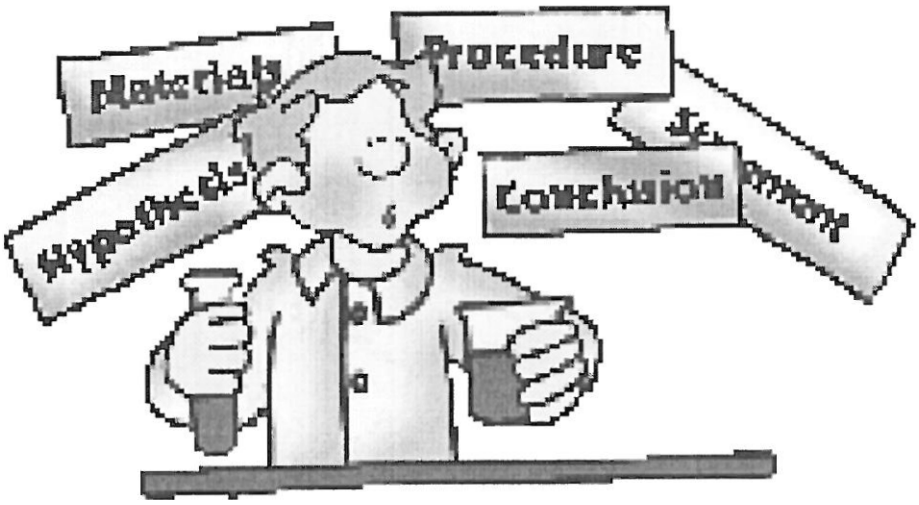
Ballard Elementary



Science/STEM Fair Project Guide

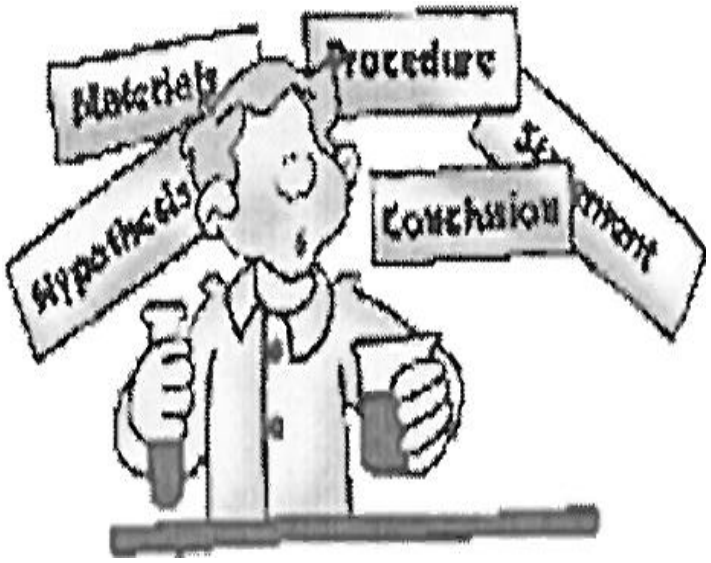
Student Name: _____

Science/ STEM Fair Timeline

Name: _____

Due Date	Activity	Earned Points	Teacher's Signature	Date
10/14	Signed Parent Letter	5		
10/17	Ideas & Choosing a Topic/Purpose	5		
10/21	Question	5		
10/25	Research/ Bibliography	10		
10/28	Hypothesis	10		
10/31	Materials	10		
10/31	Variable	10		
10/7	Procedure	15		
11/28	Record Data (Table/Graph)	10		
12/2	Conclusion	10		
12/9	Final Project Due	10		

Science/STEM Fair Project Timeline



Welcome to the Ballard Elementary Science/STEM Fair! Doing a science fair project is an exciting opportunity for our students. This book will be your guide to a fun and educational science experience. Explanations and examples of each step of the scientific method are included for your reference. You will need to have a NOTEBOOK, called your logbook, as a place to write down all your activities to complete the project.

***Note: If your experiment will take more than 2 weeks to complete (i.e.growing plants), please be sure to work a bit ahead of this schedule so you will have time to complete your experiment.**

Science/STEM Fair Project Vocabulary

Bar Graph- a bar graph is used to display data that does not occur in a continuous manner.

Conclusion - a statement about your experiment telling what you learned by doing the project and how it is important to your life

Control- the test group in your experiment that does not get changed by the variable. An untested sample to compare the tested sample to.

