Bay Area Scientists in Schools Presentation Plan

Lesson Name: Making the Band
Presenter(s): Amadu Akanu, Kwasi Apori, Celeste Chavis, Timothy Downing, David Moody

Grade Level 2nd
Standards Connection(s): Sound is vibration- describe w/pitch and volume

Vocabulary/Definitions:

Vibrate: to move quickly back and forth (scientists say oscillate). Sounds occur because the air or some other material is vibrating.
Pitch: the degree of a sound or tone. Ex. low (lion) vs. high (humming bird)
Frequency: how fast a material vibrates
Volume: the intensity of a sound. Ex. loud vs soft

Materials:

What you'll bring with you

- Materials for crafts and stations (details about crafts materials on attached handouts)…
- Musical instruments
- Handout

What students should have ready

- Pencils

Classroom Set-up:

- Empty space large enough for classroom to sit in a circle or gather around
- 3 stations (enough space to hold 1/3 of the class)
- Set up / Clean up Time: 5 mins each

Classroom Visit

1. **Personal Introduction:** **3 Minutes**

Who are you? What do you want to share with students and why? How will you connect this with students' interests?
We will introduce ourselves briefly and try to give a relatable example of what we study.

2. **Topic Introduction:** **10 Minutes**

Big Idea(s), vocabulary, assessing prior knowledge. What questions will you ask to learn from students?

- Start with story and play instruments during story (< 5 mins)
- See what students know about sound and music
- Emphasize key vocabulary: pitch, volume, frequency

- We will relate the definitions to animals like lions vs. bumblebees and perhaps bring in a tuning fork if we can find one so that they can see it vibrate
- Share instruments, show vibrations on a drum head

3. Learning Experience(s): 30 Minutes

Students will rotate through three stations to experiment with percussion, wind, and stringed instruments and explore what's vibrating,and explore how sounds are created by different kinds of vibrations.

- *Drumming (Amadu)*
  - *a. Ask questions such as what sound is.*
  - *b.* different materials/sizes produce different pitch/volume – compare homemade versus real drums and experiment
  - *c.* figure out pitch and volume relative to three homemade drums
- *Wind (Celeste)*
  - *a.* What's vibrating when you blow? What's vibrating when you hit with a pencil?
  - *b.* Experiments: bottles with different levels of water, straw oboe (see attachments)
- *Strings (Tim)*
  - a. Show has sound can travel through string → plastic cup phone (loose string and tight string) (see attachment)
  - *b.* Relate to guitar and show them a homemade guitar with different size strings/rubber bands

3. Wrap-up: Sharing Experiences and Building Connections 5 Minutes

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

- Have students recap what we learned- pitch, volume, frequency etc.

4. Close: *How can kids learn more? Thanks and good-bye! Clean-up.* **3 Minutes**

- Take-home handout – recipes for instruments kids can make

TOTAL 50 – 60 Minutes

Straw Oboe

BASIS Lesson – Making the Band

By cutting two "lips" into the flattened end of a soda straw and blowing with just the right pressure, you can make sounds resonate in the straw.

Materials:
- Soda straw
- Scissors

Optional:
- poster paper
- tape
- soldering iron

Assembly

Flatten one end of the soda straw by sticking the end in your mouth, biting down with your teeth, and pulling it out. Do this several times to make a flexible flat-ended straw.
Cut equal pieces of straw from each side of the flat region so that the straw has two lips at the end.

Do and Notice

Put the straw in your mouth, and bite down on it gently with your front teeth just beyond the lips of the straw.
Experiment with blowing hard and softly while biting down with different amounts of pressure until you make the straw sing.

What's Going On?

When you blow, a pulse of compressed air flows down the straw. The pulse travels down the straw at Mach 1, the speed of sound, and bounces off the distant open end.

When the sound bounces off the open end, the compressed air changes into a low-pressure expansion. When the expanded air reaches the lips of the straw, they are forced closed - then bounce open to admit more air. The sound bounces back and forth inside the straw and the lips of the straw open and close to create a sound.

Going Further

If you shorten the straw, the sound takes less time to travel down the straw and back, so the frequency of the sound increases (making the pitch higher). You can demonstrate this by cutting off the end of the straw with scissors. As you snip the end off, the frequency increases.

You can also find one straw that fits into another to make a longer straw with a lower frequency.

If you make holes in the straw, which you can do with a soldering iron, you can make an oboe that you can play by covering the holes with your fingers. An uncovered hole acts as the end of the straw.

If you can find two straws that fit one inside the other and yet slide back and forth, you can make a straw trombone.

You can roll a piece of paper into a cone and tape the cone onto the end of the straw to make a straw oboe with a bell. The bell makes less sound bounce off the end of the straw so that more sound goes out into the air. This makes the sound much louder.

Use poster paper to make a larger bell, and the straw oboe will become very loud.

Et Cetera

The straw oboe with a bell acts like an old fashioned ear trumpet in reverse. Instead of collecting sound, it broadcasts sound.

Source: Exploratorium Snacks - http://www.exploratorium.edu/snacks/straw_oboe/index.html

String Phone

BASIS Lesson – Making the Band

Want to send a private message to a friend? I will show you how to make a string phone. You talk into the cup on your end of the string and the sound comes out through the other cup and only your friend can hear you.

