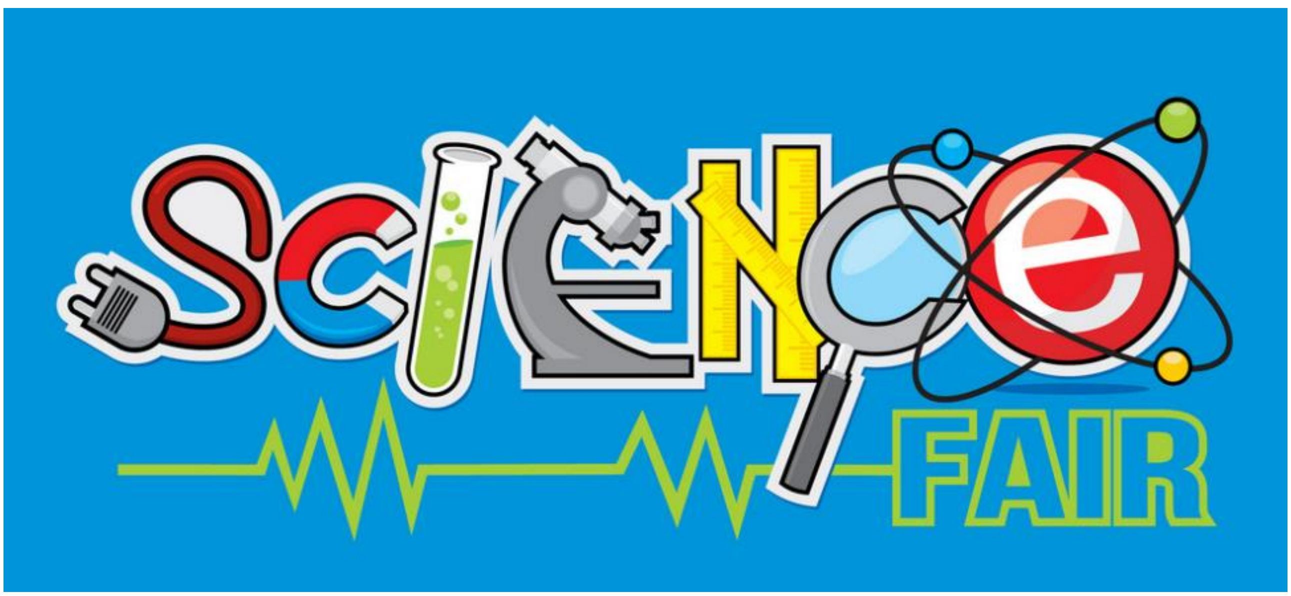
Symmes Elementary

Science Fair Project Guidelines

for Elementary Students and Parents



Contained in this booklet is the information and timelines that you will need to get started on a quality project.

Dear Parents/Guardians,

Science fair time has begun! As an extension of the Hillsborough County Science Curriculum and Symmes Elementary, students have the opportunity to complete a STEM fair project this the year. It is our mindset to inspire not require students to take part in the science fair.

Science fair is a fun time filled with investigations and experiments however, it can also be very stressful on students, parents, and teachers! We are contacting you at this time to provide you with information that will hopefully alleviate some of the stress and make science fair enjoyable for everyone.

This packet is essential for a successful science fair experience as it contains guidelines and, more importantly, a timeline that breaks the project into smaller chunks to make the process more manageable. Please review this packet with your child and keep it in a safe place so that you can refer back to it as needed.

The following suggestions and guidelines might be helpful in determining what your role in your child's science fair project will be:

- Help your child select a project that is feasible to accomplish.
- Help your child find materials for the project such as research sources, building supplies, and display materials.
- Offer support and encouragement as your child is working on her or his project. Your child should plan and direct the activity as much as possible.
- Monitor your child's progress throughout the project.
- Be sure that your child practices good safety procedures.
- Purchase a display board.
- Help your child meet the deadlines for project due dates and science fair regulations.
- Understand that your child's project will not be considered for the county science fair unless your child has participated and was chosen at the school's fair. Students chosen to represent the school in the county science fair will be notified by the school's science fair coordinator.

