The Sounds of Science

by Katrina Gordon, 2017 CTI Fellow
Selwyn Elementary

This curriculum unit is recommended for:
Second Grade Science

Keywords: sound, vibrations, pitch, observations, musical instrument

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: The intent of my curriculum unit on sound is for students to be able to share their knowledge of science concepts through guiding questions and class discussions. Students will observe, develop their own questions and experiment with more open ended activities as we move through the unit and school year. Students will have the opportunity to discuss the lessons on sound, record their findings and analyze results in their journals. They will perform several experiments on sound that address how sounds travel, pitch, and vibrations. Where possible, they will extend science lab activities to answer their own questions about what would happen if? In the culminating project, students will reflect on the sound concepts learned so far as well as using their knowledge of musical instruments from visiting the music room, in order to create their own musical instrument. The instrument should be able to play at least two different sounds or produce two different pitches. Students will then perform and record their sounds on iPads. Finally they will be able to edit their sound using the Music Memo app. Their reflection of their instruments will demonstrate mastery of all sound concepts learned and give a chance for them to reflect on what they could do differently.

I plan to teach this unit during the coming year to 18 students in my second grade science unit on sound.

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The Sound of Science

Katrina Gordon

Introduction

Rationale

In teaching science, we often accept a guaranteed formula of success for teaching a hands-on lesson, rather than invest in a series of attempts to get it right. We are not asking our students to persevere or overcome obstacles, just accept the outcome. Sometimes we rely on this method in the interest of time and other times it is the only way we know as that was written in the plans that were given to us. More often than not, elementary teachers that teach all subject areas focus most of their energies on literacy and math topics. These are the ones that are tested starting in kindergarten. These are topics on which we are judged as professionals. However, there is a shift now from being able to regurgitate facts towards application of what you know to create solutions in all topics. The process of inquiry, discovery and curiosity about our world and how to problem solve are some of the key skills we desire for everybody to possess, especially adults. So while these desired skills are not limited to a science classroom they can be easily be fostered at an early age through science.

Often veteran teachers bemoan that teaching isn't fun anymore. What they remember is being able to "teach outside the box" that administrators nowadays are fond of saying we should do, but in reality can't, if we want to get our kids "test ready". When you ask kids about what they liked best about last year, you never hear about a lesson on character analysis or fractions. It is more along the lines of going on the Nature Trail, visiting the Science Lab, or conducting an experiment on volcanoes. After field trips and PE, any lessons that are hands-on and outside of the classroom are considered fun, engaging and memorable.

Through this unit, I want to explore science through a different lens than I am used to. I look forward to making learning about science fun again for my students. As a result, students will have the same enthusiasm for the inquiry and the process of discovery. Hopefully it will encourage them to think "outside of the box". When writing a curriculum unit it will help me to focus on merging the background information of science to the experiments that make science more engaging. We start the school year with going through the scientific method. This is a great time to explore the "what if" questions that children seem to be overflowing with. Wouldn't it be great to let students choose a science experiment just like they choose what imaginative story to write, or book to read or game to play? Once I feel students have had a chance to practice making scientific inquiries while learning more about the scientific method, we will move into our first content unit on sound. We will explore sound concepts using inquiry driven activities that will culminate in students making, recording and revising their own instrument.

School Demographics

Selwyn Elementary is in the Central Learning Community on the Myers Park campus. It is a high performing school with most students on or above grade level. The total student population is 818 for the 2017-2018 school year and out of this total there are six second grade classes with about twenty students in each room. Within each class the majority of students are Caucasian, and after that three to five are either Hispanic or African American. Also each class has on average of 7 TD (talented and gifted) and 2 EC (exceptional children) students. About 2 students per class receive services through the Limited English Proficiency Department. The majority of students benefit from having educational experiences with their families outside of school. These include visits to museums, parks, sporting events and travel.

Each second grade class has access to a set of Chromebooks or iPads and Smart Boards and document cameras are in every classroom as well. Students visit the Technology classroom at least once a week. At Selwyn, we are fortunate to have a science lab where there are plenty of materials at hand to conduct experiments. It will be empowering for children to work collaboratively to pose their own questions, design experiments and display their information to others. This unit will be designed for second grade students of all abilities at Selwyn Elementary. Students will be able to use the science lab with the classroom teacher to help conduct experiments. I have planned to teach six lessons over the course of seven weeks. This will allow a two week timeframe for the culminating project to be implemented. Most lessons will take about 40 – 50 minutes to deliver.

