PrimaryConnections®
Linking science with literacy

Fully aligned with the Australian Curriculum

The PrimaryConnections program is supported by astronomer, Professor Brian Schmidt, Nobel Laureate

Look! Listen!

Year 1

Physical sciences

Primary**Connections project**

Professional learning program

Primary**Connections** comprises a professional learning program supported with exemplary curriculum resources to enhance teaching and learning in science and literacy. Research shows that this combination is more effective than using each in isolation.

Professional Learning Facilitators are available throughout Australia to conduct workshops on the underpinning principles of the program: the Primary**Connections** 5Es teaching and learning model, linking science with literacy, investigating, embedded assessment and collaborative learning.

The Primary**Connections** website has contact details for state and territory Professional Learning Coordinators, as well as additional resources for this unit. Visit the website at:
www.primaryconnections.org.au

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Look! Listen!

Year 1

Physical sciences

Light and sound surround us, bringing a wealth of information about our world. We use light and sound to communicate with each other. Sounds can be as different as beautiful music or screaming sirens. Light can transmit the pictures from a television screen or the expressions on someone's face. Almost continuously, light and sound affect what we think and do, and how we feel.

The *Look! Listen!* unit is an ideal way to link science with literacy in the classroom. It provides opportunities for students to investigate sources of light and sound, how they are produced and how light and sound travel. Students' understanding of the role of light and sound in our lives and our community will be developed through hands-on activities. Through investigations, students explore why we have two eyes instead of one.

Australian Academy of Science

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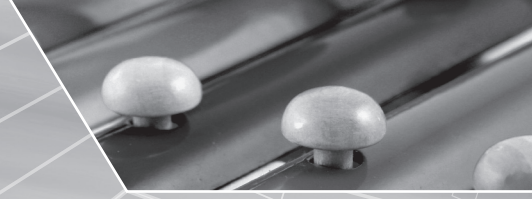

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Foreword

The Australian Academy of Science is proud of its long tradition of supporting and informing science education in Australia. 'Primary**Connections:** linking science with literacy' is its flagship primary school science program, and it is making a real difference to the teaching and learning of science in Australian schools.

The Primary**Connections** approach has been embraced by schools since its inception in 2004, and there is substantial evidence of its effectiveness in helping teachers transform their practice. It builds teacher confidence and competence in this important area, and helps teachers use their professional skills to incorporate elements of the approach into other areas of the curriculum. Beginning and pre-service teachers find the approach do-able and sustainable. Primary**Connections** students enjoy science more than in comparison classes, and Indigenous students, in particular, show significant increases in learning using the approach.

The project has several components: professional learning, curriculum resources, research and evaluation, and Indigenous perspectives. With the development of an Australian curriculum in the sciences by ACARA in December 2010, it is an exciting time for schools to engage with science, and to raise the profile of primary science education.

Students are naturally curious. Primary**Connections** provides an inquiry-based approach that helps students develop deep learning, and guides them to find scientific ways to answer their questions. The lessons include key science background information, and further science information is included on the Primary**Connections** website (www.primaryconnections.org.au).

Science education provides a foundation for a scientifically literate society, which is so important for engagement in key community debates, such as climate change, carbon emissions, and immunisation, as well as for personal decisions about health and well-being. The inquiry approach in Primary**Connections** prepares students well to participate in evidence-based discussions of these and other issues.

Primary**Connections** has been developed with the financial support of the Australian Government and has been endorsed by education authorities across the country. The Steering Committee, comprising the Department of Education, Employment and Workplace Relations and Academy representatives, and the Reference Group, which includes representatives from all stakeholder bodies including states and territories, have provided invaluable guidance and support. Before publication, the teacher background information on science is reviewed by a Fellow of the Academy. All these inputs have ensured an award-winning, quality program.

The Fellows of the Academy are committed to ongoing support for teachers of science at all levels. I commend Primary**Connections** to you and wish you well in your teaching.

Professor Suzanne Cory, AC PresAA FRS
President (2010–2013)
Australian Academy of Science

The Primary**Connections program**

Primary**Connections** is an innovative program that links the teaching of science and literacy in the primary years of schooling. It is an exciting and rewarding approach for teachers and students, with a professional learning program and supporting curriculum resources. Further information about professional learning and other curriculum support can be found on the Primary**Connections** website: (www.primaryconnections.org.au)

The Primary**Connections teaching and learning model**

This unit is one of a series designed to exemplify the Primary**Connections** teaching and learning approach, which embeds inquiry-based learning into a modified 5Es instructional model with the five phases: *Engage, Explore, Explain, Elaborate* and *Evaluate* (Bybee, 1997). The relationship between the 5Es phases, investigations, literacy products and assessment is illustrated below:

Primary**Connections 5Es teaching and learning model**

Phase	Focus	Assessment focus
ENGAGE	Engage students and elicit prior knowledge	**Diagnostic assessment**
EXPLORE	Provide hands-on experience of the phenomenon	**Formative assessment**
EXPLAIN	Develop scientific explanations for observations and represent developing conceptual understanding Consider current scientific explanations	**Formative assessment**
ELABORATE	Extend understanding to a new context or make connections to additional concepts through a student-planned investigation	**Summative assessment** of the Science Inquiry Skills
EVALUATE	Students re-represent their understanding and reflect on their learning journey, and teachers collect evidence about the achievement of outcomes	**Summative assessment** of the Science Understanding

More information on Primary**Connections** 5Es teaching and learning model can be found at: www.primaryconnections.org.au

Developing students' scientific literacy

The learning outcomes in Primary**Connections** contribute to developing students' scientific literacy. Scientific literacy is considered the main purpose of school science education and has been described as an individual's:

- scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues
- understanding of the characteristic features of science as a form of human knowledge and enquiry
- awareness of how science and technology shape our material, intellectual and cultural environments
- willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen (Programme for International Student Assessment & Organisation for Economic Co-operation and Development [PISA & OECD], 2009).

Linking science with literacy

PrimaryConnections has an explicit focus on developing students' knowledge, skills, understanding and capacities in science and literacy. Units employ a range of strategies to encourage students to think about and to represent science.

PrimaryConnections develops the literacies of science that students need to learn and to represent their understanding of science concepts, processes and skills. Representations in PrimaryConnections are multi-modal and include text, tables, graphs, models, drawings and embodied forms, such as gesture and role-play. Students use their everyday literacies to learn the new literacies of science. Science provides authentic contexts and meaningful purposes for literacy learning, and also provides opportunities to develop a wider range of literacies. Teaching science with literacy improves learning outcomes in both areas.

Assessment

Assessment against the year level achievement standards of the Australian Curriculum: Science (ACARA, 2014) is ongoing and embedded in PrimaryConnections units. Assessment is linked to the development of literacy practices and products. Relevant understandings and skills are highlighted at the beginning of each lesson. Different types of assessment are emphasised in different phases:

Diagnostic assessment occurs in the *Engage* phase. This assessment is to elicit students' prior knowledge so that the teacher can take account of this when planning how the *Explore* and *Explain* lessons will be implemented.

Formative assessment occurs in the *Explore and Explain* phases. This enables the teacher to monitor students' developing understanding and provide feedback that can extend and deepen students' learning.

Summative assessment of the students' achievement developed throughout the unit occurs in the *Elaborate* phase for the Science Inquiry Skills, and in the *Evaluate* phase for the Science Understanding.

Alignment with the Australian Curriculum: Science

The Australian Curriculum: Science has three interrelated strands—Science Understanding, Science as a Human Endeavour and Science Inquiry Skills—that together 'provide students with understanding, knowledge and skills through which they can develop a scientific view of the world' (ACARA, 2014).

The content of these strands is described by the Australian Curriculum as:

Science Understanding	
Biological sciences	Understanding living things
Chemical sciences	Understanding the composition and behaviour of substances
Earth and space sciences	Understanding Earth's dynamic structure and its place in the cosmos
Physical sciences	Understanding the nature of forces and motion, and matter and energy
Science as a Human Endeavour	
Nature and development of science	An appreciation of the unique nature of science and scientific knowledge.
Use and influence of science	How science knowledge and applications affect people's lives and how science is influenced by society and can be used to inform decisions and actions
Science Inquiry Skills	
Questioning and predicting	Identifying and constructing questions, proposing hypotheses and suggesting possible outcomes
Planning and conducting	Making decisions regarding how to investigate or solve a problem and carrying out an investigation, including the collection of data
Processing and analysing data and information	Representing data in meaningful and useful ways; identifying trends, patterns and relationships in data, and using evidence to justify conclusions
Evaluating	Considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence
Communicating	Conveying information or ideas to others through appropriate representations, text types and modes

AC All the material in this table is sourced from the Australian Curriculum.

There will be a minimum of four Primary**Connections** units for each year of primary school from Foundation to Year 6—at least one for each Science Understanding sub-strand of the Australian Curriculum. Each unit contains detailed information about its alignment with all aspects of the Australian Curriculum: Science and its links to the Australian Curriculum: English and Mathematics.

Safety

Learning to use materials and equipment safely is central to working scientifically. It is important, however, for teachers to review each lesson before teaching to identify and manage safety issues specific to a group of students. A safety icon 

is included in lessons where there is a need to pay particular attention to potential safety hazards. The following guidelines will help minimise risks:

- Be aware of the school's policy on safety in the classroom and for excursions.
- Check students' health records for allergies or other health issues.
- Be aware of potential dangers by trying out activities before students do them.
- Caution students about potential dangers before they begin an activity.
- Clean up spills immediately as slippery floors are dangerous.
- Instruct students never to taste, smell or eat anything unless they are given permission.
- Discuss and display a list of safe practices for science activities.

References

Australian Curriculum Assessment and Reporting Authority (ACARA). (2012). *Australian Curriculum: Science.* www.australiancurriculum.edu.au

Bybee, R.W. (1997). *Achieving scientific literacy: from purposes to practical action.* Portsmouth, NH: Heinemann.

Programme for International Student Assessment & Organisation for Economic Co-operation and Development. (2009). *PISA 2009 assessment framework: key competencies in reading, mathematics and science.* Paris: OECD Publishing.

Unit at a glance — *Look! Listen!*

Phase	Lesson	At a glance
ENGAGE	**Lesson 1** Scary sounds	To capture students' interest and find out what they think they know about how light and sound are produced by a range of sources and can be sensed. To elicit students' questions about light and sound.
EXPLORE	**Lesson 2** Light and sound search ***Session 1*** School sounds ***Session 2*** Where's the light? ***Session 3*** Light and sound at home	To provide students with hands-on, shared experiences of things that produce light and sound.
	Lesson 3 Good vibrations	To provide students with hands-on, shared experiences of how vibrations cause sound, which can be sensed.
	Lesson 4 Sounds on the move	To provide students with hands-on, shared experiences of sound travelling through materials.
	Lesson 5 Sensing light	To provide students with hands-on, shared experiences of how light is needed to see things.
EXPLAIN	**Lesson 6** Travelling tales	To support students to represent and explain their understanding of how light and sound are produced and can be sensed, and to introduce current scientific views.
ELABORATE	**Lesson 7** Two versus one	To support students to plan and conduct an investigation of why two eyes are better than one.
EVALUATE	**Lesson 8** All together	To provide opportunities for students to represent what they know about how light and sound are produced by a range of sources and can be sensed, and to reflect on their learning during the unit.

A unit overview can be found in Appendix 5, page 64.

Alignment with the Australian Curriculum: Science

This *Look! Listen!* unit embeds all three strands of the Australian Curriculum: Science. The table below lists sub-strands and their content for Year 1. This unit is designed to be taught in conjunction with other Year 1 units to cover the full range of the Australian Curriculum: Science content for Year 1.

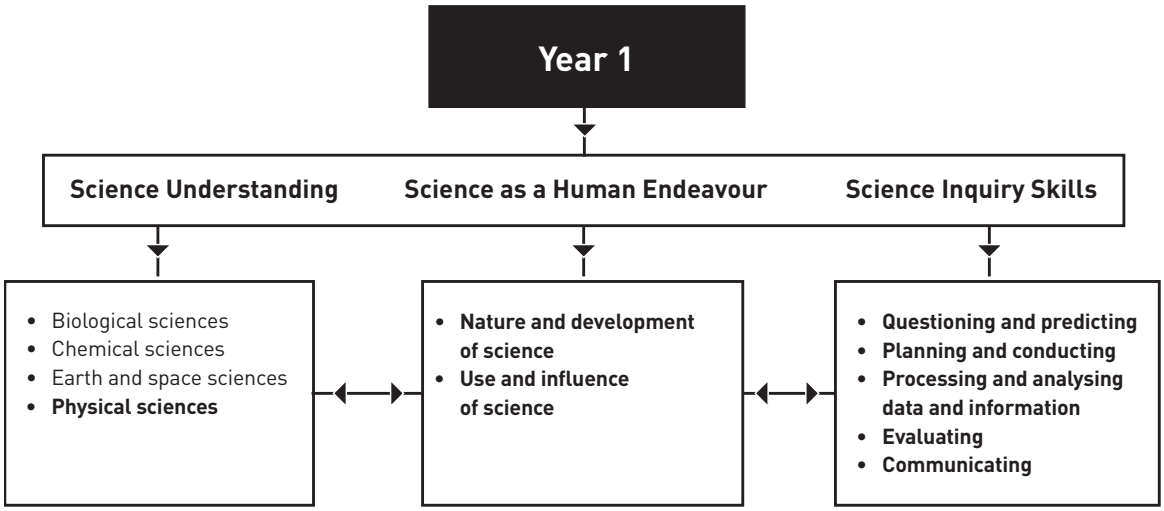
For ease of assessment the table below outlines the sub-strands and their aligned lessons.

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
Science Understanding	**Physical sciences**	ACSSU020	Light and sound are produced by a range of sources and can be sensed	1–7
Science as a Human Endeavour	**Nature and development of science**	ACSHE021	Science involves asking questions about, and describing changes in, objects and events	1, 2, 3, 4, 6
	Use and influence of science	ACSHE022	People use science in their daily lives, including when caring for their environment and living things	1, 2, 3, 4, 6
Science Inquiry Skills	**Questioning and predicting**	ACSIS024	Respond to and pose questions, and make predictions about familiar objects and events	1, 2, 3, 4, 5, 6
	Planning and conducting	ACSIS025	Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas, and accessing information sources	2, 3, 4, 5, 6, 7
		ACSIS026	Use informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate	2, 3, 5, 6
	Processing and analysing data and information	ACSIS027	Use a range of methods to sort information, including drawings and provided tables	2, 3, 6 ,7
		ACSIS212	Through discussion, compare observations with predictions	2, 3, 4, 5, 6, 7
	Evaluating	ACSIS213	Compare observations with those of others	2, 3, 4, 5, 6, 7
	Communicating	ACSIS029	Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play	1–7

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Interrelationship of the science strands

The interrelationship between the three strands—Science Understanding, Science as a Human Endeavour and Science Inquiry Skills—and their sub-strands is shown below. Sub-strands covered in this unit are in bold.



