Good Vibrations: The Science of Sound

OBJECTIVES:

- Understand that sounds are made by vibrations.
- Understand how sounds travel and are heard.
- Develop science skills of observing, comparing, and categorizing.
- Gain an appreciation for how sounds enrich our lives.

GROUP SIZE:

6–8 children per adult volunteer

TIME FRAME:

This lesson is designed for a group meeting between 30 and 60 minutes. Each activity will take about 5–15 minutes to complete.

BACKGROUND:

Sound is vibration moving through a material such as air, water, or other material. Our ears collect the vibrations and pass them down the ear canal to the eardrum. The eardrum vibrates like the head of a drum. Other small bones in the ear continue the vibrations until they reach the inner ear, where they are changed to signals that are sent to the brain.

LIFE SKILL AREAS

- The group discussions and experiments are a good way for the children to develop social skills and science skills.
- Fine motor skills and hand-eye coordination can be developed through using scissors and making the various musical instruments.

HELPS TO THE VOLUNTEER

Try these suggestions:

- Choose one or two of the following activities from each section.

LEARNING ACTIVITIES:

1. Getting Started

ACTIVITY "Matching by Shaking"

Materials: per child: non see-through plastic container (plastic eggs, empty film canister) and small items to fill containers (beans, pennies, paper clips, O-shaped cereal, popcorn kernels)

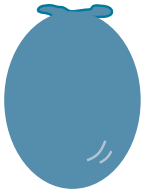
Note to the Volunteer: Before beginning this activity, place small items in pairs of containers. For example, two containers with beans, two containers with pennies, etc. You need enough containers so that each child will have one. If you have an odd number of children, the volunteer could also play.

As the children arrive, give each child a container. Tell them not to open it. They can shake it to get more information about what may be inside. Tell them that they are to find the person who has the same items. When everyone thinks they have found their match, have the children open their containers to see if they were correct. Ask the children the following questions:

- What kind of sounds did you hear?
- How did you know who had the same items in their container?
- Why did the different items in the containers make different sounds?
- What other things could be put into the containers to make sound?
- What things could you put in the containers that would not make sound?

Application: We can get important information by hearing. When are some times when listening carefully is important?

ACTIVITY "Throaty Vibrations"

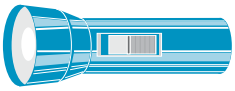


Materials: balloon

Invite the children to join you in a circle. As a demonstration, fill a balloon with air. Stretch the neck sideways to let some air out. Change the amount of air that is released. That was a funny sound. How are sounds made? Ask the children if any of them have ever "felt" a sound. Explain that sounds are made by vibrations. Have the children gently place their fingertips on their throat. Ask them to say their name in a normal, indoor voice. Try higher sounds, lower sounds, quieter sounds, and louder sounds. Explain that they are feeling the vibrations in a part of their body called the vocal cords. Ask the children the following questions:

- Could you feel a vibration when you talked?
- How did the vibrations change when you made different sounds?
- Do you ever have a hard time talking when you first wake up?

Application: Explain to the children that singers warm up their voices before a performance. Ask them if there is ever a time that they should warm up their voices? Why? Help the children to understand that vocal cords can be damaged, and they need to take care of them.



ACTIVITY "Moving Vibrations"

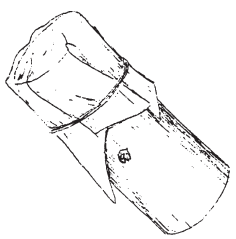
Materials: flashlight, silver sequin or piece of mirror, per three-child team: one coffee can or other container with both ends open, plastic wrap (enough to cover one end of the container), one large rubber band, about 20 grains of rice, and a radio or audiocassette player

Note to the Volunteer: Prepare one container ahead of time. Glue a silver sequin or small piece of mirror to the center of the plastic wrap.