Unit Goals

My goals for this curriculum unit are for students to be able to make meaningful scientific observations, develop their own questions to explore, and use these skills in our science unit on Forces and Motion: Sound. To achieve these goals, I will open the school year with finding out what the students already know about the topic of science and then as we move through the year ask about their background knowledge of sound, matter, weather, life cycles and genetics. These first lessons will be important to set up the framework for the types of responses and questioning that will carry over into our unit on Sound as well as all the following units I teach this year. As the teacher I need to make sure to model the statements I am looking for, encourage questions that arise and hold discussions of what was learned at the end of each lesson. From there I can address any misguided preconceptions they have as well as begin having academic conversations about science. Most students are good at recalling facts, but need more guidance at open-ended activities. There is less confidence shown when the pathway of learning is less prescribed. This past year, our school has been working on “academic conversations” as a way to dig deeper into our thinking and holding everyone accountable for listening and speaking across the curriculum.

It is important for the students to build a base knowledge about a subject in order to have ideas about experiments. Reading books, watching videos as well as finding information on the internet will be key to start our units. I also think starting off the year with some observational science activities and reviewing the steps of the scientific method will eventually help lead them into the types of science labs that are more student driven. Students still need to have guided practice making observations and reflections to demonstrate their understanding of all science topics.

The North Carolina Department of Public Instruction states in their science standards that

> "*Students should be actively involved in exploring phenomena in the natural world posing questions and seeking answers as they arise. Students develop simple skills of observation, measurement and number sense as they actively participate in simple investigations. They must have ample time to talk about their observations and compare their observations with those of others."*

Early on we will visit the nature trail to explore leaves, trees and insects. We will talk about what we observe, noting the more academic phrases used, then model questioning that evolves from the thinking. We will ask, "How can we find out more?" and make a point to do just that. I want students to feel comfortable discussing science as a scientist. From there I will build upon these skills into a few guided yet open-ended experiments using the scientific method to help shape their thinking. Discussing their hypothesis and conclusions will be important to help them reflect on their experiences and drive their curiosity about what will happen if…? As much as possible, I want to come away from the science labs that follow step after step and then always end with same result all around just so I can check my box that it was done right.

As we move into our first unit on Sound, specifically, I want my students to know that vibrating objects produce sound which can be described in terms of pitch and volume. Students will also know that our bodies make and receive sound. Our ears receive sound waves, which make our eardrums vibrate. Then those vibrations are converted into a message for our brains to interpret. We will conduct various experiments that relate to pitch, tone, vibrations and how sound travels. I want to find a way for the students to have an input into how they will add to or change the process from questions that arise. Finally the culmination of the the unit will be to build a musical instrument using certain materials but no specific plan. This time around when we make an instrument, I want to see if we could use an iPad to record the sounds made and measure the pitch or tone. Then the students will be able to revise their instruments to make it change sounds, not just limit the instrument to one sound.

I am interested in a gradual letting go from a structured environment to a guided and hopefully open environment as my ultimate goal. Students today are used to having an instant answer for almost everything. Creativity and just sitting and thinking are falling by the wayside

in our classrooms. I want my students to be able to have a conversation about science and take the time to explore, to fail and to try again. The National Science Teachers of America states, "The elementary science program must provide opportunities for students to develop understandings and skills necessary to function productively as problem-solvers in a scientific and technological world."[1] While on one hand I think " of course science labs should be this way" on the other I feel daunted by the prospect of getting there, but there needs to be a start.

Content Research

"Why? But why?" is often heard from very young children as they first start to speak. In his article in the *Science and Children*, Rodger Bybee says, "Even before elementary school, children ask questions of each other and of adults about things around them, including the natural and designed world. If students develop the practices of science and engineering, they can ask better questions and improve how they define problems." [2]

Most scientists will agree that observation is the most important skill in primary science education. It is used everywhere from formulating questions, gathering new information as well as making connections to prior knowledge. Children need to be taught how to make more effective observations. Our role as teachers in the beginning of the year is to model the skills scientist use to make meaningful interpretations of the world around them.

