School District of Manatee County

Elementary

Science & Engineering Fair



*Science & Engineering Fair (SEF) participation offers students the opportunity to utilize knowledge and skills as scientists do in the real world.*

Research Plan and Investigation Report

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Introduction**

A Science & Engineering Fair (SEF) project is one of the best experiential learning experiences for a student. He or she will gain a more thorough understanding of scientific investigation and thus additional practice with the Nature of Science state standards. Our society relies more on science and engineering every day, and the SEF is a great way for students to become more knowledgeable about how the world around them works. Winning projects will receive recognition and secondary winners will compete for the opportunity to attend the State Fair, providing them with a chance to win scholarships and cash prizes.

At the elementary level, the STEM teacher is the organizer for the school SEF, responsible for communication with parents, students, and staff about important dates and deadlines, and will support classroom teachers with required forms and information.

In middle and high school, each school will have a SEF Advisor whose role will be to run the school-based fair, and to support participating students and teachers through the inquiry and competition process.

**Components of a Scientific Research Plan and Investigation Report**

* Title Page
* (Abstract)
* Table of Contents
* Problem/Question
* Hypothesis
* Background Research
* Variables and Hypothesis
* Materials and Procedures
* Experimental Procedure
* Data Analysis and Graphs
* Conclusion(s)
* Bibliography
* (Display Board)

**Research Plan**

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

School: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Title of Project: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Adult Sponsor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Where will you complete your experiment?

Home: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ School:\_\_\_\_\_\_\_\_\_\_\_\_

Science Category:

Physical: \_\_\_\_\_\_\_\_\_ Earth/Space: \_\_\_\_\_\_\_\_ Life: \_\_\_\_\_\_\_\_\_ Engineering: \_\_\_\_\_\_\_

What is the **testable question** you are trying to answer or **problem** you are solving?

Describe the methods, materials, and procedures you intend to use:

List any major sources of information that you are using for research. If you are studying animals, please make sure to check with your teacher first and to receive permission.

Parent/Guardian Approval: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_

Teacher Approval: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_

**Things to Consider When Choosing a Topic for your Investigation:**

What type of things do you enjoy in science? There are different science categories your idea may fit into:

***Earth and Environmental Sciences***

These projects should focus on biological or physical interactions with the natural surroundings. Projects may include studies of the ocean and atmosphere in addition to human interaction with the Earth and its resources.

***Engineering***

These projects evaluate the efficiency of different devices or try to improve their function. It should be more than "Can I build...." but instead, "How can I improve..." Engineering goes beyond gadgetry. All prototypes should be tested for their intended purpose, data should be collected, modifications should be made based on the data, and then the prototype should be retested.

***Life Sciences***

These projects deal with processes of living organisms: plants, mold, and animals (including humans). Processes may include growth, maintenance, breathing rate, pulse, learning, memory, vision, etc. Animals (including invertebrates) must be treated humanely.

***Physical Sciences***

These projects involve chemistry, math, physics, and space sciences which deal primarily with non-living materials. Topics may include properties of matter, physical and chemical changes, various forms of energy, forces, motion, etc.

***Additional forms and reviews are required for any project dealing with hazardous materials, humans, molds, and vertebrates. These MUST be reviewed PRIOR to experimentation by the STEM Competition Committee and approved.***

**Research to Help Support Your Investigation**

After choosing your investigation category it is important to complete some research to better understand what your investigation is about. How do you complete research? You need to read! The information you gather while completing your research will assist in developing your hypothesis, designing your experiment or prototype, collecting data, drawing conclusions, and communicating like a real scientist. Make sure to include at least the title, author, and date published or accessed.

Books or Articles about my topic:

Internet Websites about my topic:

People I can talk to about my topic:

**Hypothesis**

The purpose of stating your hypothesis is to identify what you think will happen during the experiment and to guess at the outcome of the experiment based on the research that was collected.

The hypothesis is to be worded as an “ If … then …, because …” statement, explaining the cause-and-effect relationship that is being investigated. Evidence from your research needs to be used to support and justify your thinking:

Example (s):

* *Hypothesis for a Testable Question:* **If** I put 30 mL of water in the Huggies diaper, **then** it will absorb the most water **because** Huggiesdiapers have an extra layer of polyfiber material.
* *Hypothesis for a Problem I am trying to solve:* **If** I create a magnetic pocket casing, **then** I will lose fewer items out of my pockets **because** magnets provide a tight seal due to their characteristics.

If \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

then \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Testing the Hypothesis**

The investigation or experiment will help answer your question or solve your problem.

**Materials:**

List your materials:

**Variables:**

A variable is a factor or thing that you will be changing, keeping the same throughout your experiment, or a factor you will be measuring/observing. There are three types of variables:

* *Independent Variable:* This is the thing or factor YOU are changing on purpose!
  + (Think **I**ndependent – **I** changed it!)
* *Dependent Variable:* This is the thing or factor that changes based on what you change. You will be measuring or observing this variable.
  + *(Think* ***D****ependent –* ***D****ata collected.)*
* *Controlled Variable:* These are all the things in an experiment that will be kept the same throughout your investigation.
  + *(Think* ***C****ontrolled –* ***C****onstantly the same.)*

**Example(s):**

*Hypothesis for a Testable Question:* **If** I put 30mL of water in the Huggies diaper, **then** it will absorb the most water **because** Huggies diapers have an extra layer of polyfiber material.

• Independent Variable: Different brands of diapers that are being tested

• Dependent Variable: Amount of water absorbed (measured using mL) by each brand of diaper.

• Controlled Variable(s): temperature of the water, where the water is poured on the diaper

*Hypothesis for a Problem I am trying to solve*: **If** I create a magnetic pocket casing, **then** I will lose fewer items out of my pockets **because** magnets provide a tight seal due to their characteristics.

• Independent Variable: Different types of materials tested to create the pocket casing.

• Dependent Variable: Number of shakes the pant pocket can withstand before losing its contents.

• Controlled Variable(s): same pair of pants, same sized pocket, same items placed in the pocket casing.

The **Independent Variable** that I will be changing in my investigation will be:

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The **Dependent Variable** that will show an effect on my investigation will be:

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The **Controlled Variables** **(Constants)** in my investigation are:

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**Procedure (Designing my Experiment):** What steps will I use to carry out my investigation? It is very important that the steps in developing/designing your investigation are recorded in detail so that anyone would be able to replicate your experiment and end up with the same results.

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If I am answering a question, do I need to draw a picture of how I will set up my experiment? If I am solving a problem, a labeled diagram of the proposed solution is helpful.

**Data Analysis and Results:**

When conducting an experiment or investigation it is important to collect data (information) to prove if your hypothesis is true or false. When you are collecting data, it is important to be as detailed as possible, using labels, dates, and pictures. Once you finish collecting data it is important to record your data/results into a table and then organize it into a chart or graph to easily communicate and demonstrate your findings.

**Data and Results Collected over Time:**

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**Organizing Data and Results into Charts and Graphs:**

Examples:

**Conclusion:**

Your conclusion is a summary of your results and an evaluation of your hypothesis. Use the questions below to help guide you in sharing with anyone interested in what you have learned.

* Did your results support your hypothesis? Identify and explain the types of data you used to give evidence of this.
* What did you learn from the investigation?
* What types of problems did you encounter?
* If you would repeat this investigation, would you get the same results?
* How does your investigation make connections to real life?

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**Bibliography:**

A bibliography lists all the resources you used in your research such as books, magazines, websites, surveys, and more.

The link below can help you in creating a bibliography:

<https://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-bibliography-examples-of-apa-mla-styles>