Professor Aesop's The Crow and the Pitcher

Illustrated and interpreted by
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A Guide for Educators

How to Use the Book
Professor Aesop's The Crow and the Pitcher presents the perfect opportunity to introduce students to the scientific method and, by conducting similar experiments, to help them understand the basic principles posed in the story.

The Standards
In using the activities in this guide, you will be using standards set by the National Science Teachers Association (NSTA); the National Council of Teachers of Mathematics (NCTM); and the Standards for English/Reading Language Arts, a combined effort from the National Council for Teachers of English (NCTE) and the International Reading Association (IRA).

Getting Started
Read the story to the students, stopping just before the last two pages ("The Scientific Method According to Crow"). Brainstorm with the students the steps that the crow followed in solving his problem. Once they have finalized the steps in their own words, show the students the six steps of the scientific method as presented on the final pages.

Preparation for the Experiment—Explanation of the Scientific Method
What we call the scientific method is actually a problem-solving method—one that can be used in many different environments beyond the scientific. Once students learn how to use this method, they have learned a valuable skill.

Steps in the Scientific Method:
- What is the problem?
- Observe the situation/research the problem.
- Make a guess as to how things might turn out—form a hypothesis.
- Experiment—test the hypothesis.
- Review the data.
- Share your conclusions.

Conducting Experiments:
Review the story with students and point out that the crow was desperate for water, so he had to think fast and get a result as soon as possible. But when doing an experiment as a scientist, it is important to take steps to prove your results and conclusions to the satisfaction of other scientists. It is important to have a comparison, and that is done using **control groups**. The control group represents that part of the experiment that gets no treatment and therefore shows what would happen to the materials if none of the variables were to change. By comparing the results against the control group, the actual effects of the experiment are observed more clearly.

The use of a control group in this specific experiment is not as dramatic as in many scientific studies but, for the purposes of familiarizing students with the scientific method, it is important to introduce the concept. Here, the control group will be the cup of water that represents the pitcher the crow came upon in the desert. The crow couldn't reach the water as it was, but by doing something to the water he could make the water level rise and get his drink of water.

Materials:

- Four clear, 2-cup containers such as disposable drinking cups
- Permanent marking pen
- Metric ruler/tape measure
- Water
- Several types of objects—something that will float (plastic blocks such as Legos™), ice cubes, and rocks
- Student data worksheet on which the students will record their measurements (Note: If you plan to have several groups of students conduct the experiment, each group will need the items listed.)

Procedure:

Ask the students why they think the crow chose to use pebbles to raise the water level. Why not leaves or sticks or other objects?

1. In each of the four containers place one cup of water. Mark each cup with the marker where the water level appears.
2. Measure the level of the water and record the measurement on the data sheet in centimeters. (Note: Explain to students that scientists use metrics in all scientific experiments.)
3. The first cup of water will act as the control group. Set this one aside.
4. Have students drop the plastic blocks into the water of the second cup. Mark the level of the water on the container and label this mark. Did the water level change?
5. Measure the water level. Record the measurement on the data sheet. Then subtract this measurement from the original level and record the difference on the data sheet. Set the cup with plastic blocks aside next to the control cup.
6. Have students drop the ice cubes into the water of the third cup. Mark the level of the water on the container and label the mark. Did the water level change?
7. Measure the water level. Record the measurement on the data sheet. Then subtract this measurement from the original level and record the difference on the data sheet. Set the cup with ice cubes aside next to the control cup and the cup with plastic blocks.
8. Have students drop rocks into the water of the fourth cup. Mark the level of the water on the container and label the mark. Did the water level change?
9. Measure the water level. Record the measurement on the data sheet. Subtract this measurement from the original level and record the difference on the data sheet. Set the cup with rocks next the other three cups.

Drawing Conclusions:
Based on the data recorded on their data sheets, have students answer the following questions.

- Which of the objects made the water rise the highest? Why?
- Which of the objects made the water rise the least? Why?

Begin the discussion of weight and density of objects needed to fall to the bottom of the container and displace the water, thus making the water level rise in the container.

Based on their conclusions, ask students which of the following objects would make the water level rise the most—marbles, sticks, or leaves?

Have students speculate on what properties the rocks have that are so different from the plastic blocks or the ice. Based on their answers, you can lead a discussion about density of objects as opposed to density of water.

Math/Physics Extension
The first experiment gives students the basics of the scientific method. If your students are ready to tackle the science involved in density and measures of displacement, the following extension activities explore the relationship of mathematics and physics. If your class has already used formulas this will be a good reinforcement activity. If they are just being introduced to using basic algebra and formulas, you may want to calculate the mathematics with them as a class activity.

On the last page of the book, students may have noticed the formula D=M/V. Explain that this formula is for calculating the **density** of an object (Density = Mass/Volume).

Background:
From the first experiment students will realize that when objects were placed in the water, the level of the water rises. They learn that the rocks/pebbles make the water rise the highest. Explain to the students that this change in the water level is a measure of **displacement.** Ask students to speculate what is actually happening in displacement. The students will likely theorize that, although all the objects caused some displacement, heavy objects cause the most displacement.

Explain that weight alone is not the answer. In a large plastic cylindrical container you can drop an orange into the water and it will float, but a rock of about the same size will sink. This is caused by the differences in the density of the objects.

Once again students can conduct an experiment using the same scientific method used in the first activity.

Materials:

- Orange
- Rock or paperweight (A round object would be best. Since students will be calculating the volume of these objects, it will be easier for them to do the

calculations by standard measurement rather than by calculating the volume through the water displacement method.)
- Metric ruler/measuring tape
- Kitchen scale
- Three clear cylindrical containers large enough to accommodate the size of the orange and rock, but not so large as to make the water levels difficult to measure. One is going to act as the control and the other two will be the experimental containers.

