

Sounds Good to Me!

Summary

The students will be able to explore and identify how the size and shape of a vibrating object relates to the pitch of an object, then make a musical instrument and report on how it produces sounds.

Materials

Invitation to Learn:

- 3 different lengths of steel pipes
- Wooden dowel

Activity #1:

- 1 gong for every four students (10 hangers, 10 brads, 10 cups, string)

Activity #2:

- Tuning fork
- 3" diameter styrofoam ball attached to a string
- Music box mechanism
- 6 tubs with different types of musical instruments
- Overhead transparencies to discuss instrument discoveries
- Blackline: [What Do You Know About Sound?](#) (pdf)

Musical Instrument Activity:

- Scissors
- Transparent tape
- Small pencil
- Dental floss
- Small paper clips
- Clear 1liter or 2liter bottle

Books:

- *Uncovering Student Ideas in Science: 25 Formative Assessment Probes, Vol. 1*
, by Page Keeley, Francis Eberle, and Lynn Farrin, ISBN:13:9780873552554

Media:

- *Sound*
, by Bill Nye (Disney Educational Productions) Bill Nye videos on Light and Sound can be downloaded free at <http://www.utahitv.org/videos/search>

Background for Teachers

Sound is a form of energy caused by vibrations. Sound must have a medium to vibrate through, or it cannot be heard. Some of these mediums include gases such as air, liquids such as water, and solids such as metal or wood. If something produces more volume, or energy, the sound will be louder. Likewise, smaller amounts of energy will produce a softer sound.

Pitch describes how high or low a sound is. If an item vibrates more quickly, it will have a higher pitch. Likewise, if an item vibrates more slowly, it will have a lower pitch. Students at this age should be able to compare two items and predict which will have the higher or lower pitch. A longer tube will produce longer wavelengths and a lower pitch. A smaller tube will produce shorter wavelengths, and thus a higher pitch.

If sound or vibrations pass without touching any medium, then a sound is not heard. This is why sound does not travel through space, because if there is no air or anything else to vibrate, then a sound will not be heard.

Intended Learning Outcomes

1 d. Compare things, processes, and events.

1 f. Plan and conduct simple experiments.

4 b. Describe or explain observations carefully and report with pictures, sentences, and models.

Instructional Procedures

Invitation to Learn:

To ensure that all students understand what pitch is, have students close their eyes and test them on hearing a high pitch and a low pitch. Play two sounds, identifying the first sound as one, and the second sound as two. After hearing the sounds, ask which was the higher pitch, one or two. Without opening their eyes, students will hold up one or two fingers. Do this several times, until you are sure that students can tell the difference between a high pitch and a low pitch. Right now you are not trying to give a definition for what pitch is, just that they can tell high and low pitch. The reason for having student eyes closed is so that they will not notice that longer pipes have a lower pitch and shorter pipes have a higher pitch.

Instructional Procedures:

Activity #1: Change That Tone

Advance Preparation:

Each group of students will need a "gong," which is made from a wire hanger twisted apart and shaped into a long u-shaped gong. In the middle of the u-shape, tie a 30 -- 50 cm string which will connect the gong to a 9oz. clear plastic cup. The cup has a hole in the bottom and the free end of the string is tied around the brad. In this way, the cup is connected to the string, which is connected to the middle of the gong.

Have students try out the gong by putting the cup to their ear and dangling the hanger (gong) against their desk. Be sure each student gets a chance to hear the gong. The assignment is to have students work with together as a group and figure out some way to change the pitch of the gong, making it higher or lower.

Begin a journal entry with students writing the question they are investigating, then their hypothesis of how they think they can change the pitch. Allow students to use items in the classroom to change the pitch (string, tape, etc.), but do not give them any advice on how to do it. Record all tries in their journal. I suggest that they try at least 3 different ways to change the pitch before they decide on their final way.

Some students may think the pitch is changed when it isn't. Have one member of each group go to the next group to act as an independent auditor. The group should explain and demonstrate to the auditor how the pitch was changed. If there is still a disagreement, have a second auditor check out the pitch change. All groups will share their method of how they changed the pitch. Students will write in their journals what they learned about pitch.

Discuss the science of pitch, and how "pitch" refers to how high or low a sound is. Have students go on to the Joyful Noise activity to do more exploration before providing further explanations about pitch.

Activity #2: Joyful Noise

Sound is a vibration (show model with ball, string, and tuning fork). We only hear sounds when the vibration passes from one medium to another, such as bouncing off of molecules of air, through molecules of water, or molecules of a solid object such as wood, metal, etc. If sound cannot pass through an object, as in a space where there is no air, we will not hear a sound.