AC All the terms in this diagram are sourced from the Australian Curriculum.

Relationship to overarching ideas

In the Australian Curriculum: Science, six overarching ideas support the coherence and developmental sequence of science knowledge within and across year levels. In *Look! Listen!* these overarching ideas are represented by:

Overarching idea	Incorporation in *Look! Listen!*
Patterns, order and organisation	Students group light and sounds depending on their source.
Form and function	Students investigate how the form of different objects affects the sound or light they produce.
Stability and change	Students observe how sounds in the environment, for example, around the school, might change according to the time of day.
Scale and measurement	Students compare sounds and light using relative language, such as louder, softer, brighter and dimmer.
Matter and energy	Students explore the transmission of two different types of energy—light and sound.
Systems	Students describe simple relationships, such as sound requires matter to vibrate and eyes require light to see.

Curriculum focus

The Australian Curriculum: Science is described by year level, but provides advice across four year groupings on the nature of learners. Each year grouping has a relevant curriculum focus.

Curriculum focus Years F–2	Incorporation in *Look! Listen!*
Awareness of self and the local world	Students use their senses to make direct observations of the classroom, school grounds and home to gather information, describe and make comparisons of the sources of light and sound and how they are sensed.

Achievement standards

The achievement standards of the Australian Curriculum: Science indicate the quality of learning that students typically demonstrate by a particular point in their schooling, for example, at the end of a year level. These standards will be reviewed regularly by ACARA and are available from the ACARA website.

By the end of this unit, teachers will be able to make evidence-based judgments on whether the students are achieving below, at or above the Australian Curriculum: Science Year 1 achievement standard.

General capabilities

The skills, behaviours and attributes that students need to succeed in life and work in the 21st century have been identified in the Australian Curriculum as general capabilities. There are seven general capabilities and they are embedded throughout the units. For further information see: www.australiancurriculum.edu.au

For examples of our unit-specific general capabilities information see the next page.

Look! Listen!—Australian Curriculum general capabilities

General capabilities	Australian Curriculum description	*Look! Listen!* examples
Literacy	Literacy knowledge specific to the study of science develops along with scientific understanding and skills. Primary**Connections** learning activities explicitly introduce literacy focuses and provide students with the opportunity to use them as they think about, reason and represent their understanding of science.	In *Look! Listen!* the literacy focuses are: • science journals • word walls • tables • annotated drawings • role-plays.
 **Numeracy**	Elements of numeracy are particularly evident in Science Inquiry Skills. These include practical measurement and the collection, representation and interpretation of data.	Students: • collect, record and interpret data about the difference between using two eyes with using only one.
Information and communication technology (ICT) competence	ICT competence is particularly evident in Science Inquiry Skills. Students use digital technologies to investigate, create, communicate, and share ideas and results.	Students are given optional opportunities to: • use interactive resource technology to view, record and analyse information.
 **Critical and creative thinking**	Students develop critical and creative thinking as they speculate and solve problems through investigations, make evidence-based decisions, and analyse and evaluate information sources to draw conclusions. They develop creative questions and suggest novel solutions.	Students: • use reasoning to develop questions for inquiry • formulate, pose and respond to questions • develop evidence-based claims.
Ethical behaviour	Students develop ethical behaviour as they explore principles and guidelines in gathering evidence and consider the implications of their investigations on others and the environment.	Students: • ask questions of others respecting each other's point of view.
 **Personal and social competence**	Students develop personal and social competence as they learn to work effectively in teams, develop collaborative methods of inquiry, work safely, and use their scientific knowledge to make informed choices.	Students: • work collaboratively in teams • listen to and abide by rules to a role-play • participate in discussions.
 **Intercultural understanding**	Intercultural understanding is particularly evident in Science as a Human Endeavour. Students learn about the influence of people from a variety of cultures on the development of scientific understanding.	• 'Cultural perspectives' opportunities are highlighted where relevant • Important contributions made to science by people from a range of cultures are highlighted where relevant.

AC All the material in the first two columns of this table is sourced from the Australian Curriculum.

Cross-curriculum priorities

There are three cross-curriculum priorities identified by the Australian Curriculum:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

For further information see: www.australiancurriculum.edu.au

Aboriginal and Torres Strait Islander histories and cultures

The PrimaryConnections Indigenous perspectives framework supports teachers' implementation of Aboriginal and Torres Strait Islander histories and cultures in science. The framework can be accessed at: www.primaryconnections.org.au

Look! Listen! focuses on the Western science way of making evidence-based claims about how light and sound are produced, how they travel and are understood.

Aboriginal and Torres Strait Islander Peoples might have different explanations for the observed phenomenon of sounds travelling through different materials and the sources of light.

PrimaryConnections recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the PrimaryConnections website.

Alignment with the Australian Curriculum: English and Mathematics

Strand	Sub-strand	Code	Year 1 content descriptions	Lessons
English–Language	**Language variation and change**	ACELA1787	Explore different ways of expressing emotions, including verbal, visual, body language and facial expressions	1
	Language for interaction	ACELA1447	Understand that the purposes texts serve shape their structure in predictable ways	2, 5, 7
	Text structure and organisation	ACELA1448	Understand patterns of repetition and contrast in simple texts	1
	Expressing and developing ideas	ACELA1454	Understand the use of vocabulary in everyday contexts as well as a growing number of school contexts, including appropriate use of formal and informal terms of address in different contexts	1–8
English–Literacy	**Interacting with others**	ACELT1582	Discuss characters and events in a range of literary texts and share personal responses to these texts, making connections with students' own experiences	1
		ACELT1585	Listen to, recite and perform poems, chants, rhymes and songs, imitating and inventing sound patterns including alliteration and rhyme	3
	Interpreting, analysing, evaluating	ACELY1656	Engage in conversations and discussions, using active listening behaviours, showing interest, and contributing ideas, information and questions	1–8
	Creating texts	ACELY1788	Use interaction skills including turn-taking, recognising the contributions of others, speaking clearly and using appropriate volume and pace	1–8
		ACELY1657	Make short presentations using some introduced text structures and language, for example opening statements	2, 3, 4, 5
Mathematics–Number and Algebra	**Number and place value**	ACELY1661	Create short imaginative and informative texts that show emerging use of appropriate text structure, sentence-level grammar, word choice, spelling, punctuation and appropriate multimodal elements, for example illustrations and diagrams	2, 3, 5, 6, 7, 8
Mathematics–Measurement and Geometry	**Using units of measurement**	ACELY1660	Use comprehension strategies to build literal and inferred meaning about key events, ideas and information in texts that they listen to, view and read by drawing on growing knowledge of context, text structures and language features	1
Mathematics–Statistics and Probability	**Data representation and interpretation**	ACMSP024	Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen'	2, 7
		ACMSP263	Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays	7

AC All the material in the first four columns of this table is sourced from the Australian Curriculum.

Other links are highlighted at the end of lessons where possible. These links will be revised and updated on the website (www.primaryconnections.org.au).

Teacher background information

Introduction to light and sound

What is sound?

Sound is produced by tiny, rapid vibrations in the particles that make up materials. This can be air, liquids or solids but not in a vacuum or outer space, which have no particles. When the vibrations reach our ear, our brain translates the signal into what we call sound.

We define sound by what we can hear. Generally, human ears interpret sounds caused by an object vibrating between 20 and 20,000 hertz abbreviated as Hz. (1 Hz means one vibration per second.) Anything vibrating faster is called an ultrasonic vibration and is a higher pitch. Dogs have ears that can hear vibrations that are ultrasonic; this is why they can hear a 'silent' dog whistle and humans cannot. Elephants communicate using subsonic vibrations which are vibrations below 20 hertz and, therefore, humans are unable to hear them.

Sound is produced when the energy of vibrating objects is carried away by pressure waves. Blowing into a recorder makes the air vibrate. Drawing a bow over a violin string makes the string vibrate. Hitting a drum makes its skin vibrate. A vibrating object pushes the air, water or solid around it and then pulls away. These alternations of pushing and pulling create pressure waves in material. These are not up and down waves like those in water. The diagram below illustrates how waves of pressure travel through a slinky, a coil-shaped toy made from a ribbon of material.

If the end of the slinky is quickly moved backward and forwards, a set of pulses travels along it. For each pulse, sections of coil are compressed and then stretched apart more than normal. The overall effect is the movement of a wave pattern along the slinky. While each coil moves backwards and forwards, the slinky as a whole does not move. In sound waves, the air molecules move backwards and forwards in a similar way. This occurs much more rapidly (and with much smaller-sized vibrations) than in a slinky. Because the air molecules are moving they have movement (or kinetic) energy.

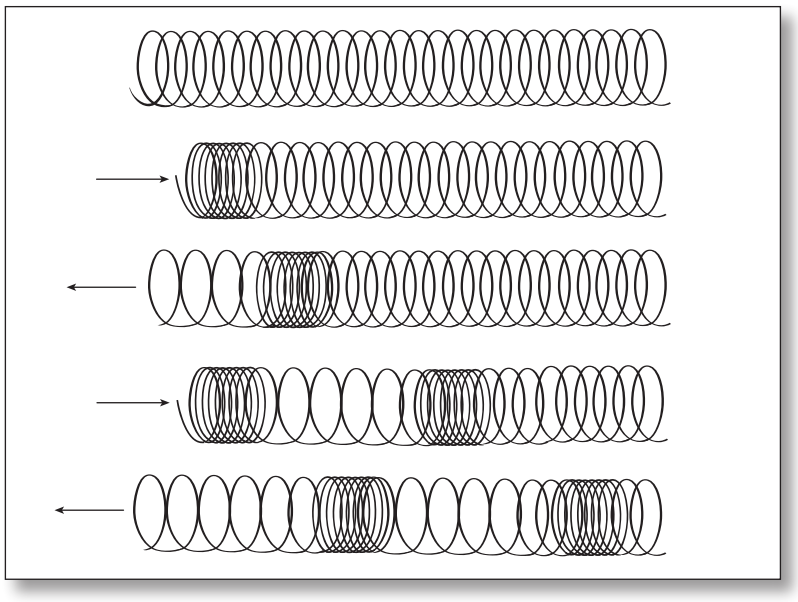
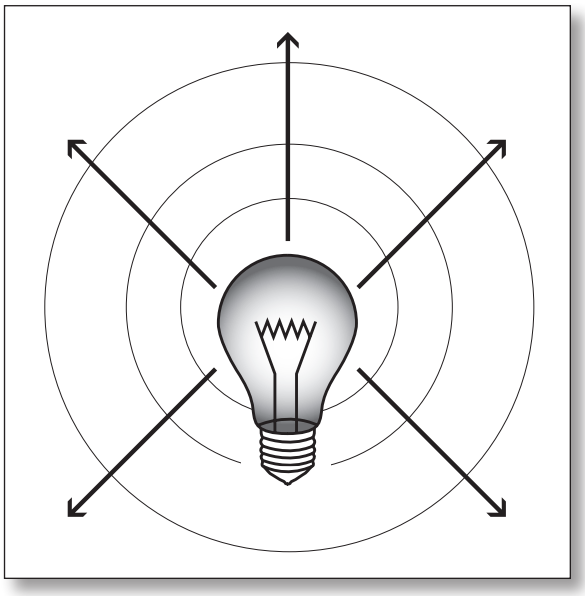


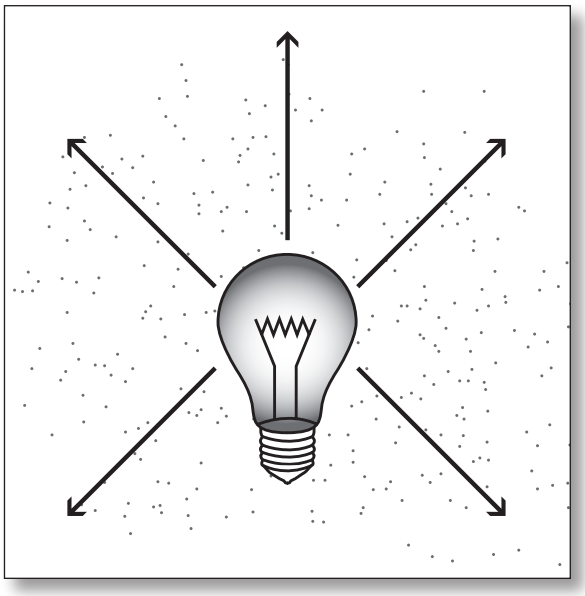
Diagram of pressure waves in a slinky

What is light?

Scientists use two models to explain light and its phenomena: the wave model and the particle model. In the wave model, light spreads out in all directions, like a wave, from a source, for example, a light globe. In the particle theory, the light streams from the source as fast-moving particles. The term 'particles' in this model doesn't refer to particles of matter but describes photons or 'packets of energy'.



Wave model



Particle model

We often hear the term light rays, for example, the sun's rays and the damage they can do, leading to the belief that light is composed of rays. However, from a scientific perspective, rays or arrows are used to show the direction in which light energy travels. These diagrams are called ray diagrams.

Light waves travel a million times faster than sound waves and can travel in a vacuum, or through a transparent solid or liquid. Light is a form of 'electromagnetic radiation'. Other types of electromagnetic radiation include x-rays, ultraviolet and infrared light and radio waves. Our eyes cannot detect all the electromagnetic radiation from the sun but only the 'visible light'. We can feel the infrared light as heat while the ultraviolet light can cause eye damage, sunburn or even skin cancer. The Earth's atmosphere filters out much of the ultraviolet 'UV' radiation.

How sound travels

A sound wave is a series of high-pressure and low-pressure zones. An object vibrating produces pressure waves in all of the materials around it. The sound energy, therefore, spreads out in all directions from the source, unless the source is designed to send sound in a particular direction, like a loudspeaker or the horn of a trumpet.

Sound pressure makes a thin membrane – the eardrum – within the ear vibrate, and connected nerves then carry the signal to the brain, where it is interpreted as sound. The ear also hears the pressure waves travelling through water as sound, which is why we can hear with our head underwater. Pressing our ear to a solid, for example, a door, allows us to directly hear the pressure waves travelling through the solid.

