Bay Area Scientists in Schools Presentation Plan

Lesson Name Waves
Presenter(s) Kelsey Johnsen
Grade Level 2 **Standards Connection(s)** Physical Science

Abstract: Students will discover the difference between transverse and longitudinal waves as well as learn that sound is also a wave. Students will discover different ways to create sound through instruments that vibrate (create waves).

Objective: *As a result of your lesson, what will students learn? What will they be able to do?*

Gives a basic understanding of the different kinds of waves and what they do. Students discover the difference between transverse and longitudinal waves as well as learning that sound is also a wave. Students discover different ways to create sound through instruments that vibrate (create waves).

Vocabulary/Definitions: *3 – 6 important (new) words*

- Vibration
- Volume
- Pitch
- Waves
- Longitudinal waves
- Transverse waves

Materials:

What will you bring with you?

- One stone
- One tuning fork
- One tub of water
- One ruler per group of students (2-3 rulers)
- Four slinkies
- Four pieces of string
- One balloon per group, already blown-up (2-3 balloons)

What should students have ready (pencils, paper, scissors)?

None

Classroom Set-up: *Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed*

Students will be in 2-3 groups for the presentation.

Classroom Visit

1. **Personal Introduction:** _____5___ **Minutes**
   Introduce self, introduce method of getting their attention (tuning fork).

   Topic Introduction: ____10____ **Minutes**
   What questions will you ask to learn from students? Big Idea(s), vocabulary, assessing prior knowledge…

   On board: drawing of three different kinds of waves, vocabulary words

   What are these three drawings on the board? Give definition of waves, write definition on board. What kinds of waves can you think of?

   When they come up with water waves, drop a stone in the bowl of water. Ask for observations.

   Have students stand in a line (if there are a lot of them, have them stand in two lines) and link arms. Move the student at the end of the line back and forth toward the other students. Explain that this is called a longitudinal wave, and have students break into four groups to explore with slinkies for 2 minutes. Label longitudinal wave on board.

   Have students stand in a line (if there are a lot of them, have them stand in two lines) and link arms. Move the student at the end of the line from side to side. Explain that this is called a transverse wave, and have students break into four groups to explore with the string for 2 minutes. Label transverse wave on board.

   If there are enough students, use half of class for longitudinal wave demonstration and half of class for transverse wave demonstration.

   Give a definition of vibration, and write definition on board.

   Do any of you know what sound is?

2. **Learning Experience(s):** ____35___ **Minutes**
   What will you do, what will kids do? Demonstrations, hands-on activities, images, games, discussion, writing, measuring… Describe in order, including instructions to kids.

   Demonstration of sound waves: hit tuning fork on something, touch it to the surface of the water in the bowl, and observe the waves made in the water.

   Demonstration of ruler activity. Hold ruler with part of it off of table or desk; press down and release the end of the ruler that is off the desk. Varying the length of the ruler that is off the desk with vary the sound it makes. Have students go to desk and work in groups to see what they can discover. After 5 minutes, they come back to the floor. What did you see/hear?

   Give definition of pitch. Write definition on board.

   Demonstration of balloon activity. Blow up balloon, tie it off, and hold it to throat. Hum and see what the balloon does. Let students go to desks in groups to discover. After 10 minutes, they come back to the floor. What happened?

3. Wrap-up: Sharing Experiences ____5____ **Minutes**

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

Much of the explanation will be done in between activities to make a more solid connection between reality and weird vocabulary or concepts.

Let students summarize what they learned in class. Ask what they saw and heard, ask for the vocabulary words they learned, ask about each activity and how it relates to the lesson.

The further application of this: musical instruments. Can you think of any instruments that use vibrations to make sound? (Hopefully, they should understand that all of them do)

Further application (not enough time during this lesson, but if the teacher wants to continue with it later, they can): create your own musical instrument (draw or make out of straws, rubber bands, etc.) that demonstrates what we saw about sound.

