

Math and Music Lesson Plan

Grade Level(s): Kindergarten, First, and Second

Lesson Title: Vibrating Things Sing

Focus: (Concept or skills to be emphasized) Vibrations, sound, pitch, listening, predicting

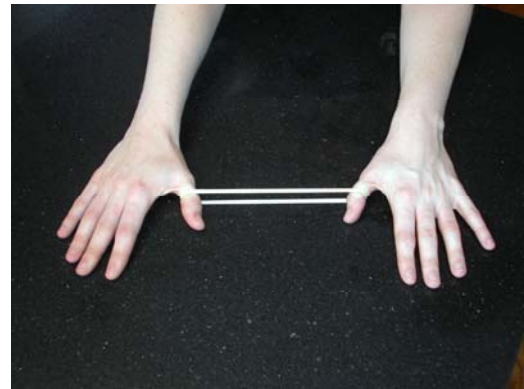
Objectives: See end of lesson for objectives and standards achieved.

Background Information: Most string instruments are played either by plucking or drawing a bow across their strings. The thickness, length, and tension of the strings are factors affecting the pitch (highness or lowness of note(s), as determined by how often and how fast the vibrations move which are producing it) of a string instrument. The materials that are used to make the strings of a string instrument also affect the timbre (a French word meaning tone color or quality) of the sound it produces. The longer, looser, or thicker a string is, the lower the note will sound. Conversely, the shorter, tighter, or thinner a string is, the higher the note will be. This lesson will allow students to experiment with varying the length of strings (using rubber bands) to produce high and low sounds.

Activities (Procedures):

1. Play the first 25 seconds of Track 4 on the audio companion, from Britten's *The Young Person's Guide to the Orchestra*. Ask students if they can guess what kind of instruments are playing in this selection. After hearing their "guesses," explain that the music they just heard includes string instruments. Tell students there are many different types of string instruments, each with a unique appearance and sound. Direct students to the String Family section in their Student Guide and allow them time to look at and listen to the audio sounds for each string instrument.
2. Talk about string instruments with students. Ask students to think about how string instruments produce sound. Tell students they will be performing an experiment that demonstrates how sound is created by string instruments.

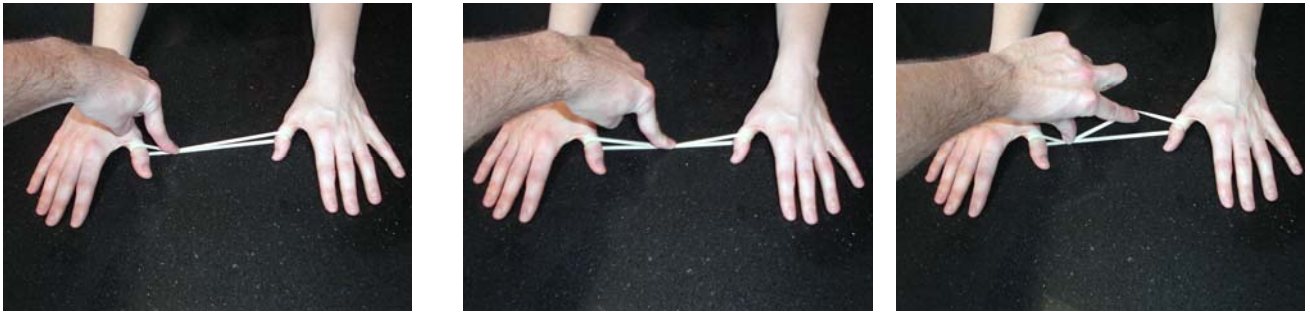
- a. Arrange students into groups of 2-3. Assign the role of "instrument" to one student and the roles of "musician" and "recorder/reporter" to the other student(s).
- b. **The Instrument:** Provide each group with one rubber band and ask them to read and follow the directions in the "Make your own string instrument" sheet in the Student Study Guide. Ask the *instruments* to place their hands palm down on a desk or table with their thumbs facing inward and explain that they must keep their hands the same distance apart during the ex-



The Instrument

periment (Note: Tell your students not to stretch the rubber bands so tightly that they will break). Tell the *musicians* to carefully stretch a rubber band between the base of the thumbs of the *instruments* (see figure). Remind them to be sure the *instruments* do not let the rubber band slip off. Ask students what they think will happen when the rubber bands are plucked and to explain why they think this will happen.

- c. Direct the *musicians* to pluck the rubber band and then have the *recorder/reporter* write down what they heard and saw. As a whole group, discuss what happened. Ask students why they think this happened.
- d. Explain that the students will now have a chance to experiment with changing the pitch of their "instruments." Demonstrate pressing down at different points along the rubber band (see figure below). Explain that each group will have the opportunity to experiment with pressing on the rubber bands after they have made a prediction about how this might change the sound produced when the rubber band is plucked. Ask each group to discuss what will happen and have the *recorder/reporter* write their predictions. Tell the *recorder/reporter* from each group to report their group's predictions to the class.
- e. Allow students enough time to experiment with pressing on different points along the rubber band. Direct the *recorder/reporter* from each group to record their observations. Return to a full group discussion and ask the *recorder/reporter* to talk about what they observed.