The pressure waves that we call sound are a form of energy. All sound comes from another form of energy. For example, when we hit a drum the movement energy of our arm is transferred to the drum, which starts vibrating. The vibrations transfer some of the drum's movement energy into sound energy in the air. Sound can be absorbed by materials if the energy contained in the pressure waves is transformed into different forms of energy. For example, sound energy could be transformed into heat energy when it hits sound-absorbing curtains.

Sound cannot exist without something to travel through. If you put an alarm clock in a vacuum the pieces will still be vibrating, but since there is nothing around them to transmit the vibrations no sound waves can be produced.

Sound bounces off objects and therefor can produce echoes. In the mountains, the waves of pressure travelling through the air, generated by a shout, can travel to a cliff face opposite, bounce off and travel back through the air to the shouter's ears. The further away the object that reflects the sound, the longer it takes to get back to the ears. Sound travels slowly compared with light, which is why we see a flash of lightning before hearing the thunder.

How light travels

Light travels as electromagnetic waves; it does not need material to travel through, unlike sound. In a vacuum, for example, in interstellar space, all forms of electromagnetic radiation travel at the same speed regardless of their wavelengths. This speed is universally referred to as the speed of light. Scientific analysis (Einstein's Theory of Relativity) shows that nothing in the universe can travel faster than light. It races towards us through the vacuum of space at about 300,000 km per second.

Theoretically, light waves from a source could travel forever. Light sources appear dimmer the further we are from them because the light spreads out. Also, light on Earth travels through the atmosphere, which has materials with which it might interact. For example, if light meets dust in the air it can be reflected, scattered or absorbed and thus the light might not be seen over a large distance.

As light is a form of energy, it has its origins in other forms of energy. Primary light sources are things that change another form of energy into light energy. For example:

- The Sun changes nuclear energy into light energy.
- A fire, glow-worms and glow sticks (cyalume sticks) change chemical energy into light energy.
- Light bulbs, lightning and computer screens change electrical energy into light energy.

Secondary light sources are things that reflect energy from a primary light source. For example, the Moon is a secondary light source that reflects light from the Sun.

Students' conceptions

Taking account of students' existing ideas is important in planning effective teaching approaches which help students learn science. Students develop their own ideas during their experiences in everyday life and might hold more than one idea about an event or phenomenon.

Some students might believe that sound can be produced without using any material objects. However, a sound is always caused by something vibrating. Sound is a transmission of energy,

not a separate, physical object. There are 'air guitar' instruments that allow players to simulate playing a guitar. Sensors pick up their hand movements and send the information to a computer which directs speakers to vibrate at the appropriate frequencies.

Whether sound produces vibrations or vibrations produce sound might confuse students, especially depending on the context. Some students might erroneously believe that sound and vibration are the same. Young students might confuse vibrate and echo, and might use both terms to mean repeat. Therefore, exploring language use and its meaning will assist students to clarify their conceptual understanding.

Some students might believe that sound cannot travel through liquids and solids. Sound travels in air, solids and liquids. In fact, sound travels faster in liquids and faster again in solids since the particles are closer together. Such differences can be experienced when sitting on a metal rail when it is tapped some distance away. The vibration in the rail will be felt and heard before the vibration travelling through the air is heard. Air transmits sound at approximately 340 metres per second and water at about 1400 metres per second.

Year 1 students might think they hear a sound simply because of its loudness or their closeness to the sound source, and not intuitively hold ideas about sound travelling.

Some students might think that light doesn't travel; rather it is thought to just exist in space. They also might think that light from weak sources doesn't travel as far as light from strong sources. In fact, all light travels from its source in all directions, regardless of its intensity, unless interrupted by matter, such as air, water or an object where it is reflected, transmitted or absorbed.

Students might think that hearing is an active choice and depends on paying attention rather than a physical vibration of the ear drum. This is perhaps a difference between the use of the terms hearing and listening. Exploring the everyday use of words and using words in a scientific way will help students clarify their understanding.

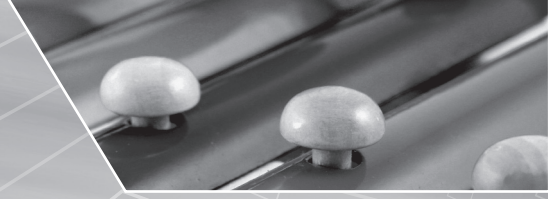
To help them develop more scientific ideas about light and sound students need a broad range of experiences and the use of language accompanied by good teacher questioning.

References

Skamp, K. (Ed.). (2012). *Teaching Primary Science Constructively* (4th Edn). South Melbourne: Cengage Learning Australia.

To access more in-depth science information in the form of text, diagrams and animations, refer to the Primary**Connections** Science Background Resource which has now been loaded on the Primary**Connections** website: www.primaryconnections.org.au/science-background-resource/.

Note: This background information is intended for the teacher only.



Lesson 1 Scary sounds

ENGAGE

AT A GLANCE

To capture students' interest and find out what they think they know about how light and sound are produced by a range of sources and can be sensed.

To elicit students' questions about light and sound.

Students:

- listen to a story
- identify objects from the story that produce light and sound
- describe how sounds are sensed.

Lesson focus

The focus of the *Engage* phase is to spark students' interest, stimulate their curiosity, raise questions for inquiry and elicit their existing beliefs about the topic. These existing ideas can then be taken account of in future lessons.

Assessment focus

Diagnostic assessment is an important aspect of the *Engage* phase. In this lesson you will elicit what students already know and understand about how:

- light and sound are produced by a range of sources and can be sensed.

You will also monitor their developing science inquiry skills (see page 3).

Key lesson outcomes

Science

Students will be able to represent their current understanding as they:

- identify the source of sounds made in a story
- describe sources of light and sound
- describe how light and sound are sensed.

Literacy

Students will be able to:

- listen to and participate in a story
- contribute to discussions about light and sound
- identify the purpose and features of a science journal
- identify the purpose and features of a word wall.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Sound makers' (Resource sheet 2)

FOR EACH STUDENT

- student science journal
- 1 copy of 'Sound makers' (Resource sheet 2)

Preparation

- Read 'How to write a science journal' (Appendix 2).
- Read 'How to use a word wall' (Appendix 3).
- Read 'Sounds in the dark' (Resource sheet 1) to become familiar with the sound effects.
- Prepare an enlarged copy of 'Sounds in the dark' (Resource sheet 1).
- Prepare an enlarged copy of 'Sound makers' (Resource sheet 2).
- *Optional:* Display 'Sounds in the dark' (Resource sheet 1) and 'Sound makers' (Resource sheet 2) on an interactive whiteboard. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed (www.primaryconnections.org.au).

Lesson steps

1. Explain to the class that you are going to read a story. Ask students to listen carefully and imagine what might be happening. Read the story 'Sounds in the dark' (Resource sheet 1), emphasising each of the sounds.
2. Introduce an enlarged copy of 'Sound makers' (Resource sheet 2). Discuss the pictures. Distribute a copy of 'Sound makers' (Resource sheet 2) to each student. Tell students that you are going to read the story again while they circle the pictures of the things they think made each of the sounds that Luke heard.
3. Allow time for students to complete the activity. Then ask students to put a cross above the pictures of objects that produce light that might have helped Luke to see.
4. Discuss the story with students asking questions, such as:
   - Why couldn't Luke see what was making the sounds in the room?
   - What things do you think were in the room making those sounds? Why?
   - Why could Luke see when he used the phone?
   - What else could Luke have used for light in the room?
5. Record students' ideas about sounds and light in the class science journal. Introduce the purpose and features of a science journal.

Literacy focus

Why do we use a science journal?

We use a **science journal** to record what we see, hear, feel and think so that we can look at it later.

What does a science journal include?

A **science journal** includes dates and times. It might include written text, drawings, measurements, labelled diagrams, photographs, tables and graphs.

Note: In the *Engage* phase, do not provide any formal definitions or correct students' answers as the purpose is to elicit students' prior knowledge.

6 Ask students to think about how we see and hear. Ask questions, such as:

- Where does sound come from?
- How do we hear sounds?
- How does sound get to our ears?
- How do we see things? What do we need to see?
- Where does light come from?

Add students' ideas to the class science journal.

7 Draw students' attention to the word wall and discuss its purpose and features.

Literacy focus

Why do we use a word wall?

We use a **word wall** to record words we know or learn about a topic. We display the word wall in the classroom so that we can look up words we are learning about and see how they are spelled.

What does a word wall include?

A **word wall** includes a topic title or picture and words that we have seen or heard about the topic.

Ask students what words from today's lesson would be useful to place on the word wall. Use words and images.

Curriculum links

Science

- Use pre-recorded sounds for students to listen to and identify.

The Arts

- Sing songs about sounds, for example, *The Marvellous Toy*.

Sounds in the dark

The door creaked **'Creeaak!'** as Luke gently pushed it open. He trembled. The room was dark, very dark. He tried the light switch, **'Click, click'** but nothing happened.

'Ring! Ring!'—Luke could hear his mobile phone ringing from somewhere in the dark room. Where was it and what was it doing in here? It was too dark to see anything. He started walking slowly towards the ringing sound.

'Twaang!' Behind him something heavy fell. What was that? Then, from out of the darkness came a **'Squeak, squeak!'** Luke shivered. **'Ring! Ring!'**—Luke kept walking carefully towards his mobile phone feeling all around him as he went.

Suddenly he heard a new sound, **'Tinkle, tinkle'**—like small bells—followed by a soft **'Prr, Prr'**. It was coming towards him and getting louder and louder all the time.

'Hello, Hello!' Who was that? Was someone else in here? Luke called out, 'Is somebody there?' **'Hello, Hello!'** There it was again. He needed a light to see! Luke felt around and touched a small cardboard box. It was vibrating—could that be his phone inside it?

'Tinkle, tinkle, Prr, Prr!' There it was again, getting closer and closer. He needed a light! Then Luke had an idea. He grabbed the phone, turned it over, and he was right—the phone's screen was lit up with a beautiful blue light. Luke turned around and shone the phone's light towards the tinkling sound.

'Ah!' Luke laughed, so that's what the tinkling and 'prrr' noise was—his cat, Max, wearing his new collar with bells!

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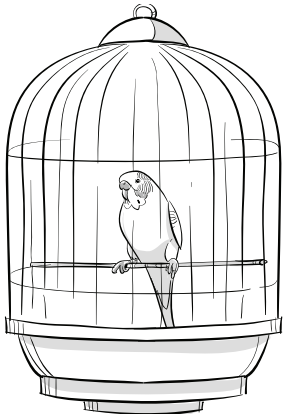
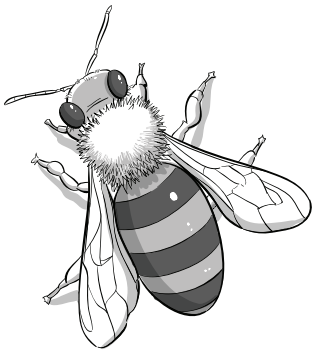
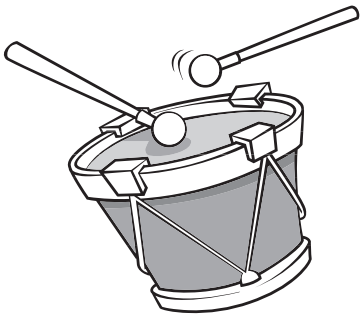
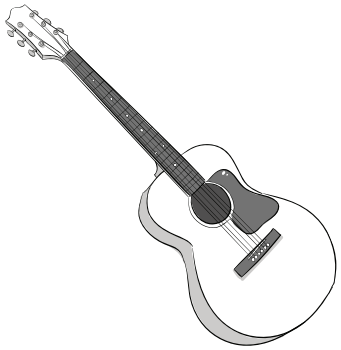
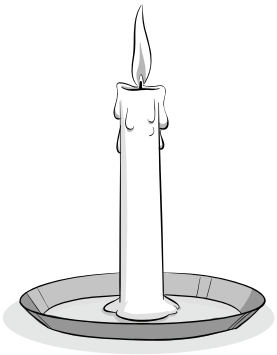
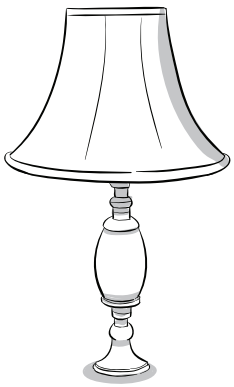
Sound makers

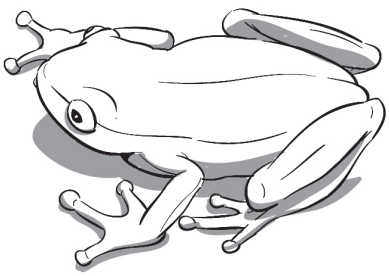
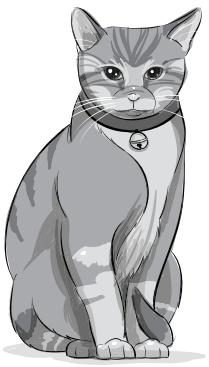
Name: _____ **Date:** _____





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Lesson 2 Light and sound search

AT A GLANCE

To provide students with hands-on, shared experiences of things that produce light and sound.

Session 1 School sounds

Students:

- identify and describe things that produce sounds inside and outside the classroom
- contribute to a class book on sounds.

Session 2 Where's the light?

Students:

- identify and describe things that produce light inside and outside the classroom.

Session 3 Light and sound at home

Students:

- observe how light and sound are used at home.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of how:

- light and sound are produced by a range of sources and can be sensed.

You will also monitor their developing science inquiry skills (see page 3).

Key lesson outcomes

Science

Students will be able to:

- identify sources of sounds in their environment
- identify sources of light in their environment
- locate light and dark places
- contribute to discussions about light and sound and how they are produced and sensed.

Literacy

Students will be able to:

- identify the purpose and features of a table
- identify the purpose and features of an annotated drawing
- create an annotated drawing to represent ideas about producers of sounds
- create a drawing to represent ideas about light and dark places
- identify questions about light and sound.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Session 1 School sounds

Equipment

FOR THE CLASS

- class science journal
- word wall
- *optional:* digital camera

FOR EACH STUDENT

- student science journal
- 1 x A5 sheet of paper

Preparation

- Prepare a table in the class science journal:

Sounds we heard	
Inside our classroom	Around our school

Lesson steps

1 Review the previous lesson focusing on the sounds that were produced by different objects.

2 Explain to students that they are going to listen to the sounds that are being made around them. Introduce the table in the class science journal 'Sounds we heard' (see 'Preparation'). Discuss the purpose and features of a table.

Literacy focus

Why do we use a table?

We use a **table** to organise information so that we can understand it more easily.

What does a table include?

A **table** includes a title, columns with headings and information organised under each heading.