Data - the information learned, gathered, or measured during an experiment

Experiment - a way to test a hypothesis

Graph -an organized picture to show the results of an experiment

Hypothesis - a smart guess to answer a science question

Line Graph- a line graph is used to display data that occurs in a continuous manner.

Log book - a dated journal to record everything you do for your project

Metric -a system of measurement using meters, grams, and degrees Celsius

Procedure -a detailed set of steps to complete an experiment

Question - a problem to answer by doing an experiment

Record - to write down information

Research - a way of finding out more about a topic by looking in books or magazines, searching on the internet, or by asking experts for information

Variable -the part of an experiment that can change

Independent Variable-the part of an experiment you are changing

Dependent Variable- the part of an experiment you are measuring

Constant - the parts of an experiment that need to stay the same to keep the experiment fair.

Science/STEM Fair Websites

Science Buddies has guides, experiment ideas, and much more.
http://www.sciencebuddies.org/

Discovery Education's all-in-one source for science fair information and help.
http://school.discovery.com/sciencefaircentral/

This is a free website to help you create a line, bar, or circle graph.
http://nces.ed.gov/nceskids/createagraph/

Here are some great sites with project ideas:

www.all-science-fair-projects.com

www.sciencebob.com/sciencefair/ideas.php

Choosing a Topic

Your assignment is to find a topic that interests you. Think about your activities outside of school or your favorite areas of science. Try to pick a topic that you are interested in- this will make completing your science fair project a lot more fun! Read science books, magazines, newspapers, talk to your teacher, family members, or friends or visit professional people and museums. Record all the ideas that you are thinking of on the log book page.

GOOD TOPICS

1. What is the effect of the mass of the bob on the period of a pendulum?

This is a good topic because it requires experimentation that you can do yourself. You must use the scientific method in completing this project.

2. How does the pH of the liquid affect the reproduction rate of the yeast?

This topic suggests the use of an experimental method. Asking a question is a good approach toward developing your topic.

POOR TOPICS

1. How volcanoes erupt?

This topic will not allow experimentation without visiting real volcanoes. Making a model that erupts is a demonstration not an experiment.

2. Microscopes-This topic is too general. Telling how one works is not experimentation.
3. Which popcorn pops better?

This is a comparison.

SAMPLE LOGBOOK ENTRY

September 4, 2019

Today I started to think about what I want to do my science fair project about. I like to play soccer and go swimming in my pool. I also like when we learn about the water cycle at school. Maybe I can do a project about water.

****IMPORTANT REMINDERS!**

- Experimentation with mold is not permitted.
- If you want to use live, vertebrate animals, such as cats, dogs, or hamsters, in your experiment, you MUST have a waiver filled out by a veterinarian before project continues.
- Use of hazardous materials is discouraged; and, if used, must have prior approval from the science fair director and a guarantee that there will be adult supervision.
- The purpose of the science fair is to encourage scientific investigation and experimentation.
- Building models is not an example of an appropriate science fair project.

Forming a Question/Purpose

After you decide on a topic, it is time to form a question that can be answered by doing an experiment. It must be a testable question. Be careful! If you can't MEASURE to find the answer to your question, the question may not be right for a science fair project. Record your question on your logbook page.

Question/Purpose can be stated:

"I wonder what would happen if _____"

or

"What is the effect of _____ on _____?"

This one sentence should explain why you are doing the experiment.

If your purpose is well worded you will have little difficulty writing a title for your project.

SAMPLE LOGBOOK ENTRY

September 5, 2019

After thinking about my topic of water, I was wondering about the water in my pool. In the spring when it is not raining in Florida, the water level goes down and my parents have to fill it back up. I wonder if the water being a clear color affects the way it evaporates.

For my science fair project, I will try to answer this question:

Does the color of water affect its rate of evaporation?

Research and Bibliography

Now that you have a question, it is time to learn more about your topic. You can take out a book or magazine on your topic, research on the internet, or ask an expert. Be sure to write down all you learn and record the SOURCE of your information in your logbook.

Here's **How:**

1. Write the author's last name, first name and middle name or initial.
2. Write the name of the article or chapter from your source in quotes.
3. Write the title of the book or source.
4. Write the place where your source was published followed by a colon.
5. Write the publisher name, date and volume followed by a colon and the page numbers.

SAMPLES:

1. Here is an example for a book or magazine-- Smith, John B., 'Science Fair Fun' Experiment Time, New York: Sterling Pub. Co., May 1990, Vol. 2:10-25.
2. Here is an example for a Web site-- Bailey, Regina, About.com Biology Site, Mar. 9, 2000.
3. Here is an example for a conversation-- Martin, Clara, Telephone Conversation, Jan. 8, 2000.