Invite the children to sit in a circle around you. Place the container on its side on a table. Have a child volunteer to talk loudly into the open end of the coffee can. Ask another child to hold the flashlight. When everyone is settled into their places, turn down the lights so the room is fairly dark. Ask the child to speak into the can. The other child, standing at a 45 degree angle, should turn the flashlight on and shine it onto the plastic wrap. The light from the sequin/mirror should reflect onto the wall. (It will help if there is a flat, light-colored wall to reflect the light on.) Each child could take a turn speaking into the can to "see" the vibrations of their voices. Remind the youth that all sounds are made by vibrations. "How can you tell there is a vibration when a sound is made?" (They may mention feeling the vibration.) Tell them that we saw the vibrations that make sound. Place the children into groups of three. Provide them with supplies. Ask the children to put the plastic wrap over one end of the container can and secure it with a rubber band. Make sure the plastic wrap is pulled taut. Turn the radio or audiocassette player on. Set the container on top of the radio or audiocassette player. Place about 10 grains of rice on top of the plastic wrap. Turn the volume up just until you see the rice start to move. Have the children observe the movement. Ask the children the following questions:

- What did you see?
- Does the rice move the same way no matter what sound is made?
- Does the rice move differently with high sounds and low sounds? How?
- What would happen if the volume is turned up or down?

Application: Have the children design their own light show using "sequin cans," flashlights, and their voices or music.



ACTIVITY "Kazoos"

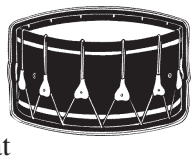
Materials: per child: 6-inch cardboard tube (toilet tissue or paper towel), wax paper (enough to cover one end of the tube), a rubber band, and crayons or markers for decorating

Note to the Volunteer: You will need to make a hole in each child's tube as shown.

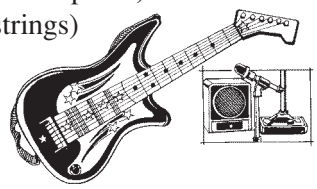
Invite the children to join you at the tables. Ask the children if they know how to hum. Have them practice humming for a minute. Tell them that a kazoo is an instrument that helps make a humming

sound louder by making more vibrations. Have the children place the wax paper over one end of the tube. Hold the wax paper in place by putting the rubber band around the tube as shown. Ask the children to hum into the open end of the kazoo. Choose a tune that all of the children know (for example: "ABC's" or "Happy Birthday" if someone's birthday is near). Have the group form a kazoo band and "play" a song as a group. Ask the children the following questions:

- Does your humming noise sound different when you use a kazoo?
- What is vibrating on your kazoo?
- Do you think that changing the length of the kazoo would change the sound? Try it.
- How do you think a larger kazoo would sound? The tube a carpet comes rolled on would show how the same sound waves spread out in a larger space make a lower sound.



Application: All musical instruments use vibrations to make sound. What is vibrating in a piano? (strings struck by the small hammers inside the piano) A clarinet? (the reed or mouthpiece) A drum? (the skin) A guitar? (strings)



2. Digging Deeper

ACTIVITY "How Sound Waves Travel"

Materials: large bowl with 2 inches of water, a rock or heavy object deeper than 2 inches that will fit in the bowl, and something that makes sound (timer, radio, etc.)

Note to the Volunteer: If you have an overhead projector available to you, a clear bowl shown through the overhead projector works well for a larger group.

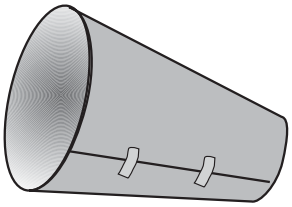
Place an item that makes sound in the room away from the group. Invite the children to join you in a circle. Have them gather as closely as possible to the bowl in the center. Ask the children if they can see sound moving through the air. Direct their attention to the item away from the circle that is making sound. "Can you hear that sound? How does that sound get from the item to your ear?" Explain that we can often see the shaking caused by the vibrations, but we can't actually see the sound in the air. If we could see sounds, they would travel a little like water waves; outward in all directions. Have a child touch one fingertip to the water in the middle of the bowl of water. Ask all the children to observe carefully what happens. The children should see waves: spreading out in all directions. Explain that sound vibrations also travel out in all directions. Each child can take a turn touching the middle of the water. Place the rock or other object into the bowl. Have a child touch the water in the center of the bowl. Ask the children to observe carefully what is happening. Ask the children the following questions:

- Can sound vibrations travel through the air?
- What did you observe when the finger touched the water?
- What happened to the waves when you were under the water?
- Can sound travel through water?
- What other materials can sound travel through?