3 Ask students to close their eyes and sit quietly for approximately thirty seconds and to put their hands up when they hear a sound. Ask students to open their eyes and share what they heard. List students' responses under the 'Inside our classroom' section of the table.

4 Ask students questions, such as:

- What was the sound like? (Loud or soft, high or low.)
- What do you think made that sound?
- How do you think that sound was made?

5 Explain to students that they will be going for a walk around the school to listen for more sounds. Ask students to predict what sounds they might hear in different places around the school. (Office—telephone ringing, computer keyboard tapping; basketball courts—balls bouncing; oval—sprinklers swishing, birds twittering.)

6 Take students for a walk around the school to listen for sounds.

Optional: Take photos of the sources of sounds to use in the class science journal, word wall or to create a class 'Sounds' book.

7 List students' responses of sounds they heard around the school in the table in the class science journal. Discuss the sounds asking questions, such as:

- Which sounds did you predict that you would hear?
- Which sounds did you hear that you didn't expect to hear?
- How were those sounds made?

8 Ask students to choose one of the listed sounds in the table to draw. Ensure each of the sounds is represented. Ask students to print the words to describe the sound next to the drawing. Discuss the purpose and features of an annotated drawing.

Literacy focus

Why do we use an annotated drawing?

We use an **annotated drawing** to show an idea or object.

What does an annotated drawing include?

An **annotated drawing** includes a picture and words or descriptions about the idea or object.

9 Model how to create an annotated drawing of the object/animal that made the sound students heard. Model how to include words that describe the sound that the object/animal made. Distribute the A5 size paper for students to create their drawings.

Work sample of annotated drawing

10 Place the drawings where the students are able to see them all. Ask students for suggestions on how the sounds might be grouped, such as loud and soft sounds, sounds grouped according to location, sounds we like and sounds we don't like. Ask students to choose one way of grouping the sounds. Staple the pages together in those groups to create a class book.

11 Update the word wall with words and images.

Session 2 Where's the light?

Equipment

FOR THE CLASS

- class science journal
- word wall
- 1 enlarged copy of 'Light and dark' (Resource sheet 3)
- *optional:* digital camera

FOR EACH STUDENT

- student science journal
- 1 copy of 'Light and dark' (Resource sheet 3)

Preparation

- Locate places around the school that are very dark or very light.

Lesson steps

1 Turn off the classroom lights and ask students questions, such as:

- What has happened to the light in the room? (It is a bit/a lot darker.)
- Can we still see without the lights on? Why or why not?
- Where else is light coming from?

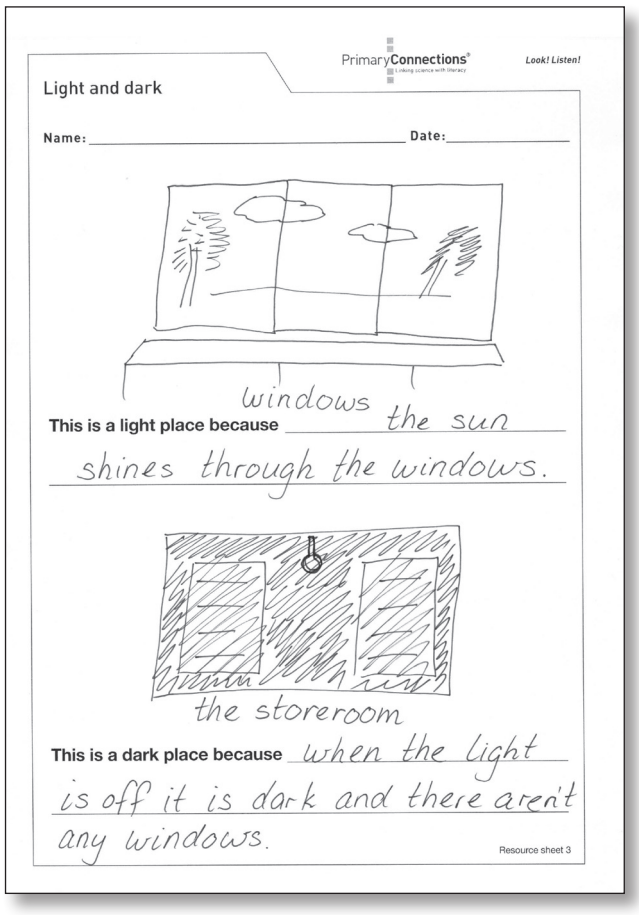
2 Ask students if there are places in the classroom that are very dark, such as inside the cupboard or inside the storeroom. List responses in the class science journal. Discuss why those places are dark.

3 Tell students that they will be going for a walk around the school to look for places that are very light and for places that are very dark. Ask students to predict what places around the school are light and those that are dark. Ask students why they think that. (I think it is very light in the art room because there are lots of windows where the sunlight comes in. I think it is very dark in the sports shed because there are no windows.)

4 Take students for a walk around the school to look for light and dark places. At each location discuss why there is a lot of light (sunlight streaming in, plenty of lights) or why it is very dark (no windows to let sunlight in, no lights turned on, sunlight blocked by a wall).

Optional: Take photos of the sources of light to use in the class science journal, word wall or to create a class 'Light and dark' book.

5 Introduce the enlarged copy of 'Light and dark' (Resource sheet 3). Read through and discuss. Ask students to draw two drawings: one place in the school that was light and one place that was dark. Model how to complete the sentences to explain why the place was light or dark.



PrimaryConnections® Linking science with literacy — Look! Listen!

Light and dark

Name: _____ Date: _____

This is a light place because windows the sun shines through the windows.

the storeroom

This is a dark place because when the light is off it is dark and there aren't any windows.

Resource sheet 3

Work sample of 'Light and dark' (Resource sheet 3)

6 Ask selected students to share one drawing with the class, explaining why it was light or dark. Ask students to share one of their drawings with a partner.

7 Update the word wall with words and images.

Light and dark

Name: _____ **Date:** _____

This is a light place because _____

_____

This is a dark place because _____

_____

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Session 3 Light and sound at home

Equipment

FOR THE CLASS

- class science journal
- 'Light and sound' collection' table (see 'Preparation')
- word wall
- 1 enlarged copy of 'Information note for families' (Resource sheet 4)

FOR EACH STUDENT

- student science journal
- 1 copy of 'Information note for families' (Resource sheet 4)

EXPLORE

Preparation

- Set up a 'Light and sound collection' table for students to place objects brought from home.

  Optional: To minimise repeated items on the table, ask groups of students to bring in different objects according to the rooms in the house or the type of sound, such as loud or soft, helpful or for playing games.

Lesson steps

1. Ask students to think of things at home that produce light and sound, such as car horns, smoke alarms and television sets. Record students' responses in the class science journal.
2. Invite students to bring in items from home that produce sound and/or light. This could be an object, a photo or a drawing. Discuss examples of what they might bring. Examples include a bicycle bell, a baby monitor, a torch, a magnifying glass with light, a clock, a small radio, wind up and battery toys, a tuning fork or a whistle.
3. Introduce the enlarged copy of 'Information note for parents' (Resource sheet 4) and discuss the types of things that students might do in the 'Tasks to do' section.
4. Show students the 'Light and sound collection' table where their items, drawings and photos will be placed.
5. Distribute 'Information note for parents' (Resource sheet 4) to students.
6. Update the word wall with words and images.

Curriculum links

Science

- List the sounds that different animals make. For example, find out how bees buzz or make a mobile for each animal and attach information about its sound.

English

- Read stories about sounds, for example, *Too much noise!* by Ann McGovern.
- Discuss how signals, signs and pictures are used instead of sound, for example, raising your hand at the start of a race before blowing a whistle to indicate 'go'.

Mathematics

- Sort sounds, as identified by students, into three groups based on the length of time they last:
  - — sounds that start and stop quickly, for example, a party popper or doorbell
  - — sounds that continue for a short time, for example, a balloon deflating
  - — sounds that keep going for some time, for example, a fire alarm.

Studies of Society and Environment

- Discuss the ways that sound is used, such as for entertainment, communication and safety.

Health and Physical Education

- Discuss how hearing impaired people use hearing aids and other devices.

Indigenous perspectives

- Indigenous people have lived in Australia for thousands of years, developing a deep knowledge of Australian flora and fauna. Indigenous names for Australian birds originate from the sounds and calls they make, for example, the Noongar (southwest Western Australia) name for the willy wagtail is djidi djidi.
- Primary**Connections** recommends working with Aboriginal and Torres Strait Islander community members to access local and relevant cultural perspectives. Protocols for engaging with Aboriginal and Torres Strait Islander community members are provided in state and territory education guidelines. Links to these are provided on the Primary**Connections** website (www.primaryconnections.org.au).

Information note for families

Name: _____ **Date:** _____

Introducing the 'Light and sound collection' project

This term our class will explore light and sound in a science unit called *Look! Listen!*

As part of this unit we are collecting objects, photos or drawings to show things that produce sound and/or light in the home.

Students are asked to find things at home that produce sound, light or both.

Tasks to do

1. Students brainstorm different sounds and lights at home with family and friends, and discuss the sound they make and how they are used.

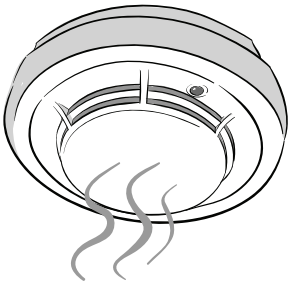
For example:

- A smoke detector—this makes a loud ringing sound to warn us of smoke and a possible fire. It also has a green light to show that it is working. A red light flashes when it is ringing.
- A bedside lamp—this has a light to help us see in the bedroom and read in bed at night.
- A kettle—this makes a whistling sound that lets us know when the water is boiling and is ready to be turned off.

2. Students bring to class something from home (or a photo or drawing of it) that produces sound, light or both.

These ideas will be shared with classmates on _____.

Class teacher



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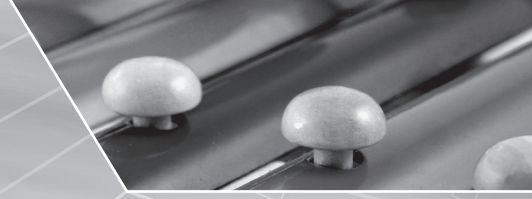


Lesson 3 Good vibrations

AT A GLANCE

To provide students with hands-on, shared experiences of how vibrations cause sound, which can be sensed.

Students:

- feel vibrations made by various objects as they produce sound.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- objects that produce sound and how those objects vibrate for sound to occur.

You will also monitor their developing science inquiry skills (see page 3).

Key lesson outcomes

Science

Students will be able to:

- describe how vibrations produce sounds
- identify objects that produce sound.

Literacy

Students will be able to:

- contribute to discussions about sounds and vibrations
- record ideas in a science journal.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Vibrations

Objects need to vibrate for sound to occur. The action causing the vibration provides the energy for sound to be produced. Hitting a surface, plucking a string and blowing a reed are all movements that give energy to an object and cause it to vibrate. A vibrating object pushes the substance, for example, air, around it, then pulls away, then pushes again and then pulls away again in quick succession. This creates pressure waves in the surrounding substance, which can be gas, solid or liquid.

The gas, solid or liquid around a vibrating object is made of molecules. The molecules closest to the vibrating object are pushed by the object's movement. These molecules in turn push the molecules around them, transferring their energy. When looking at a loud speaker cone, you can see the speaker move as the electric driving force pushes it and causes it to push the air.

Loudness of sound

The more movement (energy) the original sound source has, the more pressure difference there is in the waves produced and the louder the sound created will be. For example, hitting a drum harder makes the sound produced louder.

The intensity or loudness of a sound, sometimes called volume, depends on how much energy the vibrating object transfers to the sound wave. If a large amount of energy is transferred the difference between high-pressure zones and low-pressure zones is large and the sound produced is loud. This is the amplitude or size of the pressure wave.

Equipment

FOR THE CLASS

- class science journal
- 'Light and sound collection' table
- word wall
- 2 mobile phones
- 1 small cardboard box
- 1 guitar (or other string instrument)
- *optional:* tambourine and a teaspoon of rice

FOR EACH STUDENT

- student science journal
- 1 balloon per pair of students

Preparation

- Find a cardboard box that can be closed. Place a mobile phone in it that has sound and vibrate selected. Have a second phone ready to call the number of the one in the box.
- Blow up a balloon for each pair of students and some spares for the class.
- *Optional:* Check the Primary**Connections** website to see if an accompanying interactive resource has been developed.

Lesson steps

1. Review the previous lessons, referring to the word wall and the class science journal, focusing students' attention on how sound is produced and used.
2. Ask students to think back to the story 'Sounds in the dark' (Resource sheet 1). Ask students if they can remember how Luke knew that his phone was in the box. (The box was vibrating.)
3. Introduce the box with mobile phone inside. Ring the phone and ask students to hold the box and describe what they can feel.
4. Invite students to hum with their hand placed gently on the front of their own necks. Ask students to say 'Hello, hello' and a few lines of a song the class knows. Ask them what they can feel happening. Ask students what happens when they stop talking or singing.
5. Introduce the term vibrate to describe what they felt on their neck. Add the terms vibrate and vibrations to the word wall.

   Note: Students will also feel the larynx move up and down. This can also be felt when students swallow. Explain that vibrations make only the buzzing feeling produced when talking, not the big movement felt when swallowing.

6. Give one balloon to each pair of students. Ask students to take turns talking on to the inflated balloon while their partner holds the balloon. Ask students holding the balloon to describe what they feel when their partner is talking into the balloon. Ask pairs to swap roles and repeat the exercise.

Students investigating vibrations using a balloon

Some students might be allergic to rubber. Do not blow the balloons up too much, as they could burst. Warn students that they are not to scream or shout at the balloon or near anybody's ear.

7. Discuss with students what was happening when their partner spoke into the balloon. Asks students what they could feel when their partner stopped talking into the balloon.

8 *Optional:* Introduce the tambourine, and sprinkle rice on the surface. Ask students to observe the rice when you tap the tambourine. Ask students to describe what they see.

9 Introduce a guitar or other string instrument to the class. Ask students to remember the 'twang' sound made by the guitar in the story 'Sounds in the dark'. Ask a couple of students to place their fingers over a string of the guitar while you pluck it. Ask students what they feel. Repeat, allowing others students to feel the string vibrate.

10 Ask students what they can say about sound and vibrations after completing the activities. For example, when things vibrate they make sounds. Ask students how we know that. (Because we felt our throat vibrate when we hummed, the balloon vibrated when we talked into it and the guitar string vibrated when it was plucked.)