SAMPLE LOGBOOK ENTRY

September 10, 2019

Today I started to do my research. I looked online to find out more about evaporation. At http://www.weatherquestions.com/What_is_evaporation.htm I found a lot of information. It said that evaporation is the change of water from a liquid to a gas. Averaged across the entire Earth, water evaporates from the surface at a rate of about 3 millimeters per day (about 1/8 of an inch). The atmosphere does not get full of water because precipitation happens. This returns the water to a liquid and brings it back down to earth.
After reading Anderson, Michael, 'Color and Light', London: Harcourt Publishing, 2002, I learned that darker colors absorb more light energy than lighter colors.

Hypothesis

You need to decide on your hypothesis. A hypothesis is an educated guess about the answer to your science fair question.

Most of the time a hypothesis is written like this:

"If _____ , then _____ will happen." (Fill in the blanks with the appropriate information from your own experiment.)

Your hypothesis should be something that you can actually test, what's called a **testable** hypothesis. In other words, you need to be able to measure both "what you do" and "what will happen."

Record your hypothesis in your logbook.

SAMPLE LOGBOOK ENTRY

September 11, 2019

After doing my research I have decided on my hypothesis. If I test clear water and black water to see how fast it evaporates, then the black water will evaporate the fastest. I believe this because dark colors absorb more energy.

Variables

Variables can be tough, but don't worry. The answer to your variables is in your question and hypothesis. You need to ask yourself some simple questions to find your variables.

To find your **independent variable,** ask yourself :

What am I changing?
*I am changing*_____

To find your **dependent variable,** ask yourself:

What am I measuring? (MUST BE METRIC)
*I am measuring*_____

To find your **constants,** ask yourself :

What parts of my experiment do I need to keep the same for all trials and tests to be fair?
The things I am keeping the same are
_____.

To find your **control,** ask yourself:

Did I have a sample that I did not test the variable for? (i.e. a plant that gets water while the rest get a different liquid) My control is the _____. Or you may record, "I don't have a control in this experiment."

SAMPLE LOG BOOK ENTRY

September 15, 2019

For my project, I am changing the color of water I use for the evaporation. This is my independent variable. I am measuring the time it takes for each type of water to evaporate. This is my dependent variable. I will keep some constants. I will use the same containers for my water, I will use the same amount of water, I will put the water in the same location, and I will check the water at the same time every day. I will also place a clear water that is not colored out during my investigation. This will be my control.

Materials

You need to write a detailed list of all the materials you need to complete your project. Be **specific** and record the list in your logbook.

**Be sure to use METRIC MEASUREMENTS!
(Examples: Length is measured in centimeters NOT inches/feet/yards. Mass is measured in grams NOT ounces/pounds. Volume is measured in milliliters NOT cups/ounces/gallons.)

Good list:

- 250 ml graduated beaker
- 750 ml water 20 degrees C
- 1-20 *x* 20 cm sq. cake pan
- Celsius thermometer
- Clock with a second hand

Poor list:

- Measuring cup
- Water
- Container
- Thermometer
- Clock

SAMPLE LOGBOOK ENTRY

September 17, 2019

These are the matelials I need for my project.

- 6 clear metric measuring cups
- 600 ml of water
- black food coloring
- medicine dropper

Procedure

This is just a numbered list of all the steps you need to complete your experiment. Remember to repeat your experiment so you have 3 trials (tries) to compare when you are done. Use the metric system. Acting out the procedure can help you check if you forgot any steps. Be specific in case someone else wants to try your experiment! Record your procedure in your logbook.

Good Directions:

1. Wear safety goggles.
2. Add 3 mL magnesium sulfate solution into a test tube.
3. Observe the contents for 5 minutes.

Poor Directions:

1. Use safety equipment.
2. Put magnesium sulfate solution to one test tube.
3. Observe the contents.

SAMPLE LOGBOOK ENTRY

September 16, 2019

Here is the procedure for my project.

1. Gather all materials.
2. Pour 100 ml of water into 6 clear measuring cups.
3. To three cups, add 5 drops of black food coloring.
4. To the last three cups, add 5 drops of clear water to make the volume of all 6 cups equal.
5. Next, place all 6 cups outside in a spot that gets sunlight, but away from wind and rain.
6. Check the cups every day at the same time to record the new volume in each cup until all the water evaporates.

