Teacher Name: Tammy Heddings
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Grade Level: 3-6
Subject: Science
Time: 30 minutes
Concept: Scientific Investigation
Topic: Variables

SOLs:

Standard 3.1 The student will plan and conduct investigations in which

- predictions and observations are made:
- objects with similar characteristics are classified into at least two sets and two subsets;
- questions are developed to formulate hypotheses;
- length is measured to the nearest inch;;
- data are gathered, charted, and graphed (line plot, picture graph, and bar graph);
- time is measured to the nearest minute;
- inferences are made and conclusions are drawn; and natural events are sequenced chronologically.

4.1 The student will conduct investigations in which

- distinctions are made among observations, conclusions (inferences), and predictions;
- data are classified to create frequency distributions;
- appropriate metric measures are used to collect, record, and report data;
- appropriate instruments are selected to measure linear distance, volume, mass, and temperature;
- predictions are made based on data from picture graphs, bar graphs, and basic line graphs;
- hypotheses are formulated based on cause and effect relationships;
- variables that must be held constant in an experimental situation are defined; and
- numerical data that are contradictory or unusual in experimental results are recognized.

5.1 The student will conduct investigations in which

- appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time;
- data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams);
- accurate measurements are made using basic tools;
- predictions are made using patterns, and simple graphical data are extrapolated; and estimations of length, mass, and volume are made

Standard 6.1 The student will plan and conduct investigations in which

- precise and approximate measurements are recorded;
- hypotheses are stated in ways that identify the independent manipulated) and dependent (responding) variables;
- a method is devised to test the validity of predictions and inferences;
- one variable is manipulated over time, using many repeated trials;
- data are collected, recorded, analyzed, and reported using appropriate metric measurements;
- data are organized and communicated through graphical representation (graphs, charts, and diagrams);

Mathematics SOLs

Standard 3.14 The student will

- estimate and then use actual measuring devices with metric and U.S. Customary units to measure
- length — inches, feet, yards, centimeters, and meters

Standard 4.11 The student will

- estimate and measure length, using actual measuring devices, and describe the results in both metric and U.S. Customary units, including part of an inch (1/2, 1/4, and 1/8), inches, feet, yards, millimeters, centimeters, and meters
- collect, organize, and display data in line and bar graphs with scale increments of one or greater than one and use the display to interpret the results, draw conclusions, and make predictions

Standard 5.18 The student will, given a problem situation,

- collect, organize, and display a set of numerical data in a variety of forms, using bar graphs, stem-and-leaf plots, and line graphs, to draw conclusions and make predictions.

Standard 6.18 The student, given a problem situation,

- will collect, analyze, display, and interpret data in a variety of graphical methods, including line, bar, and circle graphs.

Rationale: Science becomes more meaningful for students when the problem of inquiry is something relevant and interesting to their lives. Making predictions, observations, and conclusions are important skills for students to develop. These skills will allow them to evaluate reported research, make informed decisions as citizens, and become actively involved in issues that require them to question and process information.

Goal: To help students become aware that many different variables can affect an outcome.

Cognitive Objectives:

After performing an experiment, the student will be able to record in writing at least 3 possible variables that may have influenced the outcome of the experiment.

Affective Objectives:

The student will be able to work cooperatively in pairs, as well as make individual contributions, during an experiment, evidenced by teacher observation.

The student will be able to, both orally and in writing; compare conclusions drawn based on observations during an experiment, and distinguish them from personal interpretation. See worksheet rubric.

Psychomotor Objectives:

The student will be able to measure length and time, using standard English units (inches and minutes), evidenced by successful completion of an experiment.

The student will be able to participate, in groups, using scientific investigation skills to complete an experiment, evidenced by completion of the experiment.

Materials:

3 different brands of bubble gum (each student receives one piece of each brand)
Clock with minute and second hand
1 ruler per student pair
Data collection sheet Content

The **independent variable** is the one that is changed by the scientist. To insure a , a good experiment has only one independent variable. As the scientist changes the independent variable, he or she **observes** what happens.

The scientist focuses his or her observations on the **dependent variable** to see how it responds to the change made to the independent variable. The new value of the dependent variable is caused by and depends on the value of the independent variable.

For example, if you open a faucet (the independent variable), the quantity of water flowing (dependent variable) changes in response--you observe that the water flow increases. The number of dependent variables in an experiment varies, but there is often more than one.

Experiments also have **controlled variables**. Controlled variables are quantities that a scientist wants to remain constant, and he must observe them as carefully as the dependent variables. For example, if we want to measure how much water flow increases when we open a faucet, it is important to make sure that the water pressure (the controlled variable) is held constant. That's because both the water pressure and the opening of a faucet have an impact on how much water flows. If we change both of them at the same time, we can't be sure how much of the change in water flow is because of the faucet opening and how much because of the water pressure. In other words, it would not be a fair test. Most experiments have more than one controlled variable. Some people refer to controlled variables as "constant variables."

In a good experiment, the scientist must be able to **measure** the values for each variable. Weight or mass is an example of a variable that is very easy to measure. However, imagine trying to do an experiment where one of the variables is love. There is no such thing as a "love-meter." You might have a **belief** that someone is in love, but you cannot really be sure, and you would probably have friends that don't agree with you. So, love is not measurable in a scientific sense; therefore, it would be a poor variable to use in an experiment

Advanced Organizer:

Tell students they have all been selected to perform a very important test. "A bubble gum company, which shall remain nameless, is being sued by another bubble gum company for claiming their gum blows the biggest and best bubbles. We need you to perform an experiment to test which brand of bubble gum really does blow the biggest and best bubbles."

Procedure:

1. Pair students with partners. Explain that they will be working with their partner to test blowing the bubbles. Explain the importance of accuracy while timing and measuring the bubbles, because after all, someone's company is at risk here.

2. Each group will select a designated chewer, a designated measurer, and a designated recorder.

3. Make sure each pair has a ruler, a data collection sheet, and access to a stopwatch/clock.

4. Explain the experiment:

    - The designated chewer will place a piece of bubble gum in his or her mouth and chew for one minute.
    - After the minute is up, the measurer begins to time the chewer for another minute. During this minute the chewer will blow bubbles.

- While the chewer is blowing bubbles, the measurer will be measuring the length (in inches) while the recorder keeps track of time and records the biggest bubble the chewer blows.
- Switch who is blowing bubbles and measuring/timing and repeat steps.

Closure:

Have students come to the board and write their name and the number of inches under the brand of bubble gum that they were able to blow the biggest and best bubble with.

Have students identify, if applicable, which bubble gum brand blows the biggest and best bubble. Because of **VARIABLES** this may not be possible, as various factors may have influenced the outcome of biggest and best bubble.

Discuss with students variables, and see if they can identify some in this experiment.

- ·weight of bubble gum may account for one being better than the other
- ·students may blow harder or softer than their classmates
- ·some students may just be better at blowing bubbles than others
- ·some students may have chewed their gum before blowing for a longer/shorter amount of time than others
- ·measurements taken of the bubble may not have been as accurate as they could be
- Also, different students may have started with different types of gum first, doing a good job with the first and second trial of gum, but by the third gum testing were tired of chewing and blowing.

Assessment:

See attached rubric for worksheet.

Click here for Bubble gum Lesson Example
Bubble gum Lesson