"Observation is the process through which we come to take notice of, become conscious of, things and happenings. It can involve the use of any of the senses - seeing, hearing, feeling, tasting, smelling - alone or in combination." [3] Senses are influenced by our prior knowledge and opinions. Take for example a delicious dinner prepared by mom. The children lick their spoon once and declare it "too spicy" while her husband praises the delicate balance of garam masala, cinnamon and cardamom in the curry. Perhaps one of the best-known visual observation that is seen differently is a car crash. Exactly how it happened and who is at fault lies not with the 6 bystanders who stand at different angles, with different attention spans but by the street camera that captures it all. Even in the classroom, students will not observe the same things about an experiment or object. Most will be able to state the obvious conclusions. "Developing the process skill of observation enables children to seek consciously for information that *extend* their ideas." [4] The role of the teacher is to provide guidance and discussion of these observations in order to help draw conclusions and create further questions. When student's notes and thoughts are shared, it gives a chance to help modify any answer that was too brief or misaligned with the topic being taught. The hope is that by refining answers and using guiding questions over and over, that the students will not only be able to become more confident in their roles as a young scientists but they will be able to dig deeper when exploring all future scientific activities.

In guiding an observational activity, students can be directed into making a connection to other objects that they are already familiar with. Comparing what is similar and what is different can help get them thinking more deeply about what they see. For example they can compare two leaves or two different rocks. Another way students can observe is to look at the cause and effect of an experiment. Students can observe what happened when you start your pendulum from a particular height. They can repeat the experiment to see what happens when it is pulled from an even greater height. It is important to provide multiple opportunities to observe and discuss topics both before and after experiments. Then allow changes to be made and go back to the experiment again and see what happens.

Teachers need to let go of expectations when in the lab. They need to allow outcomes to just happen. They should be prepared for celebration or disappointment, which is how it is in the real world. We shouldn't make our students expect that everything always turns out the way we want it to. It is important to talk about what went well, what didn't, and what will we do differently. In this way the ownership of learning is not solely on the teacher but creates an environment where students can learn from their group of peers. We need to show our students that we don't walk away from failure but should embrace it. These obstacles help our brain grow as we tackle future challenges.

Sound is an important part of our everyday life. It is the basis of most of our communication with other people. When we talk, listen to the car radio, or hear a police siren, the air acts as the medium to transmit the sound from the source to our ears. Sounds are heard as the air around an object is caused to vibrate. Our voices produce sound when air from the lungs passes over our vocal cords and makes them vibrate. These vibrations are carried through the air as a sound wave. A wave can be described as transporting energy from one location to another. Sound is a kind of energy. Since sounds make the air particles move in a vibration, it is a kind of energy. A slinky toy is often used to describe the nature of the wave. The first coil reacts and pushes on a second coil, the second coil pushes on the third and so on down the line. [5] Sound move out from a source in all directions, just like a ripple of water when a rock is dropped into a still pond.

These vibrations travel as sound waves into our ears. From the outer ear, the sound travels through the ear canal to the middle ear and causes the eardrum to vibrate. This in turn makes the three bones, the hammer, anvil and stirrup inside vibrate. As these tiny vibrations move through the cochlea in the inner ear, they travel along auditory nerves to the brain. The brain interprets where the sound comes from and identifies the sound thus causing us to react.

Solid objects and liquids can also have sounds travel through them. Snakes hear by putting their heads on ground to feel vibrations. We can feel the subway trains coming even before we see them. Playing in a swimming pool or bathtub, you can hear tapping or even

talking when under water, although you might not always understand what exactly someone is saying.

Sounds can have different volumes and pitches. The volume of sound is usually described using the words loud or soft. We often relate the explanation of volume is just like the volume of the radio. When a sound wave is made with a lot of energy, the sound will be loud. When sound waves are made with a small amount of energy, the sound will be soft. Megaphones and cupping your hands around your mouth can help make the sound louder. This is called amplifying. Covering your ears is one example of how to make a sound softer, or muffle a sound. When a sound is muffled it is harder for the sound waves to reach the inside of your ear. The pitch refers to how high or low sound is. Pitch can be shown with different size columns of air. Many students can relate high pitches to small objects, and often musical instruments are a good example to highlight these high pitches compared to a low sounding one. For example, the piccolo is a small instrument and can make a higher pitched sound compared to the similar shaped, and longer, flute. Also a xylophone has the different sized bars and when played from the longer to the shorter, it is easy to hear the pitch change from the longer bar (low) to the shorter bars (high). I often use the mnemonic device *longer means low* to help the students remember the size of the air column in relation to the type of pitch it will produce. The pitch of a sound is directly related to its frequency (see Figure 1).

