Making Waves, Making Music, Making Noise

Summary

Students will construct "talking cans" and instruments to understand how vibration of objects produces various sounds.

Group Size

Large Groups

Materials

Activity #1

Empty tin cans
Cotton string (medium thickness)
Scissors
Several thin sponges or baby wipes
Large paper clips
Duct tape
A variety of toy-type objects that make noise

Activity #2

Wooden slate board 1 1/2" x 1/4" x 20". (A meter stick cut in half also works.)
1" inside diameter PVC pipe, cut into a 3" length, with pre-drilled holes to allow three strings of fishing line to go through.
Fishing line of three different weights/test strengths (e.g., 6 lb., 20 lb., and 50 lb.)
Utility knife
Duct tape
Set of "Boomwhackers"

Additional Resources

Books

- *Horrible Science-Sounds Dreadful*
  , by Nick Arnold (Scholastic); ISBN 0-439-20723-1
- *A World of Sound*
  , by Nancy Leber and Robin Bromley (Newbridge Educational Publishing, http://www.newbridgeonline.com, includes Teacher Resource Book); ISBN 1-56784-478-2
- *Light, Sound, & Electricity*
  , by Kirsteen Rogers, Phillip Clarke, Alastair Smith, and Corinne Henderson (The Usborne Internet- Linked Library of Science, Scholastic); IBSN 0-439-44147-1
- *Primarily Physics: Investigations in Sound, Light, and Heat Energy*
  , (AIMS, http://www.AIMSedu.org, 1-888-733-2467); Item 1104

Videos

- *Sound*
  , by Bill Nye (Disney Educational Productions, 1-800-295-5010, http://dep.disney.go.com/educational/index); VHS Product ID: 68A99VL00, DVD Product ID: 77A34VL00
- *The Way Things Work--Sound*
  , (Schlessinger Media, 1-800-843-3620, http://www.libraryvideo.com); K7861
- *Breaking the Silence: An Introduction to Sound*
  , Live Action Video, (Rainbow Educational Media, 1-800-331-4047, http://www.rainbowedumedia.com/); Product ID: RB814

Background for Teachers

Consider a teacher's most frequent request throughout the day, "Quiet, please." Whether it's the insistent talking, the pencil tapping, the humming, the ongoing shuffling, or the strange and bizarre noises that emit from children--teachers are constantly asking for quiet. Why? Because children are masters at vibrating the particles around them, therefore creating--SOUND--and lots of it. *Sound* is a form of energy made by vibration--the complete back-and-forth motion of an object. This includes vibrations of anything that is a solid, liquid, and/or gas. Therefore, the chances of a child making vibrations are extremely great, varied, and frequent. However, sound cannot be made in a vacuum or in outer space where there is nothing to vibrate.

Quick Review: Sound is created with vibrations but cannot be made in a vacuum or out in space.

Solution: Be able to convert your classroom into a vacuum or contact NASA for a grant.

Sound waves are caused by vibrations through a material medium and will go out in all directions from their source. A medium is a substance through which a wave can travel. (However, the material medium just vibrates back and forth and helps transfer the sound energy. It is not carried along with the sound wave.)

Example: At the peak of lunch time in the cafeteria, when hundreds of children are eating and talking and vibrating the air (gas), the tables (solids), and the milk cartons (liquids). All of these vibrations go out in all directions from each of their little sources creating a great cacophony.

Quick review: Sound waves need a medium to travel through and will travel in all directions from the source of vibration.

Solution: Reduce the number of mediums in a given environment through which sound can travel.

The quality of the sound that children make is purely subjective. However, strictly and factually speaking, the number of sound waves an object produces in a second is called frequency. The frequency of vibrations determines how high or low the pitch of the sound is. The faster the object vibrates, the higher the perceived pitch. The slower the object vibrates, the lower the perceived pitch will be. The size and shape of an object will also affect the pitch.

Quick review: Pitch is how high or low a sound seems to be and is determined by the number of vibrations per second. Pitch also determines the extent of how far your last nerve is plucked.

