GREAT PLAINS
Center for Agricultural Health

Cups and String Telephone (socially distanced activity)

Purpose: This demonstrates how sound waves move from the source of the sound into our ears

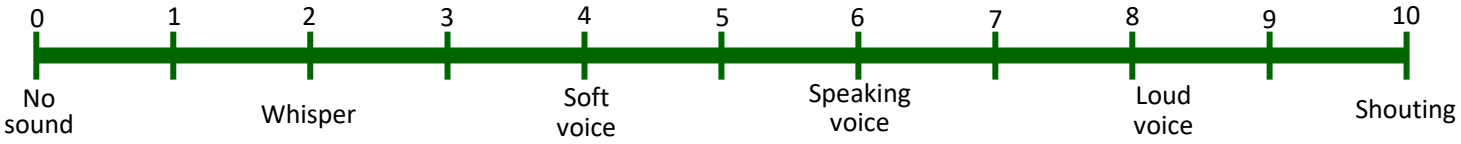
Time: 15 minutes

Materials (for each student pair):

- 10ft length of string
- 2 plastic cups (with small hole in the bottom)
- Ruler or yardstick
- Scissors
- Activity worksheet (*next page*) and writing utensil

Directions:

1. Give each pair of students a 10-foot length of string, two cups, and an activity worksheet. The students will connect the cups by passing the string through the hole in the bottom of cup and tying a knot in the string inside each cup. The pair will spread out, so the string is taut and speak/listen to each other using the cups.
2. Students will begin by talking to one another through their cup phones and mark down on their list on a scale of 1-10 how well they could hear their partner through the cups using the scale below.



3. Once they have done this, they will cut their string to approximately 6 feet in length and repeat the same steps as above. Remind them to use the same speaking volume as before.
4. Students will continue to cut the line shorter, to 4 and then 2 feet, repeating the conversation and rating of sound quality.

Take away:

Students should notice that the closer their partner is to them the easier it is for them to be heard. **This is how sound waves travel**. The less distance between the SOUND and the EAR, the easier the sound is to hear. When sound waves travel, they lose amplitude and that decreases the sound level. Sound follows the "distance doubling" rule: when you ***half*** the distance to the noise source, you ***double*** the sound level.

Questions for the class:

1. When was it easiest to hear your partner? (What distance based on their charts)
2. When have you noticed something that got much louder as it got closer?
   - Examples: A police car/ambulance/fire truck siren is quiet in the distance but when it is close the sound can be painful to your ears. The fire/intruder/tornado siren in the hallway gets quieter as you walk away from the building.

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Time: 15 minutes

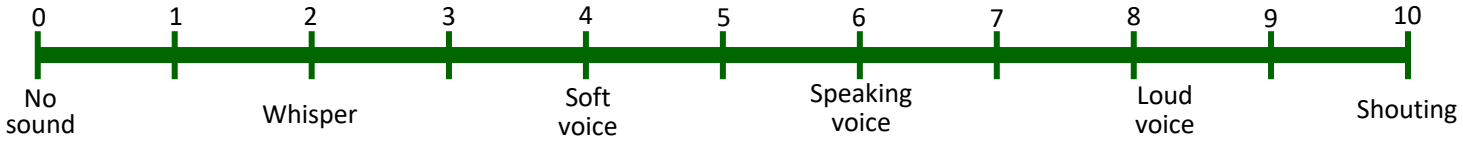
Materials (for each student pair):

- 10ft length of string
- 2 plastic cups (with small hole in the bottom)
- Ruler or yardstick
- Scissors
- Pencil or pen

Directions:

1. Connect the cups by passing the string through the hole in the bottom of the cup from outside to inside. Tie a knot on the end of the string to keep it from being pulled back out of the cup.
2. Move apart until the string is taut. Talk to your partner by speaking into the cup while they put their cup up to their ear. Take turns being speaker and listener.
3. On a scale of 0-10 (see below), rate how well you can hear your partner though the cups and string. Record it in the chart. Write any observations about the sound quality in the notes column.
4. Cut off one end of your string to make it 6 feet long and retie the knot. Record how well you can hear your partner.
5. Repeat for 4 feet and 2 feet distances. Remember to use the same speaking volume each time.

Rating scale



Distance	Rating	Notes
10 feet		
6 feet		
4 feet		
2 feet		

Discussion questions:

1. At which distance was it easiest to hear your partner?
2. When have you noticed something that got much louder as it got closer or quieter as it moved away from you?

GREAT PLAINS
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Hair cell models

Purpose: Create a model that demonstrates how hair cells are damaged by loud noises.