11 Invite students to record and complete the following in their science journals using words and pictures:

- Today I learned …
- I know this because …
- I am wondering about …

12 Discuss any objects, photographs or drawings that students have brought in for the 'Light and sound collection' table.

13 Update the word wall with words and images.

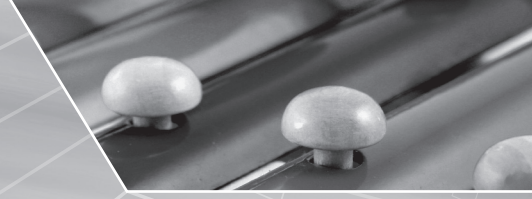
Curriculum links

Science

- Make string telephones using large paper cups and string. Ensure the string is really tight for the telephone to work.

English

- Explore onomatopoeia with words such as bang, sizzle and hoot.



Lesson 4 Sounds on the move

AT A GLANCE

To provide students with hands-on, shared experiences of sound travelling through materials.

Students:

- explore the difference between sound transmission through air and through solids.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- sound is produced by a range of sources and can be sensed.

You will also monitor their developing science inquiry skills (see page 3).

Key lesson outcomes

Science

Students will be able to:

- describe the difference between sound travelling through air and solids
- identify materials through which sound travels, for example, air and solids
- compare the transmission of sound through different materials
- explain that sounds need to reach their outer ear to be heard.

Literacy

Students will be able to:

- follow a series of oral instructions
- join in a group discussion describing their own ideas about how sound travels
- make and describe a drawing that represents their experiences of sound.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Sound cannot exist without something to travel through. When an object vibrates, it pushes the molecules around it, and these molecules push others in turn. The waves of pressure travelling through the substance are what our ear interprets as sound. Therefore, sound needs a substance to travel through. The transmission of sound depends on the properties of the materials it passes through.

How well sound travels through a given material is variable. Solids have molecules that are packed together tightly, so sound travels faster, further and more effectively through some solids, such as string wood or wire, that transmit sound well, than through air.

Sounds travelling through solids also dissipate less than those travelling through air, so the same sound will be audible at a distance through a solid but not necessarily at the same distance through the air.

Sound travels much, much slower than light, at approximately 340 metres a second through air. We can use the time between seeing a lightning strike and hearing the thunder to tell us how far away the lightning is. A delay of three seconds indicates that lightning is approximately 1000 metres or one kilometre away.

Equipment

FOR THE CLASS

- class science journal
- 'Light and sound collection' table
- team roles chart
- team skills chart
- word wall
- 1 wire coat hanger
- 2 x 40 cm pieces of string

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- 1 wire coat hanger
- 2 x 40 cm pieces of string

Preparation

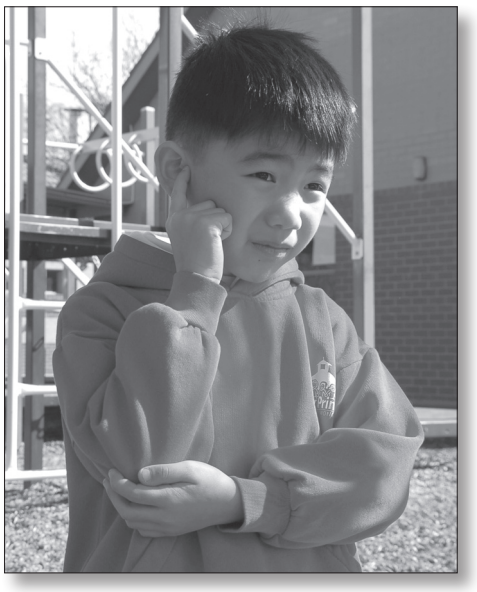
- Read 'How to organise collaborative learning teams (F–Year 2)' (Appendix 1). Display an enlarged copy of the team skills chart and the team roles chart in the classroom. Prepare role wristbands or badges for Managers and Speakers, and the equipment table.
- Tie two 40 cm pieces of string to each team's coat hanger and the class coat hanger (see Lesson step 9). Test its use.

Lesson steps

1. Review the previous lessons, referring to the information about sound and vibrations on the word wall.
2. Discuss with students how light can travel through some objects, for example, glass panes, and not through others, for example, blindfolds. Discuss how to tell if light can travel through an object, for example, because you can see it.
3. Ask students whether they think sound can travel through solid objects and why they think that. Explain to students that they are going to explore ways that sound travels using their body.
4. Model how to bend your arm so that you can touch your elbow with your other hand and point your index finger in the air. Ask students to do the same and then to tap on their elbow with a finger from their other hand, and listen carefully to the sound that they are making. Ask students:
   - What sound can you hear?
   - Where is the sound coming from?
   - How is the sound getting from your elbow to your ear? (Through my arm and then the air.)

Student tapping her elbow with her finger in the air

5. Model how to tap your elbow in the same way, but this time, place your finger on the fleshy part in the front of your ear (not inside the ear) and invite students to do the same. Ask students:
   - What sound can you hear?
   - Where is the sound coming from?
   - How is the sound getting from your elbow to your ear? (Through my arm.)



Student tapping his elbow with his finger on his ear

EXPLORE

SAFETY

During this activity, remind students to place their finger on their outer ear to hear the difference and to be careful not to put their finger inside their ears as this may cause damage.

6 Allow students the opportunity to repeat steps 3 and 4 so they can hear the difference between the sounds.

7 Lead a class discussion about students' observations during this activity. Ask questions, such as:

- Did the sound change? How did it change? (It was louder the second time.)
- Why were the sounds different? (One travelled through my arm to my ear and the other travelled through my arm and through the air to my ear.)

8 Explain that students will be working in collaborative learning teams to further explore the way sound travels to their ears.

If students are using collaborative learning teams for the first time, introduce and explain the team skills chart and team roles chart. Explain that students will wear role wristbands or badges to help them (and you) know which role each team member should be doing.

Show students the equipment table and discuss its use. Explain that this table is where Managers will collect and return equipment.

9 Explain that teams will be using a wire coat hanger to make sounds. Model how to hold the coat hanger by the two pieces of string and tap it against a hard surface, or tap the coat hanger with something hard, for example, a pencil. Then model how to wrap the string over their ears and tap the coat hanger again. Explain that students will take it in turns to tap the coat hanger and describe the sound to their team member.

Student exploring sounds with the coat hanger on string

Note: the string wraps over the students' ears, and does not touch their neck or throat.

10 Form teams and allocate roles. Ask Managers to collect team equipment.

11 Allow time for students to investigate the sound that they can hear through the air and through the string. Circulate among the groups encouraging students' thinking by asking questions, such as:

- Did you try tapping the coat hanger hard against the table and listening through the air? What did you hear?
- Is it the same as when you listen through the string? (No, it was louder through the string and sounded like metal.)

12 Ask Speakers to share their team's observations with the class. Ask questions, such as:

- When was the sound louder?
- Did it sound the same? How did it sound different?
- Did you feel anything in the strings when you were holding the coat hanger away from your ears to hit it against the table?
- Did you feel the same thing once the string was wrapped around your ears?
- Do sounds travel best through air or through string?

During this discussion encourage Managers to help Speakers by demonstrating the team's findings where appropriate and record students' answers in the class science journal.

13 Discuss any objects, photographs or drawings that the students have brought in for the 'Light and sound collection' table.

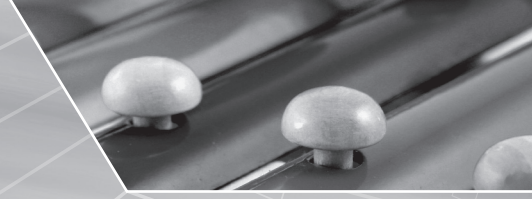
14 Update the word wall with words and images.

Curriculum links

Science

- Provide equipment for students to explore a string telephone. Encourage students to explore the telephone by using longer pieces of string, wetting the string, varying the tension in the string, using materials other than string or by whispering into the cup.

Students using a string telephone



Lesson 5 Sensing light

AT A GLANCE

To provide students with hands-on, shared experiences of how light is needed to see things.

Students:

- explore a peek box with and without light.

Lesson focus

The *Explore* phase is designed to provide students with hands-on experiences of the science phenomenon. Students explore ideas, collect evidence, discuss their observations and keep records, such as science journal entries. The *Explore* phase ensures all students have a shared experience that can be discussed and explained in the *Explain* phase.

Assessment focus

Formative assessment is an ongoing aspect of the *Explore* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of how:

- light is necessary to help us see.

You will also monitor their developing science inquiry skills (see page 3).

Key lesson outcomes

Science

Students will be able to:

- describe why we need light to see.

Literacy

Students will be able to:

- participate in discussions about light
- complete sentences revising what they have learned about light.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Seeing the light

We see objects when light travels from the object and enters our eyes. The object might give out light itself, such as a torch or a candle, or it might reflect light. For example, you can read this page because it is reflecting light from another source, such as sunlight through the window or an electric light. No rays leave our eyes. As light enters your eye, vision cells are activated which then create an electrical impulse that is sent to the brain.

In a dark room everything in it looks black. The appearance of black is merely a sign of the absence of light. When a room full of objects looks black, then the objects are neither generating nor reflecting light to your eyes.

Light comes from a variety of sources: primary sources, which generate or give out light directly, such as the Sun, stars, flames, light globes and computer screens; and secondary sources, such as the Moon and most objects that we see by daylight, which reflect light.

Students' conceptions

Some students might think that light travels from their eyes to the object that they are looking at. Some students might think that bright and shiny materials create their own light and can be seen in the dark.

Equipment

FOR THE CLASS

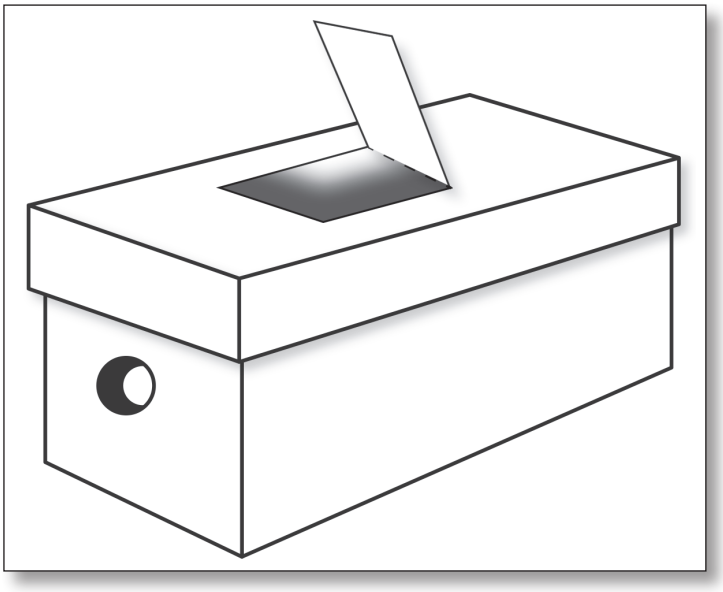
- class science journal
- word wall
- 'Light and sound collection' table

FOR EACH PAIR OF TEAMS

- each team member's science journal
- adhesive tac
- collection of birthday cards or Christmas cards
- 1 shoebox (see 'Preparation')
- 1 torch

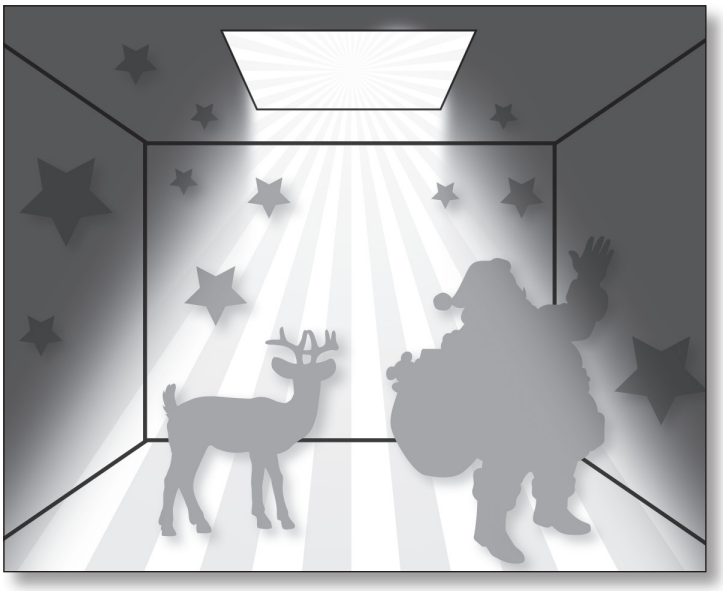
Preparation

- Collect shoeboxes. Cut a small hole in the front of each shoebox and a square hole that can open and shut on the top of the lid.



Peek box

Cut pictures from glittery Christmas or birthday cards and place in the box using adhesive tac to hold the pictures in place.



Peek box inside view

Lesson steps

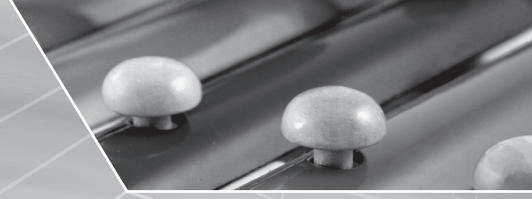
1. Revise the previous lesson, focusing on how sounds occur when things vibrate.
2. Remind students about the story 'Sounds in the dark' (Resource sheet 1) and what Luke used to be able to see in the dark room when the main light wouldn't work. Ask students what other things Luke could have used to help him see in the room.
3. Ask students if it is possible to see in a dark room. Ask students about shiny things—can we see them in a dark room?
4. Introduce the shoeboxes (see 'Preparation'). Explain that each pair of teams will share one box. Ask students to predict what they think they will see when they look in the peephole (with top flap closed).
5. Form teams and allocate roles. Combine teams to make fours. Ask one of the Managers to collect a shoebox.
6. Ask teams to look into their shoebox and say what they can see (make sure the flap at the top is closed). Ask students why they can't see anything. Ask what they could do to see the things in the box.
7. Ask students to open the top flap of the shoebox, look through the peephole again and describe what they can see. Ask students why they can see the pictures inside now that the flap is open. Ask students where the light is coming from that is getting in through the flap (sunlight, classroom light).
8. Ask students if there would be any difference to what they can see if they shine a torch into the box. Ask the other Manager of the combined team to collect a torch. Allow time for students to look at the pictures whilst shining a torch through the flaps.
9. Ask students what they can say about light after completing the activities. For example: 'We need light to see.' (Claim). Ask students how they know that. (Because we couldn't see the pictures in the shoeboxes until we let light in through the flap.)