Solution: Determine which range of highness or lowness you can tolerate and remain happy and calm. Using effective behavior modification techniques, teach your students to stay within this range.

The major differences between all creatures young and old is the amount of energy they possess. The young seem to have an endless supply, the old somewhat more limited. This amount of energy has a direct correlation to the volume of sound created. When an object is struck lightly, with little energy, it makes a soft sound. When more force is applied, it produces more energy, making a louder sound. That's why teachers will compromise and say, "Use your soft voice when talking," in hopes of encouraging children to apply less force onto their vocal cords.

Quick review: Volume is how loud or soft a sound seems to be and is related to the amount of energy contained in the vibrations. It is also the single most determining factor that constitutes a successful day of teaching.

Solution: Reduce the amount of energy in your classroom. Running multiple laps around the field in all kinds of weather is highly recommended.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning
5. Demonstrate Awareness of Social and Historical Aspects of Science
6. Understand the Nature of Science

Instructional Procedures

Invitation to Learn

Choose a ‘Talking Can’ to demonstrate to students the sound it produces. (To get maximum sound from a ‘Talking Can,’ slide a small damp sponge or baby wipe across the cotton string. How you slide across the cotton string gives you different effects (e.g., short, jerky motions verses long, smooth motions).

Pick up a different size can and ask students how the sound from this can will compare to the first can. Encourage students to observe the shape and size of the can as they think how the sound will be affected. Encourage students to think about why the different shapes and sizes of cans create different sounds.

Instructional Procedures

Activity #1—Making Waves with ‘Talking Cans’

Activity Time: 45 minutes

Advance Preparation

- Make several ‘Talking Cans’ using different shapes and sizes of empty tin cans. The more variety the better for this activity. (Use empty cans from canned foods; check with cafeteria workers for large cans.)
- Tin cans should be empty, clean, with one end of the can completely opened, and sharp edges filed down.
- Make a small hole in the center of the top of each can.
- Cut a meter-length of cotton string for each can.
- Thread the string through the hole in the top of the can and tie the top end to a large paper clip.
- Secure the paper clip (that has the tied string to it) with a piece of duct tape to the top of the can.
- The remaining string should be free to hang from the inside of the can with the top secured with duct tape.
- Continue this process for all tin cans.
- Prior to this activity, select a short story that has several characters that can be portrayed with different sounds. Make a list of characters and assign which ‘Talking Cans’ and other sound makers will be used for each character.

Hint: Stories that have several animal characters work well.

Activity

- Tell students that they will be performing the sound effects for a story.
- Assign students to various ‘Talking Cans’ and other sound makers.
- Tell students that when they hear their character mentioned, they are to follow immediately with the corresponding sound.
- Before you begin reading the story, have students practice their sound parts. Instruct students to make their sound as quiet . . . as loud . . . as high . . . and as low as they can.
- As you read the story, pause for a moment to allow students to perform their sounds. Modify the story so students have to play quiet, loud, high, and low sounds.
- *Advisory Hint:* Keep the pace of the story moving.
- After the story, talk more in depth about the science behind the sounds. Select two ‘Talking Cans’ that vary in shape and size. Have students discuss as a group the differences in sounds.
- Ask students:
  - Why do these two cans make different sounds?
  - Which one makes the higher sound and why?
  - Which one makes a lower sound and why?
  - Can you make the sounds softer? louder? How?
  - Is there a way you can make lower sounds on the smaller can? How? Why does this work?
  - Is there a way you can make higher sounds on the larger can? How? Why does this work?

Choose two different cans that vary in shape and size. Have students go through the same comparison process, writing responses to the same types of questions in their journals. Encourage students to use labeled diagrams.

Activity #2—Making Music, Making Noise

Activity Time: 30 minutes

Advance Preparation

Cut a meter-length of each of three different weights of fishing line.

Using a utility knife, carefully make three slit-type notches on both ends of the wooden slat board.

Note: Keep in mind the diameter size of each type of fishing line and make notches accordingly.