Time: 10 minutes

Materials:

- Bag of large marshmallows (1 marshmallow per student)
- Box of angel hair spaghetti (6-10 pieces per student)
- Songs (one from the list):
  - Darude- Sandstorm - https://www.youtube.com/watch?v=y6120QOlsfU
  - Deorro- Five Hours - https://www.youtube.com/watch?v=K_yBUfMGvzc
  - Eric Prydz- Opus - https://www.youtube.com/watch?v=iRA82xLsb_w
- Student activity worksheets (*next page*)

Directions:

1. Give each student a marshmallow, 6-10 pieces of spaghetti, and an activity worksheet.
2. Instruct students to construct their hair cell models by pushing the spaghetti pieces into the marshmallow (detailed instructions on the worksheet).
3. Prompt students to shake (by holding the base of the marshmallow) their hair cell models to the beat. The beat represents the sound waves.
4. As the beat increases the length of the movement should get longer and faster. This shows the "size" of a loud sound wave and will build momentum and break the hair cells.

Take away: As sound waves get louder, they become more intense. The louder sound waves cause damage to the hair cells. This damage cannot be reversed.

Assembled hair cell model

Questions for the class:

1. What did you notice about your spaghetti (hair cells) as they broke?
   - *Ex. They did not all break at once… relate this to gradual hearing loss.)*
2. How many of you listen to your music loudly?
3. How do you think that impacts your hair cells?

GREAT PLAINS
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Hair cell models

Purpose: This demonstrates how hair cells are damaged by loud noises.

Time: 10 minutes

Materials:

- 1 large marshmallow
- 6-10 pieces of angel hair spaghetti

Directions:

1. Place one of the flat sides of the marshmallow on a flat surface (table or desk).
2. Carefully push the pieces of spaghetti into the top of the marshmallow so they are standing straight up. This is your hair cell model.
3. Pick up the model and hold it by the marshmallow with the spaghetti facing up.
4. When the music starts, gently shake your hair cell model to the beat. As the music speeds up, shake faster to continue stay with the beat. As the music gets louder, shake it more and more vigorously.
5. Observe the motion of the spaghetti throughout the experiment.

Assembled hair cell model

Discussion questions:

1. What did you notice about your spaghetti (hair cells) as they broke?

2. Do you listen to your music loudly? How do you think that impacts the hair cells in your ears?

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Sound Scavenger Hunt

Purpose: Students learn to use a digital tool to explore the sound environment and identify hazardous sound levels.

Time: 15-20 minutes

Materials:

- Decibel X app download (available free for iOS and Android)
- Cell phone or tablet
- Activity worksheet (next page) and writing utensil

Directions:

1. Instruct students to download the Decibel X app onto their phone or tablet
2. Students determine who will be the recorder and who will measure the sounds.
3. Send students out into the school/surrounding area to measure the volume (in decibels) of different sounds, at three distances each, throughout the school/surrounding area. Each group should identify at least four different sounds to measure.

Take away: There are noises all around us, some of which we cannot control. With this app on their phone, students can measure the volume of the sounds in their homes and educate their families as well. Once they identify dangerous sounds, they can act to prevent hearing damage.

Questions for the class:

1. Who thinks they found the loudest noise?
    a. Is that dangerous or not?

2. What could be done to reduce the impact these sounds have on hearing? (allow students to propose a solution to the problem)

3. Can anyone think of noises in their home/day-to-day life that could be harmful?

4. Does anyone know a person who has difficulty hearing?
    a. What do they do for a living?

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Sound Scavenger Hunt

Purpose: To raise awareness of how everything around us makes noise and be given the chance to use their knowledge to propose solutions.

Time: 15-20 minutes

Materials:

- Decibel X app download (available free for iOS and Android)
- Cell phone or tablet
- writing utensil

Directions:

1. With a partner, go out into the school/surrounding area to measure the volume (in decibels) of different sounds you hear. One student will be the recorder that writes down the cause of the noise and the number of decibels. The other students will use a phone with the downloaded app to measure the sound level and communicate it to their partner.
2. For each sound you observe, record the sound level from three distances – record the approximate distance, the sound level, and any other observations you have about the sound in the chart below.

Source	Distance	Sound level (dB)	Notes

Discussion Questions:

1. What was the loudest sound you observed?
    a. Is that dangerous? Why or why not?

2. What could be done to reduce the impact these sounds have on hearing?

3. What noises in your home could be harmful?

4. Do you know anyone with hearing loss? What do they do for a living?