COOPERATIVE LEARNING

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"This is fun!" is a comment we are hearing often in our new cooperative learning science laboratories. Each week K-8 Education majors enrolled in Science 301, Science Concepts, participate in designing and presenting investigations. Working in groups, students are asked to investigate a common observation related to a natural phenomenon. For example, one group may be asked to explain the observation:

While driving along a mountain road in winter you observe icicles emerging from between many of the layers of exposed rock.

Each group researches background information, develops a hypothesis, makes a prediction from the hypothesis, and designs an experiment to test the hypothesis.

The groups receive the assignment in the laboratory and begin planning. During the following classes, work on the project continues, and the investigation is conducted at the next laboratory session. Each project is presented to the rest of the class allowing all students to see how a variety of phenomena were investigated.

Our experiences indicate that cooperative learning activities enable students to become more successful in using scientific process. In addition, students indicate they feel more secure in their understanding and approach to science.

A CHRISTMAS GRAPH OR XMAS OR YMAS

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We've noticed that too many of my general biology students have trouble with graphs . . . constructing them from their data, extrapolating data points from graphs, and interpreting them. They also find it difficult to perform various mathematical calculations involving their data. As a graphing and simple calculation exercise, I have them consider the carol "The Twelve Days of Christmas" and ask them to calculate:

1. number of gifts received on each of the twelve days (Day 1 . . . 1; Day 2 . . . 3; Day 3 . . . 6; etc.) When graphed, these data approximate an *arithmatic* or "straight-line" curve.

2. accumulated number of gifts (Day 1. . . 1; Day 2 . . . 4; Day 3. . . 10; etc. These data form an *exponential* or geometric curve.

3. total number of each gift (12 partridges, 22 turtle doves, 30 French hens, etc.) This results in a *normal* or bell-shaped curve when plotted correctly.

4. percentage of birds, mammals (maids, lords, ladies, pipers, drummers), and non-living objects (gold rings).

My inspiration for this exercise originally came from an old Steve Allen TV skit in which Steve sang the carol, and every time a particular gift was mentioned, it entered or was brought on stage. By the twelfth "round," the stage was overrun by leaping lords (36), swimming swans (42), pear trees (12), etc. The exercise also serves as a good introduction for a discussion of biological population growth and the Malthusian principle that population growth (exponentially increasing) rapidly outruns resource productivity (arithmetically increasing). The exercise also has some obvious applications to other fields such as economics and sociology. As a matter of fact, there is a marketing group which annually estimates the cost of "The Twelve Days of Christmas" using current market purchase prices and rental rates. I try to remind the students that graph interpretation is an interdisciplinary skill, that they will see similarities between the graphs in their economics and biology textbooks.