If you have any questions, please contact your child's teacher.

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Timeline for Science Fair Project

Suggested Schedule

Component	Suggested Timeline	Completion of Component
1. Topic Selection	Week 1	
2. Background Research	Week 2	
3. Prediction/Hypothesis	Week 3	
4. Materials and Procedure	Week 3	
6. Science Fair Data-Start your actual experiment and begin collection of data.	December and Early January	
7. Data Analysis (Graphs and Tables) and Conclusion	Mid January	
8. Visual Display: Backboard	Mid January	
9. Symmes Science Showcase	January 2025	

But WHY Should I Do a Science Fair Project?

Five Ways You Will Benefit from Completing a Science Project!

1. Gives students the opportunity to study a subject of individual interest.
2. Gives students the chance to experience the scientific method.
3. Involves creative thinking and problem-solving skills.
4. Can foster life-long time management skills.
5. Helps students develop poise, quick thinking, and public speaking skills.

Practical Hints for Science Fair Projects

- Pick something that interests you.
- Choose a question or topic that is testable.
- Get all the assistance you can in performing and understanding your project but <u>do the work yourself.</u>
- Don't wait until the last minute to start your project. Use the outline to stay on track.
- Your project doesn't have to be complicated to be a good science fair project.

How to Keep a Science Fair Journal

A project journal can be an important part of your science fair project. At the elementary level, a journal is not required, but can be very helpful. This is where you can record accurate and detailed notes throughout your investigation. Your notebook does not need to look perfect; it is a reference for you as you complete your project. It is a tool to keep your notes, drawings, charts, and track your progress.

What is a Scientific Experiment?

A scientific experiment is special because it uses three types of variables. **Controlled Variables** (constants) are conditions which do not change during the experiment. Scientists usually want to use as many controls as possible. The other two types of variables are the changing parts of an experiment. The **Independent Variable** is the variable that causes the experiment to start. It is the first thing that is allowed to change in an experiment. The **Dependent Variable** is the result or effect of the experiment. It is the variable that will be observed at the end of the experiment. Finally, sources of error are unanticipated, unwanted events which may cause bad experiment results and wrong conclusions. All experiments have some mistakes, or unexpected sources of error, these should be recorded in your observations/data and conclusion.

<u>Let's Discuss Variables</u>

A good investigation includes three types of variables:
- ✓ independent variable
- ✓ dependent variable
- ✓ controlled variables

To help you understand these variables, we will use an easy example of a science investigation. Let's say you want to see if the type of soil causes a change in the plant's growth.

The variable you are changing, your **independent variable,** would be the type of soil to grow the seeds. If you are viewing your experiment as a cause-and-effect relationship, your independent variable is the cause.

The variable you are observing for changes, your **dependent variable**, would be how the seeds grow. This would be the result, or effect, of your cause (which in this case is changing the type of soil for the seeds).

The final variables are your **controlled variables**. These are all of the things that should remain the same throughout your experiment. In this example experiment you are testing to see if the type of soil affects the seed growth. That means everything else about the plants should be exactly the same: the type of seeds, the containers for the seeds, the location of the containers, the amount of water given to each container, and how the seedlings are measured.

Control group: every experiment should have a control. The control group should have all of the same variables as the experimental group except for the independent variable. Your control group is your point of comparison. In the example we have been using, your control group would be grown using the recommended soil for growth. All other variables would remain the same.

It is extremely important to test ***<u>ONLY ONE</u>*** independent variable per experiment. It is also very important to conduct multiple trials of the investigation. These are necessary in order to get valid results!

Variables Example

Mr. Science filled one paper cup with sand, a second paper cup with pebbles, and a third paper cup with potting soil. He planted one lima bean seed in each paper cup and then placed all of the cups in a sunny window. Every day he watered the seeds with 20 ml of tap water. Every three days he measured the height of the seedlings in centimeters.

