Ontario

hands-on science and Technology

An Inquiry Approach With STEM Skills and Connections

Grade 1

Series Author
Jennifer Lawson

Indigenous Consultant
Jennifer Manitowabi

Coding and STEM Contributor
Kellie Ierullo

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Hands-On Science and Technology for Ontario
Hands-On Science and Technology for Ontario, Grade 1
An Inquiry Approach With STEM Skills and Connections

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Introduction to *Hands-On Science and Technology for Ontario, Grade 1*

Introduction to *Hands-On Science and Technology*

About *Hands-On Science and Technology*

Hands-On Science and Technology helps develop students' understanding of science and technology concepts, and science, technology, engineering, and mathematics (STEM) skills. It also promotes scientific literacy through active inquiry, problem solving, and decision making. Each activity in ***Hands-On Science and Technology*** encourages students to explore, investigate, and ask questions as a means of heightening their curiosity about the world around them. Students solve problems through first-hand experiences and by observing and examining objects within their environment. For young students to develop scientific and technological literacy, concrete experience is of the utmost importance—in fact, it is essential.

The Goals of the Science and Technology Program

Science and technology play fundamental roles in the lives of all Canadians. The Ontario science and technology curriculum identifies three main goals for students:

- to develop the skills and make the connections needed for scientific and technological investigation
- to relate science and technology to our changing world, including society, the economy, and the environment
- to explore and understand science and technology concepts

These goals are the foundation for the lessons in Hands-On Science and Technology.

NOTE: *Hands-On Science and Technology* provides numerous opportunities for students to investigate issues related to sustainable development. Asking students the following question can often help to clarify for them what is meant by sustainability: "Is there enough for everyone, forever?" Exploring sustainability also connects to Indigenous worldviews about respecting and caring for the Earth. The three pillars of sustainability are the environment, society, and the economy.

Hands-On Science and Technology Strands and Expectations

The Ontario science and technology curriculum for all grade levels is organized into five strands:

A. STEM Skills and Connections
B. Life Systems
C. Matter and Energy
D. Structures and Mechanisms
E. Earth and Space Systems

Two sets of expectations are listed for each grade in each strand: (1) overall expectations and (2) specific expectations.

The overall expectations describe, in general terms, the knowledge and skills students are expected to demonstrate by the end of each grade.

The specific expectations describe the expected knowledge and skills in greater detail.

The overall and specific expectations for each strand are presented in the Curriculum Correlation Chart in the introduction to each unit of ***Hands-On Science and Technology***. The chart also identifies the lessons within the unit that correspond to each specific expectation.

Hands-On Science and Technology Principles

Hands-On Science and Technology is grounded in a research-based approach that puts students at the centre of the teaching and learning process. The following principles reflect this approach.

- Effective science and technology education involves hands-on inquiry, problem solving, and decision making.

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- The development of students' understanding of science and technology concepts and science, technology, engineering, and mathematics (STEM) skills forms the foundation of science and technology education.
- Children have a natural curiosity about science and the world around them. This curiosity must be maintained, fostered, and enhanced through active learning.
- Science and technology activities must be meaningful and worthwhile and relate to real-life experiences.
- The teacher's role in science and technology education is to facilitate activities and encourage critical thinking and reflection. Children learn best by doing, rather than just listening; therefore, instead of simply telling, the teacher should focus on formulating and asking questions, setting the conditions for students to ask their own questions, and helping students make sense of the events and phenomena they have experienced.
- Science and technology should be taught in conjunction with other school subjects. Themes and topics of study should integrate ideas and skills from several core areas whenever possible.
- Science and technology education should encompass, and draw on, a wide range of educational resources, including literature, nonfiction research material, audio-visual resources, and technology, as well as people and places in the local community.
- Science and technology education should be infused with knowledge and perspectives of Indigenous Peoples, as well as other diverse multicultural perspectives.
- Assessment of student learning in science and technology should be designed to focus on performance and understanding and should be conducted through meaningful assessment techniques used throughout each unit. See the detailed overview of the ***Hands-On Science and Technology* Assessment Plan** on pages 24–29.
- Science and technology education is inclusive in nature. Learning opportunities should meet the diverse needs of all students through differentiated instruction and individualized learning experiences.

The Importance of STEM Education

The study of science, technology, engineering, and mathematics (STEM) helps students become scientifically and technologically literate citizens. STEM learning integrates and applies concepts and processes related to these subject areas through problem solving and design challenges. The skills that students develop through STEM learning include coding, innovation, computational thinking, and engineering and scientific design. STEM skills and concepts are infused throughout the units and lessons included in ***Hands-On Science and Technology***. Most lessons offer a suggestion for a STEM Makerspace project, which is designed to develop students' STEM skills in direct relation to the lesson. (See page 15 for a detailed overview of STEM Makerspaces.)

In addition, most lessons include coding activities. (See page 4 for more detailed information on coding.) ***Hands-On Science and Technology*** emphasizes the creative coding approach, which focuses on the key skills of creativity, agency, and computing, described in the Harvard Graduate School of Education's *Creative Computing Curriculum* as follows:

Creativity: Computer science and computing-related fields are often introduced to young people in a way that is disconnected from their interests and values—emphasizing technical detail over creative potential. Creative computing supports the development of personal

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connections to computing, by drawing upon creativity, imagination, and interests.

Agency: Many young people with access to computers participate as consumers, rather than designers or creators. Creative computing emphasizes the knowledge, practices, and fundamental literacies that young people need to create the types of dynamic and interactive computational media they enjoy in their daily lives.

Computing: Creating computational artifacts prepares young people for more than careers as computer scientists or programmers. It supports young people's development as computational thinkers—individuals who can draw on computational concepts, practices, and perspectives in all aspects of their lives, across disciplines and contexts.

What Does STEM Look Like in a Classroom Setting?

When students engage in STEM learning they actively work in teams, collaborating to find solutions to real-world problems using science, technology, engineering, and mathematics. They use a variety of materials and technologies to innovate and create. They draw plans, gather materials, build prototypes, and test what they have built. They conduct experiments, take measurements, and record their observations. Students use digital technology to create new content such as photos, videos, digital presentations, animations, and games. They engage in programming activities using coding and robotics. Students reflect on their work and understand that there are many possible solutions to a problem. STEM in the classroom is student centred, with the teacher acting as facilitator of the learning. The classroom is humming with excitement as students discuss their ideas and share their work.

What Is Coding?

Coding, also called computer programming, refers to giving a computer a set of specific step-by-step instructions that tell it what to do. These instructions need to be written in a language the computer understands, referred to as a *programming language*. There are many programming languages. They use letters, numbers, and symbols in their instructions. When children first learn to code, they use easy-to-learn, user-friendly languages that use visual symbols like blocks. ScratchJr and Scratch are examples of programming languages made for children. Familiarize yourself with some coding programs that can be used in the classroom, such as ScratchJr, a free app designed for student use, and Code.org, a website that offers free coding courses and activities.

The key ideas and coding concepts for students to learn in grade 1 are as follows:

- A computer or robot cannot think or make decisions; it can only do exactly what the programmer tells it to do.
- Computer code is written in a specific order (called a *sequence* or *algorithm*), so the computer knows which step to complete first, next, and so on.
- Making mistakes and figuring out how to fix them (debugging) is an important part of learning to code.

Coding concepts can be taught to students with or without the use of digital technology. In ***Hands-On Science and Technology***, there are coding activities for both *plugged* and *unplugged* learning environments. *Plugged coding* uses the programming language that a computer understands, therefore requiring the use of digital technology. *Unplugged coding* includes learning activities that introduce coding and programming through hands-on activities and games.

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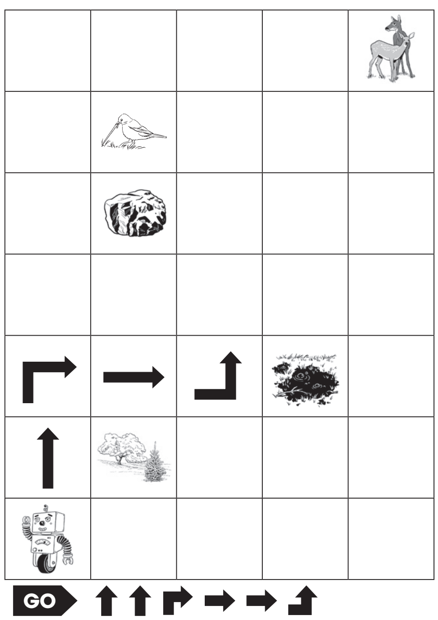
A typical unplugged coding activity for grade 1 is to provide students with a grid and a set of coding cards with directional arrows on them. Students use the arrows to create a sequence that, when followed, will direct an object to move around the grid.

Robot's Nature Walk



A typical plugged coding activity for grade 1 is to work within a specific program or app (e.g., ScratchJr) to connect a series of code blocks together to create a sequence that will make a character move around the screen.

The following resources can be used to help introduce coding into your classroom:

- Canada Learning Code: <http://www.canadalearningcode.ca/>
- Code Studio: For educators: <https://studio.code.org/courses?view=teacher> For students: <https://studio.code.org/courses>
- Hello Ruby for educators: Love Letters for Computers: <https://www.helloruby.com/loveletters>
- Coding in Elementary: A Professional Learning Resource for Ontario Educators: <http://www.edugains.ca/resourcesTELO/CE/CodingInterface/interface.html>
- ScratchJr: <https://www.scratchjr.org/>, <https://www.scratchjr.org/learn/interface>

NOTE: Check with your board or school to learn which coding apps are available to you and recommended for use in your classroom.

The Inquiry Approach to Science and Technology

As students explore science and technology concepts, they are encouraged to ask questions to guide their own learning. The inquiry approach is based on five components:

1. formulating questions
2. gathering and organizing information, evidence, or data
3. interpreting and analyzing information, evidence, or data
4. evaluating information, evidence, or data, and drawing conclusions
5. communicating findings

Using this approach, teachers facilitate the learning process. Students initiate questions; gather, organize, interpret, and analyze information; evaluate findings and draw conclusions; and communicate their learning. The process focuses on students' self-reflections as they ask questions, discover answers, and communicate their understanding.

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An inquiry approach begins with more structured inquiry, moves to guided inquiry, and, finally, leads to open inquiry:

Structured Inquiry	■ The teacher provides the initial question and structures the procedures to answer it. ■ Students follow the procedures and draw conclusions to answer the question.
Guided Inquiry	■ The teacher provides the initial question. ■ Students are involved in designing ways to answer the question and communicate their findings.
Open Inquiry	■ Students formulate their own question(s), design and follow through with a developed procedure, and communicate their findings and results.

