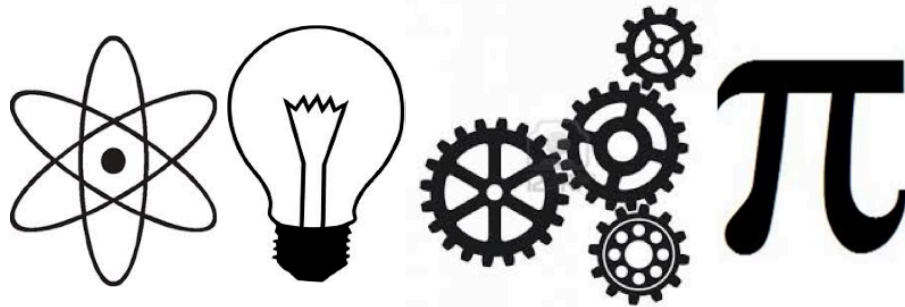


Pasco County Schools

Elementary STEM Fair



Science, Technology, Engineering, and Mathematics

Providing an opportunity for students to utilize science knowledge and skills as scientists do in the real world.

Research Plan and Investigation Report Forms

Student Name: _____

Teacher: _____



Background Information

Providing students opportunities to make meaningful connections to the real world is critical as we develop the skills, behaviors, and dispositions necessary for college, career, and life readiness. Developing a S.T.E.M (Science, Technology, Engineering, and Mathematics) Fair investigation will provide students the opportunity to use science knowledge and skills just as scientists do in the real world. The STEM Fair will provide opportunities to engage in connecting these college, career, and life skills in many ways such as writing clearly, communicating information effectively, collecting and interpreting data, using evidence to justify their thinking, managing time, and providing opportunities to ask “why” leading to the development of an experiment or designing of a solution/innovation.

The information found in this *Elementary STEM Fair Research Plan and Investigation Report Form* document will provide guidance and support in developing the project. Throughout the document there are explanations and clarifications to help better guide student thinking. Students need to complete *Elementary STEM Fair Research Plan and Investigation Report Forms* and are encouraged to keep a journal with more detailed experiences and observations as they complete their investigation.

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Research Plan

The research plan needs to be completed before beginning the investigation.

Student Name: _____ Amanda Novotny _____

School: _____ Wesley Chapel Elementary _____

Address: _____ 29725 Chapel Park Drive _____

_____ Wesley Chapel, FL 33543 _____

Title of Project: _____ Cup Wars _____

Adult Sponsor: _____ Mrs. Novotny _____

Where will you complete your experiment?

Home: _____ X _____ School: _____ Field: _____

Category (see page 4 for clarification):

Physical: _____ X _____ Earth/Space: _____ Life: _____

What is the question you are trying to answer or problem you are trying to solve?

Coffee shops serve coffee in cardboard and Styrofoam cups. Which cup keeps coffee hotter for a longer period of time?

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

By conducting an experiment with 5 trials using hot water, Styrofoam cups, cardboard cups, and a thermometer, I will see which cup keeps water hotter after a 15-minute period.

List any major sources of information that you are using for research. If you are studying animals, please make sure to reference animal care when appropriate.

Starbucks coffee shop manager, Internet, book by owner of Starbucks, Styrofoam, recycling

Parent/Guardian approval: _____ **Date:** _____

Teacher approval: _____ **Date:** _____



Things to Consider When Choosing Your Investigation

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

Physical Science: Do you find yourself wondering why or how things work? If so then you might want to choose Physical Science for your category. Topic examples may include things about matter, electricity, magnetism, sound, light, or energy.

Earth and Space Science: Do you find yourself curious about our Earth or outer space? If so then this may be the category for you. Topic examples may include things about weather, geology (things that make up the Earth such as rocks, fossils or volcanoes), or our Sun, stars and planets. Just a reminder, a model is not an experiment, so be careful when thinking about your investigation.

Life Science: Do you like plants, animals or are curious about why humans behave certain ways? If so then Life Science may be the category your investigation could fall under. (There are special rules anytime you work with animals. Please talk to your teacher to ensure you are following any rules).

