Rollin Rollin Rollin
4th Grade
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References:

- Columbus Public Schools SLC Guide

Benchmarks:

SLC 6: Evaluate a simple procedure to carry out an exploration.

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: 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, hypothesize. Also discuss terms validity, reliability and repeatability.

Materials:

- Books [to incline the incline plane]
- yardsticks
- marble or matchbox car
- flat boards for an incline plane

Initial Demonstration:

Roll a car down the ramp, ask the students to observe what happens.

Target Observations:

- The car accelerates down the ramp and then travels for some distance across the floor after it reaches the end of the ramp.

Target Model:

- If an object is placed on a slope, it will roll down.
- The further up the ramp the car is released the further the car will go.
**Procedure:**

To determine how a variable will affect the distance that a car travels down a ramp, the students need to design/conduct an experiment.

1. Set up the ramp and roll a car down it.
2. Ask the students to make observations regarding what they saw
   a. the car went down the ramp
   b. the car rolled across the floor
3. List all the possible variables that would affect the car's movement [e.g. steepness, how far up the ramp, the rolling ability of the car, the smoothness of the ramp]
4. Decide on a variable to test **define the problem**
5. Write down what you think will happen **predict what will happen**
6. Make a plan to test that variable and determine what materials you will need **test or conduct an experiment**
7. Suggest that varying the plane height is a good one to test.
8. Draw the following chart on the board, have the students copy it into their journals.

<table>
<thead>
<tr>
<th>Constants</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>ramp surface</td>
<td>ramp height</td>
</tr>
<tr>
<td>same car</td>
<td></td>
</tr>
<tr>
<td>floor surface</td>
<td></td>
</tr>
<tr>
<td>same spot on ramp</td>
<td></td>
</tr>
</tbody>
</table>

9. Draw the following chart on the board and have the students draw a similar one in their journals. Fill it in with the data collected below.

<table>
<thead>
<tr>
<th>Variable: Ramp Height</th>
<th>1(^{st}) trial</th>
<th>2(^{nd}) trial</th>
<th>3(^{rd}) trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 books</td>
<td>x(^1)</td>
<td>x(^2)</td>
<td>x(^3)</td>
</tr>
<tr>
<td>7 books</td>
<td>y(^1)</td>
<td>y(^2)</td>
<td>y(^3)</td>
</tr>
<tr>
<td>10 books</td>
<td>z(^1)</td>
<td>z(^2)</td>
<td>z(^3)</td>
</tr>
</tbody>
</table>

10. Set up the ramp with 4 books on the floor. Hold the car at the top of the ramp and let it roll. Have a student measure how far the car traveled with a yardstick. Repeat this 3 times. Each time have student from a different group make the measurement.

11. Raise the ramp to 7 books, repeat step 9
12. Raise the ramp to 10 books, repeat step 9

Have the students tell you what happened. Ask them to tell you what a variable is and then what were the variables in the experiment that was just done? What parts of the experiment were controlled? [the surfaces, the car]

Which variable caused the other variable to change? Introduce the terms **independent/explanatory variable** and **dependent variable**.

Ask the students if each trial of the experiment come out the same. If not, why? Introduce the terms **reliability** and **repeatability**.
**Target Observations:**

- The cars rolled faster and farther the higher as the ramp was raised.
- The variables were how far the car rolled and how high the ramp was.

**Target Revised Model:**

- The cars went farther when the ramp was raised higher because gravity sped them up more.

**Summary:**

A scientific experiment was designed to test how raising a ramp would affect how far a toy car rolls on the floor coming off the ramp. This test was designed to be fair by using the same car and ramp for all experiments. Data was collected and compared to reach a conclusion.