Judith Resnik

Biomedical Circuitry Challenge

MISSION SPECIALIST, ENGINEER

Resnik was a biomedical and electrical engineer who focused on the application of circuits and computer systems in space. She was the first Jewish woman in space and a strong advocate for women in STEM.

OBJECTIVE

Simulate a biomedical device that tracks a person's pulse using circuits or analog models.

STUDENTS WILL:

1. Be introduced to Resnik's engineering and medical tech background.
2. Learn how a pulse monitor works.
3. Build a device that simulates pulse tracking.
4. Present how this helps astronauts or doctors.

MATERIALS

- LED lights, copper tape, batteries (optional: micro:bit)
- Cardboard tubes, yarn, markers
- Student worksheet (engineering design process)

STEP BY STEP INSTRUCTIONS

1. **Introductions:** Share Resnik's role as a biomedical and electrical engineer.
    a. On board the Challenger, one of her NASA assigned mission goals was to deploy a communications satellite that would enhance communication between ground control and the spacecraft.
    b. See Biographical Data Sheet for her work experience with NASA
    c. Notable works of Resnik:
        i. She worked as an electrical engineer contributing research to the topic of data and signal analysis.
        ii. She operated the Canadarm during a mission on board the Discovery shuttle to help deploy satellites and conduct experiments in orbit.

STEP BY STEP INSTRUCTIONS (continued)

2. **Discuss Biomedical Devices:**
   a. What are they?
      i. **Answer –** any machine or tool that health care professionals would use to diagnose, treat, or care for individuals seeking medical care.
   b. How do they help people?
      i. **Answer –** this varies based upon which device is being used. For example, CT and MRI machines can take pictures of what is going on inside the human body, whereas a dialysis machine can clean a person's blood when their kidneys are not functioning properly.
3. **Basic Pulse Check:** Have students find and measure their pulse.
   a. A person's pulse can be taken by locating a spot where they feel the pulse (either by the radial pulse on their wrist or their carotid pulse on their neck). Once the pulse has been located and a steady heart beat has been found, have the students count the number of beats that occur within 15 seconds. Once the students have that number ask them to multiply it by 4 to obtain how many beats occurred within one minute.
      i. A normal resting pulse for school-aged children is between 75 and 110 BPM (beats per minute). This can vary based upon activity level.
4. **Design Challenger:** Build a device (low-tech: cardboard and markers / high-tech: LEDs and circuits) that represent how a sensor might detect and display a pulse.
   a. Begin by reviewing background knowledge of the student by answering the first question on the Pulse Monitoring Student Worksheet.
   b. Share with your students what supplies they will have available to create a device. Set boundaries and expectations for the supplies and activity.
   c. Have them sketch their design on the front of the Pulse Monitoring Student Worksheet.
   d. Allow time for the students to build their device.
5. **Test and Share:** Students display how their device works and explain its design.
   a. Have students complete the back of the Pulse Monitoring Student Worksheet prior to sharing so they can gather their thoughts before sharing with the class.

Optional: Micro bit Integration: Code a heartbeat monitor simulation (if available).

Extension: Design a wearable space health sensor with a labeled prototype.

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Pulse Monitor Student Worksheet

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Resnik was a biomedical and electrical engineer who focused on the application of circuits and computer systems in space. She was the first Jewish woman in space and a strong advocate for women in STEM.

What do you know about how the human body is monitored in space?

Sketch or describe your pulse-monitoring device:
[Include sensor, power, display, etc.]

What materials did you use and why?

How did you test your design? What improvements could be made?