Experiment 37— Design Your Own Experiment

Introduction

Researchers are curious and inquisitive. They observe events and investigate what causes them. Perhaps you have wondered why the apple slices in your lunch bag are brown by lunchtime, but your friend's are still creamy white. Maybe you want to know why your homemade cupcakes become moldy faster than the ones you buy. If so, you may enjoy a career in nutrition research or food science.

A nutrition researcher might conduct studies designed to see how a vitamin works in the body. Some food science researchers look for new ways to keep food from spoiling quickly. Others may create new food additives and study how they work.

When researchers want to solve a scientific problem or find answers to a question, they use a tool called the scientific method. The **scientific method** is a procedure that helps them study and learn about the world around them. The scientific method has six steps.

1. **State the objective.** The objective, or purpose, is the problem a researcher wants to solve or the question he or she wants to answer. The purpose is usually stated as a question. For example, a food scientist might ask, "What role do eggs play in muffins?" A nutrition researcher might ask, "How much calcium do teenagers need to build the strongest bones?"
2. **Conduct background research.** After stating the objective, researchers often do background research. This research helps them find out what is already known about the question they have asked. Background research may include reading at the library and searching on the Internet. It could include interviewing other scientists or visiting places like a local food processing plant or farm. Thinking about what they learned from the background research helps researchers state a hypothesis.
3. **State the hypothesis.** A **hypothesis** is an educated guess of the answer to the question posed in the study's objective. Suppose your objective is to answer "How can the amount of bacteria on kitchen sponges be reduced?" In your background research, you discovered heat helps kill bacteria. However, you do not know how hot the bacteria on sponges must get before they die. Now you are ready to make a hypothesis. The hypothesis is usually one sentence that states the topic of the experiment, the variable that will be tested, and the expected results. Your hypothesis might be "The amount of bacteria on kitchen sponges will decrease as the temperature of the water in which they are rinsed increases because heat kills bacteria." In this example, the topic is the amount of bacteria on sponges. The variable is the temperature of the rinse water. The expected result is that fewer bacteria will be found on sponges as the rinse water temperature rises.

Words to Know

scientific method. A tool used to solve a scientific problem or find answers to a question.

hypothesis. An educated guess of the answer to the question posed in a study's objective.

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procedure. The steps a researcher will follow to gather information to achieve an objective and test a hypothesis.

4. **Create a procedure.** A **procedure** is the steps a researcher will follow to gather information to achieve the objective and test the hypothesis. For example, to test the hypothesis identified in Step 3, a researcher might follow these steps:
   A. Draw lines to divide a paper plate into five equal sections. Number the sections from 1 to 5.
   B. Bring ¼ cup of water to a boil. Add two teaspoons of sugar and one packet of plain gelatin. Stir until the gelatin dissolves. Remove the pan from the heat and let cool two minutes. Pour the mixture onto the paper plate and chill until firm (about 1 hour).
   C. Use a permanent marker to draw lines on the top of a new, never used kitchen sponge to divide it into five equal parts. Wet the sponge with clean, clear water.
   D. Use the bottom of the damp sponge to scrub the kitchen counters and sink.
   E. Use sharp scissors to snip the sponge into five pieces along the lines drawn in Step C. The five pieces will become the following five variations:

      Variation #1: This is the control. Place the sponge piece on a clean paper towel labeled *Variation #1.*

      Variation #2: Rinse the sponge piece under cold running water for 1 minute. Place it on a clean paper towel labeled *Variation #2.*

      Variation #3: Rinse the sponge piece under hot running water for 1 minute. Place it on a clean paper towel labeled *Variation #3.*

      Variation #4: Add 1 cup of water to a small, clean saucepan. Place a thermometer in the pan, making sure it does not touch the bottom or sides of the pan. Place the pan over medium heat. When the water reaches 150°F (66°C), place the sponge piece in the water for 1 minute. Place the sponge piece on a clean paper towel labeled *Variation #4.*

      Variation #5: Add 1 cup of water to a small, clean saucepan. Place the pan over medium heat. When the water comes to a boil, place the sponge piece in the water for 1 minute. Place the sponge piece on a clean paper towel labeled *Variation #5.*
   F. Squeeze any excess water out of Variation #1. Gently rub the bottom of the sponge piece on the gelatin segment on the paper plate labeled #1 to transfer any bacteria on the sponge to the gelatin. Wash your hands well with soap and warm water. Repeat this step for all the other variations.
   G. Put the paper plate in a plastic bag that can be resealed. Tightly close the bag. Place it in a warm location for three days. Do not open the bag.

      The procedure describes the samples, or the items being examined in the experiment. In this experiment, one sample is one section of the sponge. All samples used in an experiment must be the same if the results are to be accurate. In the above procedure, all the samples were taken from one brand new sponge.

      The procedure also describes the variables, or factors being tested. Each sample must be exposed to only one variable. The control is not exposed to any variables. In this experiment, the control is not rinsed. The variables are the different temperatures of rinse water. If you

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expose a sample to more than one variable, you won't be able to tell which variable caused the change. For instance, if one variation had been rinsed with hot soapy water, it would not be possible to know if it was the hot water or the soap that caused the change.

5. **Collect data.** In this step, researchers make careful notes of their observations. They describe what they discovered after completing the procedure. They record everything they note, even if it does not support their hypothesis. Data that do not support the hypothesis are important, too. They can lead to new discoveries. In the sponge experiment, a researcher might record any changes he or she saw on the surface of the gelatin. For instance, one result might be that more bacteria grew on Variation #1 first. Another result may be that no bacteria grew on Variation #5. Often, the data are recorded in Data Tables like those in many of the experiments in this book. The researcher may also draw pictures or take photographs to illustrate his or her observations.
6. **Reach conclusions.** After reviewing and thinking about all the results, researchers interpret the data and draw conclusions about them. If the conclusions agree with the hypothesis, then they support the hypothesis. If not, the researcher needs to identify why the hypothesis was not supported. Perhaps there was a problem with the procedure. Perhaps the researcher needs to propose a new hypothesis to explain the observations. In the sponge experiment, researchers may conclude the hypothesis was true because they observed fewer bacteria had grown on the segments of gelatin rubbed with sponges heated at higher temperatures.

Objective

After completing this activity, you will

- learn how nutrition and food science researchers design experiments.

Procedure

1. Think about a food or nutrition problem you want to solve or a question you want to answer. State the objective of your study on the data sheet.
2. Conduct background research to learn more about the problem you want to solve or question you want to answer. You may need to visit the library, use the Internet, interview experts in the community, or visit local businesses. Summarize your research on the data sheet.
3. Make a hypothesis about what you expect you will discover about the problem or question you will research. Write your hypothesis on the data sheet.
4. Create the procedure you will follow to test your hypothesis. Be sure to identify the sample, control, and variables you will use. Write the procedure you plan to use on the data sheet. Be sure to include enough detail that others can easily understand what you plan to do.
5. Create a Data Table to record your observations.
6. Review your observations carefully. Think about what you learned and the conclusions you can reach. Also, think about how you could improve the procedure to learn more about the problem or question.

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Name _____ Date _____ Period _____

1. Study objective: _____

2. Background research findings: _____

3. Hypothesis: _____

4. Procedure: _____

Sample: _____

Variables: _____

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5. Data Table:

6. A. What conclusions can you reach after reviewing the data you collected? _____

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B. What changes would you make in the procedure if you were to repeat this experiment?

_____

_____

C. How do your conclusions agree with your hypothesis? _____

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_____

D. How do your conclusions disagree with your hypothesis? _____

_____

_____

E. What new hypothesis can you propose based on your observations? _____

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