Y4

Science

Sound

Overview: In this unit, children will explore and identify the way sound is made through vibration in a range of different musical instruments. They will also find out how the **pitch** and **volume** of sounds can be changed in a variety of ways. **Number of lessons:** 8 lessons	
R	***What knowledge and skills should children already have? (Forms pre-lesson AfL)*** In Year 1, children will have learned about our senses including how we use our ears for hearing. Children will have also investigated making different types of sounds, using a range of musical instruments, as part of the music curriculum.
A	***What knowledge and skills will children acquire?*** In this unit, children will acquire knowledge about how sounds are made, associating some of them with something vibrating. They will learn that vibrations from sounds travel through a medium (including air) to the ear. They will find patterns between the pitch of a sound and features of the object that produced it as well as the patterns between the volume of a sound and the strength of the vibrations that produced it. Children will also learn that sounds get fainter as the distance from the sound source increases. **Knowledge: Children will be able to answer the following questions**. How are sounds made on the flowing instruments? How can we make the sounds louder? How can we make the sounds quieter? How do we make a higher pitched sound? How do we make a lower pitched sound? How do we hear sounds? What mediums do sounds travel through best? Why? What mediums does sound travel through worst? Why? What happens to the volume of the sound as we walk further away from the source? What happens to the volume of the sound as we walk closer to the source? ***National Curriculum Link*** *Y1-Animals including humans (senses)* ***Y4- Sound***
D	***How will teachers facilitate children to develop their skills / knowledge?*** Through Scientific Enquiry children will… **Research:** • How sounds are both made and heard. • The work of Alexander Graham Bell (telephone). **Pattern Seeking:** • Observe the pattern between the volume of a sound and the force with which the sound is made. • Observe the pattern between the volume of a sound and the distance you stand from it. • Observe the pattern between the pitch of a sound (made on a stringed instrument) and the length of the string. **Comparative/ Fair Testing:** Children test the best materials for making affordable earmuffs for children in a third world country.
A	***How will children apply their knowledge / skills?*** Children will write/ record explanations about how sounds are made and how they are heard. Children will produce a fact file on Alexander Graham Bell (the inventor of the telephone). Children will gather data about the volume of sounds and record this in tables and graphs. Children will write short explanations (in the form of tweets) about the patterns that they have spotted between the pitch of a sound and the feature of the instrument that made it. Children will write a letter to an earmuff manufacturer to detail which materials would be best to make affordable earmuffs for children in a third world country.
R	***Notes around what children need to remember. These should be done as 'Do Now' tasks.*** Recap 1: Our senses- which body parts are associated with each sense. Recap 2: What are sounds? Recap 3: How do sounds travel? Recap 4: Who was Graham Alexander Bell? Recap 5: Which mediums do sounds travel through best? Why? Recap 6: How do you change the volume of a sound? Recap 7: How can you change the pitch of a sound?

R – Ready	A – Acquire knowledge and skills	D – Develop knowledge	A – Apply knowledge	R - Remember
Detective	Instructor	Facilitator	Mentor	Coach

Coverage within this unit

SCIENCE	Hillfort Specific	**Embody the school's values** Kindness, resilience, challenge, courage, aspiration. Understanding how successful scientists have had to show these core values.	**Cultural isolation** Embracing multiculturalism and fighting the corrosive effects of intolerance. Understanding how the work of scientists from around the world positively impact our everyday lives. **Alexander Graham Bell- creating the telephone. His mother was deaf which inspired and drove his work.**	**Closing the vocabulary gap** Plan for reading to improve tier 2 words. Introducing key scientific vocabulary (tier 3 words) through RADAR model, Knowledge organisers and working walls.	**Developing Oracy** Asking and answering questions. Articulating scientific concepts clearly and precisely. Being able to explain what we have learnt rather than what we have done.
	Key Concepts	**Science within a context** Use of real life context to maximise pupil's engagement and learning. **Making affordable earmuffs for children in a third world country.**	**Consequences and impact** How science has changed our lives in the past and how it will influence our future. Build in teaching of significant scientific discoveries of the past. How did these change thinking and understanding at the time? How did these discoveries drive society forwards? **Knowledge of sound, pitch and volume used to protect our ears.** **Ultrasounds used to see babies inside the womb and check for any possible health issues**	**Local vs Global** Understanding of whether the observations we make or results we see are likely to be similar or different in other parts of the country or in other parts of the world. **How we can use our knowledge to help people in another part of the world.**	**Concrete vs Abstract** Producing scientists who understand the difference between science that we are able to observe or experience in our own classroom or the local environment and science that requires children to think in a more abstract way.

