

Hands-On Activity

Make a Musical Instrument

In this activity, students will design and construct the prototype for a musical instrument. Students will identify variables that affect the pitch and volume of the instrument, predict how the instrument will sound, and then collect and analyze data on the functionality of the instrument as they are building the prototype.

Materials:

- A selection of the following materials for students to choose from:
 - Empty paper-towel rolls
 - Empty plastic water bottles
 - Empty metal cans
 - Plastic drinking cups
 - Glass jars or cups of different sizes
 - Dried beans, peas, lentils
 - Craft sticks
 - Toothpicks
 - Rubber bands of varying lengths and thicknesses
 - String
 - Thin metal wire
 - Aluminum foil
 - Balsa wood
 - Chopsticks
 - Cardboard or poster board
 - Tape
 - Glue
 - Craft knife
 - Wire cutters
 - Glue gun
 - Hammer
 - Brad nails
 - Paper clips
- For each student:
 - Scissors
 - Ruler

- Safety Goggles
- Blank white paper, 11 x 14
- Pencil
- Red pencil
- Eraser

Tell students that the goal of this activity is to use a selection of the available materials to make a musical instrument that can vary in pitch and loudness. They will identify variables in the design that affect pitch (frequency) and volume (amplitude) and manipulate those variables for the desired effect. Explain to students that they will first draw a design of their instrument and predict what the instrument will sound like. Designs should show how wavelength, frequency, and amplitude will be manipulated while playing the instrument. Invite students to examine the available materials before working on their designs.

Look over students' work as they complete their designs. Ask students to identify the variables that affect volume and pitch and explain how their instrument will allow for changes in volume and pitch. Then invite students to begin work on their prototype instruments. Remind students to wear safety goggles as they work. Caution students to use care with sharp cutting tools and glass jars, and to ensure safety, carefully supervise the students who choose these items.

As students work, encourage them to test the prototypes as they go to make sure the instruments are behaving in the way they would like them to. Have students note any deviations from their original design in red pencil. Point out that what they are doing when they are testing the prototype instrument is actually collecting and analyzing data on the instrument's functionality. Remind students that building a prototype is one step in the design process, and that prototypes often have unforeseen complications or do not work in the way that was planned on paper. Explain that scientists and engineers learn a great deal from experiments or prototypes that do not work as originally planned. Encourage students to explain their thinking aloud as they troubleshoot their designs. Inform students that they will have more time later in the lesson to modify their designs or "go back to the drawing board," and that at this point their prototype should reflect their original design as much as possible.

When students complete their prototypes and initial testing, have them return unused items and materials that may be useful for future modifications, and recycle or dispose of scraps as appropriate.

In this activity, students will demonstrate the following Inquiry Skills:

- Engineering and Technology
 - Uses of technology
 - Each part of a mechanical device contributes to the purpose of that device.
 - Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems.
- Gather Data
 - Use senses to observe:
 - Hearing (pitch, volume, reflection, direction)
- Interpret Data
 - Identify and interpret patterns:
 - Repeating physical or data
 - Analyzes data collected during an investigation
- Design Investigations
 - Design and conduct investigations using
 - Independent variable - the one variable the investigator chooses to change
 - Dependent variables - what changes as a result of, or in response to, the change in the independent variable
- Evaluate Evidence
 - Drawing and supporting conclusion by
 - Using data to determine the cause effect relationship observed in the investigation