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 (if applicable), 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:

Pour Your Heart Into It: How Starbucks Built a Company One Cup at a Time by: Howard Schultz and Doris Jones Yang

Internet Websites about my topic:

www.starbucks.com

www.ehow.styrofoamvspapercoffeecups.com

People I talked to about my topic:

Kathy Brewster, manager, Starbucks Coffee Shop, Bruce B. Downs Blvd.



Statement of Question I am Answering or Problem I am Trying to Solve

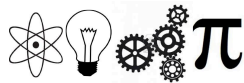
Once a category has been chosen and research has been conducted begin to think about what type of question you are going to answer OR type of problem you are going to solve.

Example(s):

- *Question I am going to answer:* “Which brand of diaper is the most absorbent?” This is a good question which would allow students to go through the scientific process manipulating only one variable; the type of diaper.
- *Problem I am going to solve:* “I am constantly losing things out of my pant pockets. How can I create a pant pocket that keeps items inside?” This problem would allow the student to design a solution and test its effectiveness.

My question I am going to answer or problem I am going to solve:

Do cardboard or Styrofoam cups keep water hotter after a 15-minute time period? _____



Hypothesis

The purpose of creating your hypothesis is to identify what you think will happen based on research that was collected. The hypothesis needs 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):

- *Question I am going to answer:* **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.
- *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 I put 100 ml. of hot water (85° C) in a 266 ml. Styrofoam cup and a 266-ml. cup, then after 15 minutes the water in the cardboard cup will be hotter when measured with a thermometer than the water in the Styrofoam cup because most large coffee shops serve coffee in cardboard cups.



Testing My Hypothesis

Now that you used some research to develop your hypothesis it is time to begin your investigation to help answer your question or solve your problem. The next few pages will help guide you in setting up and conducting your investigation.

Materials: What types of materials will be used to conduct your investigation? Make a list of them here using either words or pictures.

5 – 266 ml. Styrofoam cups
5 – 266 ml. cardboard cups
1 teakettle
1,000 ml. of hot water (85°C)
2 thermometers (standard)
1 stopwatch
Journal and pencil

Variables: A variable is a fancy word for things that you will be changing or keeping the same throughout your investigation. There are 3 types of variables:

- *Independent:* This is the variable that will be changed in your investigation.
- *Dependent:* This is the variable that will show an effect in your investigation.
- *Constants:* These are all the things that will be kept the same throughout your investigation to make sure it is valid.

Example(s):

Question I am going to answer: **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:* The different brands of diapers that are being tested (Huggies, Pampers, Luvs)
- *Dependent variable:* The amount of water absorbed (measured using mL) by each brand of diaper.
- *Constants:* temperature of the water, location in the diaper in which water is poured

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:* The different types of materials tested to create the pocket casing.
- *Dependent variable:* The number of shakes the pant pocket can withstand before losing its contents.
- *Constants:* same pair of pants and sized pocket, same items placed in the pocket casing

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

The cup – Styrofoam or cardboard

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

The temperature of the water in each cup after 15 minutes.

The **Constants** in my investigation are:

amount of water per cup, thermometer, initial water temperature, time intervals, environmental temperature, size of cups

Procedure (Designing of My Investigation): What steps will I use to carry out my investigation? It is very important that the steps in developing/designing your investigation are recorded precisely so another student can replicate the investigation.

1. Gather all necessary materials to conduct experiment.
2. Pour 200 ml. of cold tap water into a teakettle and bring to a temperature of 85°C.
3. Measure and pour 100 ml. of 85° C water into a 266 ml. Styrofoam cup and 100 ml. of 85° C water into a cardboard cup.
4. Place a thermometer in each cup.
5. Record initial temperature.
6. Set timer for 15 minutes.
7. After 15 minutes record temperature of each cup.
8. Repeat steps 2-7 for four more trials.

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 needs to be sketched here.



Data and Results

When conducting your investigation it is important to collect some data (information) to help either prove or disprove your hypothesis. When you are collecting data please make sure to be as precise as possible in using labels, dates, and even pictures. Once you finish collecting your data it is important to record your data/results into a table and then organize it into a chart or graph to easily communicate your findings. Please use additional pages or a journal to record your data and organize it into charts, tables, and graphs.

