Amgen Award for Science Teaching EXCELLENCE

2008
Winning Lesson Plan from Corbin, Kentucky

Battle of the Diapers

by Melissa Evans
Corbin Middle School

Subject: Integrated Science
Grade Level: Seventh
Duration: 4–5 Days

Overview and Purpose

This lab experience is a culminating activity to be used after the scientific method has been introduced. Students will conduct research about the composition and absorbency of diapers to formulate a hypothesis, design a plan to find out which diaper is most absorbent, make observations, collect and record data, and draw conclusions after careful observations. They will write a feature article like the ones you find in *Consumer Reports Magazine* to report their scientific findings and to make recommendations.

How is this plan innovative?

This instructional plan is innovative because it gives students the opportunity to discover the answer through experimental design. The learning is guided by the inquiry method. Instead of students being lectured and given a procedure to follow, they work in teams and devise a plan to solve the problem. It is also innovative because I have created three versions of the lesson than can be differentiated by ability level. However, I do not believe in ability grouping for every activity. It is suitable for this one.

Description of Larger Text

This unit provides the background for students to apply the concepts of the scientific method and experimental design. Students will be able to:

- Understand the basic steps of the scientific method
- Identify a testable question that leads to a proposed hypothesis
- Design a plan to investigate a testable question
- Develop and perform a scientific investigation
- Identify the independent/manipulated variable and the dependent/respondent variable
- Create a standard for comparison
- Interpret and evaluate data
- Draw conclusions
- Formulate new questions based on unexpected results

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Educational Standards

Science as inquiry, Kentucky Program of Studies and National Science Standards

Objectives

Students will:

- Formulate a testable hypothesis
- Identify resources needed to conduct an investigation
- Design appropriate protocol for testing and conducting a scientific investigation
- Record observations and data using charts and graphs
- Evaluate whether data supports hypothesis
- Identify errors and propose further investigations
- Create graphs that communicate data
- Communicate results

Materials

- Two brands of diapers
  (I have used one name brand and one generic or two name brand diapers)
- Water
- Measuring device
- Timer
- Graph paper
- Pre-recorded diaper commercials
- Rulers
- Balance

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Procedure

Review

1. Begin with a review of the previous lesson:
    a. Review the steps of the scientific method.
    b. Discuss independent and dependent variables.
    c. Discuss the need to keep some variables constant.

Engage Activity

2. Use this activity to capture the classes' attention.
    a. Show the class two diaper commercials that the teacher pre-recorded from television.
    b. Ask what scientific data the commercials presented to back up their claims.
    c. Ask how one could find out which diaper is most absorbent.
    d. Show an edition of *Consumer Reports Magazine* and discuss how the scientists go about finding the best brand for various products through experimentation.
    e. Tell the class they are going to pretend to work for *Consumer Reports Magazine* as a research scientist to find out for the public which brand of diaper is most absorbent.

Explore

3. Before students explore, allow time for the students to research each brand of diaper. I print off the information found on the packaging as well as information from their web sites. I also tell the class to measure the diapers, make observations, and record their findings in a data table or you may give them a pre-printed one like the one that is included on page 5. Once the research has been done, then a hypothesis can be formulated and the experimentation can begin. Hand out the lab sheets to the groups. I have differentiated this lesson by ability groups, so I have three versions of the assignment—low, middle, and high. I make sure my students have no idea of how I am grouping and that they are not aware of the varied instructions. I group many ways throughout the year, depending on the activity and my purpose, so students do not suspect they are being ability grouped. The handout that I give the high group has the problem stated. However, they are instructed to devise a plan to find out which diaper is most absorbent, create a data table and construct a graph. They also have to identify variables, the control, and constants. They must get approval before they begin. The middle group receives an outline of experimental design, and the low gets more specific instructions and a pre-made data table.
    After the experimentation takes place, have students create graphs from their data tables and do careful analysis of the data. Students are then instructed to draw conclusions based on their observations and analysis of the data. Also, they are to try to speculate on what material makes diapers absorbent.

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Procedure (Cont'd)

Explain

4. Have each group report their findings to the class, discuss any problems that occurred, and any other questions that came from unexpected results. Ask each group what they concluded about the material that makes diapers absorbent. After the discussion, have students tear away the lining of the diaper to reveal the polymer. Now, the students should be ready for a lesson on this substance. It is called polyacrylate which is a super absorbent polymer. Explain that a polymer is a long chain of repeating molecules, and some can soak up to 800 times their weight in water. Some polymers are natural like cotton, which was used before disposable diapers came along. Discuss that salt tends to break the bonds that hold polyacrylate and the water gel together. Urine is about 1% salt. Ask if this experiment was repeated using urine rather than water would the diaper hold more or less liquid. Allow students to extract the gel inside the diaper and pour salt on it to witness the bond being broken.

Extend

There are numerous activities that can serve as extensions. One would be an Internet scavenger hunt that can be found on sciencespot.net that involves the history of polymers. Students could explore National Geographic's website. There they will find an interactive page on polymers. The address is: nationalgeographic.com/resources/ngo/educational/plastics/. Another activity would be for students to research other uses of polymer. They will find that it is being used in forestry, gardening, and landscaping as a means to conserve water. This could be a springboard for another experiment involving the growth of plants or how much water could be conserved by using the polymer for plant growth.

Evaluate

As a way to evaluate the student's learning, I would assign students to write a feature article like one they would find in *Consumer Reports Magazine*. I would read examples from the magazine to serve as models. Students would be required to present their findings and use test features like charts, graphs, headings and captions.

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Diaper Research Data Table

Brand	Mass	Length	Width	Height	Other
Brand X					
Brand Y					

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Battle of the Diapers

Instructions

1. Devise a procedure to solve the problem of which brand of diaper is most absorbent. List this in steps.
2. Remember all the stages of experimental design from hypothesis to conclusion.
3. Create a data table to record the amount of water that is absorbed.
4. Decide what type of graph would be most appropriate to display the data. Graph the data.
5. Analyze the data and draw conclusions.

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Instructions

Use the outline to guide you through experimental design and solve the problem of which brand of diaper is most absorbent.

1. Identify the problem or purpose:
2. Hypothesis: Use your research to hypothesize which diaper will absorb the most water.
3. Materials:
4. Independent Variable:
5. Dependent Variable:
6. Control:
7. Constants:
8. Procedure: List in order the steps you will follow to solve the problem.
9. Data Table:
10. Graphs: Create a bar graph with the data.
11. Analysis: Which diaper absorbed the most? How much more?
12. Conclusion:

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Instructions

Follow the procedure to find a solution to the problem of which brand of diaper is most absorbent.

1. Problem: What are you trying to solve?
2. Hypothesis: Which diaper do you think will be the most absorbent and why? Refer to the data table that you constructed during the research phase.
3. Materials: Two brands of diapers, Water, 250mL beaker, Timer, Container
4. Independent Variable: What are you testing?
5. Dependent Variable: What are you measuring?
6. Control: What is your standard for comparison?
7. Constants: What things do you need to do the same to ensure accurate results?
8. Procedure: List in order the steps you need to follow to solve the problem.
9. Data Table:

Brands	Amount Absorbed
Brand X	
Brand Y	

10. Graph: Construct a bar graph. The X axis should represent the brand of diapers and the Y axis should represent the amount of water absorbed.
11. Analysis: Which diaper absorbed the most? How much more?
12. Conclusions: Does the data support your hypothesis? Did any errors occur?