Materials:

- 2 paper cups
- String
- Sharpened pencil

Directions:

1. Take two paper cups and poke a small hole through the center of the bottom of each cup; a pencil tip will work for this. The hole should only be big enough to fit the string through, don't make the hole too big.

2. Poke the end of the string through one of the cups and tie a knot on the part that is inside the cup.

3. Make the string as long as how far away you will be from the other person.

4. Poke the other end of the string through the hole in the other cup and tie a knot so it will not pull through the cup.

5. Now that you have a cup on each end of the string, it is ready to try.

6. Hold the cup up to your mouth and talk a little loud into it. Have your friend hold the other cup up to their ear. It is important that you keep the string tight between the cups and that nothing is touching the string. Now your friend should be able to hear your message through the cup.

7. How it works is that when you talk into the cup, your voice vibrates the string. The vibrations travel through the string like how waves travel through water. When the vibrations reach the other end, they vibrate the bottom of the cup and turn back into sound waves which your friend can hear.

Source: Projects for Kids – http://www.projects-for-kids.com/science-projects/string-phone.php

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about sound..."

Reading Connections:

Janice VanCleave's Physics for Every Kid: 101 Easy Experiments in Motion, Heat, Light, Machines, and Sound (Science for Every Kid Series) by Janice Van Cleave http://www.amazon.com/Janice-VanCleaves-Physics-Every-Kid/dp/0471525057

Sound: Loud, Soft, High, and Low (Amazing Science) by Natalie M. Rosinsky http://www.amazon.com/Sound-Loud-Soft-Amazing-Science/dp/1404803351/ref=pd_sim_sbs_b_2

Sounds All Around by Wendy Pfefer http://www.amazon.com/Sounds-Around-Lets-Read-Find-Out-Science/dp/0064451771/ref=pd_bxgy_b_img_b

More Instruments:

Exploratorium After-School – Sound Sandwich
http://www.exploratorium.edu/afterschool/activities/index.php?activity=137&program=590
Activity Instructions: http://www.exploratorium.edu/afterschool/activities/docs/soundsandwich.pdf

Exploratorium After-School – Bee-Hummer
http://www.exploratorium.edu/afterschool/activities/index.php?activity=133&firstDisplayedItem=1
Activity Instructions: http://www.exploratorium.edu/afterschool/activities/docs/beehummer.pdf

Exploratorium After-School – Cuica (Brazillian Friction Drum)
http://www.exploratorium.edu/afterschool/activities/index.php?activity=135&firstDisplayedItem=1
Activity Instructions: http://www.exploratorium.edu/afterschool/activities/docs/cuica.pdf

RAFT Bay Area – Sound Making Kits
Tuba Phones: http://www.raftbayarea.org/ideas/2-Tubaphones.pdf
Finger Phone: http://www.raftbayarea.org/ideas/Finger-Phone.pdf

Steve Spangler – Pop Bottle Sounds

http://www.stevespanglerscience.com/experiment/pop-bottle-sounds

Submitted by Mark Spangler

Abstract: When you blow on a soda bottle or clink it with a spoon, the bottle makes a noise. Sometimes the sound is high and sometimes the sound is low. I want to find out how the liquid in the bottle makes the sound change. Here's my hypothesis... When I clink the bottle with a spoon, I think the bottle will make a low sound when it is full and a higher sound when it is empty.

Materials:

- 8 glass Orange Crush bottles (all of the bottles must be the same!)
- Water
- Spoon
- Good ears

Experiments:

Test #1 Clink Two Bottles

You need two bottles for this experiment. Fill one bottle full with water and leave the other bottle empty. Clink both bottles. Are the sounds different?

Test #2 Clink Three Bottles

You need three bottles for this experiment. Fill the first bottle full of water. Fill the second bottle half full. Don't put water in the third bottle. Will the sound of bottle #2 (half full) be in the middle of the other two sounds?

Test #3 Blowing Air

This test used the three bottles from test #2. Instead of "clinking" the bottle, I want to blow air across them. My hypothesis is that they will make the same sound as clinking the bottles.

How does it work?

What I Learned About Sound

Sound comes from vibrations. When you hit the bottle with the spoon, it makes the glass vibrate. When you fill the bottle with water, the glass cannot vibrate as much. Fast vibrations make a high sound and slow vibrations make a low sound. A full bottle will produce a slow vibration and a low sound. An empty bottle will have a faster vibration and a higher sound.

My Big Discovery

I thought that blowing into the bottle would be the same as hitting it with a spoon, but I was wrong. Blowing into the empty bottle made a low sound. I learned that when you blow into the bottle, you are making the air vibrate - not the glass! When you put more water into the bottle, there is less air to vibrate. This means the air will vibrate faster and the sound is higher.

How it Works

As you blow air across the lip of the bottle, the air inside the bottle flows out as new air flows back into the bottle. This is actually an application of Bernoulli's Principle - fast-moving air creates an area of low pressure. As the air leaves the bottle, the molecules vibrate and that vibration creates a sound.

Pitch is a measure of the speed of the vibration. Rapid vibrations create a high pitch while slower vibrations result in a lower tone. You probably noticed that the pitch of the sound from the bottle changes as you add or subtract water. An empty bottle produces a lower pitch because there's lots of air in the bottle to vibrate. Adding water to the bottle decreases the amount of air space which means there is less air to vibrate. These vibrations happen more quickly and produce a higher pitch.