Controlled Variables:

- Mr. Science only used lima bean seeds.
- Mr. Science used the same type/size of paper cups for all seeds.
- Mr. Science gave each seedling 20 ml of tap water every day.
- Mr. Science put the cups in the same sunny window.
- Mr. Science measured each seedling every three days using centimeters.

Independent Variable:

Different soils (sand, pebbles, potting)

Dependent Variable:

Growth of seedlings

Possible Sources of Error:

- One seed might have been diseased.
- An insect might eat one seed.
- One paper cup might be slightly shaded.
- Mr. Science may make incorrect measurements.

Notice that the controls were things that were the same for each seed planted. For example, all the seeds were lima bean seeds. This is important because if one seed had been a radish seed a comparison of soils could not have been made. Radish and lima bean seeds do not grow at the same rate.

There is a cause-and-effect relationship between the independent and dependent variables. The independent causes the dependent to happen. Because of the different types of soil, the bean plants will grow differently.

What is an Engineering Project?

An engineering project is another type of project that can be entered in the science fair. To complete an engineering project, you would build or engineer a prototype to test. These projects allow students to design, build, model, or improve a specific device to help solve a problem. The engineering design process used to complete an engineering project is very different than the scientific method, so the criteria for judging is also different. The chart below shows the differences in the two processes.

Scientific Method	Engineering Design Process
Background research	Background research
Ask a question	Identify a need
Form a prediction or hypothesis	How can you solve the problem
Design an experiment	Draw your first design
Conduct the experiment	Build and test a prototype
Collect and analyze data	Retest and redesign as needed
Draw a conclusion	Draw a conclusion
Present results (Display)	Present results (Display)

<u>Topic/Question (a.k.a. The Problem)</u>

A science fair project starts with a question. For most students, the hardest part of science fair is selecting a good problem. It is important that the question is interesting to you. **A science fair project is an investigation, not just a report, demonstration, or model.** The topic you choose must be something you can design and experiment to test.

A well-designed investigation follows the scientific process and . . .

- Starts with a <u>question</u> that can be answered (tested) by an investigation.
- Includes a prediction or hypothesis supported by prior knowledge or research.
- Follows a procedure where only one variable is tested and all other variables stay the same.
- Repeated trials (at least 3-5 trials) are conducted and averaged in the data.
- Involves collection, organization, and display of valid data.
- Includes a written conclusion that is supported by data collected in the investigation.

All topics must be approved by the student's science teacher. Teachers have the final say.

Science Fair Rules and Regulations Prohibit the following types of projects:

1. Stay away from animal projects. Projects involving vertebrate animals (including human beings) may be <u>***observational type projects only***; approval must be granted before a student begins a project.</u>

2. No cultures isolated from the environment may be grown. Unacceptable are cultures of washed and unwashed hands, cutting boards, saliva, soil, drinking fountains, water, etc.

3. Controlled substances may not be used in projects. This includes tobacco and tobacco products, firearms, alcohol and drugs.

No vertebrate animals, no cultures, no illegal materials!

Where Do I Find a Topic?

Finding a topic for your science project can be the most difficult task of all! It's very important that you choose an experiment that interests you and is testable.

The best way to begin your search for a science project topic is to make a long list of subjects or possible experiments that seem interesting. If you're having trouble thinking of ideas, consider the following suggestions:

1. Browse the Internet. Use search words such as "science fair project" or the name of the topic of interest, or you can check out one of the websites listed in the next section.

2. Watch the news on television and read the newspaper. Some of the best science projects are ones that are developed from real problems and current events.

3. You may want to visit a museum, zoo, or science center for ideas.

4. Compare everyday products.

Science Websites

Below are a few websites to help you generate ideas for your project. Remember you MUST follow the county science fair rules so every project may not be acceptable. Your work MUST be your own! Although you may find ideas at one of these sites, your must make it your own! <u>If you copy any part, your project will be disqualified for academic dishonesty.</u>

All Science Fair Projects www.all-science-fair-projects.com

This website provides a fast way to search for ideas for your experiment; everything from plants to x-ray machines. Projects can be searched by grade level or content area. They also have several links of tips and guides resources.