Possible further activity: Sound Sandwich (*Source: Exploratorium After-School*) (http://www.exploratorium.edu/afterschool/activities/index.php?activity=137&program=590)

4. Connections & Close: ____5____ **Minutes**

What else might kids relate this to from their real-life experience? How can they learn more? Thanks and good-bye! Clean-up.

The students can hold their nose while eating dinner tonight and see if their food tastes different.

The presenter and adult volunteers will clean-up stations.

5 minutes for clean-up

Total 50 – 60 Minutes

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about transverse and longitudinal waves?"

Reading Connections:

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

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

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

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

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

Wave Machine

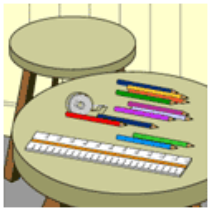
Contributed by: National Science Center (Fort Discovery)
http://tryscience.org/experiments/experiments_wavemachine_athome.html

Objective: To experiment with wave behaviors such as wave interference, standing waves, free-end reflection and wave velocity.

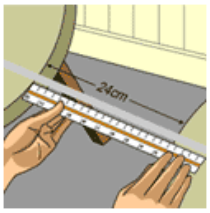
What You Need

- Transparent tape
- 11 pencils
- Two tables or chairs the same height.
- Alternate materials such as straws, shorter pencils, markers or wood splints.

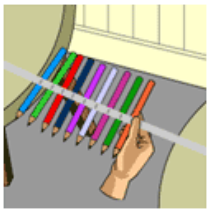
To Do and Observe



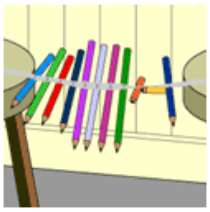
1. Cut a piece of transparent tape 32cm long.



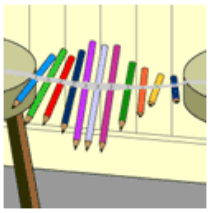
2. Place two tables about 24 cm apart and stretch the tape between them.



3. Stick the pencils to the bottom of the tape, 2cm apart, so they are horizontal in reference to the floor.



4. Tap the tip of one pencil at one end of the tape... that should produce a wave that travels to the end and reflects back. When a wave hits a boundary between media, all or some of the wave bounces back into the first medium. This is reflection.



5. Experiment with the wave machine to create other waves

What's Going On

Wave interference: Start waves at both ends at the same time to see interference. Interference affects the loudness of sounds; therefore it is an important property of sound waves, especially when designing auditoriums and in placing speakers. Constructive interference of sound waves will make the sound loud in some spots in the room; while destructive interference can cause "dead" spots where the sound cannot be heard. Destructive interference is a useful property in anti-noise technology.

Standing Waves: Pushing a single pencil up and down can create standing waves. Standing waves are the result of interference. When two waves of equal amplitude (height) and wavelength (length) pass through each other in opposite directions, the waves are always out of phase (out of synch) at the nodes. The nodes are the parts that remain stationary or have no amplitude.

Free-end Reflection: Hang the entire wave machine vertically from the table edge. How does this wave behavior differ from the waves made when the machine was attached to the table at both ends?

Wave Velocity: Changing the masses of the pencils can change wave velocity. Experiment with different objects such as: straws, shorter pencils, markers, or wood splints. Sound travels through the air at a speed of 330 to 350 meters per second. Sound travels faster through warm air; humidity also slightly increases the speed of sound. Sound travels much faster in liquids and solids than it does in gasses. For example, the speed of sound in water is about four times faster than air; while in some metals sound can travel about fifteen times faster than in air.

Parent/Teacher Tips

Experiment with your stereo speakers (if they aren't attached to the unit). What placement provides the best sound? What placement provides the worst sound?

Make waves in a pan or tub of water. Can you see the same properties?

Contributed by: National Science Center (Fort Discovery)
http://tryscience.org/experiments/experiments_wavemachine_athome.html