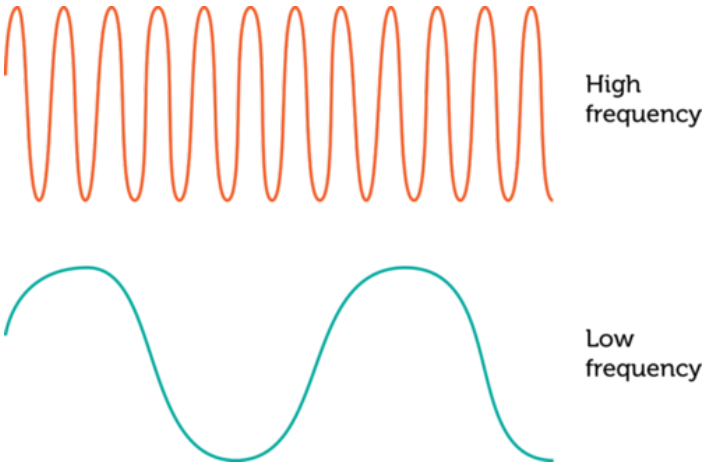

Figure 1. High and low frequency sound waves.[6]

Instructional Implementation

Teaching Strategies

Throughout this unit students will be exposed to scientific inquiry and sounds through several mediums. As we begin the year and in each new topic, I hope to build upon their background knowledge through in-depth discussions, watching video clips and reading picture books aloud.

Journals - Students will use their science journals to make notes, observations and drawings in order to help show their thinking. Recording and keeping track of their thinking is important. Notes and drawing should be as accurate as possible as well as reflecting on what was learned. Students also need to be able to see how their thinking was changed through experimenting. They also need to know that erasing their work so it only shows the right answer is never what a scientist does, but rather they learn from any misconceptions.

Science Labs - We will choose experiments that will help us reaffirm our statements made or lead us to understand new concepts. When able, we will conduct experiments over again to see if we can answer any questions that came up in our post discussions. While these experiments will need to have guidance, where possible students will opportunities to follow their own questioning.

Academic Conversations - Students will work in groups in order to collaborate on ideas and their learning. Having discussions both before and after a lab visit will help me correct any misconceptions that some students may still have. Since we are working with sound and the ultimate goal of creating musical instruments that produce more than one sound, working with the school's music teacher will be beneficial. Lessons that explore the variety of string and wood instruments and how they produce sound can help springboard ideas of creation.

Technology - Since we have Chromebooks in the classroom this year, I will have the students explore online simulations where they can "play" instruments while changing pitch and volume. The Smart Board in my room will also let me show video clips that will help explain concepts to the whole class before we go into the lab. I also will use our school iPads and download Music Memo, which is just like Voice Memo on your phone. Students can record their performance, play it back and add enhancements to their songs. They can continue to edit their music over and over.

Classroom Activities
A list of all materials needed including books, vocabulary words and website links are found in Appendix 2 and 3.

Day 1
30 - 40 minute lesson
Gather students on the carpet and have them list what they know about sounds. Guiding questions: *Who or what makes sounds? How is sound created? How can sound change? What is the purpose for the sounds we hear? How does sound travel?* Record responses on a chart. Afterwards ask *How can we sort these words?* Possible responses could be human, animal or machine sounds. Loud or soft sounds.

Read The Listening Walk by Paul Showers. Explain that you are going to take the children on a walk around the school to listen for sounds. Ask *What sounds do you think you might hear?* Children will take their science notebooks to record sounds heard inside and outside the school. As you walk down the halls, pause in places such as a classroom with the door open, outside the gym and cafeteria as well as when another class is walking past. Also take the students outside to listen for sounds in nature, traffic as well as playground sounds. When you return to the classroom, put students in groups to discuss the kinds of sounds they heard. Ask them to sort their sounds into categories of their choice and if any of their sounds changed as they walked around to the different parts of the building and outside. Students will take a few minutes to record their responses on a small poster paper and then will share out to the whole group.