Changing Pitch and Plucking Rubber Band (Note: Students can use one hand to press on the rubber band and the other to pluck the rubber band)

3. Direct students to gather around the teacher to closely watch a stretched rubber band as it is plucked. Ask them to describe what they see (it vibrates). Ask students if they notice anything about the vibrations and the sound (sound is only produced while the rubber band is vibrating). Explain that sound is created when something vibrates. Tell students that all noises, including their voices and musical instruments, are caused by vibrations. Explain that many of the sounds produced by an orchestra, such as the sound of the drums, can be felt, and that what they are feeling is actually the vibrations the instruments are producing as sound waves travel through the air.
4. Explain that the sound made by a string instrument is affected by the thickness of the string, how tightly the string is stretched, and the length of the string. Explain that in the previous experiment students were changing the length of the part of the "string" allowed to vibrate. When the length of the string allowed to vibrate is shortened, the pitch goes up, and when it is lengthened, the pitch goes down. Explain that this is the same thing that string instrument musicians do when they press on the strings on the fingerboard of their instruments.

Extensions:

1. Using a string instrument, demonstrate how the pitch of a note changes when someone presses on the string while it is plucked. Allow students to look closely at the thickness of the strings and demonstrate how this influences the pitch of each note. Adjust the tension on each string by tightening and loosening each string by turning the tuning pegs of the instrument and demonstrate how this affects the pitch of each note. Be aware that this will require the instrument to be re-tuned, so only do this if you know how to re-tune the instrument or if the person who loaned the instrument to you realizes they will need to re-tune their instrument.
2. Ask students to explain why they think length, tension, and thickness of a string affects its pitch when plucked or bowed.

Modifications (Special Needs):

1. Visual and auditory impaired students will need special consideration during this lesson with seating and materials adaptations.
2. Learning disabled students may benefit by abbreviating this lesson's content and length.
3. Varying learning styles will be addressed with the variety of activities in this lesson - tactile, visual and sensory learning styles are utilized.
4. Gifted student needs are provided through the extension activities.

Assessment/Evaluation*:

1. Identify your Formative Evaluation Plan: The teacher will observe student participation and understanding of the exploratory exercise. The teacher will facilitate all discussion points throughout the lesson.
2. Identify your Summative Evaluation Plan: The teacher will assess student comprehension by evaluating accuracy of pressure points on rubber bands during the exploratory. The teacher will evaluate the accuracy of the observations recorded by each group.

Supplemental Materials and Equipment Needed: Rubber bands, Paper, Pencils, String instrument(s) (optional), A copy of the WVSO Audio CD, CD player and Student Study Guides

Resources: Information about sound: <http://www.physicsclassroom.com/Class/sound/soundtoc.html>; and Information about the parts of an acoustic guitar: <http://entertainment.howstuffworks.com/guitar.htm>

References:

Ostdiek, Vern J. & Bord, Donald J. (2000). *Inquiry into Physics*. Brooks/Cole: Pacific Grove, CA.

National Standards:**Music**

Standard 2: Performing on instruments, alone and with others, a varied repertoire of music.

Standard 3: Improvising melodies, variations and accompaniments.

Standard 6: Listening to, analyzing and describing music.

Standard 7: Evaluating music and music performances.

Standard 8: Understanding relationships between music, the other arts and disciplines outside the arts.

Science

Content Standard B: Position and motion of objects:

Social Studies

Standard V: Individuals, Groups, and Institution

WV Content Standard Objectives: 21st Century standards are distributed separately.*Kindergarten*

- SC.K.1.1 ask questions about themselves and their world.
 SC.K.1.2 listen to stories about the lives and discoveries of scientists.
 SC.K.2.3 use scientific instruments and everyday materials to investigate the natural world (e.g., hand lens, balance, magnets).
 SC.K.3.1 recognize that models are representations of real things.
 SC.K.6.1 work in groups, listen to and be tolerant of different viewpoints.

First-Grade

- GM.1.2.5 evaluate their own musical performances.
 GM.1.3.2 create an original composition of at least one musical phrase.
 SC.1.1.1 ask questions about themselves and their world.
 SC.1.1.2 discuss the lives and discoveries of scientists after listening to stories about their lives and discoveries.
 SC.1.4.13 demonstrate that sounds are produced by vibrations.
 SC.1.6.1 listen to and be tolerant of different viewpoints while working in collaborative groups.
 SS.1.2.1 identify and practice various group roles (e.g., group leader, recorder, reporter, collector) in the classroom.

Second-Grade

- GM.2.2.12 evaluate their own musical performances.
 SC.2.2.2 manipulate scientific instruments and everyday materials to investigate the natural world (e.g., hand lens, balance, thermometer, metric ruler, magnets, weather instruments, calculators).
 SC.2.4.12 recognize that sound can change in pitch and volume.