

# Integrating Technology Across the Curriculum

A Database of Strategies and Lesson Ideas

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Date Created	09/21/1997	Date Modified	05/23/2002
Lesson title	Using Probeware in Science Activities		
Objectives/Purposes	<p>NCTM MATHEMATICS STANDARDS FOR GRADES K-4 AND 5-8:</p> <ul style="list-style-type: none"><li>• STANDARD #10: Measurement</li></ul> <p>NSTA SCIENCE STANDARDS FOR GRADES K-4:</p> <ul style="list-style-type: none"><li>• Science as inquiry</li><li>• Physical science</li></ul> <p>LESSON OBJECTIVES/PURPOSES:</p> <ul style="list-style-type: none"><li>• Tell why objects made of various substances have the same temperatures even though humans sense them as having different temperatures.</li><li>• Describe the process by which heated objects become cooler.</li><li>• Tell the difference between precision and accuracy in measurement.</li></ul> <p>ISTE NETS for Students: 5. Technology research tools--* Students use technology to locate, evaluate, and collect information from a variety of sources. * Students use technology tools to process data and report results.</p>		
Grade Level	Elementary Middle School		
Content areas	Science		
Topic Area	Physics		
Technologies Used	Probeware/MBL		
Relative Advantage	Makes abstract topics more visual, concrete. Supports manual operations in high level learning.		
Directions and Assessments	<p>Teachers and students can think of Microcomputer-Based Lab (MBL) as a kind of "lab partner" that does all the repetitious recording and calculating, while they are free to do more significant and interesting tasks. This activity focuses on three activities to explore concepts related to temperature. But MBLs (aka probeware) can be used to help with many other science experiments.</p> <p>1. The human sense of hot and cold - This experiment challenges students' belief that objects have different temperatures; e.g., sitting on a metal seat is colder than a plastic seat. Ask students to identify what they think are the coldest and hottest objects in the room. Have them insulate their hands from the probe by wearing a glove or putting a wrapper on the probe. Have students use the probe to take temperatures of the identified objects. After each one, they predict what they think will be the temperature of the next one. Also record the room temperature. Have students make a chart of the predicted and actual temperatures. Discuss the results of the experiment with students. Have them conjecture why they feel metal things as cold even though they are at room temperature. Some extension activities are:</p>		

- Find the warmest and coolest spots on your face.
- Explore how the temperature of a given spot in the room varies over twenty four hours.
- Compare variations in room temperature with those in outside temperature.

2. The effects of cooling by evaporation - Students assume that there are sources of cold (e.g., refrigerators or metal). This experiment shows them that a person feels cold only when heat is carried away. The object is to get the lowest possible temperature by evaporating a liquid. Discuss with students how heat works and why things get cooler. Have students use a variety of creative methods (e.g., blowing, waving a paper) to evaporate water off a temperature probe in order to lower its temperature. Record results of each trial. Some extension activities:

- Repeat the experiment with alcohol.
- Do controlled tests to determine which substance or mixture results in the greatest amount of cooling.
- Test the insulation properties of oil, cream, or petroleum. Ask students to determine which show the least change in temperature when the probe is wetted.

3. The difference between precision and accuracy - In this activity students compare reading a scale of temperature with its physical meaning. Use a thermometer that reads temperature to 0.1 degrees Centigrade. Calibrate one of the temperature probes. Have a container of hot water and one of cold water. Use these as high and low reference points. To explore the concept of precision, have students make two kinds of readings. One will be made from a scale marked by every 10 degrees Centigrade. The other is from a scale marked every 1 degree Centigrade. Although both are accurate, the second reading reflects greater precision. Mount the reference thermometer and probe so that students' hands cannot warm them. Have the students work in groups to take various readings using each scale. After all groups have completed and recorded their readings, calculate the range for each scale. Half the range is the "precision." The difference between the reference thermometer and the temperature probe is the "accuracy." Discuss the difference with the students.

Required resources: A Microcomputer-Based Lab (MBL) or probeware.

Assessment: Consider using these elements when constructing assessments: recorded temperatures, precision/accuracy differences,

Source

Flick, L. (1989). "Probing" temperature and heat. *The Computing Teacher*, 17(2), 15-19.