Science Buddies www.sciencebuddies.org/science-fair-projects/project_ideas.shtml

Not only does this website provide you with tips and hints for creating your science fair project it also gives you a topic selection wizard. The Topic Selection Wizard is a short questionnaire about your personal interests and hobbies. The wizard uses your responses to recommend project ideas you will enjoy.

Science Bob's Science Fair Ideas www.sciencebob.com/sciencefair/ideas.php

Okay, here is the hardest part of the whole project...picking your topic. But here are some ideas to get you started. Even if you don't like any, they may inspire you to come up with one of your own.

What are Sources?

What is a source?
A source is a book, website, magazine, article, newspaper, etc. that has to do with your topic.

How many sources do I need?
Although it is not required at the elementary level, chances are, you will find some information from a website or article. If you use a source, please use proper citations to give them credit.

What is plagiarism and how do I avoid it?
Plagiarism is copying anyone else's writing or ideas without giving them credit. Plagiarism is stealing and as part of our school's academic honesty expectation. Students and parents should take great care that they are giving credit for all thoughts that are not their own to the person responsible.

- When doing research remember if you copy a sentence directly from a book or website, you must put quotes around it in your notes and in the background paper. Paraphrasing is acceptable for notes and background papers as long as you put the book or website information in your bibliography. When reading a book or website for your sources read the section once. Then cover it with your hand and try to write IN YOUR OWN WORDS what you just read. Do not copy word-for-word from any source. Put everything in your own words and make it your own. You are required to cite your sources for all information that is not your own.

How to Create a Bibliography?

What is a bibliography?
A bibliography is a list of all the sources you used when you conducted your background research.

Use www.Bibme.org or http://www.bibliography.com/ for step-by-step instructions to correctly cite your sources. Your bibliography should include all your resources in alphabetical order.

How to Write a Prediction
(Grades 1-4)

Elementary students up through and including grade 4 can write a prediction instead of a hypothesis for their science fair projects. A prediction is a logical guess about what you think will happen in your investigation. A prediction has two parts, what you think will happen and why you think that.

I predict ______________________ because ___________________________.

Example: How does the angle of the ramp affect how far a toy car will travel?
I predict that the car will go farther when the ramp angle increases because when riding my bicycle, I go farther when I am on a steeper hill than a smaller hill.

How to Write a Hypothesis
(Grade 5)

A hypothesis is an intelligent prediction about the outcome of your experiment, based on your prior knowledge and research you have done about your topic. It answers your problem. It describes the cause and effect of your experiment.

Fifth grade students should write a hypothesis instead of a prediction. Your hypothesis should be testable. A hypothesis should be written as an **If, then, because statement.**

If the ______________________________ ______________________________
(Independent Variable) (Describe how it will be changed)
then the ___________________________ **will** ______________________________ **.**
(Dependent Variable) (Describe the expected effect)

What justification can you give for your hypothesis?

Example: How does the angle of a ramp affect how far a toy car will travel?

If the angle of the ramp increases, **then the** distance the toy car travels **will** increase.

This hypothesis is justified because according to my research cars on the road need to leave extra space for stopping when they are traveling downhill.

How to Write a Materials List

Materials are a list of equipment, supplies, and resources needed to perform your experiment including the amounts that you will need to complete the experiment.

Example: How does the angle of a ramp affect how far a toy car will travel?

Name of Materials	How Many?
Hot Wheels Super 6 Lane Raceway	1
Blue Hot Wheels Sports Car	1
Science Textbooks	4
Measuring Tape	1
Protractor	1
Clear Tile Floor	1

How to Write a Procedure

The procedure is the actual steps you will perform to conduct your experiment. This should be very specific and include repeated tests/samples. Every experiment needs to have a minimum of 3-5 trials. Your procedure should be written so that anyone else could conduct your experiment. The procedure is the most critical part of performing the experiment.

Example: How does the angle of a ramp affect how far a toy car will travel?