NOTE: According to Banchi and Bell (2008), "Open inquiry activities are only successful if students are motivated by intrinsic interests and if they are equipped with the skills to conduct their own research study." This requires careful observation and assessment by teachers to ensure that students are ready for open inquiry. Open inquiry is not commonly implemented in grade 1 classrooms, as students are still in the development stage of building research skills.

In an inquiry approach to science and technology, questions and ideas form the foundation of the teaching and learning process. The following passage, included in the Ontario Literacy and Numeracy Secretariat's overview of inquiry-based learning, speaks clearly to this approach:

> While all students ask questions and express interests in world phenomena, it takes creative and responsive teaching to transform wonder into knowledge. To begin, inquiry works best in a classroom in which ideas are placed at the centre. Establishing a culture in which students are encouraged to express ideas but also to respectfully challenge and test one another's ideas is an important first step in the inquiry process. This spirit of inquiry is achieved by welcoming ideas and trusting that even the simplest questions can lead to something greater and not yet evident. Like any good growing system, these questions need time to germinate. Students' ideas can be expressed in many forms (questions, comments, diagrams, pictures, dance, etc.) and serve the important purpose of advancing student understanding of a topic. When the classroom culture is one that views ideas as improvable, students work hard to continuously improve the quality, coherence and utility of ideas—both individually and collectively. (Scardamalia, 2002, quoted in Ontario Literacy and Numeracy Secretariat, 2013, p. 4)

Cultural Connections

To acknowledge and celebrate the cultural diversity represented in Canadian schools, it is important to infuse cultural connections into classroom learning experiences. It is essential for teachers to be aware of the cultural makeup of their class and to celebrate students' diverse cultures by making connections to curricular expectations. It is also important to explore other cultures represented in the community and beyond to encourage intercultural understanding and harmony.

Throughout ***Hands-On Science and Technology***, suggestions are made for connecting science and technology topics to cultural explorations and activities.

Indigenous Perspectives and Knowledge

Indigenous Peoples are central to the Canadian context, and it is important to infuse Indigenous knowledge into the learning experiences of all students. The worldviews of Indigenous Peoples and their approaches and contributions to science are now being acknowledged and incorporated into science and technology education. The intentional integration of Indigenous knowledge in ***Hands-On Science and Technology*** helps to address the Calls to Action of the Truth and Reconciliation Commission of Canada, particularly the calls to "integrate Indigenous knowledge and teaching methods into classrooms" (Action 62) and "build student capacity for intercultural understanding, empathy and mutual respect" (Action 63).

The traditional territories of Indigenous Peoples cover the entirety of what is now known as Ontario. It is important to recognize the diversity of Indigenous Peoples in Ontario and to focus on both the traditions and contemporary lives of the Indigenous communities in your area. Contact personnel in your school board—Indigenous education leads and consultants and Indigenous Education Councils—to find out what resources (e.g., people, books, videos) are available. Many such resources are featured in ***Hands-On Science and Technology***.

Indigenous Peoples have depended on the land since time immemorial. The environment—including geography, vegetation, climate, and natural resources—shapes their way of life. Since they observe the land and its inhabitants, the environment teaches Indigenous Peoples to survive and determines the methods they use to do so. The land continues to shape Indigenous Peoples' way of life today because of their ongoing, deep connection to it. Cultural practices, stories, languages, and knowledge originate from the land.

NOTE: When implementing land-based learning, opportunities abound to consider Indigenous knowledge and perspectives. (See page 17 for more information about land-based learning.) Outdoor learning provides an excellent opportunity to identify the importance of place. For example, use a map of the local area to have students identify the location shown on the map in relation to the school. This will help students develop a stronger image of their community and surrounding area.

It is also important to identify on whose traditional territory the school is located and where any land-based learning occurs, as well as the traditional names for these locations. The following sites provide maps of Ontario's First Nations that can be used for this purpose:

- Ontario First Nations Maps: <https://www.ontario.ca/page/ontario-first-nations-maps>
- Maps of Indigenous Communities in Ontario: <https://www.sac-isc.gc.ca/eng/1635957754306/1635957787562>
- First Nation Profiles Interactive Map: <https://geo.aadnc-aandc.gc.ca/cippn-fnpim/index-eng.html>

In addition, the educator's guide *The First Nations and Treaties Map of Ontario as an Instructional Resource* offers maps and information for teachers; it is available at <http://www.edu.gov.on.ca/eng/indigenous/the-first-nations-and-treaties-map-of-ontario.pdf>.

Incorporate a land acknowledgment once students have learned whose territory the school and land-based learning location is on. The following example can be used for guidance:

- <name of school> is located on the traditional territory of the ______and is within the boundaries set by the_____ treaty________.

NOTE: Many Ontario school boards have established protocols for land acknowledgments. Check with Indigenous education leads and consultants in your board to see if there are specific protocols to follow.

When incorporating Indigenous perspectives in the classroom, it is important to value Traditional Ecological Knowledge:

> Traditional Ecological Knowledge, or TEK, is the most popular term to denote the vast local knowledge First Peoples have about the natural

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> world found in their traditional environment. […] TEK is, above all, local knowledge based in people's relationship to place. It is also holistic, not subject to the segmentation of Western science. Knowledge about a specific plant may include understanding its life cycle, its spiritual connections, its relationship to the seasons and with other plants and animals in its ecosystem, as well as its uses and its stories. (First Nations Education Steering Committee and First Nations Schools Association, 2019, p. 13)

Indigenous Peoples developed technologies and survived on this land for millennia because of their knowledge of the land. Indigenous Peoples used observation and experimentation to refine technologies, such as building canoes and longhouses and discovering food-preservation techniques. Accordingly, TEK serves as an invaluable resource for science students and teachers.

Indigenous Peoples do not view their knowledges as "science," but view them from a more holistic perspective, as is reflected in these words from the president of the Science Museum of Minnesota, Dr. Eric J. Jolly (Cherokee):

> When I weave a basket, I talk about the different dyes and how you make them and how the Oklahoma clay that we put on our baskets doesn't permeate the cell walls, it deposits on the outside. It makes a very nice dye but if you cut through the reed you'll see white still on the inside of the reed, whereas if I make a walnut dye and if I use as my mordent, alum and I use as my acid cider, that walnut dye will permeate the cell walls. You cut through the reed and it's brown through and through. Now what I've just described is the difference between osmosis and dialysis. That Western science calls those scientific terms is really wonderful, but it's not scientific terms if you are a basket weaver. Our culture incorporates so much of what people would call scientific knowledge and ways of thinking so naturally that we haven't parsed it out and put it in a book and said this is our science knowledge versus our weaver's knowledge. When I weave a basket I also tell the stories of the spirituality and not just the ways of which I dyed it. A basket weaver is as much a scientist, as an artist, and a spiritual teacher. We'd never think that you'd separate out just the science part, but you can't weave a basket without knowing the science. (Cited in Mack et al., 2012, pp. 50–51)

Throughout ***Hands-On Science and Technology***, there are many opportunities to incorporate culturally appropriate teaching methodologies from an Indigenous worldview. Making connections to the local community is essential to learning about Indigenous knowledge and ways of knowing. As one example, Elders and Knowledge Keepers offer a wealth of knowledge that can be shared with students. Consider inviting a local Elder or Knowledge Keeper as a guest into the classroom in connection with specific topics being studied (as identified within the given lessons throughout the module). An Elder or Knowledge Keeper can guide a nature walk, share stories and experiences, describe traditional technologies, and help students understand Indigenous Peoples' perspectives of the natural world. Elders and Knowledge Keepers will provide guidance for learners and opportunities to build bridges between the school and the community.

NOTE: In *Hands-On Science and Technology*, the term *Knowledge Keeper* refers to individuals who may or may not be recognized as Elders, but who carry the teachings of their community and can be called upon for that expertise. The term *Knowledge Holder* is used interchangeably with *Knowledge Keeper* in some communities (Government of Ontario, 2020–2023).

It is especially important to connect with Indigenous communities, Elders, and Knowledge Keepers in your local area, and to study

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local issues related to Indigenous Peoples in Ontario. Consider contacting the Indigenous education lead or consultant in your school board, your local Indigenous Education Council, or the Ontario Ministry of Education to access referrals. You may also consider contacting local Indigenous organizations for referrals to Elders and Knowledge Keepers. Such organizations may also be able to offer resources and opportunities for field trips and land-based learning.

Here are a few suggestions for working with Elders and Knowledge Keepers:

- Elders and Knowledge Keepers have a deep spirituality that influences every aspect of their lives and teachings. They are recognized because they have earned the respect of their community through wisdom, harmony, and balance in their actions and teachings (see Indigenous Corporate Training, 2012).
- Some Indigenous keepers of knowledge are more comfortable being called "Knowledge Keepers" than "Elders." Be sensitive to their preference. In many communities, there are also "Junior Elders" who may also be invited to share their knowledge with students and school staff.
- Elders and Knowledge Keepers may wish to speak about what seems appropriate to them, instead of being directed to talk about something specific. It is important to respect this choice and not be directive about what an Elder or Knowledge Keeper will talk about during their visit.
- It is important to properly acknowledge any visiting Elders or Knowledge Keepers and their knowledge, as they have traditionally been and are recognized within Indigenous communities as highly esteemed individuals.

NOTE: It is important to understand the significant contribution that Elders, Knowledge Keepers, and Indigenous communities make when they share their traditional knowledge. In their culture of reciprocity, this understanding should extend past giving a gift or honorarium to an Elder or Knowledge Keeper for sharing sacred knowledge. Think deeply about reciprocity and how you can go beyond inviting Indigenous guests to your classroom. Expand your own learning and become connected to Indigenous people by, for example, engaging in Indigenous community events, working with the education department of the local Nations, or exploring ways to continue developing the relationship between the local Nations and teachers in your board.

NOTE: Indigenous resources recommended in *Hands-On Science and Technology* are considered to be authentic resources, meaning that they reference the Indigenous community they came from, they state the individual who shared the story and gave permission for the story to be used publicly, and the person who originally shared the story is Indigenous. Stories that are works of fiction were written by an Indigenous author; for stories with more than one author, at least one of the authors is Indigenous. For more information, see the First Nations Education Steering Committee's *Authentic First Peoples Resources* guides at: <http://www.fnesc.ca/authenticresources/>.

References

Banchi, Heather, and Randi Bell. "The Many Levels of Inquiry." *Science and Children*, 46, no. 2 (2008): 26–29.

First Nations Education Steering Committee. *Authentic First Peoples Resources, K–9*, 2016, and *Authentic First Peoples Resources, For Grades 10–12* and Adult Learning. http://www.fnesc.ca/authenticresources/.