Data and Results collected over time:

See attached papers for data collected from the five trials and graph of results.

Organizing my Data and Results into Charts, Tables, and Graphs:



Conclusion

During your investigation you have learned many new things including whether or not you were able to prove or disprove your hypothesis. Your conclusion should be a summary of your results and state whether or not your investigation supported your hypothesis. Use the questions below to help guide you in sharing what you learned.

- Did your results support your hypothesis? Identify and explain the types of data you used to prove or disprove your hypothesis.
- What did you learn from the trials you conducted in your investigation?
- What types of problems did you encounter throughout your investigation?
- If you conducted this investigation again, what would you do differently?
- How does your investigation make connections to real life?

In my hypothesis, I stated that the water in the cardboard cups would be hotter than the water in the Styrofoam cups when measured with a thermometer after 15 minutes had lapsed. I based my hypothesis on my research and the fact that most coffee shops serve their product in cardboard cups. I found that my hypothesis was incorrect. In each trial, the water in the Styrofoam cup remained anywhere between two and five degrees higher than the water in the cardboard cup. The results were consistent in each of the trials I conducted. All of the events of the experiment were controlled. If I were to conduct this experiment again, I would allow more time to elapse since most people do not consume a cup of coffee within 15 minutes of purchasing it. Daily, I go to Starbucks on my way to work to pick up my morning caffeine boost. My coffee is always served to me in a cardboard cup with a cardboard collar around it to prevent my hand from being seared. Yet minutes after arriving at work, my coffee is no longer piping hot. I wondered why they didn't just serve their beverage in a Styrofoam cup. During my research, I also learned that cardboard cups require less storage space than Styrofoam, but that it takes more natural resources and energy to produce cardboard cups. Cardboard cups require less storage space than Styrofoam, but that it takes more natural resources and energy to produce cardboard cups. Cardboard cups are also more expensive to purchase and take more than 20 years to break down in a typical landfill. So why not Styrofoam cups? Perhaps the fact that the main ingredient in Styrofoam is styrene, which can be found in packing materials, insulation, carpet, and is a product of tobacco smoke. Some studies even suggest that exposure to styrene may increase the risk of some cancers, lead to liver and kidney damage, and cause gastrointestinal problems. After conducting my experiment and analyzing the research, I think the best choice of a cup for my next trip to the coffee shop is a reusable tumbler from home.



Abstract

The abstract is the part in your project log in which you summarize the entire investigation. Remember to include things such as the questions you were trying to answer or problem you were trying to solve, hypothesis, procedure, data/results, and conclusions based on evidence collected.

Student Name: Amanda Novotny

Project Title: Cup Wars

School: Wesley Chapel Elementary

Coffee drinkers everywhere have their own rituals and ways of consuming hot, steamy servings of the addicting, caffeinated beverage. However, when it comes to purchasing the liquid gold at a coffee shop, it is usually delivered in a cardboard cup surrounded by a cardboard collar instead of a Styrofoam cup. This project looks at cardboard versus Styrofoam cups when it comes to keeping liquid hot. I wanted to know if Styrofoam or cardboard was a better insulator, thus explaining why coffee shops chose one over the other. To begin, 100-milliliters of water (constant) was poured into a 266-milliliter Styrofoam cup and cardboard cup of the same size (independent variable). After 15 minutes, the temperature was taken and recorded (dependent variable). Based on my research, I hypothesized that the water in the cardboard cup would retain a higher temperature than the water in the Styrofoam cup. The experimental results did not support my hypothesis. The Styrofoam cups consistently kept the water between two and five degrees higher than that of the cardboard cup. Although Styrofoam is a better insulator, I found in my research a barrage of health risks associated with the product. My next trip to the coffee shop will have me toting my own reusable insulated tumbler. Safe, hot, and environmentally responsible.



Acknowledgements

Who helped you with your project?

Backboard Suggestion

The following is a suggested layout for your backboard. You need to make sure that the abstract is in the lower left hand side of the board.

Problem/Need	Title	Data and Results
Hypothesis		
Materials/Equipment	Procedure	Tables and Graphs
Abstract	Labeled Diagrams or Pictures of Investigation or data as it's being collected	Conclusion