Procedure:

1. Purchase a toy car, 2-foot-long ramp, protractor, and tape measure.
2. Using 1 textbook create a ramp by leaning one end of the ramp on the textbook and the other end on the floor.
3. Use the protractor to measure the angle created by the ramp and the floor. Record this angle in the data table as Angle # 1.
4. Hold the toy car at the top of the ramp with its back wheels touching the edge.
5. Release the toy car.
6. Allow the toy car to travel until it comes to a complete stop.
7. Measure the distance the toy car traveled from the end of the ramp to where its back wheels stopped. Record the distance in the data table as Trial # 1
8. Repeat steps 3-7 ten more times to create Trial # 2 through 50.
9. Increase the angle of the ramp by placing a 2nd textbook under the ramp.
10. Repeat steps 3-8.
11. Increase the angle of the ramp again by placing a 3rd textbook under the ramp.
12. Repeat steps 3-8.
13. Increase the angle of the ramp a final time by placing a 4th textbook under the ramp.
14. Repeat steps 3-8.

Validity: I will repeat my experiment 5 times.

How to Collect Data

Create a Data Table
Data tables help scientists to organize the information they gather during an experiment. Data tables include information on the independent and dependent variables, units used to measure each, and the number of trials preformed during the experiment.

TAKE PICTURES AS YOU RECORD YOUR DATA TO DISPLAY ON YOUR BACKBOARD!

Example: How does the angle of a ramp affect how far a toy car will travel?

Angle of the Ramp vs. Distance Traveled

	Distance the Toy Car Traveled in Centimeters					
Angle of the Ramp (In Degrees)	**Trials 1-10 Average**	**Trials 11-20 Average**	**Trials 21-30 Average**	**Trials 31-40 Average**	**Trials 41-50 Average**	**Average**
35	31	27	33	30	29	30.0
45	41	38	44	40	39	40.4
55	53	49	55	50	49	51.2
65	60	65	58	59	60	60.4

How to Graph Data

Once data is collected on a chart, you can use a graph to create a stronger visual of what the data shows. Usually, graphs are used to show the average data results. The website https://nces.ed.gov/nceskids/createagraph/Default.aspx can be used to build a graph to display the results of your investigation.

BAR GRAPH

A bar graph is used to show comparisons between variables or to track changes over time.

LINE GRAPH

A line graph is used to show a trend in data (usually change over time). The line shows data that increases, decreases or stays the same over time.

How to Write a Conclusion

The conclusion is written as a paragraph(s). It has four parts:

- should answer the original question that started the investigation, a summary of the steps used to complete the investigation, and the results of the investigation.
- should reflect back on the original prediction/hypothesis and state whether it is supported or not and why.
- should include inferences that can be made from the results of the experiment as well as explaining why you think you obtained the data that you observed in your experiment.
- should end with a discussion of any problems that were experienced during the experiment and additional questions that could be investigated.

How to Write a Conclusion Using REC^{2}ALL

R **REASON/PURPOSE** – This is the question you are trying to answer with your experiment.

E **EXPERIMENTAL STEPS SUMMARIZED** – Look at your procedure and write a 2-3 sentence summary explaining what you did. DO NOT COPY STEPS!

C **CALL BACK AND SUMMARIZE RESULTS** – Summarize the data you obtained from your experiment. Include numbers and averages in data. Do not explain how or why you obtained the data.

C **COMPARE RESULTS TO HYPOTHESIS** – Rewrite your hypothesis. Look at the summary of the results above. Compare the results of your experiment with your hypothesis. State whether your hypothesis is right or wrong. (It is ok to be wrong.) Which of the data proves or disproves your hypothesis? (If you can cite actual data, you will really impress the reader with your scientific evidence!)

A **ANALYZE YOUR RESULTS** – Why do you think you obtained the data that you observed in your experiment? How can you explain what happened? Now is the time to make judgments, state ideas, make conjectures, identify patterns, and list reasons. Now it's time to show off your intelligence, abstraction ability, and inductive reasoning skills.

