

Pillar: Exercise and Body Systems

Division: IV

Grade Level: 11

Core Curriculum Connections: Biology 20, Math

I. Rationale:

This activity demonstrates how exercise affects heart rate and how this affects the body in the amount of oxygen and nutrients that are carried to the cells for use during exercise. In previous classes, students should have learned that the blood is the medium in which oxygen and nutrients are transported to get to the body's cells. The amount of oxygen and nutrients needed by the cells is affected by the activities that we do. An increase in oxygen results in increased breathing rates and affects the cardiac output of the heart as the heart pumps more blood from the heart to accommodate for increased cellular activity. Students will calculate cardiac output and how cardiac output is affected by different levels of activity (sitting for a low-impact activity, walking/pacing for a medium impact activity and jumping jacks for a high impact activity). All students calculate their own cardiac outputs for each activity. Students then collect the data and graph the results (scatter plot or line graph) for each activity.

II. Activity Objectives:

Students will be able to:

- calculate cardiac output from heart rate and stroke volume
- graph the cardiac output of three activities among a class sample and determine from the graph, the relationship between heart rate and cardiac output
- enjoy physical activity and recognize the importance of exercise to blood flow and oxygen for the body

III. Curriculum Outcomes:

Biology 20 Unit D: Human Systems	Math 10 Applied Topic 5: Linear Functions
<p>General Outcome 2 <i>Students will explain the role of the circulatory and defense systems in maintaining an internal equilibrium.</i></p>	<p>General Outcome: Examine the nature of relations with an emphasis on functions</p>
<p>20–D2.2k describe the action of the heart, blood pressure and the general circulation of blood through coronary, pulmonary and systemic pathways</p>	<p>Apply line-fitting and correlation techniques to analyze experimental results.</p>
<p>20–D2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions</p> <ul style="list-style-type: none"> • <i>determine, from available data, the relationship between blood pressure and exercise</i> • <i>investigate lifestyle behaviour, physical fitness and heart rate recovery, using available data, and account for discrepancies</i> 	<p>SO 5.5 Determine the equation of a line of best fit, using:</p> <ul style="list-style-type: none"> • <i>estimate of slope and one point, median–median method, least squares method with technology</i>
<p>20–D2.4s students will work collaboratively in addressing problems and apply the skills and conventions of science in</p>	

communicating information and ideas and in assessing results

- *work cooperatively with team members to measure and record blood pressure, heart rate or any other factor relating to the circulatory system*

IV. Materials:

- graph paper, looseleaf
- pens, pencils, crayons
- stopwatch or timer
- music
- ruler

V. Procedure:

1. Have students create a table on loose leaf to record the data collected during the activity. There should be three columns: "Activity", "Heart Rate", and "Cardiac Output".
2. Ask students to sit quietly in their desks and find their pulse(either neck or elbow). Students will then count the number of beats as the teacher keeps time for 1 min. Record the heart rate.
3. Then have students walk/pace up and down the halls for two minutes. Immediately right after, students stop and count their heart rate as the teacher keeps time for 1 min. Record the heart rate.
4. Then have students come back into the classroom and do some jumping jacks or run in the same spot to music for about 2 mins. Immediately after, students will count their heart rate as the teacher keeps time for 1 min. Record heart rate.
5. Students will then calculate the cardiac output of each activity for themselves.
6. Students will then gather the results of the entire class and create 3 graphs to determine the relationship between cardiac output and activity. Students can choose to graph each activity separately or graph all three on one graph. Students will then determine the correlation (positive or negative), determine a line of best fit that they can find the equation of.

VII. Assessment Ideas:

- Student calculations and graphs
- Students should be able to formulate an opinion on how exercise affects cardiac output and heart rate.

VIII. Source:

- ❖ Lesson ideas submitted by Christine Wu, Science Teacher, Bentley School, Wolf Creek Public Schools.