   Record students' thoughts in the class science journal.
10. Invite students to record and complete the following in their science journal using words and pictures:
    - Today I learned …
    - I know this because …
    - I am wondering about …
11. Discuss any objects, photographs or drawings that students have brought in for the 'Light and sound collection' table.
12. Update the word wall with words and images.

Curriculum links

Science

- Students create their own peek boxes.



Lesson 6 Travelling tales

AT A GLANCE

To support students to represent and explain their understanding of how light and sound are produced and can be sensed, and to introduce current scientific views.

Students:

- represent their understanding of how light and sound travel using drawings
- role-play how sound travels
- role-play how light travels.

Lesson focus

In the *Explain* phase students develop a literacy product to represent their developing understanding. They discuss and identify patterns and relationships within their observations. Students consider the current views of scientists and deepen their own understanding.

Assessment focus

Formative assessment is an ongoing aspect of the *Explain* phase. It involves monitoring students' developing understanding and giving feedback that extends their learning. In this lesson you will monitor students' developing understanding of:

- how light and sound are produced by a range of sources and can be sensed.

You will also monitor their developing science inquiry skills (see page 3).

You are also able to look for evidence in students' oral language and role-play to represent what they know about the transmission of sound and to give students feedback about their representations.

Key lesson outcomes

Science

Students will be able to:

- describe how sound travels from the source to the ear
- describe how light travels from the source to the eye.

Literacy

Students will be able to:

- understand the purpose and features of a role-play
- use role-play to represent the journey of light and sound
- represent their understanding of the journey of light and sound using drawings.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Sound

Sound is a pressure wave caused by a vibration moving through a material. Young students might have difficulty conceptualising how a sound can move through a material. Therefore, in this lesson, students will role-play the transmission of a sound wave in which shaking of body parts represents sound vibrations. The students stand in a line linking their hands to represent the particles in a material. When they feel one hand shaking, they should start shaking the other. This represents how the sound travels through materials.

An object that receives energy (from hitting, plucking or blowing) starts vibrating. These vibrations start pressure waves in all materials around the object that travel in all directions. The pressure waves travel easily through some materials, such as metals or wood, and are absorbed as they travel through other materials, for example, cottonwool. When the waves reach our ears, generally through air, we hear a sound. It is important to emphasise that air is the material through which most sound reaches our ears, as students do not see air or feel the vibrations in air. For a sound to be heard, it must reach our ears with enough energy to make the internal ear pieces vibrate.

Light

We see objects because light reflected from the object enters our eyes. To see, light must enter our eyes—light does not leave our eyes. We direct our vision to the point of interest; the light enters the eye and activates vision cells, which then create an electrical signal that is sent to the brain via nerves. Rays or arrows are used to show the direction that the light is travelling from the object to our eyes. Light from the object is either produced from it, such as a torch or candle, or reflected by the object, such as a book that is reflecting sunlight or the light from a light bulb.

Students' conceptions

Year 1 students' conceptions about air might influence their understanding of how sound travels. Air is a gas made of particles and transmits sound. Sound does not travel in a vacuum or in space.

Students might believe that to see objects merely requires looking at or seeing the object and might not realise that light is needed for vision or the role that light plays. Some students might think that light goes from their eyes to the object and that is why they can see rather than the other way around.

Equipment

FOR THE CLASS

- class science journal
- word wall
- 'Light and sound collection' table
- 6 large cardboard arrows (see 'Preparation')
- 1 large cardboard ear (see 'Preparation')
- 1 large cardboard eye (see 'Preparation')
- musical triangle
- torch

FOR EACH STUDENT

- student science journal

Preparation

- Prepare two large cardboard cut outs of an ear and an eye and six large arrows.

Lesson steps

1 Review the class science journal, the word wall and the 'Light and sound collection' table asking questions, such as:

- What have we learned about light?
- What have we learned about sound?
- How do you make a sound? (Cause a vibration.)
- How do you stop something from making a sound? (Stop the vibration.)

2 Ask students to draw two pictures in their science journals.

- A drawing of themselves listening to a musical triangle and showing how the sound of the triangle gets to their ear.
- A drawing of themselves looking at a torch showing how the light gets to their eyes.

3 Explain that students are going to role-play how a sound vibration travels through the air. Discuss the purpose and features of a role-play.

Literacy focus

Why do we use a role-play?

We use a **role-play** to show how something works by acting it out.

What does a role-play include?

A **role-play** includes speech, actions and props.

4 Demonstrate the role-play by asking a few students to stand in a semi-circle, holding hands. Explain that when they feel one hand shake, they should start gently shaking their other hand. When the first hand stops shaking, they stop shaking their other hand.

5 Ask all students to stand in semi-circle holding hands. Ask a student at one end of the line to hold the large 'ear'. Ask one student to stand at the other end of the line and tap a musical triangle. Shake the free hand of the student at that end of the line. Watch the 'vibration' transmit itself down the line to the 'ear' at the other end of the line.

6 Encourage other students to choose a sound producer from the 'Light and sound collection' table to have a turn at creating a sound to cause the vibration to transmit down the line to the 'ear'.

7 Discuss with students what is happening. Ask questions, such as:

- Where does the vibration start?
- Where does it finish?
- How does it travel down the line?

8 Explain to the students that to show how light gets to our eyes we use arrows to show which way the light travels.

9 Choose a light producer from the 'Light and sound collection' table, for example, a torch. Ask a student to hold the torch and another student to hold the large 'eye'. Ask three other students to hold the arrows and move from the torch to the eye.

10 Discuss with students what is happening. Ask questions, such as:

- Where does the light start from?
- Where does the light go to?

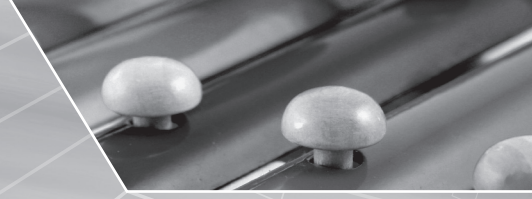
11 Ask students to look back at their two drawings that they did at the start of the lesson. Ask students if they want to make any changes to their pictures to show how sound gets to their ears and how light gets to their eyes.

12 Invite students to explain any changes that they made and why they made those changes.

13 Discuss any objects, photographs or drawings that the students have brought in for the 'Light and sound collection' table.

14 Update the word wall with words and images.

EXPLAIN



Lesson 7 Two versus one

AT A GLANCE

To support students to plan and conduct an investigation of why two eyes are better than one.

Students:

- investigate perception through playing a cup and coin game.

Lesson focus

In the *Elaborate* phase students plan and conduct an open investigation to apply and extend their new conceptual understanding in a new context. It is designed to challenge and extend students' science understanding and science inquiry skills.

Assessment focus

Summative assessment of the Science Inquiry Skills is an important focus of the Elaborate phase (see page 3).

Key lesson outcomes

Science

Students will be able to:

- understand that light helps our eyes to see
- understand that if we block light to one eye then our quality of sight is affected
- identify the importance of two eyes for certain activities.

Literacy

Students will be able to:

- record and report on an investigation
- follow directions to complete a simple investigation.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Teacher background information

Why do we have two eyes instead of only one?

There are four main advantages of having two eyes: a spare eye in case one is damaged, a wider field of view, better ability to detect faint objects and improved depth perception. Having two eyes enables us to judge distance. With one eye we can make some depth judgment, but with two eyes each eye receives light from a different angle. This enhances the perception of depth and of distances in identifying where an object is positioned. Two eyes give us overlapping frontal views of the world as well as more accurate depth perception, which is crucial for hand–eye coordination.

Equipment

FOR THE CLASS

- class science journal
- 'Light and sound collection' table
- team roles chart
- team skills chart
- word wall
- 1 enlarged copy of 'Testing eyes' (Resource sheet 5)

FOR EACH TEAM

- each team member's science journal
- role wristbands or badges for Manager and Speaker
- 1 clear plastic cup
- 1 coin
- 1 copy of 'Testing eyes' (Resource sheet 5) per team member

Preparation

- Prepare an enlarged copy of 'Testing eyes' (Resource sheet 5).

Lesson steps

1. Revise the previous lesson, focusing on how light and sound travel to help us hear and see.
2. Discuss with students why they think we have two eyes instead of one. Record students' responses in the class science journal.
3. Explain that students are going to work in collaborative learning teams to investigate why we have two eyes instead of one.
4. Form teams and allocate roles. Ask Managers to collect equipment.
5. Introduce the enlarged copy of 'Testing eyes' (Resource sheet 5). Model with a cup and coin how students will cover one eye and drop a coin into the cup. Explain how students will put a tick or cross according to whether they were able to drop the coin into the cup. Tell students that they will each have six tries at dropping the coin into the cup.
6. Explain that after covering one eye teams will then do the same activity using both eyes.

'Testing eyes' investigation

7 Discuss how the investigation needs to be fair and what students need to do to ensure this (have cup same distance away, use same coin, use same cup).

8 Form teams and allocate roles. Ask Managers to collect team equipment. Allow teams time to complete their investigation.

9 After the investigation, discuss the results of each team. Discuss that how we sense light depends on how our eyes work in receiving light. Discuss the investigation and record in the class science journal students' responses to questions, such as:

- What difference did you find between using two eyes and using one eye?
- How does having two eyes help us see?
- What other things do you think it would be difficult to do using only one eye?

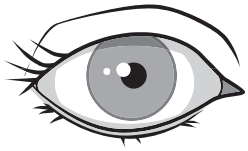
10 Discuss any objects, photographs or drawings that the students have brought in for the 'Light and sound collection' table.

11 Update the word wall with words and images.

Testing eyes

Manager's name: _____ **Date:** _____

Speaker's name: _____



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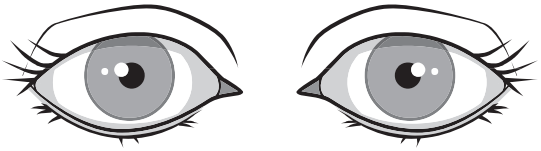

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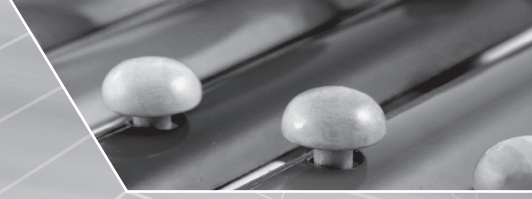
 ISBN 978 0 85847 335 5

Lesson 8 All together



AT A GLANCE

To provide opportunities for students to represent what they know about how light and sound are produced by a range of sources and can be sensed, and to reflect on their learning during the unit.

Students:

- respond to pictures showing different objects that produce sound and/or light
- draw about the journey of sound.

Lesson focus

In the *Evaluate* phase students reflect on their learning journey and create a literacy product to re-represent their conceptual understanding.

Assessment focus

Summative assessment of the Science Understanding descriptions is an important aspect of the Evaluate phase. In this lesson you will be looking for evidence of the extent to which students understand of:

- light and sound are produced by a range of sources and can be sensed.

Key lesson outcomes

Science

Students will be able to:

- identify sources of light and sound
- explain how light and sound travel

Literacy

Students will be able to:

- participate in discussions about how light and sound are sensed.
- represent their understanding of how light and sound travel.

This lesson also provides opportunities to monitor the development of students' general capabilities (highlighted through icons, see page 5).

Equipment

FOR THE CLASS

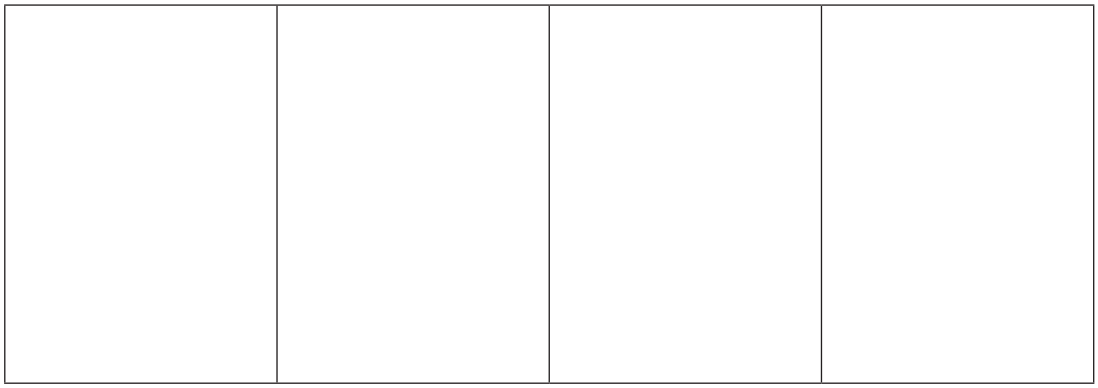
- class science journal
- 'Light and sound collection' table
- word wall
- 1 enlarged copy of 'Light or sound?' (Resource sheet 6)

FOR EACH STUDENT

- student science journal
- 1 copy of 'Light or sound?' (Resource sheet 6)
- 2 x A4 sheets of paper folded into four
- 2 different-coloured pens

Preparation

- Prepare an enlarged copy of 'Light or sound?' (Resource sheet 6).
- Prepare for each student one A4 sheet of paper folded to create four spaces:



- *Optional:* Display 'Light or sound?' (Resource sheet 6) on an interactive whiteboard. Check the Primary**Connections** website to see if an accompanying interactive resource has been developed (www.primaryconnections.org.au).

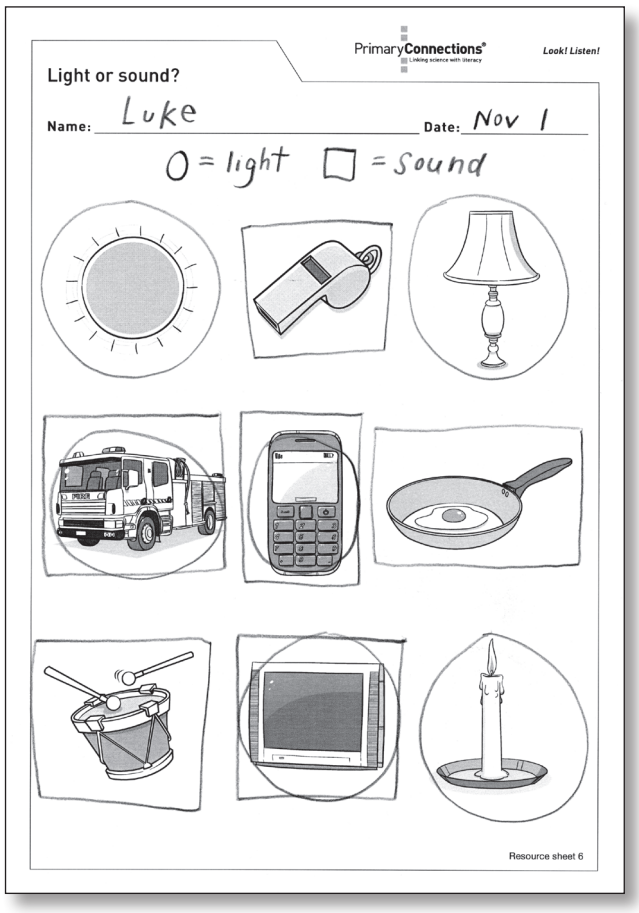
Lesson steps

1 Review the class science journal, word wall and the 'Light and sound collection' table.

2 Introduce the enlarged copy of 'Light or sound?' (Resource sheet 6) and discuss with students what each picture represents.