Scientific Concepts- Types of enquiry	**Observation over time** Observing changes that can take place over seconds, minutes, hours, days or longer (seasons).	**Pattern Seeking** Looking for patterns between two sets of measurements or variables. **Volume and distance** **Volume and force** **Pitch and length of string**	**Identifying, Classifying and Grouping** Children use observational skills to look for similarities and differences. Children make links and organise things into groups.	**Comparative and Fair testing** Children testing outcomes based on changing specific variables. **Testing the best material for earmuffs.**	**Researching** Children use a range of secondary sources to find evidence. Children need to decide upon the validity of a source. Excellent opportunity to practice reading and oracy (explanation) skills. • **Alexander Graham Bell.**

Scientific Skills (enquiry)	**Plan**			**Do**			**Review**
	Asking questions and planning an enquiry	Making predictions	Setting up an enquiry	Observe and measure	Record	Interpret and report	Evaluate
Scientific Skills (wider)				Using equipment accurately	Application of Maths skills	Skills of a scientist: problem solving,	

Overview of lessons

1	In this session the children will learn about how sounds are produced and heard (vibrations travelling through a medium to the ear).
2	In this session the children will research the famous scientist Graham Alexander Bell and learn about the inspiration behind his work (his deaf mother).
3	In this session children will develop their knowledge of sound and vibration by carrying out the TAPS investigation into the string telephone.
4	Children will explore patterns between the volume of a sound and the strength with which it is made.
5	Children will explore patterns between the volume of a sound and the distance from its source.
6	Children will explore patterns between the pitch of a sound and the features of the instrument that made it.
7	Over the course of these two sessions, children will learn how scientists have used their knowledge of sound to help move society forwards (ultrasounds). Through the context of developing affordable earmuffs for children in a third world country, children will investigate which materials are the best insulators.
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Lesson 1

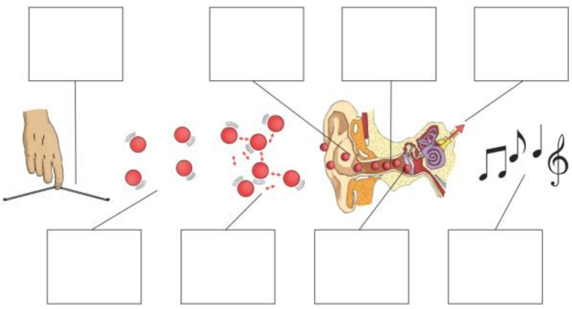
Overview: In this session the children will learn about how sounds are produced and heard (vibrations travelling through a medium to the ear).

New key vocabulary: Sound, vibration, medium, hearing, ear canal, ear drum

Recap (AFL): Children should recap which part of the body are associated with each of our senses.
Acquire knowledge & skills: Children will learn how sounds are created (through vibrations- this could be demonstrated using a number of different instruments) and how they travel in waves through a medium (e.g. air) to our ear. Once the sound wave enters our ear it travels down the ear canal to the ear drum, which vibrates and sends messages to our brain about the sound that has been heard.
Develop knowledge & skills: sound travel can be demonstrated by getting the children standing in a line holding two tennis balls each (these represent particles in a medium): Ask the child at one end to hit a drum (the source of the sound), the energy from this action should them be passed down the line (in a wave) until it reaches the human ear at the other end. Children will then need to learn what happens once the sound reaches the ear (TigTag video- Journey through the ear).
Apply knowledge & skills: Written explanation of sound production and travel.

Task: Children annotate a diagram to explain how sounds are created and how they travel through a medium to the human ear.

