The Good Vibrations Lab: What's the Secret to Sound?

Big Idea: We can investigate the relationship between vibrations, sound, and pitch using everyday objects.

Learning Objectives:

- Students will be able to explain that sound is caused by vibrations.
- Students will be able to demonstrate that changing the speed of a vibration changes its pitch.
- Students will be able to differentiate between pitch (how high/low a note is) and volume (how loud/quiet a sound is).

Materials (per group of 2-3 students):

- 1 open-topped container (e.g., a shoebox, plastic food container, tissue box)
- 3-4 rubber bands of different sizes and thicknesses
- 1 ruler

Teacher Preparation (5 minutes)

1. Organize materials into bins or kits for each group to ensure a quick start.
2. Set up a teacher demonstration station with the same materials.
3. Write the lab's guiding question on the board: **"How are sound, vibrations, and pitch related?"**

Lab Procedure & Teacher Moves (45-minute period)

Part 1: Launch & Initial Exploration (10 minutes)

Teacher Moves:

- **(5 min) Engage:** Gather students. Hold up a rubber band and the box. Ask the class: *"How could we use these simple objects to make sound?"* Pluck the rubber band. *"What did you observe? What did you hear?"* Introduce the guiding question on the board.

- **(5 min) Instruct & Distribute:** Explain that they will be "sound scientists" today. Quickly explain the three parts of the lab. Pass out the materials.

Student Procedure:

1. Choose one rubber band and stretch it lengthwise around the open part of your container.
2. Gently pluck the rubber band like a guitar string. Watch it closely. What do you **see**? What do you **hear**?
3. Pluck it again, but this time, gently touch the vibrating rubber band with your finger. What do you **feel**? What happens to the sound when the vibration stops?
4. Discuss with your group: **What seems to be causing the sound?**

Part 2: Investigating Pitch (15 minutes)

Teacher Moves:

- Bring the class back for a moment. Ask: *"Did anyone figure out how to change the sound? How could we make a higher or lower note?"* Listen to a few ideas.
- Introduce the term **pitch** – explaining it means how high or low a note sounds.
- As students work, circulate and ask probing questions: *"What are you changing about the rubber band to change the pitch?" "How does a shorter vibrating part move compared to a longer one? Does it look faster or slower?"*

Student Procedure:

1. Place the ruler under the rubber band, across the top of the container.
2. Pluck the rubber band. Listen to the pitch.
3. Now, use one finger to press the rubber band down firmly against the ruler at the halfway mark. This shortens the part that can vibrate.
4. Pluck the shortened side of the rubber band. Listen to the pitch now. Is it **higher** or **lower** than before?
5. Experiment by pressing down at different spots on the ruler. Try to make the highest pitch you can and the lowest pitch you can with one rubber band.
6. Discuss with your group: **What is the relationship between the length of the vibrating rubber band and its pitch?**

Part 3: Pitch vs. Loudness (10 minutes)

Teacher Moves:

- Frame this final part explicitly to address the misconception. Say: *"Great job figuring out how to change the pitch! Now for a different challenge. Without changing where you press on the ruler, can you make the same note, but make it louder?"*
- Listen as groups experiment. Reinforce the vocabulary: *"So plucking harder changes the **loudness**, or **volume**, but changing the length changes the **pitch**."*

Student Procedure:

1. Choose one spot to press down on the rubber band.
2. First, pluck the rubber band very gently. Listen to the pitch and the loudness (volume).
3. Now, without moving your finger, pluck the rubber band much harder.
4. Did the **pitch** (the note) change, or did the **loudness** (the volume) change?
5. Discuss with your group: **What do you do to change a sound's pitch? What do you do to change a sound's volume?**

Part 4: Cleanup & Wrap-up (5 minutes)

Teacher Moves:

- Give a 2-minute warning for cleanup.
- In the final minutes, have a few groups share their answer to the final discussion question from Part 3. Revisit the guiding question on the board and ask for a concluding thought. *"So, what's the secret to sound?"* (Answer: Vibrations!)