Note: Describing the pictures will help students understand what the pictures represent and avoid any confusion, for example, a fire engine can be quiet if it is parked without its siren going.

3 Explain that students will circle the pictures of things that produce sound in one colour, for example, blue, and the things that produce light in another colour, for example, red.



Work sample 'Light or sound?' (Resource sheet 6)

4 Allow time for students to complete the activity.

5 As a class, discuss sources of light and sounds that did not appear on 'Light or sound?' (Resource sheet 6).

6 Explain that students will draw on folded A4 paper to show how sound vibrations travel from the sound producer to their ear. Remind students of the sequence of sound travel that they demonstrated in the role-play.

7 Distribute one A4 sheet of paper folded to create four spaces (see 'Preparation').

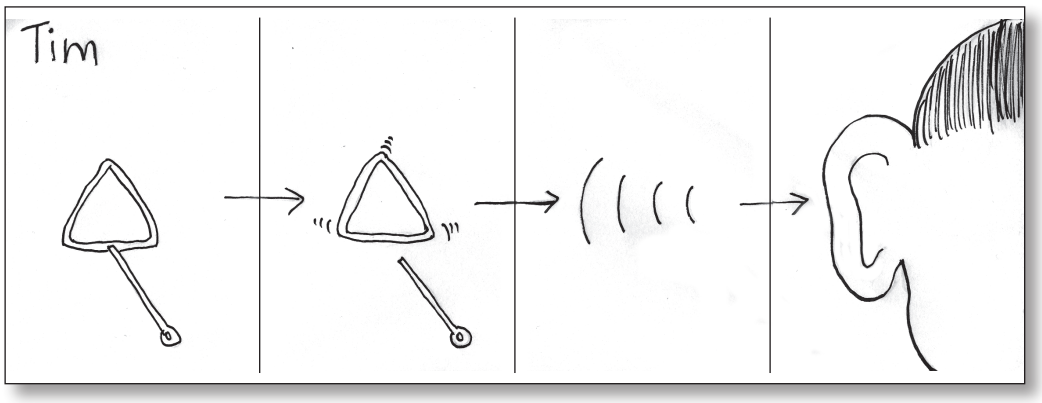
8 Ask the students to draw, in the first space, something they have used to produce a sound. It might be helpful for the students to choose a sound producer from the pictures on the 'Light or sound?' (Resource sheet 6).

9 Ask students to draw an arrow from their chosen sound producer to the second space and draw what happens to the sound next.

10 Repeat step 8 until all students come to the space where they have drawn the sound reaching an ear or until they think they are finished. Some students might not fill all four spaces and some could ask for more paper (suggest they use the reverse side).

Note: There is no need to specify an end point or insist that students fill every space. This is an opportunity for them to demonstrate that they have understood how sound travels to the outer ear.

EVALUATE

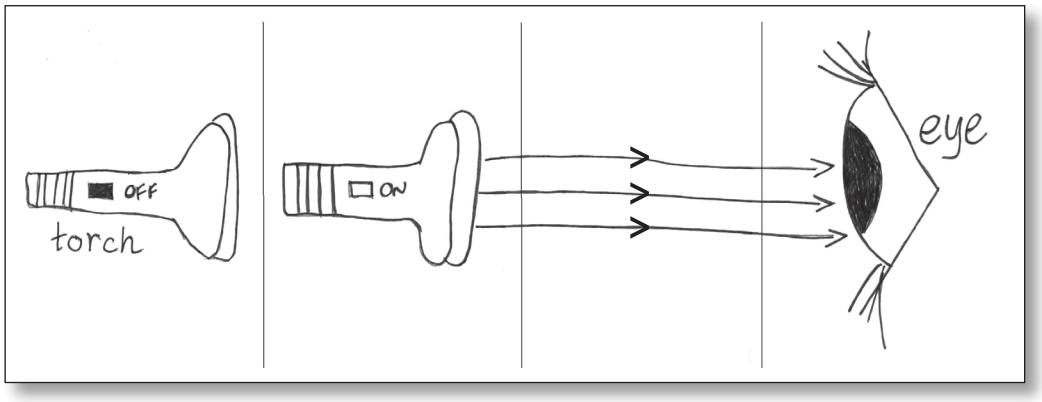


Student work sample

11 Distribute another A4 sheet of paper folded to create four spaces (see 'Preparation'). Explain to students that they will be drawing how light travels to their eye.

12 Ask the students to draw, in the first space, something they have used to produce light. Remind students to choose something from the 'Light and sound collection' table to help them choose a light source.

13 Ask students to draw the part of the body that senses light in the last box. Ask students to think about and show how light travels from the light source to the eye. Remind students that they might not need to draw in all four boxes.



Student work sample

14 Review the Look! Listen! unit with the class, asking questions, such as:

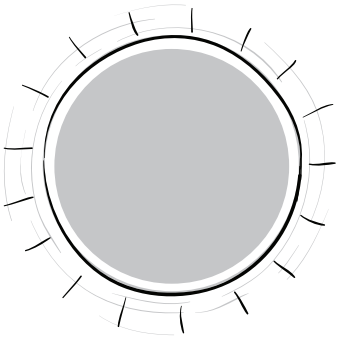
- Which activity helped you to learn something new?
- Which activity did you enjoy? Why?
- What questions do you still have about light and sound?

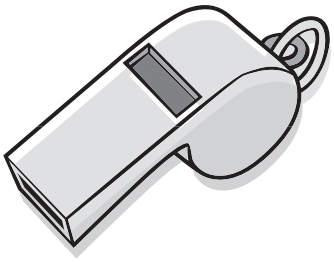
Record students' responses in the class science journal.

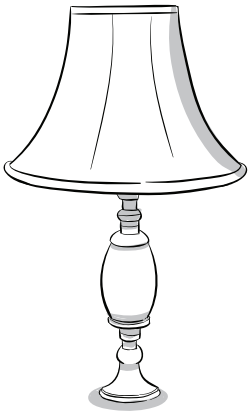
EVALUATE

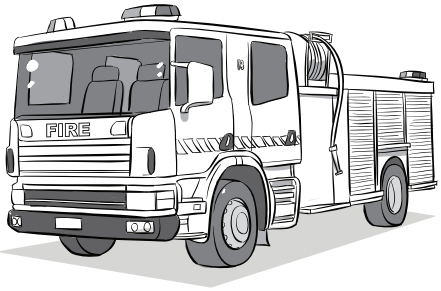
Light or sound?

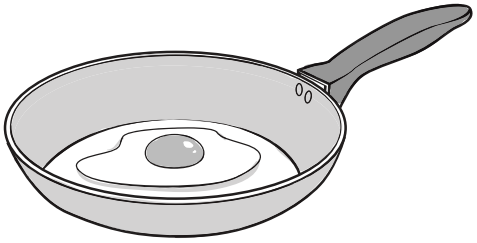
Name: _____ **Date:** _____

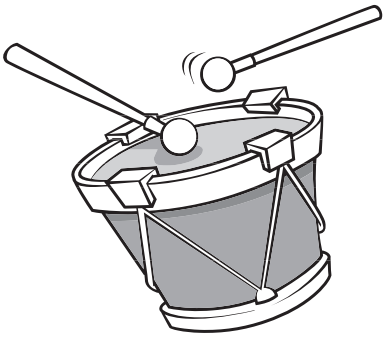


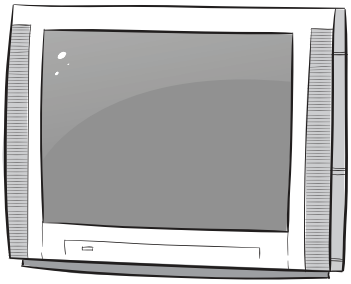


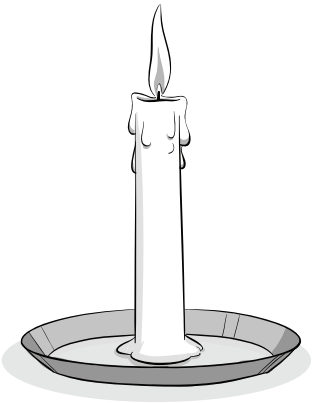












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Appendix 1
How to organise collaborative learning teams (F–Year 2)

Introduction

Students working in collaborative teams is a key feature of the Primary**Connections** inquiry-based program. By working in collaborative teams students are able to:

- communicate and compare their ideas with one another
- build on one another's ideas
- discuss and debate these ideas
- revise and rethink their reasoning
- present their final team understanding through multi-modal representations.

Opportunities for working in collaborative learning teams are highlighted throughout the unit.

Students need to be taught how to work collaboratively. They need to work together regularly to develop effective group learning skills.

The development of these collaborative skills aligns to descriptions in the Australian Curriculum: English. See page 7.

Team structure

The first step towards teaching students to work collaboratively is to organise the team composition, roles and skills. Use the following ideas when planning collaborative learning with your class:

- Assign students to teams rather than allowing them to choose partners.
- Vary the composition of each team. Give students opportunities to work with others who might be of a different ability level, gender or cultural background.
- Keep teams together for two or more lessons so that students have enough time to learn to work together successfully.
- If you cannot divide the students in your class into teams of three, form two teams of two students rather than one team of four. It is difficult for students to work together effectively in larger groups.
- Keep a record of the students who have worked together as a team so that by the end of the year each student has worked with as many others as possible.

Team roles

Students are assigned roles within their team (see below). Each team member has a specific role but all members share leadership responsibilities. Each member is accountable for the performance of the team and should be able to explain how the team obtained its results. Students must therefore be concerned with the performance of all team members. It is important to rotate team jobs each time a team works together so that all students have an opportunity to perform different roles.

For Foundation–Year 2, teams consist of two students—Manager and Speaker.
(For Year 3–Year 6, the teams consist of three students—Director, Manager and Speaker.)

Each member of the team should wear something that identifies them as belonging to that role, such as a wristband, badge, or colour-coded peg. This makes it easier for you to identify which role each student is doing and it is easier for the students to remember what they and their team mates should be doing.

Manager

The Manager is responsible for collecting and returning the team's equipment. The Manager also tells the teacher if any equipment is damaged or broken. All team members are responsible for clearing up after an activity and getting the equipment ready to return to the equipment table.

Speaker

The Speaker is responsible for asking the teacher or another team's Speaker for help. If the team cannot resolve a question or decide how to follow a procedure, the Speaker is the only person who may leave the team and seek help. The Speaker shares any information they obtain with team members. The teacher may speak to all team members, not just to the Speaker. The Speaker is not the only person who reports to the class; each team member should be able to report on the team's results.

Director (Year 3–Year 6)

The Director is responsible for making sure that the team understands the team investigation and helps team members focus on each step. The Director is also responsible for offering encouragement and support. When the team has finished, the Director helps team members check that they have accomplished the investigation successfully. The Director provides guidance but is not the team leader.

Team skills

Primary**Connections** focuses on social skills that will help students work in collaborative teams and communicate more effectively.

Students will practise the following team skills throughout the year:

- Move into your teams quickly and quietly
- Stay with your team
- Take turns.

To help reinforce these skills, display enlarged copies of the team skills chart (see the end of this Appendix) in a prominent place in the classroom.

Supporting equity

In science lessons, there can be a tendency for boys to manipulate materials and girls to record results. Primary**Connections** tries to avoid traditional social stereotyping by encouraging all students, irrespective of their gender, to maximise their learning potential. Collaborative learning encourages each student to participate in all aspects of team activities, including handling the equipment and taking intellectual risks.

Observe students when they are working in their collaborative teams and ensure that both girls and boys are participating in the hands-on activities.

TEAM ROLES

Manager

Collects and returns all materials the team needs

Speaker

Asks the teacher and other team speakers for help

TEAM SKILLS

1 Move into your teams quickly and quietly

2 Stay with your team

3 Take turns

Appendix 2
How to use a science journal

Introduction

A science journal is a record of observations, experiences and reflections. It contains a series of dated, chronological entries. It can include written text, drawings, labelled diagrams, photographs, tables and graphs.

Using a science journal provides an opportunity for students to be engaged in a real science situation as they keep a record of their observations, ideas and thoughts about science activities. Students can use their science journals as a useful self-assessment tool as they reflect on their learning and how their ideas have changed and developed during a unit.

Monitoring students' journals allows you to identify students' alternative conceptions, find evidence of students' learning and plan future learning activities in science and literacy.

Keeping a science journal aligns to descriptions in the Australian Curriculum: Science and English. See pages 2 and 7.

Using a science journal

1. At the start of the year, or before starting a science unit, provide each student with a notebook or exercise book for their science journal or use an electronic format. Tailor the type of journal to fit the needs of your classroom. Explain to students that they will use their journals to keep a record of their observations, ideas and thoughts about science activities. Emphasise the importance of including pictorial representations as well as written entries.
2. Use a large project book or A3 paper to make a class science journal. This can be used at all year levels to model journal entries. With younger students, the class science journal can be used more frequently than individual journals and can take the place of individual journals.
3. Make time to use the science journal. Provide opportunities for students to plan procedures and record predictions, and their reasons for predictions, before an activity. Use the journal to record observations during an activity and reflect afterwards, including comparing ideas and findings with initial predictions and reasons. It is important to encourage students to provide evidence that supports their ideas, reasons and reflections.
4. Provide guidelines in the form of questions and headings and facilitate discussion about recording strategies, such as note-making, lists, tables and concept maps. Use the class science journal to show students how they can modify and improve their recording strategies.
5. Science journal entries can include narrative, poetry and prose as students represent their ideas in a range of styles and forms.