Using the method from the first experiment, you can show students how to calculate the density of the objects with the formula they see in the book on the last page (D = M/V). Explain that the D stands for density, M for mass, and V for volume. For the sake of this experiment, weight is being used as a stand in for mass and will be found by weighing the orange and the rock. But before they can find the density, they will need to determine the volume for the orange and the rock using the following formula: $V=(4/3)\pi r^3$.

Tell the students that to use this formula they must first calculate the **radius** of the sphere. To do this they will need to first measure the **circumference** of the spherical objects by measuring the distance around the middle. Using this measure the students can now calculate the radius of the sphere using the formula for the circumference of a circle: $C=2\pi r$.

As an example, if the circumference of the orange is 25cm, then:

$25cm=2\pi r$
$25cm/2(3.14)=r$
$3.98cm=r$ (Note: All amounts are rounded to the nearest hundredth.)

Now that the students have the radius, they can calculate the **volume** of the orange:

$V=(4/3)\pi r^3$
$V=(4/3)(3.14)(3.98cm)^3$
$V=(4/3)(3.14)(63.04cm)$
$V=263.93\ cm^3$

Now weigh the orange to calculate the density. For example, if the orange weighs 200g, then:

$D=M/V$
$D=200g/263.93\ cm^3$
$D=.76g/\ cm^3$

Repeat these calculations for the round rock.

For the rock, lets assume for the sake of this example that the volume is the same as the orange. But in weighing the rock, we find that it weighs 600g. In doing the calculations, we find the density of the rock to be $2.27g/cm^3$.

By comparing the two results, the students will see that, although the orange and the rock are the same size, the density of each of the items is quite different.

Water Displacement Method:
If you take two objects such as an apple and an irregular-shaped rock, you can still calculate the volume and thus the density of each item. This time you will need to find the volume of each of the objects using the **water displacement method**, a more advanced calculation for students ready to tackle more difficult scientific and mathematical measurements and concepts of displacement.

Materials:
- Apple
- Irregular-shaped rock
- Metric measuring tape
- Three clear, cylindrical containers. One will act as the control; the other two as the experimental containers
- Water

Take a large, clear cylindrical container. Fill the container half full of water. Measure the amount of water with the measuring tape/ruler and record the water level height. Then calculate the volume of the water.

For example, if the cylindrical container has a 6cm radius and my water level is 6cm then the volume is:

$V=\pi r^2 h$
$V=(3.14)(6cm)^2(6cm)$
$V=678.24\ cm^3$

Now place the apple in the water of the second container. It will float so it needs to be submerged in the water to get the full measure of water displacement. Push it down with your finger until the apple is just below the water level. Measure the water level and record. Find the difference between the beginning water level and the level when the apple is submersed. This difference is the **water displacement measurement**.

Now calculate the volume of the displaced water. If the water level difference was 3cm and we know the radius of the cylinder is 3cm, the volume of the displaced water is:

$V=\pi r^2 h$
$V=(3.14)(6cm)^2(3cm)$
$V=339.12\ cm^3$

Now, weigh the apple. If, for example, the apple weighs 250g, the density of the apple would be calculated as follows:

D=M/V
D=250g/339.12 cm^3
D=.74g/cm^3

Repeat his procedure to find the density of the rock.

Place the control container and the containers containing the apple and the rock next to each other. You can also calculate the density of the water using the same procedure. Students would then find that the density of the objects and the density of the water provide the correlation as to why some things will float and others will sink.

Language Arts Activities:
The following activities will help students place themselves in the role of the scientist and is a good way to have them use writing and critical thinking skills to culminate their thoughts about the experiment(s) they have participated in.

On the final spread of the book there is a bust of Thomas Alva Edison with a quote that reads, “Genius is 1% inspiration and 99% perspiration…” Have students write a paragraph about what they think this quote means. They may need to look up the words "inspiration" and "perspiration" before they begin. Once they have written down their ideas, lead a class discussion on what the quotation means, first in relation to the story of *Professor Aesop's The Crow and the Pitcher*, and then on how it could apply to their own lives.

Throughout the book a determination dial tells the reader how the crow is feeling. Sometimes his determination is high, sometimes it is low. What causes these changes in the crow’s determination? What happens when his determination is high? Ask the students to think of a time when their determination was high, then write about what happened and what was accomplished when determination was at its highest. What lessons were learned from these accomplishments?

This guide for educators is intended for use in conjunction with *Professor Aesop's The Crow and the Pitcher*, published by Tricycle Press. ISBN 1-58246-087-6

Student Data Sheet
The Scientific Method

In order to solve a problem like the crow did, we are going to conduct an experiment using the scientific method. Let's first review the steps of this method.

Steps in the scientific method

1. Start with a question.
2. Gather up the facts to find the answer to that question.
3. Form a hypothesis, an educated guess.
4. Tackle the experiment and put it to the test.
5. Review the results to get a sense of your success.
6. Be a true scientist and share your results.

The question

What was the crow's question? _____

Gather the facts to find the answer

What did the crow do first to solve his problem? _____

Form a hypothesis

What was the hypothesis the crow came up with? _____

_____

Tackle the experiment

You are going to try out several different objects to see which is best to solve the problem. Follow the instructions your teacher gives you and fill out the chart below.

Object	***Water level in cm***
#1	
#2	
#3	

Review the results

Which of the objects made the water rise the highest?

_____

Why do you think these were the best objects to use to raise the water level? _____

_____

Which of the objects made the water rise the least?

_____

Based on what you know, which of the following objects would raise the water level the most? Marbles, sticks, or leaves? _____

Tell all your classmates!