Day 2

45 minute lesson

Gather students on the carpet and read Sounds All Around by Wendy Pfeffer. This book explains vibrations, sound traveling in waves, how sound is used in communication and how it is measured using decibels.

Explain sound vocabulary words from the text and their meaning to the students: sound, volume, vibration, sounds wave. Explain that sounds are made when something vibrates. These vibrations travel in waves from the object to our ears. Sounds can travel through air, solids and liquids. See Appendix 3 for sound vocabulary definitions.

Take students to the science lab. To demonstrate sound waves, hand out tuning forks to groups of 3 to 4 students. Have students strike the tuning fork on the edge of the desk and look closely to see movement. You will be able to see the tuning fork vibrate back and forth clearly. Strike again and bring close to ear. You will hear a humming noise. Ask students to describe what happened out loud and in their notebooks. Next, fill a bowl or container with wide opening with water. Strike the tuning fork on the table and place the fork into the water. They will see the water move similar to ripples in a pond. Explain what they observe and why it happened. Lastly, put plastic cling film over the bowl as tight as possible. Place about a teaspoonful of sugar on the cling film. Strike the tuning fork again and place it just above the sugar. Repeat again with rice. When put close to these objects the tuning fork vibrations will make them dance. Describe the type of movement seen. Ask about their ideas on how else to observe the tuning forks vibrate, and if possible, allow exploration time with the tuning forks.

Back in the classroom, you can do a quick experiment that shows how sound travels through a solid object by making a telephone from cups and strings. The materials should be prepared ahead of time. Put a small hole in the bottom of a paper or plastic cup using a sharp pencil. Push the end of a string 15 feet in length through the hole into the bottom of the cup.

Next, tie a paper clip to the end of the string inside the cup. Repeat with the other end of the string into the other cup. Pull the string tight between the cups. The sound stops if the string is loose and cannot vibrate. Whisper into the one end as a partner listens at the other end. The sound travels through the string, which is a solid object. Have the partner write down what is said. Students can come back to this experiment, testing out different lengths of the string and different types of string to see how that affects the quality of sound. Keep a log of what they observe in their notebooks. Make sure to discuss how well they could hear or not, and the reasons why each time.

Day 3

30 - 40 minute lesson

Play a YouTube video on different frequencies. A link to the video is in Appendix 2 under Day 3. Students will listen to different sounds and will raise their hands if they can hear them. Have students participate as if they were there in the audience. After the video, have students share out what they thought and discuss any new vocabulary words with them such as pitch and frequency. Also include amplify and muffle. All definitions for these words are found in Appendix 3. Explain that making sounds louder is called amplifying, such as using a megaphone or cupping your hands around your mouth. Covering up your ears is one way to muffle sounds. This might be something we do when we hear a police siren. Sounds are all different. They can be loud or soft, this is called volume. Loud sounds are made with lots of sound energy. Sounds can be high or low, too. This is called pitch. High pitch sounds are made with small objects and will vibrate quickly, like a whistle. Big things produce low, deep sounds, like a drum. Use alliteration to help remember: the *longer* the air column, the *lower* the sound.

Today you will make a pitch pipe. Hand out two straws and scissors to each student. Show how to blow across the end of the straw to produce a sound. Describe the sound as having a soft volume and low pitch. Demonstrate how to cut off about two inches from the bottom of the straw and have the students copy with their own straws. Blow across the top again and discuss how the sound has changed. Students should notice that the pitch is now higher. Cut another two inches off the bottom and again note the change in sound. Line up all straw pieces from tallest to shortest. Use a second straw to cut into more pieces to fill in size spaces. Lay out the pieces flat on a desk and line up one end of the straws so they are all level. Lay a piece of clear tape on top of the straws to hold them together. Students should be able to pick up and play their pitch pipe. At the end of the lesson, have them draw a picture of their pitch pipe in their science notebooks and label with high and low pitch, as well as explaining how the sounds were made.

