



Using Physiology to Explore Graphing

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Grade - Level:

High School

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Introduction:

Making graphs can be a challenging process for some students to understand. My students tend to have the most trouble setting up the graph. Activities I have used to help include having students use the scale on a map to predict distances. Students are then asked if it is important that maps have an accurate scale. I then relate this to graphs. In order to see relationships on graphs, students need to understand that the x- and y-axis need to follow scales. In fact, I have my students write the scale on the x- and y-axis (1 line equals 15 feet). I also have students make numerous graphs of data tables. I use a workbook called *Refresher Math for Basic Science Classes* by David Newton as a source of “canned” data.

As students do the following activities, challenge them to do repeated trials and if possible, improve their procedures. Then have students analyze their graphs, and compare them to other students’ graphs. After this, ask students if they want to look for any other relationships. Continue to discuss graphs, and the proper setup, throughout the year, and you should see improvement.

Purpose:

Using graphs and student-collected data, students will learn how to construct and interpret graphs. Students will also design an experiment patterning the scientific method.

Objectives:

Students should be able to:

- develop simple experiments.
- designate x and y axis, scale, label and plot points on a graph.
- determine blood pressure and extrapolate heart rate using pulse, sphygmomanometer, and stethoscope.
- collect, organize, display, and analyze experimental data.
- discover factors affecting heart rate and pressure.

Materials (for all modules):

- poster paper
- newspapers
- ruler
- string
- maps
- watch with second hand or stopwatch
- sphygmomanometer
- stethoscope

Procedure:

This activity is split into four modules. I find that groups not larger than three work best in facilitating active participation of all students. Usually, I have students work in the smallest-sized group that the equipment and materials dictate. The first module is an

introduction to the graphing, and the second discusses the importance of scale in a graph. The third module involves brainstorming and discussing factors affecting heart rate. Then students design experiments to test their hypotheses. The fourth module is the same as the third, however, students test hypotheses on blood pressure.

Safety and Other Considerations:

Be aware of students with asthma or other conditions that may cause discomfort to students. I recommend using radial pulse for convenience and safety. Have the students practice finding the pulse for several minutes.

Module 1 – Graphing Heart Rate

Materials:

- newspapers
- poster paper

Procedure:

Students will work in small groups (3). Each group will receive a newspaper. Let the students spend several minutes locating and analyzing several graphs.

Tell students to select a graph, study it more carefully, and give a presentation on what the graph is attempting to illustrate.

Discuss as a class the labels and numbering on the axes. Also discuss the types of graphs used and if they are appropriate for the information presented.

Give students multiple sets of data and have them graph some portion of the data with the type of graph they choose. Students will make large graphs. The class will discuss and critique each graph.

Module 2 – Importance of Scale (Uniform Axes) in Graphs

Introduction:

Students will use maps to predict distances between two points. After completing this activity, students should realize:

- a map is a type of graph;
- a scale for the x and y axis is as important as a scale on a map; and
- dimensional analysis is used to solve real world problems.

Materials:

- ruler
- maps
- string

Procedure:

1. Distribute maps.
2. Discuss what is shown on the map. Is this a graph?

3. Point out the key. Then pick a familiar place on the map and ask students how far it is to that point. Have students measure distance with a ruler.
4. Point out scale. Let students calculate distance. Discuss results. Compare calculated distance to known distance.
5. Have students make additional predictions of distances between unfamiliar towns and landmarks. Discuss the importance of a uniform scale on a map. Point out to students that like a scale of a map represents a specific distance, each division on an axis must represent a specific amount of time, distance, beats per minute, volume, etc.

Module 3 – Graphing Heart Rate

Introduction:

Start this activity by finding out what students know. List factors students think affect heart rate. After you have a good list, ask them what they are basing these observations on – perhaps their experiences or what they have heard.

Show students places on the body where one can find a pulse. Have students practice finding a pulse at those points on the body. Ask students: where does a pulse come from? What are we feeling? Have students count their pulse for 20 seconds, and multiply the number by 3 (ask them why 3?) for their pulse rate.

Materials:

- watch with second hand or stopwatch
- poster paper

Procedure:

Now that students can find their own pulse, ask them if they can design experiments to show the effects of various activities (see brainstorming list) on heart rate. Have each group design an experiment and present it to the instructor for approval before allowing them to proceed with the data collection.

Make sure they have created the appropriate table for recording their data.

When students are performing their experiment, there may be a certain amount of chaos in the room – this part should be fun.

Evaluation:

As soon as students finish their data collection, get them focused on putting together a presentation showing what they tested, why, how, and what they found out. Make sure students include a graph in their presentations.

Module 4 – Graphing Blood Pressure

Introduction:

Start this activity by finding out what students know. List factors students think affect blood pressure. After you have a good list, ask them what they are basing these observations on – perhaps their experiences or what they have heard.

Show students places on the body where one can find a pulse. Have students practice finding a pulse at those points of the body. Ask students where does a pulse come from, and what are we feeling? You may discuss flow, pressure, and diameter of vessels here.

Materials:

- sphygmomanometer
- stethoscope
- poster paper

Procedure:

Now that students can find their own pulse, ask them if they can design an experiment to show the effects of various activities (see brainstorming list) on blood pressure. Have each group design an experiment and present it to the instructor for approval before allowing them to proceed with data collection.

Make sure they have created the appropriate table for recording their data.

When students are performing their experiment, there may be a certain amount of chaos in the room – this part should be fun.

Evaluation:

As soon as students finish their data collection, get them focused on putting together a presentation showing what they tested, why, how, and what they found out. Make sure students include a graph in their presentations.