Start Experiment and Collect Data

Now it is time to do your experiment! Data refers to information gathered during your experiment. Collect all of your materials so you are ready. Follow your procedure and get your experiment going. Decide how often you need to check on your experiment and draw a data table to record all your information. Keep your data table in your logbook. Continue experiment until it is finished.

**Remember this is a rough draft so do not go back and change any of your previous thoughts. Keep the original "sloppy copy" in your log book.

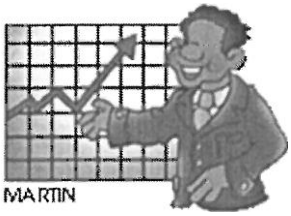
SAMPLE LOGBOOK ENTRY

September 19-26, 2019

Today I followed my procedure and put my measuring cups of water in the sun. Here is the data table I will use to record my information each day. I will record how much water is left each day.

Data Table

Day/ Water	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Clear 1	lOOml	85ml	64ml	51ml	35ml	18ml	Oml
Clear 2	lOOml	84ml	62ml	49ml	34ml	17ml	Oml
Clear 3	lOOml	85ml	62ml	48ml	33ml	19ml	Oml
Black 1	lOOml	61ml	29ml	Oml			
Black 2	lOOml	62ml	27ml	Oml			
Black 3	lOOml	60ml	29m!	Oml			



Analyze Data

It is now time to look at the data you have collected. Try to find a pattern. Ask yourself what the data is showing you and make inferences about the experiment. Understanding your data will help you be able to explain the results of your experiment.

SAMPLE LOGBOOK ENTRY

October 1, 2019

My water is all gone! The black water only took 4 days to evaporate. The clear water took 7 days to evaporate. The black water evaporated quicker than the clear water. I can infer that the water that was darker must have absorbed more heat than the clear water. This helped make the black water evaporate quicker than the clear water.

Make a Graph

Now it is time to draw a graph to display your data. Sometimes, looking at a graph helps you analyze your data and draw your conclusion better. It helps you to see patterns in your data. Your graph should show your data from all three trials and an average of your trials.

You can use a bar graph, line graph, or circle graph. Pick the one that will show your data the easiest. (Remember... since there must be 3 trials your graph should be in color so you can tell the difference between each item.) You can make a graph on graph paper OR create a free graph online at:

http://nces.ed.gov/nceskids/createagraph/

QUANTIFICATION OF DATA

The data collected during the course of your experiment needs to be measurable. Scientists use metrics when making their measurements. They do not use standard measurements and then convert them to metrics. Metric measurements are required.

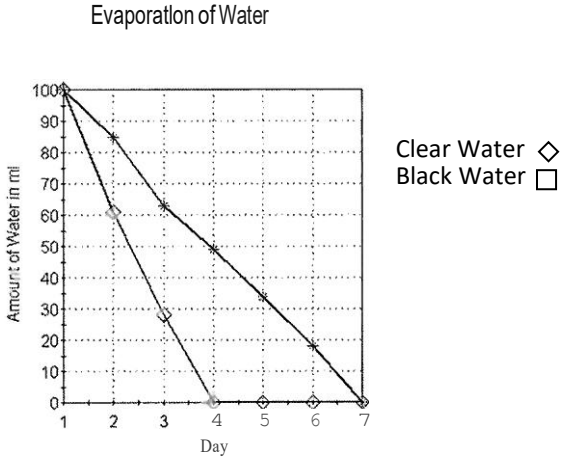
A graph must have:

1. Title
2. Both axes labeled (metric units)
3. Appropriate scale
4. Key

SAMPLE LOGBOOK ENTRY

October 5, 2019

Today I went online and made a graph at https://nces.ed.gov/neeskids/createagraph/.



Writing a Conclusion

Next, by looking at the data and thinking about the experiment you need to draw conclusions. *Your conclusion statement should answer these five questions:*

1. Did the data show your hypothesis was right or wrong?
2. Was your data or conclusion similar or different to the information you learned in your research?
3. Why is your experiment important to the real world?
4. What were the strengths of your procedure/experimental design? What can you do better if you had to do this experiment again?
5. What other questions about your experiment would you like to try in the future?

*Write these answers in a paragraph for your conclusion.

SAMPLE LOGBOOK ENTRY

October 2, 2019

My hypothesis was correct; the black water did evaporate faster than the clear water. The data did match my research that said darker colors would absorb more light energy. My experiment is important to people in Florida with pools. They should keep them crystal clear to avoid as much evaporation as they can. My experiment design was strong in the area of just testing one variable. The only weakness was I couldn't control the wind during the experiment. I would love to do an experiment with the colors of the rainbow next. I wonder what results I would find.