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First Nations Education Steering Committee and First Nations Schools Association. *Secondary Science First Peoples Teacher Resource Guide*, 2019. http://www.fnesc.ca/wp/wp-content/uploads/2019/08/PUBLICATION-SCIENCE-FIRST-PEOPLES-Secondary-TRG-2019.pdf.

Government of Canada. “Maps of Indigenous Communities in Ontario.” Indigenous Services Canada, Geomatics Services, 2020. https://www.sac-isc.gc.ca/eng/1635957754306/1635957787562.

Government of Canada. “First Nations Profiles Interactive Map.” https://geo.aadnc-aandc.gc.ca/cippn-fnpim/index-eng.html.

Government of Ontario. “Ontario First Nations Maps.” https://www.ontario.ca/page/ontario-first-nations-maps.

Government of Ontario. *The First Nations and Treaties Map of Ontario as an Instructional Resource: An Educator’s Guide*, 2020. http://www.edu.gov.on.ca/eng/indigenous/the-first-nations-and-treaties-map-of-ontario.pdf.

Government of Ontario. “KnowledgeCurriculum and Resources: Glossary.” 2020–2023. https://www.dcp.edu.gov.on.ca/en/search?persona=educator&type=glossary_term&term=knowledge%20holder

Harvard Graduate School of Education. *Creative Computing Curriculum*. http://scratched.gse.harvard.edu/guide/index.html.

Indigenous Corporate Training. “Indigenous Elder Definition.” 2019. https://www.ictinc.ca/blog/aboriginal-elder-definition.

Mack, Elizabeth, Helen Augare, Linda Different Cloud-Jones, Dominique David, Helene Quiver Gaddie, Rose E. Honey, Angayuquaq O. Kawagley, et al. “Effective Practices for Creating Transformative Informal Science Education Programs Grounded in Native Ways of Knowing.” *Cultural Studies of Science Education*, 7 (2012): 49–70. https://doi.org/10.1007/s11422-011-9374-y.

Ontario Literacy and Numeracy Secretariat. *Inquiry-Based Learning*. Capacity Building Series 32, 2013. https://ontariosummerlearning.org/wp-content/uploads/2015/02/CBS_InquiryBased.pdf.

Ontario Ministry of Education. *The Ontario Curriculum, Grades 1–8: Science and Technology*, 2022. https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology.

Scardamalia, Marlene. “Collective Cognitive Responsibility for the Advancement of Knowledge.” In *Liberal Education in a Knowledge Society*, edited by Barry Smith, 67–98. Chicago: Open Court, 2002.

Truth and Reconciliation Commission of Canada. *Truth and Reconciliation Commission of Canada: Calls to Action*. Winnipeg: University of Manitoba, 2015.

How To Use *Hands-On Science and Technology* in Your Classroom

Unit Overview

Hands-On Science and Technology for Ontario is organized in a format that makes it easy to plan and implement. The book opens with an introduction (which includes assessment reproducibles) and is divided into four units that cover the selected topics of study for the grade level:

- Life Systems: Needs and Characteristics of Living Things
- Matter and Energy: Energy in Our Lives
- Structures and Mechanisms: Everyday Materials, Objects, and Structures
- Earth and Space Systems: Daily and Seasonal Changes

The units relate directly to the strands, expectations, fundamental concepts, and big ideas outlined in *The Ontario Curriculum, Grades 1–8: Science and Technology* (2022) document. Each unit opens with About This Unit, an introduction to the unit that summarizes the general goals for the unit. About This Unit provides background information for teachers, planning tips, and lists of vocabulary related to the unit, as well as other pertinent information such as how to embed Indigenous perspectives into student learning.

Additionally, About This Unit includes lists of related resources (books and online videos), annotated websites suitable for students, and coding and STEM resources.

Each unit is organized into numbered lessons composed of topics and activities based on the overall and specific expectations. Lessons are arranged in the following format:

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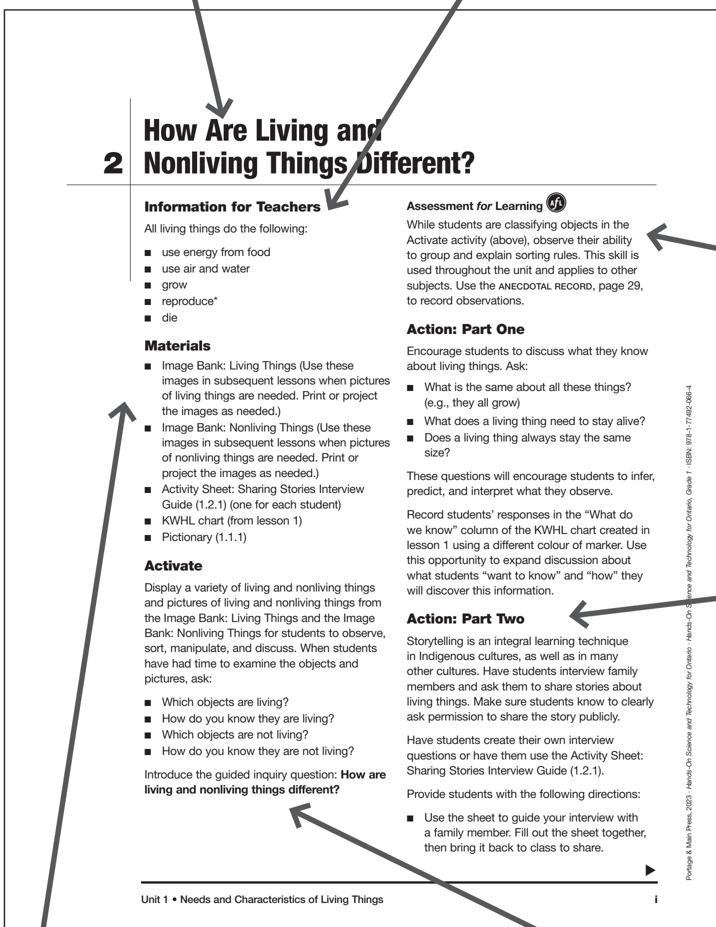
Lesson Title
- posed as a guided inquiry question related to the expectations addressed in the lesson

Information for Teachers
- provides basic scientific and technological knowledge needed for the activities



2 How Are Living and Nonliving Things Different?

Information for Teachers

All living things do the following:

- use energy from food
- use air and water
- grow
- reproduce*
- die

Materials

- Image Bank: Living Things (Use these images in subsequent lessons when pictures of living things are needed. Print or project the images as needed.)
- Image Bank: Nonliving Things (Use these images in subsequent lessons when pictures of nonliving things are needed. Print or project the images as needed.)
- Activity Sheet: Sharing Stories Interview Guide (1.2.1) (one for each student)
- KWHL chart (from lesson 1)
- Pictionary (1.1.1)

Activate

Display a variety of living and nonliving things and pictures of living and nonliving things from the Image Bank: Living Things and the Image Bank: Nonliving Things for students to observe, sort, manipulate, and discuss. When students have had time to examine the objects and pictures, ask:

- Which objects are living?
- How do you know they are living?
- Which objects are not living?
- How do you know they are not living?

Introduce the guided inquiry question: **How are living and nonliving things different?**

Assessment *for* Learning AfL

While students are classifying objects in the Activate activity (above), observe their ability to group and explain sorting rules. This skill is used throughout the unit and applies to other subjects. Use the ANECDOTAL RECORD, page 29, to record observations.

Action: Part One

Encourage students to discuss what they know about living things. Ask:

- What is the same about all these things? (e.g., they all grow)
- What does a living thing need to stay alive?
- Does a living thing always stay the same size?

These questions will encourage students to infer, predict, and interpret what they observe.

Record students' responses in the "What do we know" column of the KWHL chart created in lesson 1 using a different colour of marker. Use this opportunity to expand discussion about what students "want to know" and "how" they will discover this information.

Action: Part Two

Storytelling is an integral learning technique in Indigenous cultures, as well as in many other cultures. Have students interview family members and ask them to share stories about living things. Make sure students know to clearly ask permission to share the story publicly.

Have students create their own interview questions or have them use the Activity Sheet: Sharing Stories Interview Guide (1.2.1).

Provide students with the following directions:

- Use the sheet to guide your interview with a family member. Fill out the sheet together, then bring it back to class to share.

Unit 1 • Needs and Characteristics of Living Things i

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Assessment For, As, and Of Learning
- provides suggestions for authentic assessment, which includes assessment *for* learning, assessment *as* learning, and assessment *of* learning
- focuses on the specific expectations related to the particular lesson (assessment strategies are outlined in ***Hands-On Science and Technology*** Assessment Plan on page 25)

Action
- details a step-by-step procedure, including higher-level questioning techniques, and suggestions for encouraging the development of new knowledge and skills
- identified as Action: Part One, Action: Part Two, and so on (when there is more than one Action activity in a lesson)

Materials
- lists all materials required to conduct the main activities
- includes items for display purposes or for recording students' ideas
- suggests visual materials (e.g., large pictures, sample charts, diagrams) to assist in presenting ideas and questions and to encourage discussion
- connects to Image Bank visuals, which may be printed or projected for specific activities (see Appendix on page 277 for thumbnails and free access)

Activate
- activates prior knowledge, piques students' curiosity about related concepts, and introduces the lesson's guided inquiry question
- teachers may choose to record the guided inquiry question for display (e.g., on a sentence strip) so students can refer to it during activities and discussion