Tie a large knot at one end of each fishing line.

Thread each line through the 3” piece of PVC pipe and then secure the knotted end into the slit-type notches. After all three are secured to one end of the board, wrap a piece of duct tape around that end to help prevent strings from slipping.

To secure the other end, pull each string to find the amount of tension it can take. Make a knot at the tension point and secure with a slit-type notch. After all three strings have been secured, wrap a piece of duct tape around to help prevent strings from slipping.

These instruments can be used:

- As a class demonstration.
- In a sound center.
- With each group of students if cooperative groups are used and if you make enough for each group.
- As an introduction to making individual musical instruments.

Have students think about the following questions as they manipulate the BoJo. Record their responses in their journals.

Move the PVC piece slowly up and down the base.

- What does lengthening and shortening the strings do to the sound?
- Why do you get higher sounds with shorter strings?
- Why do you get lower sounds with longer strings?

Pluck the strings gently.

- What happens to the volume?
- Why does it become softer?

Pluck the strings harder.

- What happens to the volume?
- Why does it become louder?

Move the PVC piece 3/4 up the board. Play the thinnest string and the thickest string.

- Is there a difference in sound?
- Why is the thinner string higher than the thicker string if they are both the same length?
- Is there a way to make the pitch the same between the thinner string and the thicker string?

Have students think about the following questions as they manipulate the ‘Boomwhackers.’ Record their responses in their journals.

- Predict which of the ‘Boomwhackers’ will give the highest sound when played properly.
- Arrange the rest of the “Boomwhackers” in order from highest to lowest.
- Record your prediction in your journal.
- *Note:* Playing the ‘Boomwhackers’ properly is gently tapping each tube on your own head and listening to the sound.
- Test your prediction and record data in your journal.
- Explain in detail why the shorter tubes make the higher sounds and the longer tubes make the lower sounds.

Strategies for Diverse Learners

- Reduce length and/or complexity of written assignments and post vocabulary and key concepts in the room.
- Have the class help design a scoring rubric to assess their musical instrument. Establish time lines to guide students in project completion.
- Communicate the expectations and timeline of making a musical instrument to students and their parents. Come to an agreement on any adaptations that might be helpful for individual students.

Extensions

- Focus on cause/effect relationships and use a flow chart graphic organizer.
- Design an advertisement for this instrument. Include the following:
  - An original name.
  - List of features the instrument can do.
  - A diagram illustrating how it works.
  - An explanation of the science behind why it works.

Family Connections

- Quietly sit somewhere in your home for five minutes. Record all of the sounds that you hear in that time frame.
- Have each student select a short story with accompanying sounds, family members perform the story with sound effects.
- Have each student build a model of a simple ‘telephone’ using cups and string. Try it with family members. Record observations and discoveries. The following may be used to help with the investigation:
  - Stand apart the distance of the string on the phone. Begin talking softly to your partner without the telephone. Now talk at the same level using the telephone—make sure the string is pulled tight. Why does talking through the ‘telephone’ make it easier to hear your partner?
  - Talk to your partner in a very low voice. Then talk in a very high voice. Why do lower pitches sound clearer than higher pitches through the ‘telephone’?
  - Talk to your partner in a low voice with the string relaxed and saggy. Why do tight strings work better than saggy strings?
  - Design a way to have a conference call with more than two people. Draw a diagram of your design. What features made it work the best?
  - Why does adding more people to the ‘telephone’ system make the sound less clear?

Assessment Plan

Performance Task

- Make an instrument that has the following criteria:
  - It is durable and can be played.
  - It can be played loud or soft.
  - It can play both high and low pitches.

Constructed Response

- Choose one or more demonstrations to do in front of the class. Have students explain the science behind the demonstration(s) using science language and the basic concepts learned about sound. Encourage students to include diagrams with their explanations.
- The following are suggested demonstrations:
  - Resonating box and tuning fork
  - Singing tube
  - Popping tube
  - What’s wrong with the video clip in Star Wars when there is sound coming from lasers in

space?

Authors

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