Ears, brains and da Vinci's sound waves

(Biology and Physics)

Overview and rationale:

This Y4 topic is the first time that our children take a deeper look into how sound works and how the ear and the brain work together to interpret those invisible sound waves, first discovered by Leonardo da Vinci! Music plays a key role as the children learn about volume, pitch, wavelength and vibration and become fascinated with the intricacies of how our bodies interact with the natural and physical world. As with every science topic, the children learn a balance of knowledge and skills through enquiry and practical investigative learning and consolidate their understanding of how to conduct fair and reliable experiments to give them a greater understanding of how we gain meaning in our wonderful natural world.

SCIENCE LEARNING STATEMENTS

Area of Learning	Knowledge and Skills
Scientific Enquiry and applying knowledge in context	I can raise my own relevant questions about the world around me and begin to look for answers.
	I am given a range of scientific experiences including different types of scientific enquiry to answer questions.
	I can start to make my own decisions about the most appropriate type of scientific enquiry I might use to answer questions and give justifications.
	I can set up simple practical enquiries, comparative and fair tests. I can recognise when a simple fair test is necessary and help decide how to set it up.
	I can talk about criteria for grouping, sorting and classifying; use simple keys and explain how they should be used.
	I can recognise when and how secondary sources might help me to answer questions that cannot be answered through practical investigations. I can use a selection of resources.
	I can make systematic and careful observations. I can make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used.
	I can look for naturally occurring patterns and relationships; decide what data to collect to identify them.
	I can take accurate measurements using standard units, learn how to use a range of equipment, such as data loggers and thermometers, appropriately.
	I can collect and record data from their own observations and measurements in a variety of ways: notes, bar charts, tables. I can select and use the most appropriate standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse the data.
	I can look for changes, patterns, similarities and differences in their data in order to draw accurate conclusions and answer further questions
	I can confidently use relevant scientific language to discuss their ideas and communicate their findings, in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions.
	I can identify new questions arising from my data, making predictions for new values within or beyond the data I have already collected and finding ways of improving what I have already done.

MATHS AND SCIENCE ACROSS THE CURRICULUM – Data Handling and Statistics

Science NC: recording findings using simple scientific language, drawings, labelled diagrams, bar charts/bar line graphs

NATIONAL CURRICULUM OBJECTIVES

1. identify how sounds are made, associating some of them with something vibrating
2. recognise that vibrations from sounds travel through a medium to the ear
3. find patterns between the pitch of a sound and features of the object that produced it
4. find patterns between the volume of a sound and the strength of the vibrations that produced it
5. recognise that sounds get fainter as the distance from the sound source increases

Enrichment activities (including trips/visitors, etc)

Making sound catchers to amplify sound entering the ear.

Role play / dance to show the path of sound vibrations.

KEY VOCABULARY

sound, source, vibrate, vibration, travel, pitch (high, low), volume, faint, loud, insulation, sound waves, da Vinci

