1.5 Explore

1.5 Explore: A Revised Procedure

1.5: Part 1 of 4 – Redesign Your Procedure
As a class, discuss changes that could make your procedure more consistent. Your teacher will make a list of procedural differences you noticed during your first investigation. As a class, decide on the procedural details that all groups will use. This should ensure that all groups have a more consistent procedure. After the class has decided on the procedure, record these details on the Procedure Sheet. The new procedure sheet will communicate the important details of how the investigation will be carried out. If all groups follow the same procedure consistently it should eliminate some outlying data, which resulted from earlier procedural differences.

Record the details of your updated procedure on the 1.5 Revised Procedure Sheet.

1.5: Part 2 of 4 – Run Your Investigation
Follow your updated procedure to collect data from 10 trials. You will have 10 minutes to collect and record your data. Your group will share your data like last time to create a class data set. Be sure to follow your new procedure carefully.
1.5 Explore

Complete your new procedure and record the results on your 1.5 Revised Procedure Data Sheet.

1.5: Part 3 of 4 – Share
Now that your group has collected data, your teacher will ask each group to share their data with the class. As before, record data from every group on one histogram sheet.

Record your class data on the 1.5 Revised Procedure Histogram Sheet and analyze the histogram.

After all groups report their data your teacher will have the class compare the new data (from the revised procedure) to the old data (from the original procedure). What differences do you notice?
1.5: Part 4 of 4 – Add to Your Understanding: Experimental Design

Science and engineering requires using well-designed, consistent procedures for measuring and collecting data. To do this, scientists and engineers carefully record their procedure so that they and others can repeat the procedure and verify measurements.

Specifying and carefully following these procedures is important to make sure that data is consistently collected. If consistent procedures are not used, then changes in the procedures might cause differences in data collected. When these procedural differences are unintentional then we say that they add error to the data. Scientists try to remove as much error from their data as possible.

For example, in the first investigation (Section 1.4) many groups let the height of the ramp change between trials. These different ramp heights meant the procedure was not consistent and therefore the distance data had error due to differences in ramp height. Ramp height is an example of a variable. A variable is any part of the procedure that could change.
1.5 Explore

An *independent variable* is a variable that the investigator systematically changes during the experiment. For instance, an experimenter might vary the amount of water that a plant gets, in order to see how different amounts of water affect the height of plants.

A *dependent variable*, on the other hand, is a variable that the experimenter measures during the experiment. Often, the independent variable is predicted to affect the dependent variable. For instance, an experimenter might think that the amount of water (independent variable) will affect plant height (dependent variable). The dependent variable (plant height) depends on the amount of the independent variable (water).

In the second investigation (Section 1.5), every group should have used the same ramp height. Because each group consistently used the same height for all trials, ramp height became a *controlled variable*. A controlled variable is a variable that is “controlled” so that it stays the same each time the procedure is run. Controlling a variable usually reduces error. In this case, each group controlled the ramp height variable, which should have reduced error. The data should have been more accurate, and thus more clustered together on the histogram.
1.5 Explore

**Error** – The difference between the observed value of a quantity and the true value of that quantity: *Because he estimated the height of the opening, there was error in his measurement for a new door.*

**Variable** – Any feature of the procedure that can vary (change). *In their experiment, the amount of water given to the plant was a variable because they could give the plant different amounts of water.*

**Independent Variable** – A variable that is systematically changed during the experiment. *In their experiment, the amount of water given to the plant varied to see how different amounts of water affect plant height.*

**Dependent Variable** – The variable that is measured during the experiment. *In their experiment, plant height is measured to see how it depends on the amount of water provided.*

**Controlled Variable** – A variable that is “controlled” so that it stays the same each time the procedure is run. *In their experiment, the amount of water given to the plant was a controlled variable because they always used 500 milliliters.*