Resources: A range of musical instruments (string, percussion, wind), a large slinky or skipping rope, sound diagram to annotate (see below).



Assess: Do children know that all sounds are made through vibrations? Do they know that sound must pass through a medium (particles are needed to pass on the sounds)

Notes to teacher: Some children think that the musical instrument itself, such as a recorder, flute or clarinet, vibrates rather than the column of air inside it.

Lesson 2

Overview: In this session the children will research the famous scientist Graham Alexander Bell and learn about the inspiration behind his work (his deaf mother).

New key vocabulary: telephone

Recap: Recap sound production and travel from last week.
Acquire knowledge & skills: Children will learn that through advances in technology (the telephone), scientists have made it possible for sounds to be made on one side of the world and heard on the other side of it. Children will learn about the life and work of inventor Graham Alexander Bell- the inventor of the telephone. The children should learn about how Bell's mother (who was deaf) was the inspiration behind his work.
Apply knowledge & skills:
Children will need to present their findings on Bell. This should be done in the form of a fact file (this way the teacher can control the headings e.g. what was the inspiration behind his work? How have his discoveries/ inventions changed our lives?

Task: Children produce a fact file on Graham Alexander Bell.

Resources: Children will need to be provided with a range of useful websites and texts to use to research Bell.

Assess: Do the children know who GA-B was? Can they explain the impact he had on our modern lives?

Notes to teacher: Children may need to write their fact files as part of a Literacy session.

Lesson 3

Overview: In this session children will develop their knowledge of sound and vibration by carrying out the TAPS investigation into the string telephone.

New key vocabulary: Medium

Recap: Recap Graham Alexander Bell and his invention of the telephone from last week.
Acquire knowledge & skills: Children will learn how telephones work by reading the document 'The science of telephones' (see below).
Develop knowledge & skills: Children carry out the TAPS investigation 'String telephones' (see below).

Task: Children investigate what makes the best string telephone, supporting with questioning as necessary. Give time for the children to reflect and test their designs so that they can be modified and improved.
After the investigation, children demonstrate their telephones to the class and explain why their telephone is/is not good.

Resources: String, plastic cups (enough for one per child),

Assess: Can children explain how to make the best possible string telephone? Can the children suggest reasons for the improvements to their design?

Notes to teacher: As a very practical lesson, this learning should be captured using a photograph and personalised using an individual tweet.

Lesson 4

Overview: Children will explore patterns between the volume of a sound and the strength with which it is made.

New key vocabulary: volume

Recap: How sounds are produced from lesson one.
Acquire knowledge & skills: Children that the term volume is used to describe a sound's loudness. Quiet sounds have a small volume and loud sounds have a big volume. Children will learn that the 'harder' an instrument is played, the louder the sound produced.
Develop knowledge & skills: Children should explore creating loud and soft sounds on a range of different musical instruments.
Apply Knowledge & skills: Children produce a written explanation explaining the patterns they have seen between energy applied and the volume of the sound produced.

Task: Children write a paragraph that describes their observations of the instruments that they have played. E.g.
As more energy is given to the string the volume of the sound increases. Volume is a measure of the loudness of the sound. Louder sounds have more energy in their vibrations, so as these vibrations get bigger the sound becomes louder.

Resources: A collection of musical instruments (string, percussion and wind), sound meters.

Assess: Can children describe the pattern between the amount of energy applied to playing an instrument and the volume of the sound it produces?
Notes to teacher: After experimenting with a range of instruments, children should pick just one to explore in more detail and to write about specifically (this could be tailored depending on the ability of the child e.g. LA children could describe more obvious instruments e.g. a drum, whereas HA children could work with wind instruments).