'CORE' KNOWLEDGE	'ADDITIONAL' KNOWLEDGE
1) I know what pitch, volume, tempo, beat and rhythm means and can use these terms to describe different music. **PLAN: Ask questions and plan enquiry: INVESTIGATING PITCH**	a) I can use technical vocabulary like pitch, volume, tempo, beat and rhythm when talking about different types of music.
	b) I understand that there are different genres of music and can describe their properties and how they make me feel.
	c) I know how factors like pitch, volume, tempo, beat and rhythm can affect the distance that a sound travels and can test this fairly.
2) I know that sound is caused by vibrations. **REVIEW: Interpret and report: STRING TELEPHONES**	a) I can demonstrate sound is made by vibrations using a drum or my voice box.
	b) I know that the volume of a sound depends on the size of the vibrations made.
	c) I know that sound enters our ears through vibrations, these vibrations are carried through the outer and inner ear and our brain converts those to recognisable sound.
3) I know that sound vibrations travel in waves.	a) I know that Leonardo da Vinci first discovered that sound travels in waves in 1490 when he inserted a tube into water and was able to detect vessels by ear.
	b) I know that sound travels as waves and is different depending on the pitch (high and low frequency) and volume of the sound – some pitches of sounds are too high or low for us to hear, but other animals, lie dogs, can!
	c) I know that sound waves get fainter as the distance from the source increases.
4) I can explain what each part of the ear does and can use the correct term: Pinna, outer ear, ear canal, ear drum, ossicles, hammer, stirrup, anvil, and cochlea.	a) I know the ear is made up of the outer, middle and inner ear.
	b) I can explain how the parts of the ear work together by transferring vibrations to help us to hear sounds. From the Pinna, outer ear, ear canal, ear drum, ossicles, hammer, stirrup, anvil and cochlea.
	c) I know that sometimes our ears don't work the way they should and can be easily damaged. I understand ways in which we can amplify peoples' hearing e.g. hearing aids and cochlea implants.
5) I know that the shape of our ears helps to funnel sound waves into our ear canal, therefore helping us to hear better.	a) I know the shape of my ear doesn't just funnel sound waves, it amplifies them by funnelling sound waves.
	b) I know that our ears are designed to amplify and funnel sounds from the front and from the side, but to reduce sound waves from behind.
	c) I know animals have different shaped ears and the Elephants ears are amazing – they are large, therefore help funnel quiet sounds and they are thin to help cool them down in the heat.
6) I know that Casey Baugh is a contemporary American artist and that he uses charcoal to create his artwork.	a) I know that charcoal can be blended using different tools e.g. cotton buds, paper towels and my fingers.
	b) I know what contrast means and I can use this in my drawings by creating darks and lights.
	c) I know that paper has a 'tooth' and pushing too hard with drawing tools can damage this. I understand that drawings are created in layers.

Possible 'higher order' questioning

Remember	What bones can be found in the ear? What are their jobs?
Understand	How do invisible sound waves work? Can you describe the process of how our brain interprets sound?
Apply	Why are some people unable to hear? How do hearing aids help?
Analyse	Does the shape of our ears help? Compare human ears with other animal ears. What can we infer from the way they look?
Evaluate	What would happen if our ears were just holes in the side of our heads? What impact would it have if our ears were on our knees?
Create	Can you create an investigation to compare people's hearing? What can you infer from the results?

School Value	Topic relevance: How/when/where/why is it needed?
Resilience	People who have hearing loss require resilience in order to adapt and respond to the world around them. Evelynn Glennie, a deaf musician who responds to the vibrations caused by musical instruments is a great example.
Respect	There are many different genres of music – can we learn to respect all types of music, even if they aren't to our personal tastes?
Responsibility	Hearing is precious and the parts of the ear are delicate – why is it our responsibility to look after our own and other people's hearing by being responsible?
Happiness	Music is a great mood enhancer! What music makes you happy?
Kindness	How can we adapt our behaviours to accommodate those with hearing difficulties?

ART AND DESIGN

Exploring and Developing

Exploring and developing ideas	Explore ideas for different purposes.
	Question and make thoughtful observations.
	Explore the roles and purposes of artists, craftspeople and designers working in different times and cultures.
Evaluating and developing work	Adapt their work according to their views and describe how they might develop it further.
	Annotate work in sketchbook.

Painting

National Curriculum	Additional Skills	Knowledge	Key Vocabulary
Explore relationships between line and tone, pattern and shape, line and texture.	-Alter and refine drawings and describe the changes using the appropriate art vocabulary. -Explain the effect of different pencils. -Evaluate their work and make appropriate changes, using their sketchbooks to develop ideas.	-Know how to show facial expressions in sketches and paintings. -Know how to use marks and lines to show texture. - Know how to use line, tone, shape and colour to represent reflection. -Know when to use cross-hatching, hatching and contour hatching.	Cross hatching, hatching, contour hatching, lighter shading effect, pressure, angles, different pencil densities, dimension, observe, H pencils lighter, B pencils darker, depth, dimension, observe

Artist/Style/Activities

Casey Baugh

Using charcoal to draw the human ear – experiment with contrast (in the style of the artist)