Application: If sound travels in all directions, why is it harder to understand someone when they are facing away from you? (Solid objects can change the path of the wave.)

Why would it be important to face someone when you are talking to them?

ACTIVITY "Making a Megaphone"



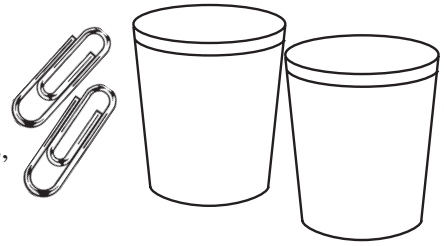
Materials: clear tape, one sheet of construction paper (9 x 12 inches or larger) for each child, markers or crayons for decorating, and scissors (optional)

Explain to the children that sound waves travel out in all directions, but we can make those sounds travel in a ceratin direction by making a megaphone. Help the children to shape the construction paper into a cone with a large hole at one end and a small hole (about $^1/_2$ inch in diameter). Hold the cone in place with tape. If you wish, cut the ends of the cone to make them even. Let the children decorate the outside of their megaphones. Try them out! Ask the children:

- What does it sound like when someone talks through the megaphone?
- How is it different than when someone talks without the megaphone?
- What does it sound like when they point the megaphone away from you when they talk?
- Why do you think this happens? (Explain that the megaphone only allows the sound to travel out in the direction of the hole in the cone.)

Application: Sometimes cheerleaders use megaphones at sporting events. When are some other times that you would want to direct sound in a certain direction? (whispering in someone's ear, calling someone to come in from outside, when someone wants to listen to the radio but others don't want to hear it) How would you direct the sound? (cupping hands, using earphones)

ACTIVITY "Telephone"



Materials: for each pair of children: two plastic cups, two paper clips, and 5–8 feet of string

Note to the Volunteer: You will need to poke holes in the bottoms of the cups using a nail and hammer or scissors before beginning this activity.

Have the children pair up and stand 5–8 feet apart. Give each of them a cup. Ask one child to talk into the cup. Have the other partner hold a cup up to their ear. Can you hear what your partner is saying? Have the children thread the string through the bottom of the cups. Then tie the paper clip to the ends of the string in the cups. Volunteers may have to help children tie the paper clips onto the string. Pull the string tight. The children can take turns talking and listening through the telephone. (Tell the children not to let the string get too loose.)

Ask the children the following questions:

- Could you hear your partner through the telephone?
- Could you hear your partner better when the string was loose or tight?

Application: How could you connect your phones so that four people could be connected at the same time?

More Challenges: Let children try different types or lengths of string, dental floss, or fishing wire, or different types of cups.

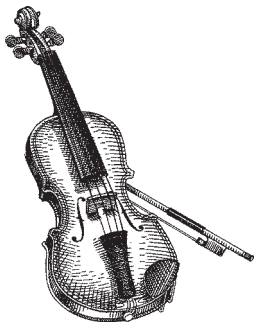
ACTIVITY "Quacky Cup"

Materials: bowl filled with water, per child: a plastic cup (bathroom or 8 ounce size), 18-inch cotton string, and a paper clip

Note to the Volunteer: You will need to poke a hole with scissors or a nail and hammer (big enough for the string to fit through) in the bottom of each plastic cup prior to the activity.

Have the children tie one end of the string to the paper clip. (This may be done ahead of time for younger children, or it could be an opportunity for learning how to tie.) Thread the other end of the string through the inside of the cup and pull the string down until the paper clip rests on the bottom of the cup. The children should dip the string in the bowl of water and get their fingers wet. Have them pull their fingers down the string. (It should make a loud noise. If it doesn't work well, make sure their string is wet.)

Note to the Volunteer: If time allows, let the children experiment with different sizes and types of cups and different types and lengths of string. What type of cup makes the loudest noise? The quietest? Does the type or length of string affect the sound your cup makes? How?



Ask the children the following questions:

- What happens when you pull your fingers down the string?
- What causes the loud noise? (Your fingers create friction on the wet string which vibrates in the cup and creates a sound.)
- What does the "quacky" cup sound like?
- How could you change your cup to make a different sound?