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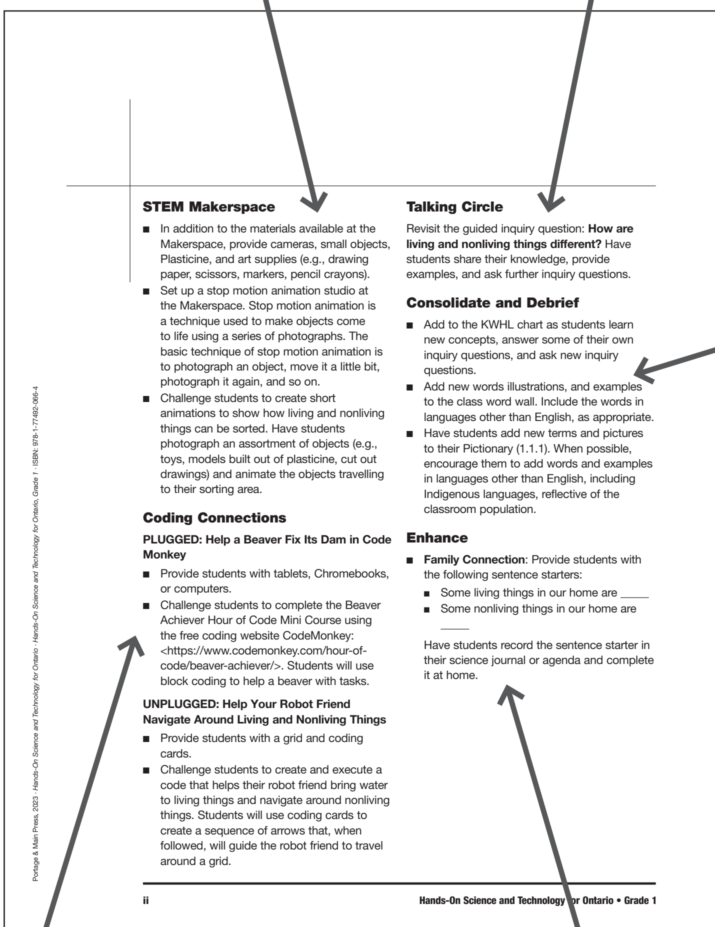
STEM Makerspace
- addresses STEM concepts and skills and promotes personalized learning, open inquiry, discovery, creation, and innovation related to the unit expectations
- suggests materials, equipment, and challenges related to the specific science and technology topics of study, while correlating with other subject areas

Talking Circles
- provides students with opportunities to participate in a Talking Circle (see page 15 for more information) to demonstrate their learning through consolidation and to debrief on guided inquiry questions

Consolidate and Debrief
- suggests activities that review the main ideas of the lesson, focusing on fundamental concepts, big ideas, and overall and specific expectations
- offers ways for students to demonstrate what they have learned through consolidation and reflection, allowing for synthesis and application of inquiry and new ideas
- embeds learning by adding to graphic organizers; having students record, describe, and illustrate new vocabulary and communicate investigations and ideas in a science and technology journal; and adding new science and technology vocabulary to the classroom word wall
- provides opportunity to reflect the cultural diversity of the classroom and the community by including new terminology in languages other than English, including Indigenous languages



STEM Makerspace
- In addition to the materials available at the Makerspace, provide cameras, small objects, Plasticine, and art supplies (e.g., drawing paper, scissors, markers, pencil crayons).
- Set up a stop motion animation studio at the Makerspace. Stop motion animation is a technique used to make objects come to life using a series of photographs. The basic technique of stop motion animation is to photograph an object, move it a little bit, photograph it again, and so on.
- Challenge students to create short animations to show how living and nonliving things can be sorted. Have students photograph an assortment of objects (e.g., toys, models built out of plasticine, cut out drawings) and animate the objects travelling to their sorting area.

Coding Connections

PLUGGED: Help a Beaver Fix Its Dam in Code Monkey
- Provide students with tablets, Chromebooks, or computers.
- Challenge students to complete the Beaver Achiever Hour of Code Mini Course using the free coding website CodeMonkey: <https://www.codemonkey.com/hour-of-code/beaver-achiever/>. Students will use block coding to help a beaver with tasks.

UNPLUGGED: Help Your Robot Friend Navigate Around Living and Nonliving Things
- Provide students with a grid and coding cards.
- Challenge students to create and execute a code that helps their robot friend bring water to living things and navigate around nonliving things. Students will use coding cards to create a sequence of arrows that, when followed, will guide the robot friend to travel around a grid.

Talking Circle

Revisit the guided inquiry question: **How are living and nonliving things different?** Have students share their knowledge, provide examples, and ask further inquiry questions.

Consolidate and Debrief
- Add to the KWHL chart as students learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new words illustrations, and examples to the class word wall. Include the words in languages other than English, as appropriate.
- Have students add new terms and pictures to their Pictionary (1.1.1). When possible, encourage them to add words and examples in languages other than English, including Indigenous languages, reflective of the classroom population.

Enhance
- **Family Connection**: Provide students with the following sentence starters:
  - Some living things in our home are _____
  - Some nonliving things in our home are _____

  Have students record the sentence starter in their science journal or agenda and complete it at home.

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Coding Connections
- provides suggestions for plugged and unplugged coding activities; see page 4 for an explanation of plugged and unplugged coding

Enhance
- encourages active participation and learning through Family Connections, tasks that students complete at home with their family members, then bring back to school to share
- suggests additional optional activities to extend, enrich, and reinforce the expectations

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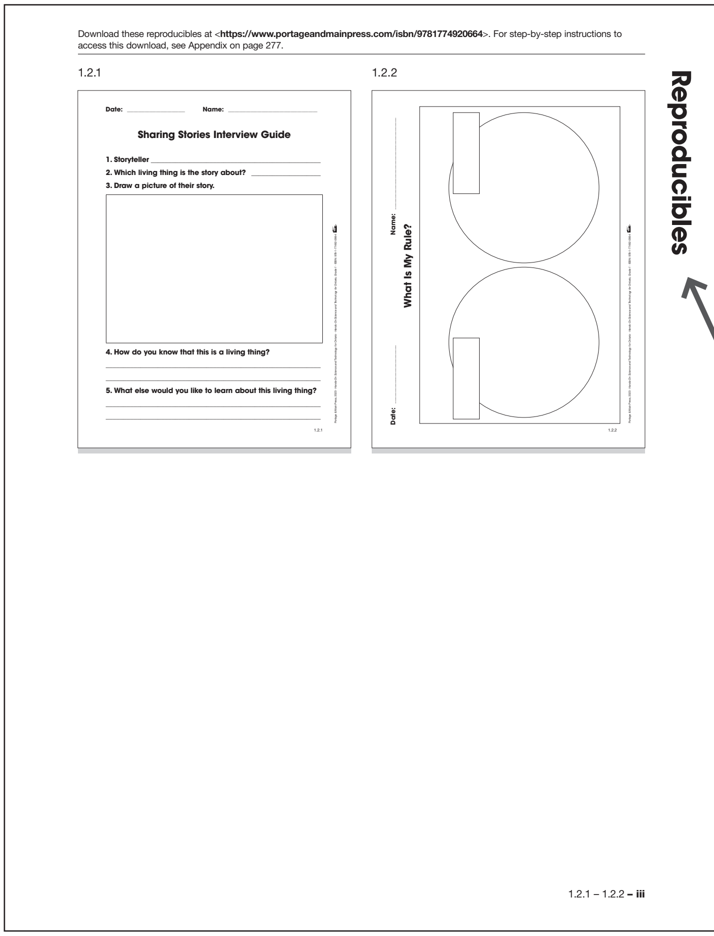
Download these reproducibles at <https://www.portageandmainpress.com/isbn/9781774920664>. For step-by-step instructions to access this download, see Appendix on page 277.

Reproducibles

1.2.1

Date: Name:

Sharing Stories Interview Guide

1. Storyteller
2. Which living thing is the story about?
3. Draw a picture of their story.
4. How do you know that this is a living thing?
5. What else would you like to learn about this living thing?

1.2.2

What Is My Rule?

Name:

Date:

1.2.1 – 1.2.2 – iii

Reproducibles

- are included as thumbnails following the lesson
- may be used to guide activities or record data
- may also serve as a template for designing and constructing graphic organizers

NOTE: Activity sheets are meant to be used only in conjunction with, or as a follow-up to, the hands-on activities. The activity sheets are not intended to be the science and technology lesson in itself or the sole assessment for the lesson.

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Talking Circle

Each lesson encourages the class to participate in a Talking Circle to consolidate learning and debrief on guided inquiry questions. Talking Circles originated with First Nations leaders as a process to encourage dialogue, respect, and the co-construction of ideas. The following process is generally used in a Talking Circle:

- the group forms a complete circle
- one person holds an object such as a stick, feather, shell, or stone
- only the person holding the stick talks, while others listen
- the stick is passed around in a clockwise direction
- each person talks until they are finished, being respectful of time
- the Talking Circle is complete when everyone has had a chance to speak
- a person may pass the stick without speaking if they choose (for more information, see First Nations Pedagogy Online, "Talking Circles," at <www.firstnationspedagogy.ca/circletalks.html>

Consider inviting a local Elder or Knowledge Keeper to share with the class the process of a Talking Circle.

STEM Makerspace

To address STEM concepts and skills and promote personalized learning, each unit of ***Hands-On Science and Technology*** includes a variety of suggestions for STEM Makerspace materials, equipment, and challenges related to the specific science and technology topics of study, while correlating with other subject areas. Suggested materials and challenges are intended to support open inquiry, discovery, creation, and innovation related to the unit expectations.

A Makerspace is a creative do-it-yourself environment, where students pose questions, share ideas, and explore hands-on projects. In the school setting, a STEM Makerspace is usually cross-curricular and allows for inquiry, discovery, and innovation. Sometimes, the STEM Makerspace is housed in a common area, such as the library, which means it can be used by the whole school community. A classroom STEM Makerspace is usually designed as a centre where students use knowledge, concepts, and skills acquired in a particular lesson and apply them to STEM challenges. Students often create do-it-yourself projects, learning together and collaborating on cross-curricular ideas or classroom themes. It is important to remember that learning is not directed here. Rather, the goal is simply to create conditions for learning to happen and give students the opportunity to work with a variety of age-appropriate tools. The centre may evolve to foster inquiry within a specific topic.

There is no list of required equipment that defines a STEM Makerspace; however, there are some items that should be included such as paper, cardboard, everyday recycled materials, tape, and glue. You may wish to Include reusable building materials such as interlocking plastic building blocks, snap cubes, pattern blocks, and straws and connectors. Additionally, arts-and-crafts materials such as construction paper, modelling clay, fabric, buttons, and pipe cleaners are often integrated into Makerspace offerings.

Consider the following when planning and developing a STEM Makerspace centre:

- Always address safety concerns, ensuring materials, equipment, and tools are safe for student use. Include safety gloves and goggles, as appropriate.

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- Consider space and storage needs. Mobile carts and/or bins are handy for storing raw materials and tools.
- Work with students to write a letter to parents/guardians to explain the purpose of the Makerspace and ask for donations of materials.