Day 4

30 minute lesson

Start off today's activity by showing a website called Changing Sounds that will allow students to simulate playing instruments such as a guitar, drum and blowing across a bottle. Then they have to answer questions relating to pitch and volume.

Students can also explore changing the vibrations of a ruler on a desk. Place the ruler flat on the desk with the end hanging off the edge by a few inches. Observe what happens when you twang it to make it vibrate. Ask what they can do to change the sound and amount of vibration. Record predictions and observations in their science notebooks. Afterwards discuss how the vibrations changed when more of the ruler was hanging off the edge of the desk. What conclusion can students make about the length of the ruler and the type of sounds?

Next, visit the music classroom (after you pre-arrange this with the music teacher) or ask the music teacher to borrow a variety of instruments for this lesson. (Instruments might include - drums, xylophones, triangles, maracas, recorders, etc.) Put children in small groups of 3 to 4 and have them "make music" with their instrument. Remind students they are scientists and not musicians today. Record how the instrument makes sound and how they classify the pitch and volume of it. Rotate around to all instruments available. As students work, monitor groups and their understanding of the production of sound. Music teachers should be able to help with this too.

Day 5

30 minute lesson

This day is needed to help build background into how our bodies make and receive sound. Explain the humans primarily use sound to communicate. Refer back to the chart of sounds created on the first day. Explain that today we are going to learn how humans use vibration and air to create sound just like the objects we have explored in our labs. We push air from our lungs across our vocal cords, which vibrate thus creating sound. Have students put their hands over their throats and hum in order to feel the vibrations. Practice making low and high pitched sounds. Show a diagram of the ear. Explain that there are three parts of the ear: the inner ear, middle ear, and outer ear. Briefly go over the major parts of each section of the ear using the diagram. Explain that the outer ear is responsible for funneling sound into the middle ear, which is why our ear has its funnel like shape. The outer ear is also responsible for helping us detect the source of a sound. Relate how a dog's ears lie flat against their heads and what happens when they hear a noise outside? Their ears stand up tall, collecting the sounds. We can cup our hands behind our ears to help amplify the sounds too. Next, explain how sound travels through the inner and middle parts of the ear eventually reaching the brain where it is interpreted. The brain tells us where the sound is coming from and what the sound is. Explain that students will learn more about how we hear from a short YouTube video on hearing.

After watching the video clip have students cut, paste/tape, and color the diagram of an ear, which is also a foldable. After completing have students draw arrows showing how sound passes through the ear.

Students who finish early or who need further explanation can watch Scholastic Study Jams video clip on Hearing as well as take the quiz online. The quiz will give instant feedback on how they answered questions about how the ear hears.

Day 6

2 - 45 minute lessons (over two days)

This is the final project for this unit. Students will build a musical instrument that produces two different sounds or can change pitch. Remind students about the actual instruments they saw in previous lessons and how they produced sound. (While there are numerous websites that give ideas for making instruments, I purposely didn't include them in my unit) Provide materials for students to choose from to make their instrument. This list includes but is not limited to: craft sticks, cardboard boxes, rubber bands of different sizes and widths, different kinds of yarn and string, straws, paper clips, paper cups, construction paper, paper towel tubes, tape and glue. This activity can be done in the classroom or the science lab.

To make this activity more interesting, let students know that they are trying out for the school band. They will need to make their instrument creative as well as produce two different sounds or can change pitches. It will also be demonstrated in front of the class for about 10 - 15 seconds in order for them to make the band.

Allow plenty of time for students to brainstorm and share ideas with their table groups first. Ask them to go through their science notebooks to reflect on ideas and concepts learned, especially their notes from the exploring musical instruments. Once they gather materials they need, allow plenty of time to create, practice, and change their instrument. Students will write up a short description of their instrument as well. This should include the name, how it produces and changes sound and a quick sketch of the final project.

As students perform, record their sound using the Music Memo app on an iPad. If you have a set of iPads, it would be ideal for students to record their sounds on their own iPads, so they can edit their work at the same time. Discuss how the students met the criteria and if need be, what they could do to make their instrument produce better sounds. Have students record their thoughts about how they did and how they could make it better. Then allow them to use the app to make changes and enhancements to their sound.