Application: How are a guitar and a violin like the instrument you just made? What other musical instruments use strings to make sounds? (banjo, fiddle, harp, cello, piano)

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ACTIVITY "Kitchen Sounds"

Materials: kitchen gadgets: metal, wooden, and plastic (for example: large metal spoons, whisks, wooden spoons, baking racks, spatulas, tongs, measuring cups); string and pencils (one for each pair of children)

Note to the Volunteer: Cut the string into 2-foot lengths. Tie a gadget in the center of each piece of string.

Ask the youth if the kitchen gadgets you have in front of you make sounds. What types of sounds do you think they make? We are going to listen to sounds in a fun and different way. Demonstrate how to listen to the kitchen gadgets. Wrap the ends of the string around your index finger several times. Hold it in place with your thumb. Hold your fingers up to your ears as if plugging them. Ask one of the children to strike the gadget with a pencil. Explain the sound you hear to the group. Have the children work in pairs to test the different items. Encourage them to try out all the gadgets and to talk with their partner about what they are hearing.

Ask the children the following questions:

- How were the sounds alike? How were they different?
- Why do you think you can hear sounds through the string? (Sounds travel better through solids than through the air. The string vibrates and causes the sound to travel to the ear.)

Application: Ask the children to categorize the kitchen gadgets in different ways. Let them discuss the categories that they used. What were their favorite and least favorite gadgets for making sounds?

ACTIVITY "Rubber Band Guitar"

Materials: pictures of musical instruments, a shoe box or another container about the same size such as a loaf of bread, three to five different-sized rubber bands that will fit over the container, and items to decorate the guitars

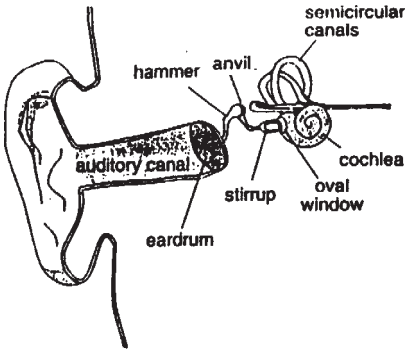
Ask the children to name some musical instruments. If they have a hard time naming some, show them the pictures to get started. Help them think of instruments that would fit into each of these categories: strings (guitar, violin), percussion (drum, bells, wind chimes), keyboards (piano), woodwinds (flute), and brass (trumpet). Remind the children that all sounds are made of vibrations. Every musical instrument has to create a vibration to make noise. They are going to be making a rubber-band guitar that uses vibrations to make sounds.

Give the children the materials. Have them put the rubber bands over the container. Put the rubber bands on in order from thinnest to thickest. Show the children how to pluck the rubber bands to make sound. Invite them to play their guitars. Have them observe how the rubber bands move. Ask the children the following:

- Which rubber bands make the highest sounds? The lowest sounds?
- How can you make the sounds louder? Quieter?

Application: How could you write down the song that you played so that someone else could play the some song?

3. Looking Within



ACTIVITY "The Amazing Ear"

Materials: copies of ear drawing for each child (or ear diagram blown-up on overhead projector or poster board), optional: audiocassette player and tapes of nature sounds or everyday sounds (libraries often have these available for check-out)

Have the children close their eyes and for 45 seconds quietly listen to the sounds around them. Ask them to sit as quietly as possible. (You may want to have them listen to their natural environment first, and then play tapes of nature sounds and everyday sounds.) Discuss the sounds that they heard. We know all sounds are made up of vibrations, but how do we hear them? Let the children explain what they know about how we hear. Explain that what most people call the ear is only the outside of the ear, the point where the vibrations enter. Vibrations travel inside your ear. They strike the eardrum that vibrates like the top of a drum. This starts the three tiny bones vibrating. The vibrating sends a signal to the brain for us to hear the sound. This all happens very quickly! Ask the children the following questions:

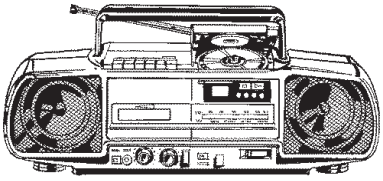
- What parts inside the ear help you to hear?
- Are vibrations important?

Application: Pretend that we can't make any sounds. How would we communicate with each other? Some people can not hear. How do they communicate?

