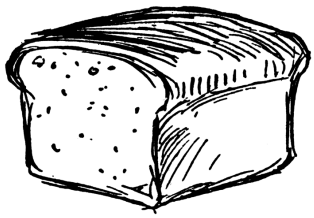
Name _____ Date _____ Period _____ 7/2019

Activity 02-07 Experimenting Skills: Understanding Variables (11)

Malcolm used his grandmother's recipe to bake a loaf of bread.

Grandma's Favorite Bread



1 ½ cups warm water
1 package dry yeast
1 teaspoon salt
2 tablespoons sugar
2 tablespoons melted butter
3 ½ cups flour

Mix all of the ingredients together, and knead well. Cover the dough and let it rise for 2 hours, Put the dough in a greased pan, and bake at 400°F for about 35 minutes.

Unfortunately, Malcolm's bread collapsed while it was cooking. "Snap!" he thought, "What could have gone wrong?" What could Malcolm change the next time he makes the bread? Two examples are given.

He could add more salt
He could take the bread out of the oven sooner.

_____

_____

_____

Varying Your Variables

A **factor** is anything in an experiment that can influence the outcome. A **variable** is a factor in an experiment that can be changed. For example, because you can change the amount of salt in the bread recipe, the amount of salt is a variable.

Malcolm's grandmother suggested that he added too little flour or too much liquid. Therefore, Malcolm thought about changing one of the following variables:

- the amount of water
- the amount of melted butter
- the amount of flour

In science class, Malcolm learned to change only one variable at a time. Why is that important?

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Scientists strive to perform controlled experiments. A controlled experiment tests only one factor at a time. In a controlled experiment, there is a **control group** and an **experimental group**. All of the factors for the control group and the experimental groups are the same except for one. The one factor that differs is called the **independent variable**. Because this variable is the only factor that differs between the control group and the experimental group, scientists can be more certain that the independent variable is the cause of any differences that they observe in the outcome of the experiment. All of the factors that are prevented from changing or are kept the same for both the control group and the experimental group are called **constants**.

Malcolm tried reducing the amount of water to 1 cup. Thus, he made the amount of water the **independent variable**. What factors were Malcolm's **constants**? (Hint: There are several of them! Refer to the recipe.)

_____

_____

As it happened, Malcolm chose the right variable to change. With less water, the bread came out perfect. He concluded that only 1 cup of water should be added.

Inputs and Outputs

The **dependent variable** in an experiment is the *effect* of your change. For instance, when you bake bread, the *effect* is the quality of the loaf of bread. Often an **dependent variable** is something that you will measure. Following is an example:

> Henry and Eliza conducted an experiment using plant fertilizer. They added different amounts of fertilizer to seven pots of bean sprouts. The posts were the same size and had the same type and amount of soil. They were given the same amount of seeds, light, and water. To find out how the fertilizer affected the growth of the sprouts, Henry and Eliza measured the height of the bean sprouts in each pot and calculated the average. Here are the factors in their experiment:
> **Independent Variable:** amount of fertilizer
>
> **Constants:** size of pots, amount of light, amount of water, amount of soil, number of seeds
>
> **Dependent Variable:** Measured heights of the bean sprouts
>
> **Prediction:** Adding fertilizer will make the beans grow taller.
>
> **Hypothesis:** If I add different amounts of fertilizer to the bean sprouts it will affect the height of the bean sprouts.

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Your Turn

Identify the independent variable, constants, and dependent variable for the following examples. Then write a prediction for the experiment.

1. In a recent study, middle school students were given a math exam after various amounts of sleep. One group slept 8 hours or more, and the second group slept fewer than 8 hours. The students had similar skills in math. They ate the same meals the previous day. The data showed that out of the thirty students who slept 8 hours or more, 27 of them scored a B grade or better. Of the 30 students who slept fewer than 8 hours, 13 scored a B grade or better.

Independent Variable: _____

Constants: _____

Dependent variable: _____

Prediction: _____

Hypothesis: _____

2. Our science club built a catapult out of craft sticks, glue and a rubber band. We wanted to determine what size rubber band was best for launching a gumball across the classroom. We thought that if the rubber band was too small, the gumball wouldn't travel very far. If it was too big, it would be too loose to work well. We found that a rubber band with a circumference of 5-cm sent the gumball 2 meters, a rubber band with a circumference of 7-cm sent the gumball 4 meters, a rubber band with a circumference of 11-cm shot the gumball 7 meters, and a rubber band with a circumference of 12-cm shot the gumball 5 meters.

Independent Variable: _____

Constants: _____

Dependent Variable: _____

Prediction: _____

Hypothesis: _____