Measuring Heart Rate with Doppler Ultrasound

**Grade Level:** 6th to 8th; **Type:** Engineering, Health and Medical Science

**Objective:**

Learn about the scientific principles behind Doppler ultrasound and evaluate how effective it is at measuring heart rate compared to other, more conventional methods of heart rate measurement.

**Research Questions:**

- How does Doppler ultrasound work?
- How can Doppler technology be used to measure heart rate?

Doppler ultrasound is a non-invasive test that can be used to measure blood flow and blood pressure by bouncing high-frequency sound waves off of circulating blood. In this experiment, you will use Doppler ultrasound to calculate your heart rate and compare its accuracy to other methods of heart rate measurement.

**Materials:**

- 3 MHz Pocket Doppler device ($50-$75)
- Ultrasound gel
- Wrist heart rate monitor ($30-$75)
- Stopwatch
- Notebook for recording and analyzing results

**Experimental Procedure:**

*Perform all heart rate experiments while at rest. If you must move around between measurements, wait 3-5 minutes before resuming to allow your heart rate to return to a normal resting level.*

**Part A**

1. Perform Steps 2-4 with your Doppler device:
2. Place a small drop of ultrasound gel over the axial pulse in your wrist. Place the wand of the pocket Doppler device firmly on top of the gel and listen carefully. Move the wand around until you can hear your pulse. Count the audible pulsing sounds for one minute. Record this number.
3. Locate the carotid pulse in your neck. Place a small drop of ultrasound gel over the location of your carotid pulse, and measure heart rate with the Doppler device by counting the pulsing sounds that you hear for one minute. Record this number.
4. Place the Doppler device over your heart and record the number of beats that you hear in one minute.

**Part B**

1. Perform the following steps using your fingers.
2. Place two fingers on your axial pulse and count the pulses that you can feel for one minute. Record this number.
3. Place two fingers on your carotid pulse and count the beats that you feel for one minute. Record this
Part C

1. Put on your wrist heart rate monitor to measure beats per minute. Record this measurement.
2. Look at your data. Every measurement should be recorded as beats per minute (bpm), which is the standard metric for heart rate measurement.
3. Do you observe variability among the different ways of measuring heart rate? Which measurement do you think is most accurate? Why?

Terms/Concepts: Doppler ultrasound; calculating heart rate; carotid pulse; radial pulse