ACTIVITY "Music and Movement"

Materials: recorded music and device for playing the music (music should include several different "moods" of music from slow and sad sounding to fast and happy), an option would be to have a musician visit who can play music, expressing different moods.

Talk to the children about how music often helps people show their feelings. Some people use music to help them feel better when they are sad. Other people use music to show they are excited. Some people use music to help them relax. Tell the children to listen to the music. When they think that they have picked up a "feeling" from the music, have them move in a way that shows that feeling. Change the music and have them change their movements accordingly. Do this several times.



Ask the children the following questions:

- Did your feelings change when I changed the music?
- When would you like to listen to slow music?
- When would be a good time to listen to fast music?

Application: Music is often used at parties and celebrations. What songs do you know that make a party or celebration fun? If everyone in the group knows the song, they can all sing it together.

4. Bringing Closure

ACTIVITY "Recording Sounds"

Materials: copy of sheet music for each team of three to four children, five glass jars (all the same size), water, food coloring (four to five colors), white paper, crayons or markers, and a wooden stick

Note to the Volunteer: Prior to the activity, place varying amounts of water in the five jars. Color the water in each jar with a different color. (If you only have four bottles of food coloring, you can mix two colors to get a third. For example: red and yellow food coloring will make orange when mixed together.) Put the jars in order from the least amount of water to the most. Caution is needed with the glass jars. Make sure that the children know the jars must stay just where they are at all times.

Ask the children to predict (guess) what kind of sound the jars will make when you tap them. Will all the jars sound the same? Show them how to carefully tap the jars. Put the children in teams of three to four. Give the children an opportunity to make sounds with the jars. Explain that we can keep a record of the music we like to hear. Show them the sheet music and point out the notes. Ask the children to make a record of their own song. Have them color dots on a piece of paper to match the colors of the bottles they played. The children may share their song with the entire group or trade songs between teams for playing. Ask the children the following questions:

- What did you hear from the jars when you tapped them?
- How were the sounds different?
- Which jar was highest? Lowest? Softest? Loudest?

Application: Why is it important to write down music? When are other times you need to write things down?

5. Going Beyond

ACTIVITY "Sound Sharing"

Materials: guest speaker

Note to the Volunteer: Discuss proper etiquette for having a visitor before the guest arrives.

Invite a guest speaker to share sound information with the children. Types of visitors might include:

- Band member or director—to share instruments and how they work, how a band plays together
- Musician—to share their instrument and how they read music
- Worker that wears ear protection—to share safety information
- Someone who communicates without sound—to share how their life is different without sound

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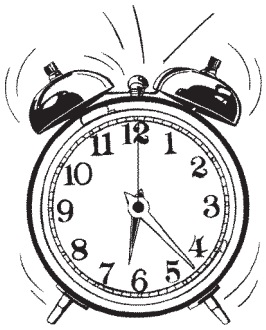

ACTIVITY "Helpful vs. Harmful Sounds"

Materials: newsprint and markers

Encourage the children to appreciate sound by making a list of all the helpful sounds they hear. (an alarm clock in the morning, a horn on a car warning you of danger or to say hello, a doorbell letting you know someone is waiting outside your door, the timer on the stove reminding you to take the cookies out of the oven, the radio giving the daily weather forecast, etc.) Not everyone is able to hear, and some people cannot hear as well as others. Those who don't hear as well can use a device called a hearing aid that helps them to hear sounds better, just like people wear glasses to help them see better. People who can hear need to do certain things to protect their ears from damage. Help the children generate a list of sounds that can be damaging to their ears. (loud music, loud machinery, spending a lot of time around the outside of airplanes when they take off and land, very high sounds)

Application: What can people do to protect themselves from damaging sounds?

Reading Adventures

This listing of reading materials can be used as background information, for sharing before the group activity to set the stage for learning, or for sharing afterwards to reinforce the activity.

All About Sounds, by Ruth Thompson
The Hee-Haw River, by Dee Lillegard
The King's Collection, by Ruth Craft
Mr. Brown Can Moo! Can You?, by Dr. Seuss
Night Noises, by LaVerne Johnson
Polar Bear, Polar Bear, What Do You Hear?, by Bill Martin