Lesson 5
Overview: Children will explore patterns between the volume of a sound and the distance from its source.
New key vocabulary: volume, distance, decibels.
Recap: Recap the lesson on the volume of sounds from last week. **Acquire knowledge & skills**: Explain to the children that as well as the amount of energy applied to playing an instrument, there is another way to affect the volume of the sounds that we hear- the distance we stand from the source of the sound. **Develop knowledge & skills**: Children carry out a pattern seeking investigation into how the distance we stand from a sound source effects the volume that we hear. Children will gather data using appropriate measuring devices (tape measures and sound meters) and then record this in tables. **Apply knowledge & skills:** Children convert the data they have collected into a line graph.
Task: On the playground/ field, children collect data about the volume of a sound (using a sound meter) at specified distances (e.g. 5 meters, 10 metres, 15 metres, 20 metres etc.) away from a constant sound (this could be a piece of music being played on a stereo). Children should record the volume at each point in a table. Back in class children should convert their data into a line graph.
Resources: tape measures/ trundle wheels, a stereo, sound meters (there is an app on the iPads), record table, graph template.
Assess: Can children explain the pattern between the volume of a sound and the distance they are away from its source. Can children use equipment accurately to measure out the distance they are from the source? Can children use equipment accurately to collect data on the volume of the sound? Can children record results in a table? Can children transfer data into a line graph?
Notes to teacher: Producing the line graph may need to be done as part of a maths session.

Lesson 6
Overview: Children will explore patterns between the pitch of a sound and the features of the instrument that made it.
New key vocabulary: Pitch
Recap: Remind the children that in a previous lesson they looked at how different musical instruments make the vibrations that create sound waves. **Acquire knowledge & skills**: That musical instruments can produce different notes (this is how we play songs). Another word for the different notes that are produced by musical instruments is their **pitch**. **Develop knowledge & skills**: Children create an elastic band guitar (using a tissue box and elastic bands). They should explore how to change the pitch of the sound that their elastic band makes. **Apply knowledge & skills:** Children discuss and record their observations. Note: More able children could draw diagrams of how the vibrations in the band alter as it is increasingly stretched.
Task: Children write a 'tweet' to explain what they have learnt from their exploration of pitch.
Resources: tissue boxes (one per pair), elastic bands (one per pair), photographs of the activity, tweet templates.
Assess: Can children explain the patterns they have seen between the characteristics of an instrument and the pitch of the sound it produces? Do children know the difference between pitch and volume?
Notes to teacher: Some children confuse pitch and volume and think higher notes produce louder sounds. It is worth pointing out that high notes can be loud or quiet.

Lesson 7 and 8

Overview: Over the course of these two sessions, children will learn how scientists have used their knowledge of sound to help move society forwards (ultrasounds). Through the context of developing affordable earmuffs for children in a third world country, children will investigate which materials are the best insulators.

New key vocabulary: insulator

Recap: Children's experiences of loud or unpleasant sounds (noises).

Acquire knowledge & skills: Children will learn that loud noises can be damaging to our ears. They will learn that we can protect our hearing by wearing products like earmuffs which are made from materials that are good 'insulators' or sound. Children will learn that good 'insulators' do not let sound travel through them easily.

Develop knowledge & skills: Through the context of needing to help an earmuff manufacturer develop low cost earmuffs for children living in third world countries (perhaps they are forced to work on noisy construction sites to try and help feed their families), children should investigate the sound absorption of different materials to discover which makes the best ear protectors. This will be done as a **fair test.**

Apply knowledge & skills: Children write a letter to the ear manufacturing company.

Task: Generate a constant frequency sound at a constant volume using a computer. Children open the sound meter app on an IPad and then cover the sensor with the first test material. Children then measure and record the sound level (in a simple table). Note: Remind the children that sound is measured in units called decibels (dB). Repeat for all test materials. Children then discuss their results and write a letter to the manufacturers to explain their findings and suggest the best material for their new, cheap earmuffs.

Resources: Class computer, IPads (with sound meter app), a range of materials to test, record table, letter head paper.