The following resources provide information about including STEM in the classroom:

- Ontario Science Centre STEM Education Toolkit: <https://www.ontariosciencecentre.ca/teachers-plus-students/teacher-resources/stem-education-toolkit>
- Ontario Council for Technology Education: <https://www.octe.ca/en/resources>
- Let's Talk Science: <https://letstalkscience.ca/>

Classroom Environment

The classroom setting is an important component of the learning process. An effective classroom environment is inclusive of the diverse backgrounds and learning needs of all students. The strengths students bring to school are identified and nurtured. At the same time, every student is supported so they can succeed. The classroom must also be a space that encourages inquiry and discussion. The following are suggestions that can be used to promote inquiry in the classroom:

- Encourage students to ask questions and to appreciate different perspectives.
- Foster a nonthreatening atmosphere in which all students are comfortable sharing.
- Provide lots of opportunities for students to reflect on questions, share ideas, and generate further questions for inquiry.
- Promote discussion with and between students, as they need to talk about ideas with each other and with the teacher to help make meaning.
- Model for students how to gather the information they need so they have an adequate foundation for discussion.
- Ensure questions are clear and vocabulary is appropriate to learners.
- Avoid dominating discussion.
- Provide equal opportunities for all learners to participate.
- Model good questions and questioning strategies.
- Guide students in discovering answers to questions.

An active environment—one that gently hums with students' purposeful conversations and activities—indicates that meaningful learning is taking place. When your class is studying a specific topic, display related objects and materials in the room, including student work; pictures and posters, maps, graphs, and charts made during activities; and anchor charts of important concepts, procedures, skills, or strategies that are co-constructed with students. Visuals serve as a source of information, reinforce concepts and skills that have been stressed during lesson activities, and support students who are visual learners. As a support throughout the unit, display charts outlining success criteria so that vocabulary and concepts are visible to students at all times.

Planning Units

Timelines

No two groups of students explore topics and materials at the same rate, and so planning the duration of lessons and units is an important responsibility of the teacher. In some cases, students will not complete a lesson's activities during one block of time. In addition, students may be especially interested in one topic and want to expand on it. Consider the individual needs of your class; there are no strict timelines for ***Hands-On Science and Technology.*** It is

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important, however, to spend time on every unit in the book so that students focus on all the curriculum expectations established for this grade level.

Classroom Management

Hands-On Science and Technology provides students with many opportunities to participate in hands-on activities; they will benefit more from this type of primary experience than if you merely demonstrate the activities. Although hands-on activities are emphasized throughout this book, how these experiences are managed is up to the teacher, since it is you who ultimately determines how your students function best in the learning environment. In some cases, you may have all students manipulating materials individually; in others, you may choose to organize the class into small groups.

Organizing the class into small working groups of three or four students is the most productive and beneficial way to manage the activities. Group work encourages the development of social skills, enables all students to be active in the learning process, and can reduce the cost of materials and equipment. Students learn from their classmates while working in collaborative groups.

When your class is working in collaborative groups, it may be helpful to assign each student a role, as follows:

- **leader**: makes sure everyone in the group has an opportunity to share their ideas and opinions
- **recorder**: records the group's data, research, questions, and any other information on the lesson's sheets or charts
- **reporter**: reports the group's ideas, findings, or answers back to the class
- **gopher**: collects and returns all materials needed for each activity

The quantity of materials required will depend on how you conduct activities. If students are working individually, you will need enough materials for each student. If students are working in groups, the materials required will be significantly reduced.

Classroom Safety

The nature of science and technology, and of scientific and technological experimentation, means that safety concerns do arise from time to time. In these instances, teachers may decide to demonstrate an activity themselves, while still encouraging as much student interaction as possible. Throughout ***Hands-On Science and Technology***, whenever there is a potential safety issue to be aware of, the following safety icon appears:

Land-Based Learning

Land-based learning replaces the classroom walls with the natural environment. Land-based learning offers all students first-hand opportunities to observe, explore, and investigate the land, waters, and atmosphere of the natural world. Land-based learning promotes a healthy interplay between society and nature and helps students envision a world where there is meaningful appreciation and respect for our natural environment—an environment that sustains all life forms. Many lessons in ***Hands-On Science and Technology*** incorporate land-based learning activities, ranging from a casual walk around the neighbourhood to examine trees to a more involved exploration of local waterways. When land-based learning connections are made in ***Hands-On Science and Technology***, the following icon appears:

▶

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References

First Nations Pedagogy Online. "Talking Circles." www.firstnationspedagogy.ca/circletalks.html.

Ontario Ministry of Education. *The Ontario Curriculum, Grades 1–8: Science and Technology*, 2022. https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology.

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Scientific and Engineering Design Processes

Scientific Inquiry Skills: Guidelines for Teachers

Hands-On Science and Technology is based on a scientific inquiry approach. While involved in the lessons, students use a variety of inquiry skills as they answer questions, solve problems, and make decisions. These skills are not unique to science and technology, but are integral to students' acquisition of scientific and technological literacy. They include initiating and planning, performing and recording, analyzing and interpreting, as well as communicating and working in teams. In the primary grades, basic skills should focus on scientific inquiry and problem solving.

Use the following guidelines to encourage students' development of inquiry skills in specific areas.

Observing

Students learn to perceive characteristics and changes using all five senses. Encourage students to safely use sight, smell, touch, hearing, and taste to gain information about objects and events. Observations may be qualitative (e.g., texture, colour), quantitative (e.g., size, number), or both.

Observing includes:

- gaining information through the senses
- identifying similarities and differences, and making comparisons

Encourage students to communicate their observations in a variety of ways, including orally, in writing, by sketching labelled diagrams, and by capturing evidence digitally (e.g., using a camera or tablet).

Questioning

Generating thoughtful inquiry questions is an essential skill for students when participating in inquiry-based learning. Encourage students to be curious and to extend their questions beyond those posed to them.

Students should learn to formulate specific questions to investigate, then create, from a variety of possible methods, a plan to find answers to those questions.

Exploring

Students need ample opportunities to manipulate materials and equipment in order to discover and learn new ideas and concepts. During exploration, encourage students to use all of their senses and observation skills.

Oral discussion is also an integral component of exploration; it allows students to communicate their discoveries. At a deeper level, discussion allows students to make meaning by discussing inconsistencies/misconceptions and comparing/contrasting their observations with others. This is the constructivist model of learning, which is essential in inquiry-based learning.

Classifying

Classification is used to group or sort objects and events and is based on observable properties. For example, objects can be classified into groups according to colour, shape, or size. Two strategies for sorting are the use of sorting mats and Venn diagrams. Sorting mats show distinct groups, while Venn diagrams intersect to show similar characteristics among sets.

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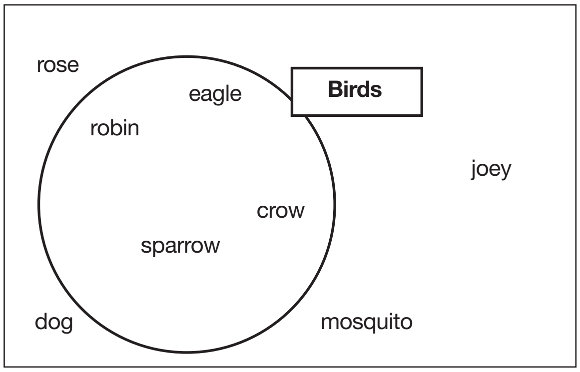
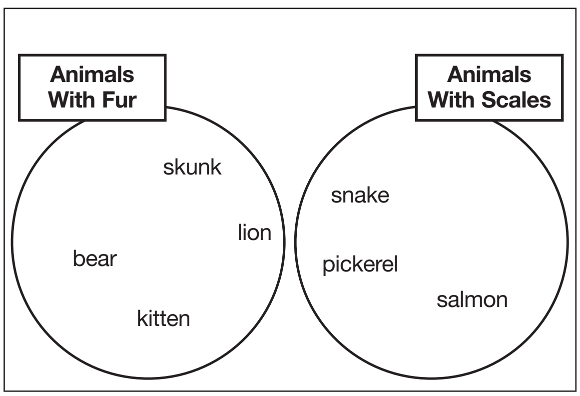
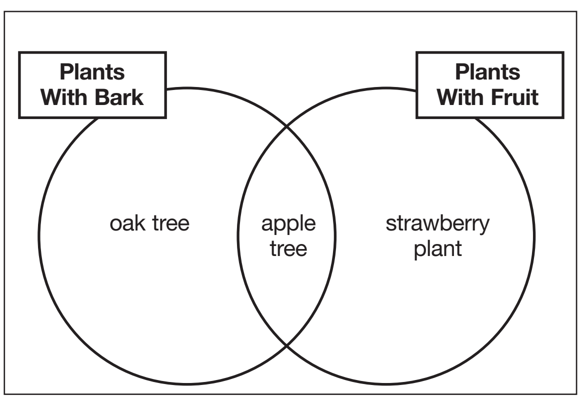
Single Sorting Mat



Double Sorting Mat



Double Venn



Measuring

Measuring is the process of discovering the dimensions or quantity of objects or events and, at the grade 1 level, usually involves comparing and ordering objects by length, area, volume, or mass. In the primary grades, measuring activities first involve the use of nonstandard units of measure; for instance, interlocking cubes or paper clips may be used to determine length. In grade 1, students use only nonstandard measurement as they build understanding of how to observe, compare, and communicate dimensions and quantity. This is a critical prelude to measuring with standard units.

An essential skill of measurement is estimating. Encourage students to estimate before they measure, whether in nonstandard or standard units. Estimation provides opportunities for students to take risks, use prior knowledge, and enhance their measuring skills by comparing estimates and actual results.

Communicating, Analyzing, and Interpreting

In science and technology, communication is achieved through diagrams, graphs, charts, maps, models, and symbols, as well as written and spoken language. Communicating includes:

- reading and interpreting data from tables and charts
- constructing tables and charts
- reading and interpreting data from pictographs
- constructing pictographs
- constructing labelled diagrams
- constructing models
- using oral and written language
- sequencing and grouping events, objects, and data according to attributes

▶

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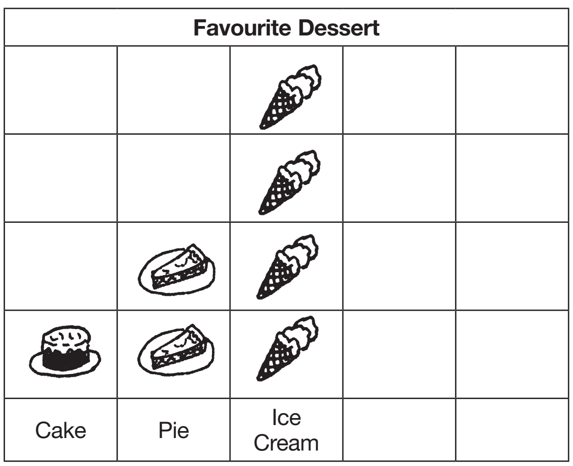
When presenting students with charts and graphs, or when students make their own charts and graphs as part of a specific activity, the following guidelines should be followed:

- A **pictograph** has a title and information on one axis that denotes the items being compared. (Note that the first letter of each word of both the title and the axis text is capitalized.) There is generally no graduated scale or heading for the axis representing numerical values.



