



mobile inquiry technology

Teacher Notes

Pulse Rate Introduction

In this activity, the students will study key life science concepts regarding regulation and human exercise. The students will measure and compare their pulse rates while experiencing different levels of physical activity.

The students will use a spreadsheet and graphing application to record and display data. The students will examine data displayed in a pie graph to make inferences regarding the relationship between their exercise and their pulse rate.

The students will gain experience with inquiry skills, including:

- identifying variables that can affect the outcome of an experiment;
- gaining skills and confidence in using technology, as well as the spreadsheet and graphing capacity to represent and analyze data.
- designing a systematic investigation (identifying and controlling variables)
- using tools and mathematics to gather and interpret evidence
- making logical conclusions about cause/effect from data





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Discussion Guide

Begin a discussion with students by asking them how they can tell how fast their hearts are beating. Since counting beats for an entire minute can be tedious, ask the class how they could determine beats per minute (BPM) in less time. (A convenient technique is to count for 15 seconds and multiply by 4.) After everyone has mastered the technique, do a whole class trial and have each student report on the results. Record responses on a chart or overhead transparency. Initiate a discussion about the results.

Probe for comments regarding the variation in the data. Introduce the terms range, median, and mean to the students. For range and median, it may be helpful to place a sample set of data on a number line. Locate the largest and smallest number and demonstrate finding the range by taking the difference between these two values. Explain to the students that the median can be found by locating the exact middle of the data when it is placed in order as shown on the number line. Have the students find the sum of all of the numbers in the data set. Explain they can find the mean by dividing the sum by the number of data points in the set.

Direct the students to "Thinking About the Question". After a few minutes hold a class discussion for them to share their ideas. Ask what might account for the variation among students in the class and record their ideas. Ask what variables might change their individual heart rates. List their responses.

At least one student will probably suggest that exercise is one possible variable. Suggest that they could do an investigation about the effect of exercise on heart rate. Conduct a discussion on how that investigation should be designed. Depending on the prior experience of the class this might be done as a written group task or a whole class brainstorm. The goal of the discussion should be to develop the understanding that if we want to find out the impact of period of exercise on heart rate all other variables must be held constant. It is best if this understanding is the results of their deliberations and testing. One option might be to do an initial practice trial by having everyone run in place for one minute and immediately take their pulse rate. The results will probably vary more than they did on the initial trail at rest. This could lead to an exploration of possible other variables, such as how fast each child was running. One technique for controlling for running speed might be to run to a predetermined count. You will also have to decide how long to rest before doing each trial. Since the investigation requires stopping to take pulse rate, it will be necessary to rest to bring pulse rate back to the resting rate before beginning each trial.

Once the class has agreed to an experimental procedure direct the students to go to "Investigation I".

Note: Review the medical records of your students that may experience medical problems (e.g., asthma). Since exercise is involved, you may wish to have a signed consent form for these students.





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Additional Teacher Background

Typically, heart rate is easily measured by placing the tips of your fingers on the radial arteries of the wrists. This method is often referred to as finding your pulse rate.



If students have difficulty finding their pulse at this location, their heart rate can also be measured at different locations on their body by placing the tips of their fingers on the carotid arteries of the neck (alongside the trachea) or the temporal arteries at the sides of their head.

As exercise begins, signals are passed to the brain's medulla that increase the heart's output. These signals originate from the stretch receptors of the muscles, tendons, and joints. Muscles consume more oxygen and produce more carbon dioxide during exercise. The chemoreceptors in the carotid artery of the neck register the change in the gases after the blood circulates through the aorta in the chest, to further increase in the rate of the heart. The amount that your heart rate increases is based on your physical fitness.

Exercise elevates pulse rate, so how could you depress your heart beat? When a hand is submerged in cold water, the blood supply to the capillaries of the skin is reduced. Due to the temperature decrease, blood passes directly from arteries to veins---conserving heat loss and slowing down your pulse rate.





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Pulse Rate Suggested Timeline

The amount of time you spend on introductory discussions, data collection, and analysis, will determine your overall timeline. The following represents a possible timeline.

- One class period - Introductory Discussion
- One class period - Investigation I: Finding your resting pulse rate
- One class period - Investigation II: Determining pulse rate during exercise
- One class period - Analysis

Additional days can be used for further investigations.



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