Appendix 1: Teaching Standards

My unit of study on Sound Science will meet all of the second grade science standard in Forces and Motion throughout the class and lab work. In addition, the North Carolina Department of Instruction outlines for all Kindergarten through 2nd grade that "all students should be actively involved in exploring phenomena in the natural world posing questions and seeking answers as they arise. Students develop simple skills of observation, measurement and number sense as they actively participate in simple investigations. They must have ample time to talk about their observations and compare their observations with those of others. They should be encouraged to employ oral language, drawings and models to communicate results and explanations of investigations and experiments." My unit is designed to also meet these expectations of observing and discussing science. Throughout the lessons there are multiple times to meet standards in writing when recording in their science notebooks. Speaking and Listening standards will be met when discussing sound in whole and small groups.

Essential Standard
2.P.1 Understand the relationship between sound and vibrating objects.

2.P.1.1 Illustrate how sound is produced by vibrating objects and columns of air.

2.P.1.2 Summarize the relationship between sound and objects of the body that vibrate – eardrum and vocal cords.

W.2.7 Participate in shared research and writing projects

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.1 Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.

Appendix 2: Materials for teaching lessons

Science notebooks and Smart Boards to show videos and pictures will be needed throughout the unit.

Day 1
The Listening Walk by Paul Showers
Chart paper
Construction paper

Day 2
Sounds All Around by Wendy Pfeffer
Tuning forks
Bowls
Cling film
Water
Rice
Sugar
Paper or plastic cups
String - at least 15 feet in length for each telephone, string of different lengths will be needed for future experiments
Paper clips

Day 3
YouTube video on frequencies
https://www.youtube.com/watch?v=sZHWY1KBHwc

Straws - at least 2 per student
Scissors
Clear tape

Day 4
Website - Changing Sounds
http://www.sciencekids.co.nz/gamesactivities/changingsounds.html

Rulers
Musical instruments (from music room)

Day 5
Ear diagram

http://ffden-2.phys.uaf.edu/211.fall2000.web.projects/p%20marvin%20and%20r%20gray/humanear.jpg.jpg

YouTube video on how we hear
https://www.youtube.com/watch?v=HMXoHKwWmU8

Study jams video on hearing
http://studyjams.scholastic.com/studyjams/jams/science/human-body/hearing.htm

Ear diagram foldable
http://www.scholastic.com/listencarefully/pdf/starkey_68_imallears.pdf

Day 6

craft sticks, cardboard boxes, rubber bands of different sizes and widths, yarn/string, straws, paper clips, paper cups, construction paper, paper towel tubes, tape and glue.

Set of iPads with the Music Memo app downloaded

Appendix 3: Vocabulary words and definitions

Sound - a type of energy made of vibrations that is transmitted through air, liquid or solid

Volume - how loud or soft a sound makes

Vibration - to move quickly back and forth

Sound wave - invisible waves that carry sound

Amplify - make a sound louder

Muffle - make a sound softer

Pitch - how high or low a sound is

Frequency - how often the air particles vibrate

Ear drum - a membrane of the middle ear that vibrates in response to sound waves

Appendix 4 Unit Assessment

Band Tryouts Today!

In order to be in the school band, you will need to design, create and perform on a musical instrument that produces more than one sound or pitch.

1. Think about what type of instrument you want to make.
2. Gather materials you might need to create this instrument from the collection of items.
3. Construct your instrument and test it out. Be creative and think about how you can make your instrument even better.
4. Practice your performance.

Name your new instrument: _____

Explain how this instrument produces sound. Don't forget to include Sound vocabulary words like vibration, pitch, volume, etc. :

_____

_____

_____

_____

_____

Draw a sketch of your instrument below with labels for each part:

AFTER YOUR PERFORMANCE:

On a scale of 1 to 10, with 10 being the best performance ever and with 1 having the instrument fall apart before it made a sound, how do you think you did? _____ Why?

_____

_____

_____

_____

What could you have done to make your instrument even better? _____

_____

_____

_____

Grading Rubric

	1	2	3	4
Construction	Flimsy, falling apart	Sturdy at first, but didn't hold up	Sturdy and well made	Well made and creative
Written explanation	Missing or incomplete	Filled in, but didn't use sound vocabulary	Filled in with complete explanation	Detailed drawing and complete explanation
Sounds produced	1 sound, less than 10 seconds in performance	Only 1 sound, but played the entire time	2 sounds, less than 10 second performance	2 sounds and played entire time
Reflection	missing	Incomplete thoughts	completed	Completed honestly and thoughtfully

Score 14 - 16 Congratulations! You made the band!