Sound can also pass through some materials better than others. Have students listen to the music box as I play it. Then have them listen to the same music box as you set it on a solid surface, instead of the sound just traveling through air (place music box on whiteboard, on projector, or on desk). Have them notice the difference in volume.

The vibrations can also cause musical sounds. The vibration of a string, wire, drum, or reed can cause some musical sounds. Sometimes moving air can be vibrated at certain frequencies, also causing musical sounds. The pitch of a sound usually depends on what type of wire or string is being plucked, as well as the thickness, length, and tightness of a string.

Many musical instruments also have a hollow body to allow sound to vibrate back and forth inside, creating a resonance. This will amplify (or increase) the sound, and create a musical tone. Another way to amplify the sound of an instrument is to use more energy to pluck or hit it. More energy will create more volume.

Students will explore different musical instruments, then be challenged to create their own instrument. Their created instrument must be able to change to at least three different pitches, as well as change volume from loud to soft.

Set up a journal entry to record changes in pitch and volume. As students rotate in groups through a variety of musical instruments, they will record the name of each instrument, how it changed pitch, and how it changed volume.

Ideas for instrument centers include:

- Different lengths of musical pipes (take apart a wind chime, spread pieces on eggshell foam)
- Different lengths of pvc pipe, or plastic pipe ("Boppers")
- 9oz clear plastic cups tied to a chair leg (poke hole in bottom of cup, attach to string by using a brad to connect string to cup)
- Different diameters and lengths of cans with one end cut off, string attached to bottom
- Straws cut to different lengths
- Different thicknesses of strings or rubber bands stretched across a box
- Identical bottles filled with different amounts of water
- Different diameter containers used to make drums
- Purchased musical instruments (if using flutelike instruments, include wetwipes for cleaning between students)

Have students share what they learned about pitch and volume. Be sure they have recorded their findings in their journal, as well as a final summary of what they now understand about pitch and volume and how their instrument produces sound. Have them also record any "wonderings" they still have about musical instruments pitch, and volume.

Hand out the assessment page, "What Do You Know About Sound?" Students will fill this out, record their thinking, then have a class discussion. All of the items on the page will produce a vibration, because sound is a vibration. As you discuss results with students, it will help you check for misconceptions they might have about sound.

Lesson and Activity Time Schedule:

Lesson: 70 minutes.

Activity: Making a Musical Instrument -- 20 minutes.

Total lesson and activity time is 90 minutes.

Activity Connected to Lesson:

Making a Musical Instrument

Students may also make a homemade instrument by using a one or two liter plastic bottle.

Teacher supervision is needed for punching holes and cutting the side of the bottle.

Materials needed for each student: bottle, dental floss, small paper clip, short pencil or dowel.

Punch a hole in the end of the bottle large enough to thread dental floss through.

Cut a hole about three fingers high and three fingers wide about 10 cm from the bottom of the bottle. You could use part of the cut plastic to make a "guitar" pick.

Cut dental floss twice the length of the bottle, plus an additional 10 cm.

Fold the floss in half, then push the loop of floss through the hole in the bottom, using fingers through the side hole to pull it through the bottle and partway out the top (lid removed).

Loop the end around a small pencil at the top of the bottle (tape in place on pencil). Tie the other end of the floss to a small paper clip at the bottom of the bottle and tighten the floss with knots. Spin the pencil to put knots in the string to tighten the string. This instrument is played by plucking the string while adjusting tension with the pencil.
Play a song.

Extensions

Advanced Learners: Science is a great way to provide enrichment. Challenge students to research different aspects of sound, musical instruments, etc. Some products they may make include making a PowerPoint presentation for the class on sound, making different types of musical instruments, new adaptations for hearing impaired people, etc. They could also explore the correlation between math and producing different pitches.

Special needs/English Language Learners will need a partner or teacher supervision to setup their data table.

Math and science are easily integrated. Fractions are used when making instruments that produce different pitches. To integrate language arts, have students make an advertisement and poster telling the features of their musical instrument.

When students bring their homemade instruments to class, have a "Battle of the Bands," in which girls compete against the boys to play the best song with their combined instruments. Allow students about 5 minutes to come up with a song, then they must perform with each other.

Family Connections:

Assignments to do with parents:

Homemade musical instruments are great to make as a family. Then have a family band as each member plays his/her instrument.

Make a radio broadcast similar to those done in the past. Select a story to be read, while family members create the sound effects to go with the story.

Sit in a quiet place at home, and record all the sounds your hear for five minutes.

Assessment Plan

Look at journal entries in which students record their understanding of pitch, as well as their data table from instrument labs.

The "What Do You Know About Sound?" assessment page will help you discover student misconceptions about sound and vibration, (Note: All items produce a vibration.)

Make an instrument which changes at least 5 pitches and can change volume.

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