- A **tally chart** is a means of recording data as an organized count. The count is grouped in fives so the total can easily be determined by counting by fives.

Favourite Sport		
Sport	**Tally**	**Total**
baseball	𝍸 |	6
hockey	𝍸 𝍸	10
soccer	𝍸 𝍸 ||	12

- A **chart (table)** has an appropriate title, and both columns and rows need specific headings. (Note that the first letter of each word in all titles and headings is capitalized.) In some cases, pictures can be used alongside or in place of words to make the chart easier for young students to understand. Charts can be made in the form of checklists or can include room for additional written information and data.

Checklist Chart

Which Substances Dissolve in Water?		
Substance	**Dissolves in Water**	**Does Not Dissolve in Water**
Beads		√
Sugar	√	
Drink Mix	√	
Rice		√
Pepper		√

Data Chart

Local Snowfall		
Month	**2016/2017 Snowfall (cm)**	**Average Snowfall (cm)**
October	7	5
November	9	8
December	23	20
January	29	25
February	16	18
March	11	10

Communicating also involves using the language and terminology of science and technology. Encourage students to use the appropriate vocabulary related to their investigations (e.g., *object, metal, pliable, absorbent, characteristic*). The language of science and technology also includes terms such as *predict, infer, estimate, measure, experiment*, and *hypothesize*. Use this vocabulary regularly throughout all activities and encourage students to do the same. As students become proficient at reading and writing, they can also be encouraged to use this vocabulary in written form. In each unit, students develop whole-class glossaries (word walls), and their own *pictionary* (picture dictionary) in which they ▶

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can record the terms they have learned and define them in their own words.

Predicting

Predicting refers to the question, "What do you think will happen?" For example, ask students to predict what they think will happen to a blown-up balloon that is placed in a basin of water. It is important to provide opportunities for students to make predictions and for them to feel safe doing so.

Inferring

In a scientific context, inferring generally refers to asking why something occurs. For example, ask students to infer why a blown-up balloon floats when placed in a basin of water. Again, it is important to encourage students to take risks when making inferences. Instead of explaining scientific phenomena to them, give students opportunities to infer for themselves using a variety of perspectives, and then build their knowledge base through inquiry and investigation.

Inquiry Through Investigation and Experimentation

When investigations and experiments are conducted in the classroom, it is essential to plan and record both the process and the results. The traditional scientific method uses the following format:

- purpose: what we want to find out, or a testable question we want to answer
- hypothesis: a prediction; what we think will happen and why
- materials: what we used to conduct the experiment or investigation
- method: what we did
- results: what we observed and measured
- conclusion: what we found out
- application: how we can use what we learned

This method of recording investigations may be used in later school years. However, in primary grades, it is more useful to focus on a narrative style of reporting that includes the following:

- what we want to know
- what we think might happen
- what we used
- what we did
- what we observed
- what we found out

A simpler four-question narrative that includes the following questions may also be used with any age group.

1. What was I looking for? (Describe the question you were trying to answer or the hypothesis/prediction you were testing.)
2. How did I look for it? (Tell what you did. Include materials and method.)
3. What did I find? (Describe observations and data.)
4. What does this mean? (Draw conclusions and consider applications to real life.)

This narrative may be completed in a variety of ways: oral discussion as a class, recording findings as a class, having students use drawings and writing to communicate independently, or a combination of these.

Throughout ***Hands-On Science and Technology***, a variety of methods are used to encourage students to communicate the inquiry process, including those listed above. Formats such as concept maps and other graphic organizers are also used.

Engineering Design Process

Throughout ***Hands-On Science and Technology***, students have opportunities to use technological problem-solving skills to design and construct objects. For example, in unit 1, lesson 7, students design and construct models ▶

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of an animal's environment to show how the animal meets its basic needs.

The engineering design process involves having students seek solutions to practical problems. The process includes the following steps:

1. **Identify a need**. Recognize practical problems and the need to solve them.
2. **Create a plan**. Seek alternate solutions to a given problem, create a plan based on a chosen solution, and record the plan in writing and using labelled diagrams.
3. **Develop a product or prototype**. Construct an object that solves the given problem, and use predetermined criteria to test the product.
4. **Communicate the results**. Identify and make improvements to the product and explain the changes.

The engineering design process also involves research and experimentation.

When the engineering design process is featured in a lesson of ***Hands-On Science and Technology***, the following icon is used:

Inquiry Through Research

In addition to hands-on inquiry, research is another aspect of inquiry that involves finding, organizing, and presenting information related to a specific topic or question. Even at a young age, students can begin to research topics studied in class if they are provided with support and guidelines. This is also an effective way to integrate oral communication, reading, writing, and media literacy expectations from the Ontario language curriculum for grades 1–8 (2006).

Guided research is a teaching and learning strategy that is encouraged throughout ***Hands-On Science and Technology***. Guided research provides an opportunity for students to seek further information about subjects of inquiry, personal interests, or topics of their choice. Accordingly, students are empowered and engaged in the process. Guided research encourages students and teachers to do the following:

Students	Teachers
■ ask questions of interest related to a topic being studied by the class ■ choose resources ■ collect information ■ make a plan to present findings ■ present research in a variety of ways	■ provide opportunities for students to ask questions of personal interest ■ provide access to appropriate resources. ■ model and support the research process ■ offer opportunities for students to present their findings in a variety of ways and to a variety of audiences

In ***Hands-On Science and Technology***, the approach to scientific inquiry and research is one of gradual release, where the teacher provides substantial support in initial inquiry experiences, and gradually presents students with more and more opportunities for directing their own research. Suggestions for guiding research are presented regularly throughout ***Hands-On Science and Technology***.

Online Considerations

As our technological world continues to expand at an accelerating rate and information is increasingly available online, students will turn to the internet more and more. Accordingly, ***Hands-On Science and Technology*** is replete with opportunities for students to use online resources for research and investigation. Discuss online safety protocols with students and be vigilant in supervising their internet use. Review websites and bookmark those that are appropriate for student use.

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Discuss plagiarism with students; explain that copying information word for word—from a book, the internet, or any other resource—is wrong. Such information should usually be paraphrased in the student's own words (sometimes including short direct quotations marked as such), and the source of the information cited. Photos, drawings, figures, and other images found online should also only be used with permission and citation of the source. Alternatively, students can source images for which permission has already been granted for use, such as through Creative Commons Canada, a nonprofit organization that "promotes and enables the sharing of knowledge and creativity…[and] produces and maintains a free suite of licensing tools to allow anyone to easily share, reuse, and remix materials with a fair 'some rights reserved' approach to copyright." See <http://ca.creativecommons.org>.

Addressing Students' Early Literacy Needs

The inquiry process involves having students ask questions and conduct investigations and research to answer these questions. At the grade 1 level, students may benefit from support for research, reading, and writing. Consider having volunteers, student mentors, or educational assistants help students during these processes. In some cases, such helpers may also scribe for students to communicate their findings.

References

Creative Commons Canada. http://ca.creativecommons.org.

Ontario Ministry of Education. *The Ontario Curriculum, Grades 1–8: Language,* 2006. http://www.edu.gov.on.ca/eng/curriculum/elementary/language18currb.pdf.

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The *Hands-On Science and Technology* Assessment Plan

Hands-On Science and Technology provides a variety of assessment tools that enable teachers to build a comprehensive and authentic daily assessment plan for students. Based on research about the value of quality classroom assessment (Davies, 2011), lessons include suggestions for authentic assessment, which includes assessment for learning, assessment as learning, and assessment of learning.

Ontario's policy on assessment is outlined in the document *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools* (2010). The document describes the roles of teachers and students in the learning and assessment process:

> In a traditional assessment paradigm, the teacher is perceived as the active agent in the process, determining goals and criteria for successful achievement, delivering instruction, and evaluating student achievement at the end of a period of learning. The use of assessment for the purpose of improving learning and helping students become independent learners requires a culture in which student and teacher learn together in a collaborative relationship, each playing an active role in setting learning goals, developing success criteria, giving and receiving feedback, monitoring progress, and adjusting learning strategies. The teacher acts as a "lead learner," providing support while gradually releasing more and more responsibility to the student, as the student develops the knowledge and skills needed to become an independent learner. (p. 30)

Hands-On Science and Technology supports Ontario's *Growing Success* policy by focusing assessment suggestions on the learning process during performance-based activities. Although many of the suggestions involve student writing, there are no tests or quizzes included with the units. This is because each lesson includes such a wide variety of suggested activities for teachers to choose from that tests and quizzes could not possibly reflect the specific tasks in which students participated. Since assessment needs to be directly connected to learning, ***Hands-On Science and Technology*** suggests assessment strategies that can be used in a variety of ways, and that can be modified for use with individual students or groups of students.

The primary purpose of assessment is to improve student learning. Assessment *for* learning provides students with descriptive feedback and coaching for improvement. Assessment *as* learning helps students self-assess by developing their capacity to set their own goals, monitor their own progress, determine next steps, and reflect on their learning. Assessment *of* learning is summative in nature and is conducted by teachers to identify student progress in relation to learning expectations. The challenge for teachers is to integrate assessment seamlessly with other learning goals. The Ontario assessment model, described in *Growing Success*, uses the following process:

- **Establish learning goals from curriculum expectations**. Develop learning goals from curriculum expectations and include them in lessons, using student-friendly language. Share them with students and use them to guide instruction.
- **Develop success criteria**. Establish success criteria, using assessment task exemplars of student work or the Achievement Chart for Science and Technology (provided on page 34) from *The Ontario Curriculum, Grades 1–8: Science and Technology* (2022), or in collaboration with students. Write these descriptors in student-friendly language to help students understand what successful learning looks like.
- **Provide descriptive feedback**. In conversations with students, identify what criteria they have and have not met, and provide any needed instruction. Work with

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students to determine next steps and how they can improve. This may include differentiating instruction.

- **Use information for peer and self-assessment**. Have students assess their own work and the work of their peers to determine what still needs to be done.
- **Establish individual goals**. Encourage students to determine what they need to learn next and how to get there.

Hands-On Science and Technology encourages assessment strategies that infuse these five elements of the Ontario assessment model, providing assessment suggestions, rubrics, and templates that can be used during the teaching/learning process. Assessment suggestions include tasks related to assessment for learning, assessment as learning, and assessment of learning.

Assessment *for* Learning AfL

It is important to assess students' understanding before, during, and after a lesson. This information will help you determine students' needs and plan next steps in instruction.