Preparing and Organizing Your Display Board

It is time to start preparing all of your information for your board! The information on your board should include: QUESTION, RESEARCH, HYPOTHESIS, VARIABLES, MATERIALS, PROCEDURE, DATA, GRAPH, and CONCLUSION.

Placement of your information should make sense. Think of it as a story with a beginning, middle and end. You should type or rewrite your information neatly for your display board. Do a good job. This is the final presentation of ALL your hard work!

Here are some tips:

- Do not put your name on the front of the board. Your full name, grade, and teacher should be written on the back, top right, corner.
- Include pictures from your experiment, but DO NOT put pictures of your face on the board.
- The title should be big and easily read from across the room. Choose one that accurately describes your work, but also grabs peoples' attention.
- Print out or write your information on paper that you will attach to your display board. Be sure to proofread each sheet before you attach it.
- Glue sticks or double sided tape work well for attaching items to your display board.
- Tip: Instead of regular paper, use cover stock (67#) or card stock (110#). These heavier papers will wrinkle less when you attach it to your display board, especially if you use a glue stick. Matte paper is preferable to glossy because it won't show as much glare-glare makes your display board difficult to read.
- Use color construction paper or boarders to add accents to your display board. A common technique is to put sheets of construction paper behind the white paper containing your text.

Also, practice talking about your project. You will need to tell your class about your project. You are the expert, so relax and tell what you did and what you learned.

Question	**PROJECT TITLE**		Data
	Variables	Materials	
Hypothesis			Graph
Research	Procedure	Visuals (Photos, drawings, etc.)	Conclusion

- Maximum size for any display is 76 cm deep, 122 cm open width and 274 cm high.
- Only paper and pictures should be on the display board. There should not be any other items attached to the board, such as 3-dimensional objects, vines, foam board backing, aluminum foil, fabric, lights, etc. Items other than paper and pictures will be removed. Corrugated border or paper border is acceptable.
- No plants or animals can be part of a student's exhibit at the district level.
- Logbook is <u>required</u> to be with the display so judges can look for needed information.

How Will My Project Be Graded?

Two judges will be grading your project and interviewing you. The scores will be averaged together to get your final score. Be sure to read through the grading checklist questions below and be sure that your board has the information and you can answer the questions when you are interviewed.

Purpose/Hypothesis					
1. How well is the purpose question stated?	0	1	2	3	4
2. How creative is the approach used to answer the questions?	0	1	2	3	4
3. How well does the hypothesis relate to the purpose?	0	1	2	3	4
4. Student Response Question: How did you choose your question?	0	1	2	3	4
5. Student Response Question: What did you predict would happen?	0	1	2	3	4
Subtotal					
Variable/Constant/Control					
6. How thorough was the materials list? (using metric units)	0	1	2	3	4
7. Did student identify the one variable changed in the experiment?	0	1	2	3	4
8. Did student identify **all** factors held constant in the experiment?	0	1	2	3	4
9. Did student identify the control or state "No Control"?	0	1	2	3	4
10. Student Response Question: What variable were you testing?	0	1	2	3	4
Subtotal					
Procedure					
11. Are step-by-step directions sequenced and clear so that anyone can set up the experiment?	0	1	2	3	4
12. Do procedures include specific directions including metric units?	0	1	2	3	4
13. How detailed was the log or notebook kept?	0	1	2	3	4
14. How well do the displayed procedures and log indicate the amount of trials completed (minimum of 3)?	0	1	2	3	4
15. Student Response Question: Is there anything you would have done differently? Why or why not?	0	1	2	3	4
Subtotal					
Graph/Data					
16. Were data measurements done precisely and related directly to the hypothesis?	0	1	2	3	4
17. Was the data collected in **quantitative, metric units?**	0	1	2	3	4
18. Does the graph show evidence of three trials and an overall average of those trials?	0	1	2	3	4
19. Does the graph have a title and correctly labeled axes?	0	1	2	3	4
20. Student Response Question: Explain your graph.	0	1	2	3	4
Subtotal					
Conclusion					
21. Is there a clear statement that shows support or non-support of the hypothesis?	0	1	2	3	4
22. Is there evidence stated in the log of student research?	0	1	2	3	4
23. Student Response Question: Why is this experiment important?	0	1	2	3	4
24. Student Response Question Can you think of another experiment you would like to try now that this one is complete?	0	1	2	3	4
Subtotal					
TOTAL SCORE					