Which is Which
4th Grade
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References:

- 2003-04 Columbus Public Schools Science SLC Guide

Benchmarks:

SLC 6,8: Evaluate a simple procedure to carry out an exploration. Analyze observations made by others.

Objectives:

To show students that, when doing experiments, scientists must be sure that the experiments are reliable and the results are valid. They must eliminate or test all variables that can affect the results of an experiment. The teacher will want the students to gain familiarity with the following terms: bias, reliable, valid, hypothesis, independent variable, dependent variable, and control. You will also want to stress the procedural design of the scientific method: predict, test, observe, and hypothesize.

Materials:

- 6 cans of Coke
- 6 cans of Pepsi
- plastic cups of two different colors [x2 the number of students]

Initial Demonstration:

Ask the students what kind of soft-drink they like best. Suppose that they were going to invite several friends over to a birthday party, but could only get one type of soda, how would they pick which type most of their friends would like best?

Optional introduction- Last class time some of you said that you liked the sugary water, but some of you did not. How can you decide what type of drink most people like best?

One problem we often have when trying to collect data is that sometimes we think we know the answer ahead of time or really want one of the two choices to be correct. How do we get rid of that bias? [introduce term here if necessary]
**Target Observations:**

- Some people like different drinks better. How do you decide which one the most people will like?

**Target Model:**

- Students must remove bias from an experiment to get valid and reliable results.

**Procedure:**

1. Before the students enter the room, pour some Coke into one color glass [one for each student] and some Pepsi in the other color glass [again, one for each student], but do not tell the students which is which.

2. Ask the students which type of drink they prefer, make a T-chart on the board with their predicted preference.

3. Pass out the drinks, instruct the students to not drink until you say it is OK and also instruct them not to tell anyone what they think, it will ruin the experiment.

4. Tell the students to drink the drinks.

5. Ask the students which drink in which color cup they liked better.

6. Have the students fill in the second T-chart on preference. Ask the class, by a show of hands, which how many ended up preferring Coke and how many ended up preferring Pepsi. Have the students place these numbers on a T-table

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<table>
<thead>
<tr>
<th></th>
<th>Coke</th>
<th>Pepsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>Actual</td>
<td>x</td>
<td>y</td>
</tr>
</tbody>
</table>
```

7. Have the students identify which parts of the experiment were the variables. Are they independent/explanatory or dependent?

8. What part(s) of the experiment helped to eliminate bias?

9. What factors other than taste might affect which product we think like better? [e.g. temperature of the drink, advertising, cost, availability in the store, peer pressure] Did the experiment we ran control for these variable? What would we have to do account for these?

10. Make the students explain the process and steps that they took to do the experiment, starting with what was the question. This is also a good time to discuss such terms as validity and reliability and repeatability.
**Target Observations:**

- Students couldn’t tell the pops apart by looking at them.
- Not everyone could pick out their “favorite” pop.
- This was a fair test.

**Target Revised Model:**

- Taking bias out of an experiment makes it fair.

**Summary:**

Students have been taught what bias is, and how to eliminate it in a scientific experiment. It is important to be unbiased when conducting an experiment, otherwise our results might be false.