Experimenting for Answers

By Trista L. Pollard

[1] There are many questions in life. Some are answered after little research; however, some go unanswered for many years, possibly forever. The way scientists search for the answers to their questions is through the science process skill called **experimenting**.

[2] When you experiment in your science class, you may think you are just "doing something to see what happens." However, to true scientists, when you experiment you change objects or events to learn how nature changes them. Experimenting is one of the most important process skills because it also includes the other six process skills: observing, classifying, communicating, inferring, predicting, and measuring. During an experiment scientists state a **hypothesis** and design **procedures** with **controlled variables** to test their hypothesis.

[3] When scientists hypothesize, they make inferences that they want to test. This is called stating an **operational question** or scientific question. For example, you are helping your favorite physical education teacher clean out her equipment closet. As you are herding the various types of balls into their labeled bins, you observe one ball roll from the top shelf to the floor and bounce very high after it hits the floor. You began to wonder, "Does height at which the ball is dropped affect how high it will bounce?" You have just stated a hypothesis based on your observations. Operational questions or hypotheses help scientists to focus on the specific action they want to take to produce a result. In this case you want to determine if the ball's drop height will affect the ball's bounce height.

[4] Now that you have your operational question to test, you need to develop procedures for your experiment. When scientists design experiment procedures, they think about the conditions they want to vary and the conditions they want to control within that experiment. Controlling variables is a huge part of experimenting. As a scientist you must control variables in order to determine what conditions in an experiment make a difference. Since you are testing whether drop height affects bounce height, you need to change the variable, drop height. You would keep the type of ball the same (i.e., large rubber playground ball), the way you measure bounce height the same (i.e., bouncing the ball near an upright meter stick), the manner in which you drop the ball the same, and change the drop height of the ball. You might choose three different levels at which to drop the ball. You may also include the same number of attempts for each drop height. Keep in mind, that if the ball is not dropped in the same manner from each level of height in the same way for all attempts, you may have faulty conclusions at the end of your experiment. For example, let's say you decided to drop the ball with one hand for one attempt and both hands for the second attempt. This change, although slight, may impact your measurements and as a result, your conclusions.

[5] Once you have developed your procedures you can begin the fun process of testing your hypothesis. You may also want to have some of your friends conduct the same experiment so that you can compare results. As scientists, you want to acquire as much data as possible so that you can make a sound inference or judgment about the data. You could also extend your operational question by observing if the type of ball or size of ball affects the bounce height. Give it a try. You may be surprised at the answers you acquire at the end of your experiment.

Name: _____ Science Pd: _____

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1. Scientists search for the answer to their questions through the process of _____. (A) Guessing (B) Experimenting (C) Looking it up in the dictionary (D) Asking someone else	2. What are the six process skills included in the process of experimenting?
3. When scientists make hypotheses, they are making _____. (A) Inferences they want to test (B) Observations about experiment data (C) Conclusions about experiment data (D) Something to eat	4. During scientific experiments, scientists do not control variables. (A) False (B) True
5. Designing procedures helps scientists to _____. (A) Think about the variables they want to vary and control (B) Think about data from previous experiments (C) Think about the possible conclusions to the experiment (D) Think about the predictions they made for the experiment	6. You have developed the following hypothesis: will the size of the ball I use affect how high the ball will bounce? What variables will you need to control in order to test this hypothesis?
7. Why is it important to control variables in an experiment? (A) It's not important (B) Otherwise you get bored (C) You may get faulty conclusions at the end of your experiment if you don't (D) So that the data all comes out exactly the same	8. Why do scientists need to conduct many attempts during an experiment to test their hypotheses?