Begin by finding out what students already know. This will allow you to identify misconceptions students may have about science and technology concepts and can help when making connections to new learning.

To assess students as they work, use the assessment for learning suggestions provided with many activities. While observing and conversing with students, consider using one or both of the following templates to record assessment for learning data:

- **Anecdotal Record:** To gain an authentic view of student progress, it is critical to record observations *during* lessons. The ANECDOTAL RECORD template (page 30) provides a format for recording observations about individuals or groups.
- **Individual Student Observations**: To focus more on individual students over a longer period of time, consider using the INDIVIDUAL STUDENT OBSERVATIONS template (page 30). This template provides more space for comments and is especially useful during conferences, interviews, or individual student performance tasks.

Assessment *as* Learning AaL

It is important for students to reflect on their own learning in relation to science and technology. For this purpose, a STUDENT SELF-ASSESSMENT template is provided (page 30), as well as a STUDENT REFLECTIONS template (page 30).

In addition, the SCIENCE AND TECHNOLOGY JOURNAL (page 31) can be used to encourage students to reflect on their own learning. Print several copies for each student, cut the pages in half, add a cover, and bind the pages together. Students can create their own title pages for their journals. For variety, have students use the blank reverse side of each page for other reflections, such as drawing or writing about:

- new science and technology challenges
- favourite science and technology activities
- real-life experiences with science and technology
- new terminology
- new places explored during investigations

Students may also journal in other ways, such as by adding notes to their portfolios, or by keeping online science and technology blogs or journals to record successes, challenges, and next steps relating to the learning goals.

NOTE: The SCIENCE AND TECHNOLOGY JOURNAL template is provided as a suggestion, but journals can also be made from simple notebooks or recycled paper.

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When working in groups, students will benefit from reflecting on their ability to listen to others respectfully, share ideas, and participate actively in the inquiry process. For this purpose, use the COLLABORATION SKILLS SELF-ASSESSMENT template (page 31).

Assessment *of* Learning (AOL)

Assessment *of* learning provides a summary of student progress related to accomplishing the learning goals at a particular point in time. To draw conclusions about what a student knows and can do, it is important to gather a variety of assessment data. Consider collecting student products, observing processes, and having conversations with students. Determine which student work is formative and which is summative, and use only the most recent and consistent evidence.

Assessment *of* learning suggestions are provided with the culminating lesson of each unit of ***Hands-On Science and Technology***. To record student results, use the ANECDOTAL RECORD template (page 30), the INDIVIDUAL STUDENT OBSERVATIONS template (page 30), and the RUBRIC (page 32).

Always assess a student's individual accomplishments, rather than the work they do in a group. However, you may assess *how* an individual student works within a group. Such skill development includes the ability to listen to others respectfully, share ideas, and participate actively in the inquiry process. For this purpose, use the COLLABORATION SKILLS TEACHER ASSESSMENT template (page 31).

As mentioned on page 25, ***Hands-On Science and Technology*** does not provide tests and quizzes for units of study. Any formal assessment of students needs to be connected to the specific skills and concepts focused on during lessons, and since each teacher will select different activities from those provided within each lesson, assessment tasks will look different in each classroom. Consider focusing on the various assessment suggestions provided and using the Achievement Chart for Science and Technology on page 34 as your guide.

Performance Assessment

Both assessment *for* learning and assessment *of* learning include performance assessment. Performance assessment is planned, systematic observation and assessment based on students actually doing a specific science and technology activity. Teacher- or teacher/student-created rubrics can be used to assess student performance.

Use the SAMPLE RUBRIC and the RUBRIC template (page 32) for this assessment. For any specific activity, before the work begins, discuss with students success criteria for completing the task. This will ensure that the success criteria relate to the lesson's learning goals. Record these criteria on the rubric.

When conducting assessment *for* learning, review the rubric with students to determine strengths, challenges, and next steps related to learning goals.

When conducting assessment *of* learning, use the rubric to determine summative data. For example, use the rubric criteria to assess student performance, and students can receive a check mark for each criterion accomplished to determine a rubric score from a total of four marks. These rubric scores can then be transferred to the RUBRIC CLASS RECORD template (page 32).

When using the rubric for assessment *of* learning, consider using four levels of achievement to correlate with the Achievement Chart for Science and Technology (page 34).

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For example:

1. achievement that falls much below the provincial standard
2. achievement that approaches the provincial standard
3. achievement that meets the provincial standard
4. achievement that surpasses the provincial standard

Hands-On Science and Technology provides numerous opportunities for students to apply their skills. Consider using the same levels of achievement throughout the year to track student learning and determine when students have a thorough understanding and demonstrate in-depth application of concepts and skills.

Portfolios

A portfolio is a collection of work that shows evidence of a student's learning. There are many types of portfolios—the showcase portfolio and the progress portfolio are two popular formats. *Showcase portfolios* highlight the best of students' work, with students involved in selecting pieces and justifying their choices. *Progress portfolios* reflect students' progress as their work improves and aim to demonstrate in-depth understanding of the materials over time.

Select, with student input, work to include in a science and technology portfolio or in a science and technology section of a multi-subject portfolio. Selections should include representative samples of student work in all types of science and technology activities.

Use the PORTFOLIO TABLE OF CONTENTS template (page 32) and PORTFOLIO ENTRY RECORD (page 33) to organize the portfolio.

Indigenous Perspectives on Assessment

From an Indigenous perspective, assessment is community-based, qualitative, and holistic, and includes input from all the people who influence an individual student's learning—parents, caregivers, Elders, Knowledge Keepers, community members, and teachers. An assessment that includes all these perspectives provides a balanced understanding of what represents success for Indigenous students and their family/community. A strong partnership between parents/guardians/community and school improves student achievement. Be aware that some Indigenous students may feel apprehensive about a formal process of assessment; others may find that Western achievement goals do not fit their worldview. In ***Hands-On Science and Technology***, consideration has been given to assessment from an Indigenous perspective. The following suggestions support this perspective:

- Consider learning and assessment in a holistic way, acknowledging that each student will find identity, meaning, and purpose through connections to the community, the natural world, and values such as respect and gratitude.
- Incorporate family and community in learning and assessment. Include parents/caregivers, siblings, grandparents, aunts and uncles, cousins, and community members such as Elders, Knowledge Keepers, daycare staff, babysitters, and coaches. For this purpose, consider using the FAMILY AND COMMUNITY CONNECTIONS: ASSESSING TOGETHER template (page 31). After any lesson or module, students can take home a copy of this template to complete with family or community members (with permission). This template can also be completed by students in pairs, to enhance the sense of community in the classroom.

- Have students take home one of their self-assessment templates (STUDENT SELF-ASSESSMENT, STUDENT REFLECTIONS, SCIENCE AND TECHNOLOGY JOURNAL, or COLLABORATION SKILLS SELF-ASSESSMENT) to explain it to a family or community member. These templates can also be shared with a peer to enhance the sense of community within the school.

Evidence of Student Achievement Levels for Evaluation

At the end of each unit, determine achievement levels for each student. Assessment *of* learning information gathered throughout the unit can be used to identify these levels, according to the Ontario Achievement Chart for Science and Technology. The most recent and consistent assessment information should be used to determine achievement levels. The Achievement Chart for Science and Technology is provided on page 34.

Important Note to Teachers

Throughout ***Hands-On Science and Technology***, suggestions are provided for assessment *for* learning, assessment *as* learning, and assessment *of* learning. Keep in mind that these are merely suggestions. Use the assessment strategies presented in a wide variety of ways, and build an effective assessment plan using these assessment ideas, as well as your own valuable experiences as teachers.

References

Davies, Anne. *Making Classroom Assessment Work* (4rd ed.). Courtenay, BC: Connections Publishing, 2020.

Ontario Ministry of Education. *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools; Covering Grades 1 to 12*, 2010. http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf.

Ontario Ministry of Education. *The Ontario Curriculum, Grades 1–8: Science and Technology*, 2022. https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology.

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Achievement Chart for Science and Technology

The achievement chart identifies four categories of knowledge and skills and four levels of achievement in science and technology.

1. Knowledge and Understanding – Subject-specific content acquired in each grade (knowledge), and the comprehension of its meaning and significance (understanding)				
Categories	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	The student:			
Knowledge of content (e.g., facts, terminology, definitions)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Understanding of content (e.g., concepts, ideas, theories, principles, procedures, processes)	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content
2. Thinking and Investigation – The use of critical and creative thinking skills and inquiry and problem-solving skills and/or processes				
Categories	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	The student:			
Use of initiating and planning skills and strategies (e.g., formulating questions, identifying the problem, developing hypotheses, scheduling, selecting strategies and resources, developing plans)	uses initiating and planning skills and strategies with limited effectiveness	uses initiating and planning skills and strategies with some effectiveness	uses initiating and planning skills and strategies with considerable effectiveness	uses initiating and planning skills and strategies with a high degree of effectiveness
Use of processing skills and strategies (e.g., performing and recording; gathering evidence and data; examining different points of view; selecting tools, equipment, materials, and technology; observing; manipulating materials; proving)	uses processing skills and strategies with limited effectiveness	uses processing skills and strategies with some effectiveness	uses processing skills and strategies with considerable effectiveness	uses processing skills and strategies with a high degree of effectiveness
Use of critical/creative thinking processes, skills, and strategies (e.g., analysing, interpreting, problem solving, evaluating, forming and justifying conclusions on the basis of evidence, developing solutions, considering diverse perspectives)	uses critical/creative thinking processes, skills, and strategies with limited effectiveness	uses critical/creative thinking processes, skills, and strategies with some effectiveness	uses critical/creative thinking processes, skills, and strategies with considerable effectiveness	uses critical/creative thinking processes, skills, and strategies with a high degree of effectiveness

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3. Communication – The conveying of meaning through various forms				
Categories	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	The student:			
Expression and organization of ideas and information in oral, visual, and/or written forms (e.g., diagrams, models, articles, project journals, reports)	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
Communication for different audiences (e.g., peers, adults, community members) and purposes (e.g., to inform, to persuade) in oral, visual, and/or written forms	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness
Use of conventions, vocabulary, and terminology of the discipline in oral, visual, and/or written forms (e.g., symbols, formulae, International System of Units)	uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	uses conventions, vocabulary, and terminology of the discipline with some effectiveness	uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
4. Application – The use of knowledge and skills to make connections within and between various contexts				
Categories	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	The student:			
Application of knowledge and skills (e.g., concepts and processes; procedures related to the safe use of tools, equipment, materials, and technology; investigation skills) **in familiar contexts**	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
Transfer of knowledge and skills (e.g., concepts and processes, safe use of equipment and technology, investigation skills) **to new contexts**	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness

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Making connections within and between various contexts (e.g., connections between sciences; connections to everyday and real-life situations; connections among concepts within science and technology; connections involving use of prior knowledge and experience; connections among science and technology and other disciplines, including other STEM [science, technology, engineering, and mathematics] subjects)	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness
Proposing courses of practical action to deal with problems relating to our changing world	proposes courses of practical action of limited effectiveness	proposes courses of practical action of some effectiveness	proposes courses of practical action of considerable effectiveness	proposes highly effective courses of practical action

Source: Ontario Ministry of Education. "Assessment and Evaluation of Student Achievement." Elementary Science and Technology (2022). https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology/context/evaluation.

