Findley Elementary
SCIENCE FAIR

GETTING STARTED PACKET

Includes information on the scientific and engineering methods as well as project ideas

The Science Fair gives children the opportunity to use scientific or engineering methods to answer questions they develop from their own observations and to share what they learn with the school community. All Findley students, Grades K-5, are eligible to participate.

Findley Science Fair Website:

http://www.findleypto.com/science-fair/

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SCIENTIFIC METHOD

Step 1: Ask a question.*
Ask a question based on your own observations in an area of science, math, or technology that interests you: “How does _____ affect _____?”

Step 2: Research your question.
List what you already know that can help you answer your question. Learn more at the library, on the internet, or from a scientist. Do you need to revise your question?

Step 3: Form a hypothesis.
Predict the answer to your question: “I think that _____.”

Step 4: Test your hypothesis.*

Design an experiment. Write a step-by-step procedure to test your hypothesis. Identify the variable you will change. Identify the data you will measure or observe each time you change the variable. Identify factors that could affect the data, and make sure those factors will not change during the experiment.

Gather supplies. List the supplies you need to complete the experiment and gather them with help from your parents. Will your experimental procedure work? You may need time to troubleshoot your experiment. Will you be able to finish the experiment in time for the Science Fair?

Perform the experiment. Prepare a table to record the data for each value of your variable. Collect the data. Repeat the experiment to verify your results.

Step 5: Analyze the data.*
Show the data in a way that is easy to understand using a table, chart, or graph. You may also use photos or drawings to illustrate what happened. Describe the data in your own words. Do you see a pattern? Did anything unexpected happen?

Step 6: Write a conclusion.
Was your hypothesis correct? Why? Do your results suggest a new question?

Step 7: Communicate the results.
Create a display to share your results with the school community at the Science Fair.

*See the next page for an example and some guidelines for parents to help with forming the question, performing the experiment and analyzing the data.

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HOW TO BEGIN YOUR EXPERIMENT

Think of a good question based on your own observations!
Revise the question until you can form a hypothesis
you can test using the SCIENTIFIC METHOD!

An Example for Children:

You like to play ball outside in winter. You wonder if a ball bounces higher when it is cold.

You ask "How does temperature affect the height of the ball's bounce?" That is your **question**.

You guess the answer is "A cold ball will bounce the highest." That is your **hypothesis**.

To experiment, you drop a ball and measure how high it rises on the first bounce. Your **variable** will be the temperature of the ball. Your **data** will be the bounce height. You will keep all other factors that you think might affect bounce height (the ball, height, floor) the same for each drop. You repeat the experiment several times to be sure of the results.

The Fine Print for Parents:

- To simplify our language for children, **variable** refers to the independent variable in the experiment; **data** refers to the dependent variable; **factor** refers to any variable that could add bias or additional variability to the experimental data.
- The **question should be simple, but it should not be answered by a simple yes or no**. "How does temperature affect the height of a ball's bounce?" suggests a better experiment with several values for the variable than "Does temperature affect the bounce of a ball?" However, for younger children a specific comparison that limits the variable to two values is appropriate: "Which bounces higher, a cold ball or a warm ball?"
- The **question should not be answered by a survey of the personal opinions or preferences** of family, friends, or classmates. Experiments using human subjects will be screened for safety and consent.
- The **hypothesis does not have to be proven correct** for the experiment to be a success.
- The **variable does not have to affect the data in expected ways** for the experiment to be a success.
- The **experiment should have only one variable** that changes.
- The **experiment should be practical and repeatable** and your child should repeat the experiment several times for each value of the variable.
- The **experiment should not be a simple demonstration**. Mixing baking soda and vinegar is a fun demonstration of a chemical reaction. Your child can make it an experiment by varying the amount of baking soda or vinegar.
- The **data should be measured in units to suit your child's mathematical skill**. Using the bounce experiment as an example, if your **five**-year-old can only count to 10, it may be best for her to mark bounce heights on a paper tape and display the tape as data. She can report the quantitative comparison in its simplest form: whether the cold ball bounced higher or lower than the warm ball. If your **eight**-year-old can count past 100, he can certainly measure bounce height to the nearest centimeter, but if he does not yet understand averages, it may be best for him to display bounce heights as individual vertical bars in a graph and report the general trend. If your **eleven**-year-old can calculate averages, she is ready to graph the average bounce height for each temperature.

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SAMPLE QUESTIONS

These sample questions show how to revise a question to limit the scope of the experiment for success using the scientific inquiry method.

Which freezes faster, salt water or fresh water?
Which boils faster, salt water or fresh water?
Which dissolves a sugar cube faster, hot tea or iced tea?
Which floats higher in water, syrup or oil?
Which type of cup keeps hot chocolate hot the longest?
What colors heat the most under sunlight?
How does soil temperature affect the time it takes a bean seed to germinate?
Which juice contains the most vitamin C, fresh or frozen?
Which brand of AA battery lasts the longest?
How does the distance from a light affect the size of plastic minifigure's shadow?
How does the angle of a ramp affect the distance a toy car will roll?
Which type of ball bounces the highest?
How does ball temperature affect the height of its bounce?
How does magnet temperature affect the strength of its attraction?
How does the launch angle affect the distance you can shoot a rubber band?
Which falls faster, a golf ball or a ping pong ball?
How does string length affect the period of a pendulum?
How does distance from the center affect the weight required to balance a seesaw?

For more ideas and inspiration, visit

www.sciencebuddies.com

pbskids.org/zoom/activities/sci.

or just search online (with parent guidance).

Please do not think in any way that you need to purchase an experiment.

IMPORTANT: Remember to read the 'Guidelines for Display' before you bring your display board to school. Guidelines are available on the website: http://www.findleypto.com/science-fair/

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ENGINEERING METHOD

NOTE TO PARENTS: The method listed below is more detailed than the 5 steps listed on the registration form, but the ideas are the same. The engineering method is more flexible and iterative than the scientific method.

Step 1: Define your problem.
Identify a need or problem you can solve by answering the following questions: What is the problem or need? Who has the problem or need? Why is it important to solve? Then you can phrase your problem: ___[who]__ needs (or wants) ___[what]__ because ___[why]_. Example: **I** want to build a **device that will water my plants** because **I go on vacation and can't water them myself**.

Step 2: Research your problem.
List what you already know that can help you solve your problem. Learn more at the library, on the internet, or from an engineer. Do you need to revise your problem?

Step 3: Specify Requirements.
List the important characteristics your design must meet in order to be successful—your success criteria. Also, document any constraints on your design (for example materials or size of structure).

Step 4*: Brainstorm solutions and choose an idea.
Think of possible solutions that meet the requirements, and then choose an idea you'd like to pursue. In some cases, it may not be the very best idea due to constraints on time, budget, parental consent, etc. However, choose the best idea you can reasonably implement!

Step 5*: Develop a build plan and create a prototype.
List the steps needed to complete your design idea and then follow them. The result is called your prototype.

Step 6*: Develop a test procedure and then follow it to test your prototype.
Did your prototype meet all of your success criteria? If not, and you have time and resources, you may modify your design and test again. Even if all success criteria are met, you may have ideas for improvements that you want to share with others or try out yourself.

Step 7: Communicate the results.
Create a display to share your results with the school community at the Science Fair!

*When you follow the engineering method, Steps 4-6 are often iterative. An initial plan may not meet all requirements, and modifications may be required. If you have the time and resources to go through multiple build plans, you are encouraged to do so!

Resources for engineering project ideas:

http://pbskids.org/designsquad/ (this one has some fun videos)

http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml