Grade 4 Learning Experiences: Sound and Light with a Purpose

Experience 1: The Impact of Light and Sound on our Environment

[Long Range Plan: Grade 4 Model 1](#)

Overview of learning experiences – why these activities	**Overview of Learning Experiences** In this series of activities, students will first become aware of issues related to light and noise pollution produced by humans **(Experience 1)**. They will then be called to design solutions such as better lampposts, or sound-dampening surfaces for example (**Experience 2**). There are also optional experiments that would help students in their design if the topics of sound and light, reflection, and absorption have not yet been addressed (**Experience 3**). For the *Career Spotlight*, the class connects with an expert in the field to either get ideas for the design, get feedback on their design or make career path connections (**Experience 4**). **Guiding Questions** What is sound and light pollution and how does it affect living things? How do machines that make sounds and lights affect living things?
Prior Knowledge / Prior Skill Set(s)	**Background Knowledge and Concepts (Teacher)** ● Maintain safe facilities & laboratory equipment ● Identify potential workplace hazards & mitigation measures ● Aware of [Transferable Skills](#) ● Aware of [Culturally Relevant & Responsive Pedagogy](#) ● Aware of universal design and differentiation [Learning for All](#) UDL (p.13), DI (p.17) ● Aware of strategies to help new language learners [Supporting English Language Learners A practical guide for Ontario educators Grades 1 to 8](#) ● Understand how to engage in [Scientific and Engineering Design Processes](#) ● Understand basic block-based coding concepts, platforms, functions, and algorithms for software such as [Scratch](#) and [Micro:bit Make Code](#).

The following resources can be used by teachers to review the material or for students to do research.

Research and concept resources

Light pollution
Light pollution primer from Let's Talk Science
Light pollution - Earth Day
Dark Sky - Light Pollution Effects on Wildlife and Ecosystems

Noise pollution
Noise pollution - National Geographic
Noise in our environment Ontario Government
For Whales Noise is Pollution too

Background Knowledge and Skills (Students)

The sound and light concepts may have been seen with students in a previous unit (potential experiments can also be done before or during the engineering design process; see Experience 3).
- Light travels in a straight line.
- Light is reflected and absorbed differently by various surfaces.
- Sound travels in a straight line.
- Sound is reflected and absorbed differently by various surfaces.

Animal habitat concepts
- Light and sounds are part of animal habitats
- Some animals are active during the day, night, or dawn/dusk (diurnal animals, nocturnal animals, crepuscular animals)
- Some animals use sounds to communicate, and/or to locate themselves (echolocation) in their habitat

Students often have misconceptions about Sound and Light. Some can be found on the Amasci Children's Misconceptions about Science website.

For example:
- A white light source, such as an incandescent or fluorescent bulb, produces light made up of only one color.

	● Light is associated only with either a source or its effects. Light is not considered to exist independently in space; hence, light is not conceived of as "traveling". ● Light reflects from a shiny surface in an arbitrary manner Additionally, students may not understand that light and sound travel from a source.
Strand A - [STEM Investigation and Communication Skills](#)	**The following expectations from the A strand will be covered in the activities.** (?) **A1.1** use a scientific research process and associated skills to conduct investigations **A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes **A.2** identify and describe impacts of coding and of emerging technologies on everyday life, including skilled trades **A3.1** describe practical applications of science and technology concepts in various occupations, including skilled trades, and how these applications address real-world problems **A3.2** investigate how science and technology can be used with other subject areas to address real-world problems **Specifically, the Strand A expectations are combined and connected to the following four activities:** (?) **A1.1, A1.5 Light and Sound in Cities** **Experience 1: Research on light and noise pollution** Students explore how light and sound pollution in cities affects animals living in and around cities. Option 1: students produce a report either digitally, coded, or

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	written with their findings and share it with their classmates. Option 2: use the research for the design of a solution.
Overview / Big Ideas/ Fundamental Concepts	**Big Ideas** Light and sound affects the habitats and life of animals. The engineering process can help us find solutions to problems. **Fundamental Concepts** https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology/context/fundamental-concepts **Structure and Function:** This concept focuses on the interrelationship between the function or use of a natural or human-made object and the form that the object takes. **Sustainability and Stewardship:** Sustainability is the concept of meeting the needs of the present without compromising the ability of future generations to meet their needs. Stewardship involves understanding that we need to use and care for the natural environment in a responsible way and making the effort to pass it on to future generations no less than what we have access to ourselves. Values that are central to responsible stewardship are as follows: using non-renewable resources with care; reusing and recycling what we can and switching to renewable resources where possible.
Learning Goals / Success Criteria	The following success criteria are examples of what can be co-created with the class. **Experience 1 Research on light and noise pollution** Learning Goal: Students will research the problems related to sound and light in our environment. Success Criteria: ● I can find a problem (related to sound or light pollution) ● While reading, listening, and watching videos, I can find important information about the problem (who, what, where, when, why) ● I can express my research clearly (report, video, poster, slides, audio recording, short summary, conversation with the teacher)

	Ministry of Education Key Points
	The key points listed below will be addressed within these experiences.
	STEM Skills and Connections: Perspectives and approaches that provide opportunities for students to investigate and apply concepts and skills from all areas of learning. **Research and Experimentation Processes**: Provides students with the scientific literacy skills needed to approach scientific questions that are becoming a part of everyday life. **Emerging Technology**: Ensures that students are aware of exciting and innovative solutions in science and technology that are being implemented today and that may be introduced in the future. **Skilled Trades**: Students consider the practical application of skills and concepts within the skilled trades and related occupations. **Contributions to Science and Technology**: Showcases the important contributions made to science and technology by people with diverse lived experiences. Students also explore real-world issues by connecting scientific and technological knowledge systems and perspectives from various cultures, including connecting Indigenous sciences and technologies and Western science and technology.
Learning Experience(s) **Minds-on**	**Minds-on** This minds-on activity can be done at the beginning of Experience 1 or any of the other experiences (2, 3, or 4) if Experience 1 is skipped. Discussion as a class: - Can you think of times when light/sound bothered you? (bright light, loud music) - What did you do? (put on sunglasses, close the blinds to sleep in the dark, turn down the music, and close a window) - What do you notice or wonder about these images (Grade 4 - Sound & Light - Images to prompt discussion) Draw from student experience about different living environments, how we light our dwellings inside and out, and what produces sounds in our surroundings. Use images to support multiple language learners. Note: Students have a wealth of experience to draw on. Some students may have (or know someone that has) sensory sensitivities and can pull from that

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	experience to explain to others what they can do. Some may be familiar with city centers and construction sites. Some students may be familiar with the lights from greenhouses in agricultural settings.
	Note: The focus of the research in Experience 1 and design in Experience 2 is on problems with sounds and light from urban centers, but some students may not be familiar with extreme sounds/lights from city centers and may need additional images and videos to situate the following research. Using visuals is essential for some and beneficial to all.
	Building vocabulary: this is a great opportunity to build vocabulary. As discussions unfold words can be written on an anchor chart or in a virtual word wall like slides with additional images. For example, light, sound, noise, brightness, night, day, loudness dampening, headset, sunglasses, blinds/curtains.
Action ⓘ**A1.1**	**Experience 1 - Research** Teacher prompt: Animals are also affected by light and sound. Light and sound are part of animal habitats. Let's find out how light and sound can affect wildlife and what we can do. Co-create criteria for success for research (see the section above Learning Goals / Success Criteria for ideas). As a class, brainstorm what information students would need to find one problem and identify key information (who, what, where, why, when) (see Appendix A - Sample Template - Light and Sound Pollution Research). Students research problems related to sounds and light and animals. The research can be done as a whole class, individually, or in small groups. (See resources above in the Prior Knowledge / Prior Skill Sets section). Some students may already have ideas or have heard of other impacts besides those presented in the resources above. The school library may have additional local resources on how noise and light pollution affects wildlife. Note: when reading texts online, students can benefit from hearing the text being read to them simultaneously using text-to-speech such as Read&Write and the use of online dictionaries. Options: The choice of texts and resources can be prescribed to students based on interest or modality (oral, written), or it can be left open to choice and be expanded upon from library resources and other digital resources purchased by

	specific school boards. Texts can also be read as a whole class, or through guided reading in small groups. Presentation options: Students can present their results by filling out a template ([Appendix A - Sample Template - Light and Sound Pollution Research](#)), making a poster, recording an audio recording of them explaining their findings, or a video recording of a slide deck. The results can also be simply used for the design and presented formally at the end of the design process.
Consolidation 🗩🗩 👤 👤 **A1.5**	**Consolidation** The consolidation can be the culmination of a combination of the 4 activities Students may choose from a variety of ways to present their research (Experience 1), experiments (Experience 3), and/or design and reflection on potential improvements (Experience 2). Potential formats include oral presentations, posters, slide decks recorded through screen capture, podcast interviews of students by students, design fairs with invited guests, and gallery walks). The intended public can include the experts of the Career Spotlight (see Experience 4), other classes, and community members. Students are invited to reflect on how they can make connections with the concepts of sound and light and animal habitat and the designs presented. The teacher can remark when students are using appropriate vocabulary.
Science and Technology Expectations	**C. Matter and Energy: Light and Sound** C1.1 assess the impacts on society of devices that use the properties of light or sound, or both C1.2 assess the impacts on the environment of light energy and sound energy produced by various technologies, while taking different perspectives into account C2.6 describe how different objects and materials interact with light and sound energy **B. Life Systems: Habitats and Communities** B1.1 assess positive and negative impacts of human activities on habitats and communities, while taking different perspectives into account

	B1.2 analyse the impact of the depletion or extinction of a species on its habitat and community, and describe possible actions to prevent such depletions or extinctions

B2.1 describe habitats as areas that provide organisms, including plants and animals, with the necessities of life, and identify ways in which a local habitat provides these necessities |
| Science and Technology Vocabulary | **Light** - Radiative energy that can be detected by the human eye and makes things visible. When light strikes a surface, it is absorbed, reflected, or transmitted.

Sound - A kind of energy that is produced by vibrating matter and transmitted by waves through air and other media; the sensation produced when these waves stimulate the organs of hearing. The eardrums convert this vibrational energy into signals that travel along nerves to the brain, which interprets them as voices, music, or noise.

Energy - The capacity to do work.

Reflection - Changing of the direction of a light ray by bouncing it off a surface. All objects reflect light to some extent (some, such as a mirror, better than others). Sound can also be reflected; a common example of this is an echo.

Absorption - When the light or sound is absorbed by a surface and not reflected.

Skyglow - The brightness of the night sky in a built-up area as a result of light pollution.
Glare - Strong and dazzling light.
Light trespass - Light trespass occurs when spill light is cast where it is not wanted.

Loudness - The attribute of a sound that determines the magnitude of the auditory sensation produced
Dampening - Make less strong or intense

Opaque - Not allowing light to pass through.
Translucent - Allowing light, but not detailed shapes, to pass through; semitransparent. |

	Transparent - Allowing light to pass through so that objects behind can be distinctly seen. **Daytime** - During the day **Nighttime** - During the night **Diurnal animal** - Active during the day **Nocturnal animals** - Active during the night **Crepuscular animals** - Active early in the morning (dawn) and in the evening (dusk). **Natural light** - Light coming from the sun or fire **Artificial light** - Light coming from a human-made source **Migration** - The movement of animals from one region to another. In most cases, organisms migrate to avoid local shortages of food, usually caused by winter or overpopulation. Animals may also migrate to a certain location to breed, as is the case with some fish.
Equipment and Materials	**Potential materials:** **Household/Classroom Items (examples)** Cardboard, paper, tape, glue, paint, materials from the recycling bin to use as building materials, paint, and markers. **Devices or printed documentation for research**

Timeline and Preparation	These are approximate times that can be shortened or extended based on student engagement, interest, and additional inquiry.
	
	      Minds-on 20 minutes
	      Experience 1 Research 40 minutes
	      Consolidation 80 minutes
	      (for Experience 1, or a combination of activities 1-4)

Safety Considerations	Depending on the building projects that are chosen, review safety guidelines before using tools (saws, scissors, glue gun, etc.). Refer to these safety resources Safety in Elementary Science and Technology (STAO) Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE)

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Opportunities For Assessment	**Potential examples:** **Assessment FOR Learning** ● Classroom discussions with initial prompts **Assessment AS Learning** ● Classroom discussions ● Small group discussions, giving each other peer feedback ● Student self-assessment using the criteria for success (see Learning Goals section above). **Assessment OF Learning** ● Research notes (see Appendix A - Sample Template - Light and Sound Pollution Research) ● Presentation of research See Appendix B: Assessment Checklist and Rubric Suggestions for samples of rubrics that could be co-created with students. Information to fill these rubrics can be collected through verbal conversations with the students, student presentations (synchronous/asynchronous), observation of the students, journals, notes, design books, and sometimes in the final product as mentioned above. It is also possible to use the "I Can" statements from the section above: Learning Goals / Success Criteria.
Instructional Strategies and Adaptability	Strategies from the following documents have been embedded throughout the activities. ● Culturally Relevant & Responsive Pedagogy ● Aware of universal design and differentiation Learning for All UDL (p.13), DI (p.17) ● Strategies to help new language learners Supporting English Language Learners A practical guide for Ontario educators Grades 1 to 8 For example:

	● Giving student voice and choice ● Pulling from students' lived experience ● Building vocabulary collaboratively ● Offering visuals to support language learning ● Using assistive technology to access texts ● Offering multiple ways of showing understanding ● Doing assessment and evaluation by using conversations and observations to accompany the process and products
Additional Supporting Resources	**Research and concept resources** **Light pollution** Light pollution primer from Let's Talk Science Light pollution - Earth Day Dark Sky - Light Pollution Effects on Wildlife and Ecosystems **Noise pollution** Noise pollution - National Geographic Noise in our environment Ontario Government For Whales Noise is Pollution too **Misconceptions in science** http://amasci.com/miscon/opphys.html **Careers** CareersInTrades.ca Career Profiles - Let's Talk Science Ashley Noseworthy, CEO/Founder of Edgewise Environmental **Safety** Safety in Elementary Science and Technology (STAO) Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE) Ontario Curriculum Program Planning – Health and Safety
Cross-Curricular Opportunities	**Language:** Oral and written communication (questions to the expert, hypothesis/observation/conclusion, presentation of the design). **Math:** Measurements while doing designs, builds, and experiments **Social Studies**: Use the social studies inquiry

	process to investigate some issues and challenges associated with balancing human needs/wants and activities with environmental stewardship in one or more of the political and/or physical regions of Canada (B2)
Future Opportunities / Next Steps	**Next Steps:** ● Continuing with Experience 2 ● Researching positive perspectives. For example, trails in conservation areas are lighted for the safety of those who use the trails in the evenings. OR, highways are illuminated to promote better visibility for drivers at night. Some focus on how inventions with light and sound can also improve our lives so that students understand the complexity of solving their real-world problems. Another perspective to consider is those living with diverse abilities and using sound and light for safety. ● Overall next step: Students start a Lights Off Campaign at their school to help with energy conservation and do an energy audit in their school. Check out Canada Ecoschools for resources.

Appendix A - Sample Template - Light and Sound Pollution Research

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Light and Sound Pollution Research

Name(s):_____

Class:_____

What is the problem:

_____

_____

_____

Why is it a problem:

_____

_____

_____

What animal is affected (who):

_____

_____

_____

Where is the habitat located:

_____

_____

_____

When does this problem occur:

_____

_____

_____

Sources:

_____

_____

_____

Appendix B: Assessment Checklist and Rubric Suggestions

Assessment Checklist and Rubric Suggestions

These are samples of rubrics that could be co-created with students.

Information to fill these rubrics can be collected through verbal conversations with the students, student presentations (synchronous/asynchronous), observation of the students, journals, notes, design-book, and sometimes in the final product.

Experience 1: Research

Next steps *Prochaines étapes*	Meeting Expectation (Level 3) *Répond aux attentes (Niveau 3)*	Exceeds expectation (Level 4) *Surpasse les attentes (Niveau 4)*
	● The student can identify a problem where science could play a role in finding a solution ● While reading, listening and watching videos, the student can find important information about the problem (who, what, where, when, why) ● The student can express their research clearly through an appropriate format (report, video, poster, slides, audio recording, short summary, conversation with the teacher)	
	● L'élève peut identifier un problème où la science pourrait jouer un rôle dans la recherche d'une solution ● En lisant, écoutant et regardant des vidéos, l'élève peut trouver des informations importantes sur le problème (qui, quoi, où, quand, pourquoi) ● L'étudiant peut exprimer clairement sa recherche à travers de média approprié (rapport, vidéo, affiche, diapositives, enregistrement audio, court résumé, conversation avec l'enseignant)	