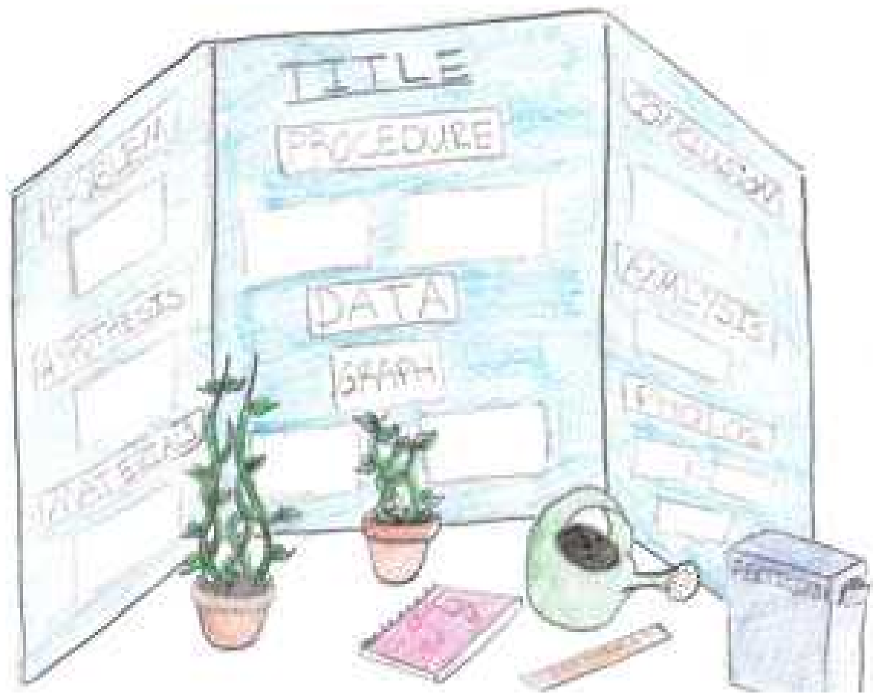
Make your display as uniform as possible. Use the same borders for each element. Use the same font for headers, and the same font for the information in each section. Make sure the sections are all aligned the same on each panel of the board. We like to left align the right panel, center align in the middle, and right align the left panel. Try to leave about the same amount of space between each section.

Extras - You can use photographs of your experiment to enhance your project and to make your display board look balanced. It's also nice to have some of your project items to display in front of your board. Many schools do not allow food or chemicals in the fair itself, but empty containers or imitation food will work fine. You can take an empty bottle and use a permanent marker to add a 'label'. A dollar store is a great place to find inexpensive props for your experiment. Try to vary the height of the objects you display. A log or your abstract can also be part of your display.

Assembly - LAY OUT THE PROJECT COMPLETELY BEFORE YOU GLUE OR STICK! We've had major disasters when we've not followed this rule. Use a thin layer of white glue instead of a glue stick. (One year, as our son walked into the school with his science project, I watched from the car as half of the information fell off. It had come "un-glue-sticked" overnight.) Another option is to use spray adhesive, just don't get it on your carpet unless you don't like the carpet you have now. (I got hard wood floors after we ruined our beige rug!)

So - are you ready to go?! Choose your topic, your experiment, gather your materials and get started! And, in case we haven't shamelessly plugged them enough, remember that we have science projects of every type at http://www.24hourscienceprojects.com.

We'd love to help you and your child with a science project that is a winner! We hope you have a wonderful time with your project.



Other Resources

We'd also like to invite you to check out our other educational products:

Wake Up from the Homework Nightmare – a parent's guide to surviving a night of homework.

Focus Pocus – 100 Ways to help your child pay attention.

The Pac-Kit – a Planner/Agenda/Calendar designed especially for ADHD children.

Kayla Fay is the author of 24 Hour Science Projects, and the publisher of Who Put the Ketchup in the Medicine Cabinet?, a website about ADHD-Inattentive Type. She is the mother of four sons. Kayla and family live in North Carolina. Follow her on Twitter, Friend her on Facebook, or subscribe to her blog.