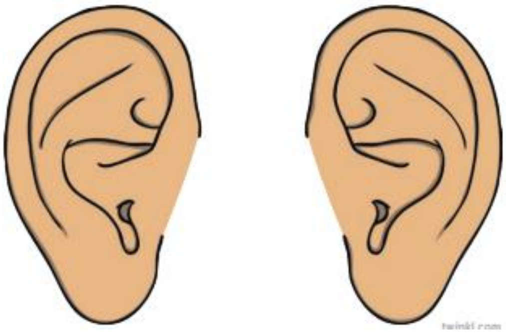
Assess: Do children understand that loud noises are dangerous for our ears? Do children know that some materials are good insulators and some are poor insulators? Can children carry out a fair test? Can children suggest the best material for making earmuffs and explain the reason why?

Notes to teacher: This will certainly take a couple of lessons but children may still need to write their letter as part of a literacy lesson.

AFL: Children match the right body part to the right sense

Hearing

Touch



Sight

Smell

Taste

The Science of Telephones (Reading activity):

The Science of Telephones

The Science Behind it . . .

How do landline telephones work?

When you speak into a landline phone, your voice travels in small sound waves. The sound waves are carried to a thin metal disk inside the phone, called a diaphragm, and are converted into electrical energy. The electrical energy travels over wires to another phone and is converted from electrical energy to sound waves again which can be heard by someone on the other end of the phone!

How do cell phones work?

A cell phone does not use wires to transfer your voice. When you speak into a cell phone a microphone turns your voice into electrical signals. A microchip in the phone modulates (or varies) a radio wave using the electrical signal. The radio wave travels through the air to a nearby cell tower; the tower sends your voice to the person you are calling and the process is reversed so that the person on the other end can hear your voice.

How does the string telephone work?

A string telephone works very much like a landline phone. When you talk into the cup your voice sends sound waves inside the cup, vibrating the bottom of the cup. The vibrations are transferred to the string, across the string and into the bottom of the other cup. The sound waves become vibrations inside the second cup, transferring the sound of your voice.

TAPS investigation:

BATH SPA UNIVERSITY

TAPS Plan for Focused Assessment of Science

why& how?

Topic: Sound	Year 4 Age 8-9	Title: String Telephones

Working Scientifically
Review: Identify differences, similarities or changes related to simple scientific ideas and processes

Concept Context
Recognise that vibrations from sounds travel through a medium to the ear

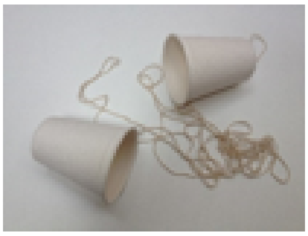
Assessment Focus
- Can the children explain how to make the best possible string telephone?
- Can the children suggest reasons for the improvements?

Activity *Today we are acoustic engineers.*
Explore how to use a string telephone. Discuss how this works; vibrations in air, vibrations in string, the cup amplifies the vibrations, vibrations travel to ear.
Provide a range of pots (yoghurt pots, paper/plastic beakers, polystyrene cups etc) and different types of string/wool.
In groups, ask children to investigate what makes the best string telephone, supporting with questioning as necessary. Give time for the children to reflect and test their designs so that they can be modified and improved.
After the investigation, children demonstrate their telephones to the class and explain why their telephone is/is not good. Discuss how their research has informed their design – detailing improvements they have made and reasons for making those improvements.

Adapting the activity

T7

Support: During investigation ask questions to support evaluation, e.g. What have you changed? Which is better? Why is it better?
Extension: Can you eavesdrop on another phone call? (Connect another string).
Other ideas: Use a data logger to measure sound (decibels)



Questions to support discussion
- How does the sound travel through your telephone?
- What have you changed on your telephone?
- Which was the best telephone? Why?
- How can you make your telephone better?
- How will you know if your telephone is better?
- Does your telephone always work? What stops your telephone working?
- What modifications did you make to your original telephone design? Why? Did they have the desired effect?

Assessment Indicators
Not yet met: Can select the best string telephone but not explain why in terms of properties.

Meeting: Can talk about features which make a good telephone, *e.g. all work when the string is tight, the bigger cup is better.*

Possible ways of going further: Can relate observations to vibrations, *e.g. it doesn't work when you hold the string because you stop it vibrating.*

End of Unit Assessment:

Concept Map

Year 4: Sound

volume

sound

notes

distance

sound waves

ear

pitch

energy

vibration