***Science**

Musical Messages

Peter Rabbit "lives" for his music. What is music anyway? The sound of music is produced by a sender and then heard by a receiver, but how? Peter needs to understand that sound is transmitted, reflected, and absorbed in order to be sure that his musical message is shared with others.

Kentucky Science Standards
Patterns, Systems, Scale and Models, Constancy, and Change Over Time (2.2-2.6) Grades 4-6
Sound: Position and Motion of Objects; Transfer of Energy
Academic Expectations:
2.3 Students identify and analyze systems and the ways their components work together or affect each other.
2.4 Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics that might be observed.

Ohio Science Standards: Physical Sciences
Sound: Force and Motion
Benchmarks Grades 4-5
F. Describe the properties of light and **sound** energy.
Grade 6
Note: There is no direct alignment/correlation for Grades 4 and 6.

Objective:

Students will:

- Explore and test multiple variables that affect the travel of sound waves.

Assessment:

Students will be able to:

- Identify and describe properties of sound energy focusing on transmission, reflection, and absorption.

Sample selected response items to gauge student understanding:

1. Which of these is not a property of sound energy?
    a. reflection
    b. absorption
    c. conduction
    d. transmission

    Answer: c. conduction
2. Explain why people sitting in the back of a large room have a difficult time hearing what a speaker is saying.

    Answer: Sound waves that come from the sender lose energy the farther they travel. The back of the room is receiving weaker sound waves, therefore sound emitted becomes harder to hear.

3. You are the sound manager preparing for a large musical show. Your job is to determine where to place speakers so that the audience can hear the music. Describe and/or illustrate placement of speakers to solve this task. Include specific reasoning for your decisions.
   Answer: Speakers should be placed to provide equal access to sound waves by all audience participants. Sound waves should arrive to the receiver(s) at similar energy levels.

Vocabulary:

- Transmission
- Absorption
- Reflection
- Vibration
- Sender
- Receiver
- Resonance
- Distance
- Variable
- Sound waves
- Volume, loudness

Materials:

- Chart paper for word bank
- Markers for recording on chart paper
- 2 paper or plastic cups for each pair of students, holes punched in the middle of the bottom of each cup large enough to push string through and tie a knot larger than the hole
- String for each pair of students (The string should be of the same type and length, or variables of type and length may be used to provide alternative investigations about mediums/conditions that carry sound well.)
- Hallway or room (see description in plans)
- Tape recorder with various sounds recorded
- Student journal or recording sheets
- Handout

Activity

Sounds All Around Us

Teacher will:

1. Engage students with sounds of guitar music for recall of attendance at The Children's Theatre of Cincinnati's production of *The Rockin' Adventures of Peter Rabbit*.
2. Introduce/review the listed vocabulary terms. Introduce a model of a "string telephone."
3. Facilitate students' making of string telephones. Each telephone will have a string attached to a paper or plastic cup on each end. String's knots are inside the cup, tied large enough to prevent them from

pulling through the hole punched in the middle of the bottom of the cup.

4. Facilitate paired student exploration with the string telephones. Students will apply different tightness of the string as one student speaks into his/her cup and the other student listens to his/her cup.
5. Have students describe (using scientific vocabulary) when they were best able to hear the sound from their partner and how the cups and strings were positioned/held in order for this to happen. (Focus discussion on identifying the sender and receiver, the string as the carrier of the vibration, and the tightness of the stings allowing the vibration to be transmitted easier.)
6. Make a recording of common sounds such as a chord on an organ, or a whistle, etc. on a tape player. Explore and record different sounds in specific locations to determine best transmission of sound waves.
   NOTE: This activity MUST be tested by the teacher prior to using with students to determine the exact location, distance, and volume to use for the exploration.
7. Introduce the activity to students as an exploration of sound and sound properties. Review the scientific "facts" identified in the string telephone activity.
8. Position students at the one end of a long, rectangular hallway or room. (See Handout, "Room Diagram"). Have students draw a diagram of the set up for the exploration.
9. Hold the tape recorder/speaker facing away from students and toward a "far" wall of the hallway/room. Have students listen to the pre-recorded sounds.
10. Facilitate discussion focusing on identifying the sender (recorder) and receiver (students) and what was heard. Focus on volume, sound identification (what did they hear, what was the sound) and conditions. Students will label the sender and receiver and use arrows to show the direction of the sound waves on previous diagram.
11. Facilitate discussion for how energy was transferred and how the strength of the vibrations decreased the farther it traveled.
12. Repeat the previous procedure using the same recording and same volume setting. Re-locate the recorder to different places in the room. Add sound barriers that block sound waves. Guide the students to compare the conditions and results of each procedure. Have students observe factors that allow for change in sounds received. Emphasis on comparison of strength of resulting sounds, distance sound waves traveled and volume of the sound when it reached the receiver.
13. Have student record details, vocabulary, and diagrams of the explorations in note taking journals to draw conclusions about how sound travels based upon observations. Challenge students to continue explorations with changing variables.

*** Science**
Handout: Room Diagram

Diagram example for indicating the direction and strength of the sound waves.

XXX represents students (receivers)
O represents recorder (sender)

Arrows represent the directions of the initial sound waves and when reflected from the wall, the intensity of the sound decreasing the farther the vibration travels. Therefore, the sound in the left diagram would be weaker when received than in the right diagram.