Score 12 - 13 We'll need you, too!

Score 8 - 11 Almost!

Score 4 - 7 Let's go back and review!

Student Resources

Books -

The Listening Walk by Paul Showers

Follow a girl as she goes on a listening walk around her town and find out what she hears.

Sounds All Around by Wendy Pfeffer

A read-and-find-out science picture book that describes how people and animals use different kinds of sounds to communicate.

Investigate Sound by Hilary Maybaum

A student book that explains how to create a sound experiment following the steps of the scientific method.

Websites -

"How Your Ears Work." YouTube video, 5 minutes and 7 seconds long https://www.youtube.com/watch?v=HMXoHKwWmU8 Follow two cartoon characters as they travel through an ear while they explain how it works.

"StudyJams! The Senses: Hearing." http://studyjams.scholastic.com/studyjams/jams/science/human-body/hearing.htm Short video that explains how our ear hears and controls our balance with a summary and optional quiz at the end.

"Science Games for Kids: Changing Sounds." http://www.sciencekids.co.nz/gamesactivities/changingsounds.html Interactive simulation on pitch and volume as viewers can manipulate a guitar, drum and bottle.

Teacher Resources

See all Student Resources for easy to understand information on sounds and hearing.

Music Memo app for iPads and iphones

A very simple and free app to use to record sounds. You can add a guitar or band to help accompany your recorded sound.

The National Science Teachers Association (NSTA) website has many good (and free) articles on current teaching trends and concepts for science teachers.

Notes

[1] National Science Teachers Association, Position Statement
[2] Bybee, Scientific and Engineering Practices in K - 12 Classrooms.
[3] Harlen, *Primary science: Taking the Plunge*, 85.
[4] Harlen, *Primary science: Taking the Plunge*, 86.
[5] The Physics Classroom, Sound is a Mechanical Wave
[6] PowerSchool Learning, Williams Science: Wave Frequency

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Butzow, Carol M., and John W. Butzow. 2000. *Science through children's literature: an integrated approach*. Englewood, Colo: Teacher Ideas Press. This book contains instructional units to use with science trade books written for children to help introduce many topics in life, earth and physical science.

Bybee, Rodger W. 2011. "Scientific and Engineering Practices in K - 12 Classrooms" *Science and Children.* http://common.nsta.org/resource/default.aspx?id=10.2505%2f4%2fsc11_049_04_10 10 - 16 (accessed September 3, 2017) Understanding and applying science practices such as asking questions, planning and carrying out investigations, and analyzing data.

EarMaster. Acoustics for Music Theory.

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Harlen, Wynne, Jos Elstgeest, and Sheila Jelly. 2001. *Primary Science: Taking the Plunge*. Portsmouth, NH: Heinemann. Gives advice to teachers to ensure those students' science activities offer genuine learning experiences. It also gives advice on what kinds of questions teachers should ask, how to assess children's process skills, and how to support children's understandings through inquiry.

Kids Health. "How Your Ears Work." Filmed August 22, 2013. YouTube video, 05:07. Published August, 2013. https://www.youtube.com/watch?v=HMXoHKwWmU8 Follow two cartoon characters as they travel through an ear while they explain how it works.

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Scholastic Inc. "I'm All Ears!". Scholastic.com. http://www.scholastic.com/listencarefully/pdf/starkey_68_imallears.pdf (accessed October 13, 2017) A pdf to print out of a mini model of the ear.

Scholastic Inc. "StudyJams! The Senses: Hearing." studyjams.scholastic.com http://studyjams.scholastic.com/studyjams/jams/science/human-body/hearing.htm (accessed October 13, 2017) Short video aimed at kids that explains how our ear hears and controls our balance with a summary and optional quiz at the end.

Science Kids. "Science Games for Kids: Changing Sounds." sciencekids.co.nz http://www.sciencekids.co.nz/gamesactivities/changingsounds.html (accessed October 13, 2017) Interactive simulation on pitch and volume as viewers can manipulate a guitar, drum and bottle.

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