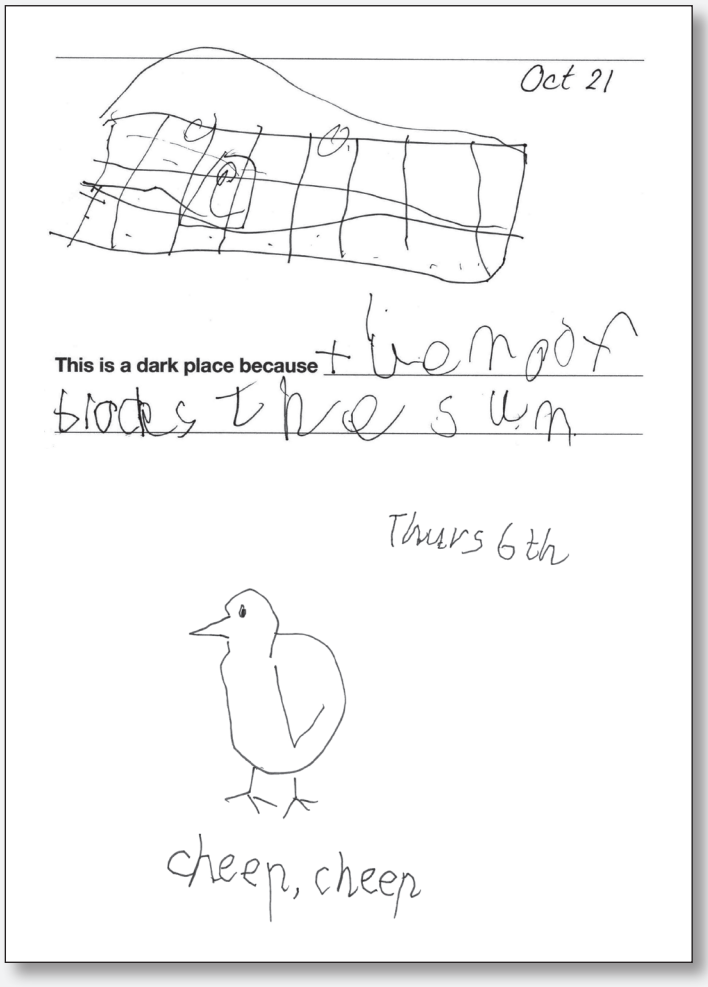
6 In science journal work, you can refer students to display charts, pictures, diagrams, word walls and phrases about the topic displayed around the classroom. Revisit and revise this material during the unit. Explore the vocabulary, visual texts and ideas that have developed from the science unit, and encourage students to use them in their science journals.

7 Combine the use of resource sheets with journal entries. After students have pasted their completed resource sheets in their journal, they might like to add their own drawings and reflections.

8 Use the science journal to assess student learning in both science and literacy. For example, during the *Engage* phase, use journal entries for diagnostic assessment as you determine students' prior knowledge.

9 Discuss the importance of entries in the science journal during the *Explain* and *Evaluate* phases. Demonstrate how the information in the journal will help students develop literacy products, such as posters, brochures, letters and oral or written presentations.

***Look! Listen!* science journal**



Appendix 3
How to use a word wall

Introduction

A word wall is an organised collection of words and images displayed in the classroom. It supports the development of vocabulary related to a particular topic and provides a reference for students. The content of the word wall can be words that students see, hear and use in their reading, writing, speaking, listening and viewing.

The use of a word wall, including words from regional dialects and other languages, aligns to descriptions in the Australian Curriculum: English. See page 7.

Goals in using a word wall

A word wall can be used to:

- support science and literacy experiences of reading, viewing, writing and speaking
- provide support for students during literacy activities across all key learning areas
- promote independence in students as they develop their literacy skills
- provide a visual representation to help students see patterns in words and decode them
- develop a growing bank of words that students can spell, read and/or use in writing tasks
- provide ongoing support for the various levels of academic ability in the class
- teach the strategy of using word sources as a real-life strategy.

Organisation

Position the word wall so that students have easy access to the words. They need to be able to see, remove and return word cards to the wall. A classroom could have one main word wall and two or three smaller ones, each with a different focus, for example, high-frequency words.

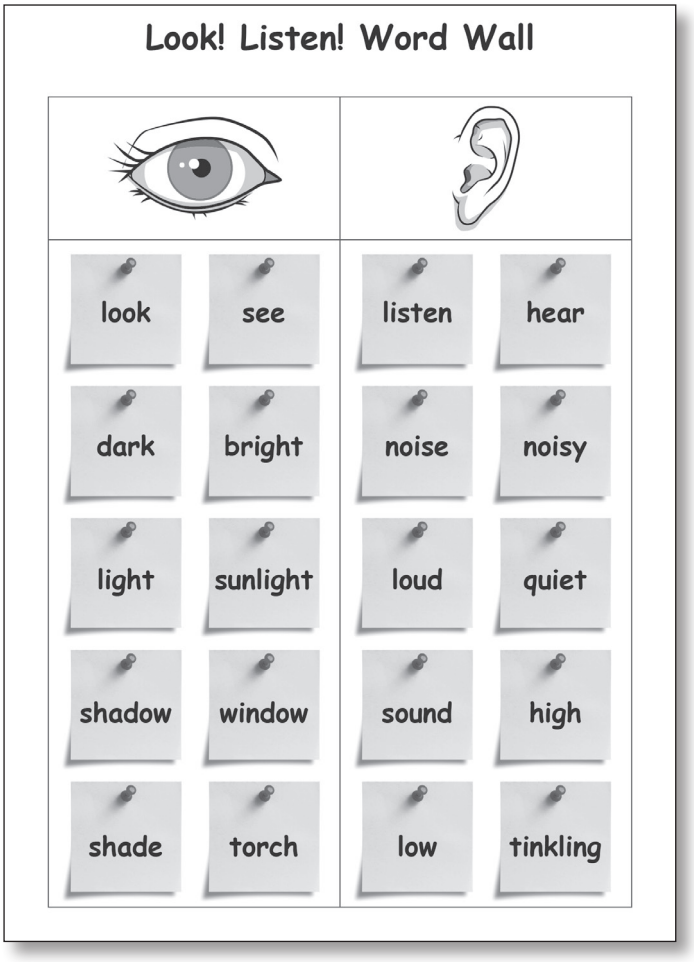
Choose robust material for the word cards. Write or type words on cardboard and perhaps laminate them. Consider covering the wall with felt-type material and backing each word card with a self-adhesive dot to make it easy for students to remove and replace word cards.

Word walls do not need to be confined to a wall. Use a portable wall, display screen, shower curtain or window curtain. Consider a cardboard shape that fits with the unit, for example, an apple for a needs unit.

The purpose is for students to be exposed to a print-rich environment that supports their science and literacy experiences.

Organise the words on the wall in a variety of ways. Place them alphabetically, or put them in word groups or groups suggested by the unit topic, for example, words for a *Look! Listen!* unit might be organised under headings, such as ‘Sound producers’, ‘Light producers’ and ‘Light and sound producers’.

Invite students to contribute different words from different languages to the word wall. Group words about the same thing, for example, hard, soft, powder, runny, on the word wall so that the students can make the connections. Identify the different languages used, for example, by using different-coloured cards or pens to record the words.



***Look! Listen!* word wall**

Using a word wall

1. Limit the number of words to those needed to support the science and literacy experiences in the classroom.
2. Add words gradually, and include images where possible, such as drawings, diagrams or photographs. Build up the number of words on the word wall as students are introduced to the scientific vocabulary of the unit.
3. Encourage students to interact with the word wall. Practise using the words with students by reading them and playing word games. Refer to the words during science and literacy experiences and direct students to the wall when they need a word for writing. Encourage students to use the word wall to spell words correctly.
4. Use the word wall with the whole class, small groups and individual students during literacy experiences. Organise multi-level activities to cater for the individual needs of students.

Appendix 4
Look! Listen! equipment list

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	2	2	3	4	5	6	7	8
		SESSION		1	2	3						
Equipment and materials												
A4 paper	2 per student											●
A5 paper	1 per student			●								
cardboard arrows, large	6 per class									●		
balloon	1 per pair						●					
cardboard box, small	1 per class						●					
cards, birthday and Christmas	collection per team								●			
coat hanger, wire	1 per class							●				
coat hanger, wire	1 per team							●				
coin	1 per team										●	
plastic cup, clear	1 per team										●	
cardboard ear, large	1 per class									●		
cardboard eye, large,	1 per class									●		
guitar (or other string instrument)	1 per class						●					
mobile phone	2 per class						●					
pens, different-coloured	2 per student											●
rice *optional*	1 teaspoon per class						●					
adhesive tac	per 2 teams								●			
shoebox	1 per 2 teams								●			
‘Light and sound collection’ table	1 per class					●	●	●	●	●	●	
string, 40 cm pieces	2 per class							●				
string, 40 cm pieces	2 per team							●				

EQUIPMENT ITEM	QUANTITIES	LESSON	1	2	2	2	3	4	5	6	7	8
		SESSION		1	2	3						
Equipment and materials (continued)												
tambourine *optional*	1 per class						●					
torch	1 per class									●		
torch	1 per 2 teams								●			
triangle, musical	1 per class									●		
Resource sheets												
'Sound makers' (RS2)	2 per student		●									
'Sound makers' (RS2), enlarged	1 per student		●									
'Light and dark' (RS3)	6 per class				●							
'Light and dark' (RS3), enlarged	1 per pair				●							
'Information note for families' (RS4)	1 per class					●						
'Information note for families' (RS4), enlarged	collection per team					●						
'Testing eyes' (RS5)	1 per class										●	
'Testing eyes' (RS5), enlarged	1 per team										●	
'Light or sound?' (RS6)	1 per team											●
'Light or sound?' (RS6), enlarged	1 per team											●
Teaching tools												
class science journal	1 per class		●	●	●	●	●	●	●	●	●	●
student science journal	1 per student		●	●	●	●	●	●	●	●	●	●
word wall	1 per class		●	●	●	●	●	●	●	●	●	●
team roles chart	1 per class							●			●	
team skills chart	1 per class							●			●	
role wristbands or badges for Manager and Speaker	1 set per team							●			●	
Multimedia												
digital camera *optional*	1 per class			●	●							

Appendix 5
Look! Listen! unit overview

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to represent their current understanding as they:	Students will be able to:	Students:	
ENGAGE	**Lesson 1** Scary sounds	• identify the source of sounds made in a story • describe sources of light and sound • describe how light and sound are sensed.	• listen to and participate in a story • contribute to discussions about light and sound • identify the purpose and features of a science journal • identify the purpose and features of a word wall.	• listen to a story • identify objects from the story that produce light and sound • describe how sounds are sensed.	**Diagnostic assessment** • 'Sound makers' (Resource sheet 2)

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 2** Light and sound search ***Session 1*** School sounds ***Session 2*** Where's the light? ***Session 3*** Light and sound at home	• identify sources of sounds in their environment • identify sources of light in their environment • locate light and dark places • contribute to discussions about light and sound and how they are produced and sensed.	• identify the purpose and features of a table • identify the purpose and features of an annotated drawing • create an annotated drawing to represent ideas about producers of sounds • create a drawing to represent ideas about light and dark places • identify questions about light and sound.	***Session 1*** School sounds • identify and describe things that produce sounds inside and outside the classroom • contribute to a class book on sounds ***Session 2*** Where's the light? • identify and describe things that produce light inside and outside the classroom ***Session 3*** Light and sound at home • observe how light and sound are used at home.	**Formative assessment** • Annotated drawings • 'Light and dark' (Resource sheet 3) • 'Light and sound collection' table items

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 3** Good vibrations	• describe how vibrations produce sounds • identify objects that produce sound.	• contribute to discussions about sounds and vibrations • record ideas in a science journal.	• feel vibrations made by various objects as they produce sound.	**Formative assessment** • Annotated drawings • 'Light and dark' (Resource sheet 3) • 'Light and sound collection' table items
	Lesson 4 Sounds on the move	• describe the difference between sound travelling through air and solids • identify materials through which sound travels, for example, air and solids • compare the transmission of sound through different materials • explain that sounds need to reach their outer ear to be heard.	• follow a series of oral instructions • join in a group discussion describing their own ideas about how sound travels • make and describe a drawing that represents their experiences of sound.	• explore the difference between sound transmission through air and through solids.	**Formative assessment** • Science journal entries • 'Light and sound collection' table items

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EXPLORE	**Lesson 5** Sensing light	• describe why we need light to see.	• participate in discussions about light • complete sentences revising what they have learned about light.	• explore a peek box with and without light.	**Formative assessment** • Science journal entries • 'Light and sound collection' table items
EXPLAIN	**Lesson 6** Travelling tales	• describe how sound travels from the source to the ear • describe how light travels from the source to the eye.	• understand the purpose and features of a role-play • use role-play to represent the journey of light and sound • represent their understanding of the journey of light and sound using drawings.	• represent their understanding of how light and sound travel using drawings • role-play how sound travels • role-play how light travels.	**Formative assessment** • Role-play • Drawings • 'Light and sound collection' table items
ELABORATE	**Lesson 7** Two versus one	• understand that light helps our eyes to see • understand that if we block light to one eye then our quality of sight is affected • identify the importance of two eyes for certain activities.	• record and report on an investigation • follow directions to complete a simple investigation.	• investigate perception through playing a cup and coin game.	**Summative assessment** of Science Inquiry Skills • 'Testing eyes' (Resource sheet 5) • 'Light and sound collection' table items

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

		SCIENCE OUTCOMES*	LITERACY OUTCOMES*	LESSON SUMMARY	ASSESSMENT OPPORTUNITIES
		Students will be able to:	Students will be able to:	Students:	
EVALUATE	**Lesson 8** All together	• identify sources of light and sound • explain how light and sound travel.	• participate in discussions about how light and sound are sensed. • represent their understanding of how light and sound travel.	• respond to pictures showing different objects that produce sound and/or light • draw about the journey of sound.	**Summative assessment** of Science Understanding • 'Light or sound?' (Resource sheet 6) • Drawings

* These lesson outcomes are aligned to relevant descriptions of the Australian Curriculum. See page 2 for Science and page 7 for English and Mathematics.

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Year	Biological sciences	Chemical sciences	Earth and space sciences	Physical sciences
F	*Staying alive*	*What's it made of?*	*Weather in my world*	*On the move*
1	*Schoolyard safari*	*Spot the difference*	*Up, down and all around*	*Look! Listen!*
2	*Watch it grow!*	*All mixed up*	*Water works*	*Push pull*
3	*Feathers, fur or leaves?*	*Melting moments*	*Night and day*	*Heating up*
4	*Plants in action*	*Material world*	*Beneath our feet*	*Smooth moves*
	Friends and foes	*Package it better*		
5	*Desert survivors*	*What's the matter?*	*Earth's place in space*	*Light shows*
6	*Marvellous micro-organisms*	*Change detectives*	*Earthquake explorers*	*It's electrifying*
				Essential energy

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