L **LAPSES** – Report ALL mistakes, problems, and possible experimental errors. (Remember it's better for you to point out your own errors than to have someone else point them out. It makes others see that you really understand!)

L **LIGHT BULB** – List at least two concepts you learned, and one question for future research. The concepts usually answer or explain the problem.

Science Fair Project Checklist

Your project will be judged on how well you follow the scientific method or engineering design process. Use this checklist to make sure that you have included all necessary information.

- ◻ Was my project approved by my science teacher?
- ◻ Is my project idea original?
- ◻ Does my project look neat and appealing?

Purpose:

- ◻ What is my project about?

Prediction or Hypothesis:

- ◻ What do I think will happen?
- ◻ Why do I think that?
- ◻ IF writing a hypothesis, did I use an if, then, because statement?

Materials:

- ◻ Did I list ALL materials for my experiment?

Procedure:

- ◻ Did I explain my experiment in detail?

Observations/Results:

- ◻ Did I collect my data by conducting a minimum of three trials?
- ◻ Did I use graphs, charts, drawings, pictures, etc. to display results?

Conclusion:

- ◻ Did I answer my purpose?
- ◻ Did I summarize my investigation?
- ◻ Did I explain whether or not my prediction/hypothesis was verified?
- ◻ Did I analyze my results and give proof from my investigation?
- ◻ Did I explain what I learned and share next steps?

How to Create a Backboard

When you plan your science fair backboard, remember this is a case in which you CAN judge a book by its cover. If you do a really good job at completing your display everyone will stop to look at your project. However, if you do a messy job, no one will take the time to discover all the fascinating research you have done or look at the results of your detailed experiment.

Plan Your Board: Make a small sketch of where everything will go. Lay it out before you glue anything down to make sure it looks good.

You should have the following components on your board:

1. Title: Make it fun!
2. Problem/Purpose
3. Hypothesis/Prediction
4. Background/Research (optional)
5. Materials
6. Procedure
7. Data Tables
8. Graphs
9. Photographs
10. Conclusion
11. Bibliography

Colors and Text:

- You can use the labels that come with your board or create your own on the computer.
- Use colors that are appealing. They should contrast with your board color. If you have a white board, make your text a bright color. Try backing your text with colored paper to make your words pop.
- You must type your text or print it neatly. Use stencils or premade letters if you prefer. Make your lettering large enough for everyone to see.

Finishing Touches:

- Make sure you proofread all your written work.
- Make your project colorful.
- Lay out your project to decide which placement looks best before gluing.
- Erase all pencil guidelines.
- Add stickers, clipart, or borders to make it look good.
- Student name and photos of the student should NOT be seen on the front of the board.

Backboard Example

Appendix A: Categories

1. **BEHAVIORAL/MEDICINE AND HEALTH SCIENCES:** The science or study of the thought processes and behavior of humans and other animals in their interactions with the environment studied through observational and experimental methods. The science of diagnosing, treating, or preventing disease and other damage to the body or mind.

2. **CHEMISTRY:** The science of the composition, structure, properties, and reactions of matter, especially of atomic and molecular systems.

3. **EARTH SCIENCE:** The study of sciences related to the planet Earth (geology, mineralogy, physiography, oceanography, meteorology, climatology, seismology, geography, atmospheric sciences, etc.)

4. **ENGINEERING:** The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, processes, and systems. The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical machines and systems.

5. **ENVIRONMENTAL SCIENCES:** The analysis of existing conditions of the environment.

6. **LIFE SCIENCES:** The science concerned with the study of living organisms, including biology, botany, zoology, and microbiology.

7. **MATHEMATICAL SCIENCES:** The study of the measurement, properties, and relationships of quantities and sets, using numbers and symbols. The deductive study of numbers, geometry, and various abstract constructs, or structures. Mathematics is very broadly divided into foundations, algebra, analysis, geometry, and applied mathematics, which includes theoretical computer science.

8. **PHYSICS AND ASTRONOMY:** Physics is the science of matter and energy and of interactions between the two. Astronomy is the study of anything in the universe beyond the Earth.