Lesson Plan 4: Practical – Observing and Measuring the Short-Term Effects of Exercise on the Cardiorespiratory System

Learning Aims

All learners should:	Develop understanding of the short-term effects of exercise on the cardiorespiratory system through participation, measurement and observation; take physiological measurements before and after exercise
Most learners should	Describe and explain these changes
Some learners should	Using three different sports/exercise activities, compare and contrast how the cardiorespiratory system responds to short-term exercise

Keywords: heart rate, breathing rate, stroke volume, cardiac output

Starter

Using student input, recap the short-term effects of exercise.

Main

1. Explain the practical and hand out log sheets.
2. Students should measure their resting values for heart rate and breathing rate (per minute).
3. a) Lead a group warm-up.
   b) Students should then take turns to perform a period of exercise which will elicit short-term changes (a series of sprints, circuit training or aerobics, brisk walking). The exercise should be of sufficient intensity and duration to elicit physical changes.
4. Immediately following the exercise period, students need to measure their heart rate and breathing rate. This should be done simultaneously, therefore the student must either 1) use a heart rate monitor to measure heart rate and count breathing rate manually or 2) have a partner to measure either heart rate or breathing rate while they count the other.
5. Students should also take note of observable changes to the skin (sweating and reddening). While resources will not permit for tidal volume to be measured, students can note that they breathe much more deeply following exercise and this indicates that tidal volume has increased.
6. Using the values obtained, students will be able to calculate estimated cardiac output. Students should note the considerable difference in cardiac output before and after exercise. Students should be able to describe and explain the changes observed.

NB: *Students can create a report from this practical. More able students should perform three different sports (or activities which mimic the intensity of different sports) and compare the effects. Students should be required to write up their results, providing full explanations for the changes observed and the reasons for the differences. This practical provides an opportunity to assess mathematical skills. More able students can perform further calculations – for example, the percentage increase of cardiac output before and after exercise.*

Opportunity to assess mathematical skills

Short-Term Effects of Exercise on the Cardiorespiratory System: Practical

Name:	**Date:**

1. Measure your resting values

   Heart rate: ..... beats/minute Breathing rate: ..... breaths/minute

2. Perform a period of intensive exercise.

   Describe the exercise which you have performed (activity and duration):

   .....

   .....

   .....

   .....

3. Measure your post-exercise values

   Heart rate: ..... beats/minute

   Breathing rate: ..... breaths/minute

4. Note any observable changes:
   - skin reddening
   - sweat production
   - depth of breathing

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5. Estimate cardiac output during and after exercise.

   *(Values for **stroke volume** vary greatly in individuals because of a range of factors including gender, age and training status. For the purpose of this practical, assume that during rest your stroke volume is 80 ml and as a result of exercise it increases to 120 ml.)*

   Resting cardiac output

   Resting heart rate × 80 ml = ... ml/min

   Post-exercise cardiac output

   Post-exercise heart rate × 120 ml = ... ml/min

6. Create a report describing and explaining the changes you have measured and observed.