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Unit 1

Needs and Characteristics of Living Things

About This Unit

This unit of ***Hands-On Science and Technology for Ontario, Grade 1*** focuses on the characteristics and basic needs of living things. Throughout the unit, students will demonstrate an understanding of the basic needs of animals and plants (e.g., food, air, water). Students will investigate the characteristics of animals and plants and gain an awareness that both animals and plants depend on their environment to meet their basic needs. In addition, students will learn to describe the requirements for good health for humans.

Planning Tips for Teachers

- Since it is not possible to bring all types of plants and animals into the classroom, collect pictures of living things. Consider sending a letter home to students' families to request help with this project. Sources for pictures of animals and plants are:
  - wall calendars
  - magazines (e.g., *Canadian Geographic*, *National Geographic*, *Chickadee*, *Owl*, *Chirp*)
  - Google Images (be sure to monitor any Google Image searches students conduct)
- Contact local nature centres, conservatories, botanical gardens, zoos, garden clubs, pet shelters, government organizations (e.g., Ministry of Natural Resources and Forestry), and other similar nongovernment organizations. These organizations can often provide resources (and other services) about animals and plants in your community. Put feelers out to find any resident experts within the broader school community. This is a great way to expand resources and make connections in the community.
- Collect a variety of reading materials at a range of reading levels appropriate for your class. Include fiction and nonfiction resources.
- If possible, arrange time for students to visit animal and plant websites. Always preview any websites students may use.
- Collect shoeboxes or cereal boxes, which will be required in lesson 7, for students to create dioramas of animal habitats. Send home a letter to students' families in advance to ask for help collecting the boxes.
- Have students make land-based journals for use throughout the unit. Use notebooks with sturdy covers or drawing paper and clipboards. Provide a zipper-lock bag for each student to carry their journal and journal supplies (e.g., pencils, sharpeners, pencil crayons [rather than markers, which will bleed if wet], stretch gloves [for journaling on cooler days]).
- Keep all charts and displays created during each lesson, as well as any other completed work. These are often referenced in subsequent lessons.
- Consider recording each lesson's guided inquiry question (e.g., on a sentence strip) for display throughout related investigations.
- Add unit-specific materials to the STEM Makerspace that encourage learning about the characteristics of living things, in addition to the general materials listed in the introduction to ***Hands-On Science and Technology for Ontario, Grade 1*** (see page 15). Include items such as natural materials (e.g., leaves, sticks, rocks, sand, soil), as well as equipment such as magnifying glasses, tweezers, and measuring devices.

SAFETY NOTE: Engage in a discussion about safety and respect at the STEM Makerspace with students before beginning this unit. Consider small parts and potential hazards for students of all ages and abilities who will have access to the Makerspace area.

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Coding

Familiarize yourself with some coding programs that can be used in the classroom, such as ScratchJr, a free app designed for student use, and Code.org, a website that offers free coding courses and activities.

No previous coding experience is necessary to engage students in coding activities. Use the suggested coding activities throughout the unit as an opportunity to learn alongside students. Making mistakes and using logical reasoning to fix them (debugging) are key parts of learning to code. Provide students with plenty of free exploration time when introducing a new program so they can discover its features before working on a specific task.

NOTE: For more information about coding, see "What Is Coding?" in the Introduction on page 4.

Prepare unplugged coding kits for students to use with the Coding Connections activities throughout the unit. Unplugged coding kits are easy to make using common classroom materials. Include some of the following items in your kits:

- **Loose Parts**: In unplugged coding, students use loose parts as obstacles or goals. Consider including items such as coloured tiles or chips, two-sided counters, multi-coloured linking cubes or centimetre cubes, LEGO pieces, game pawns and pieces, small toys, stickers, natural materials (e.g., pebbles, polished stones, shells, pinecones, woodchips), printable images related to the unit's theme, paper, pencils, crayons, markers, and scissors (so students can draw and cut out their own images). Be creative and use what is available. A printable set of images is included with this unit (page 42). Have students draw additional images on the blank cards (page 43).
- **Grids**: Students use grids to design challenges and execute code. In the unplugged coding kits, consider including chart paper with gridlines, printable grids of various sizes, game boards with squares (e.g., checkers, chess), and hundreds charts. Create larger grids on tabletops, carpets, or floors using masking tape or painter's tape. To create a foldable grid that is easy to store, paint or tape a grid onto a blanket, sheet, tablecloth, or drop cloth. Use sidewalk chalk or paint to create grids in outdoor learning spaces. A printable blank grid is included with this unit (page 42).
- **Coding Cards**: Students use coding cards to create algorithms (sequences of actions) that direct the movements of objects or people along the grid.

  Create a DIY set of coding cards by drawing or printing images on cardstock, using suggestions and examples provided with the lessons in this unit. Include directional arrows (left, right, up, down), arrows with elbows for right turns and left turns, and stop and go cards (e.g., a red stop sign, a green go sign). As students become more familiar with coding, consider allowing them to add cards to the deck. Ask them to explain their reasons for including the new cards. To help students organize their coding cards when initially creating sequences, provide 5 frames or 10 frames to use as a graphic organizer. A printable set of coding cards is included with this unit (page 42) and free printable sets of coding cards are available online; for example, ScratchJr offers printable images of coding blocks for download: <https://www.scratchjr.org/teach/resources>.

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Indigenous Knowledge and Perspectives

Incorporate Indigenous knowledge and perspectives into lessons whenever possible. Traditional teachings for many Indigenous Peoples that connect to the needs and characteristics of living things include the following:

- It is important to have a respectful relationship with nature, with an intention to sustain natural resources for generations to come.
- All life—plant, animal, and human—lives in harmony and all living things depend upon one another for survival.
- Humans have special relationships with animals, which are seen as teachers, guides, and companions, and are key to human survival.
- Life has a cyclical nature. Plants and animals (e.g., insects, amphibians, fish, birds, reptiles, mammals) have daily, annual, and multi-year cycles.
- We borrow the land from those to be born seven generations from now, and we must ensure we have not caused irreversible damage.
- Many illnesses can be mitigated by medicinal plant or animal remedies. Consider having a local Elder or Knowledge Keeper share this knowledge with students.

Science and Technology Vocabulary

Throughout this unit, use—and encourage students to use—vocabulary such as:

- *alive, animal, body part, bones, brain, characteristic, die, environment, food, grow, hearing, heart, human, living thing, lungs, muscles, needs, offspring, plant, reproduce, senses, sight, smell, space, stomach, taste, touch*

Infuse vocabulary related to scientific inquiry skills into daily lessons. Display this vocabulary in the classroom throughout the year, as it relates to all science and technology units. Have students determine which skills they are being asked to use as they work through particular lessons. Discuss what the skill looks and sounds like as students explore and investigate. Vocabulary related to scientific and technological inquiry skills include:

- *ask, brainstorm, collect, compare, construct, create, describe, estimate, explain, explore, find, follow, graph, identify, improve, investigation, match, measure, observe, order, plan, predict, record, research, select, test*

In lesson 1, have students start a *pictionary*—a picture dictionary in which they can record new vocabulary introduced throughout the unit.

Also in lesson 1, create a science and technology word wall for the unit on a bulletin board, poster paper, or chart paper. Record new vocabulary on the word wall as it is introduced. Ensure the word wall is located where all students can see it and refer to the words during activities and discussion.

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NOTE: Include terminology in languages other than English on the class word wall and pictionary. This is a way of acknowledging and respecting students' cultural backgrounds, while enhancing learning for all students. Resources such as Google Translate and Microsoft Translator can be used to assist with this.

To translate terms into Indigenous languages, there are a variety of online dictionaries available. For example:

- The Ojibwe People's Dictionary <https://ojibwe.lib.umn.edu/>
- Freelang Mohawk-English Dictionary <https://www.freelang.net/online/mohawk.php>
- Nishnaabemwin Dictionary <https://dictionary.nishnaabemwin.atlas-ling.ca/#/help>
- First Voices: Explore Languages <https://www.firstvoices.com/explore/FV/sections/Data>
- First Voices: Language Apps <https://www.firstvoices.com/content/apps>

Online dictionaries are also available for other languages that may be reflective of the class population.

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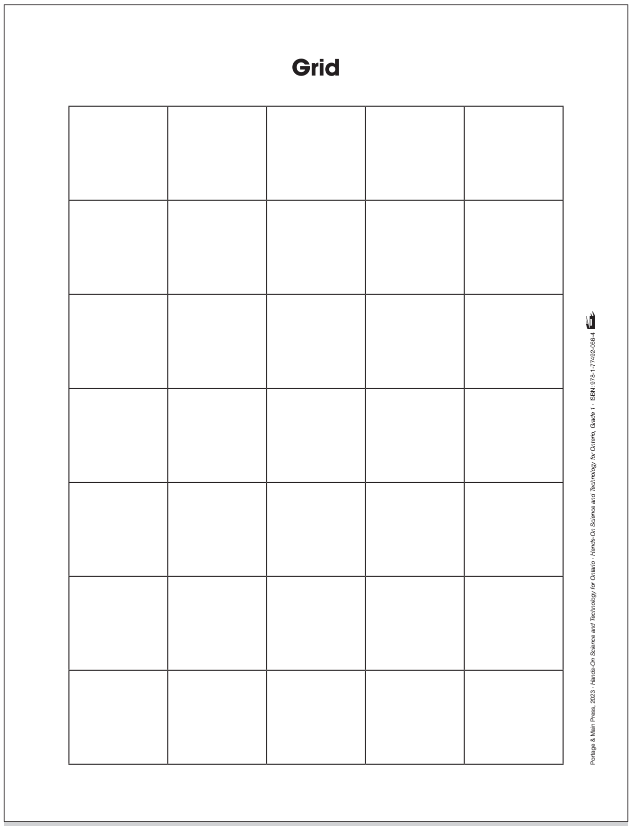
Grid



Coding Cards

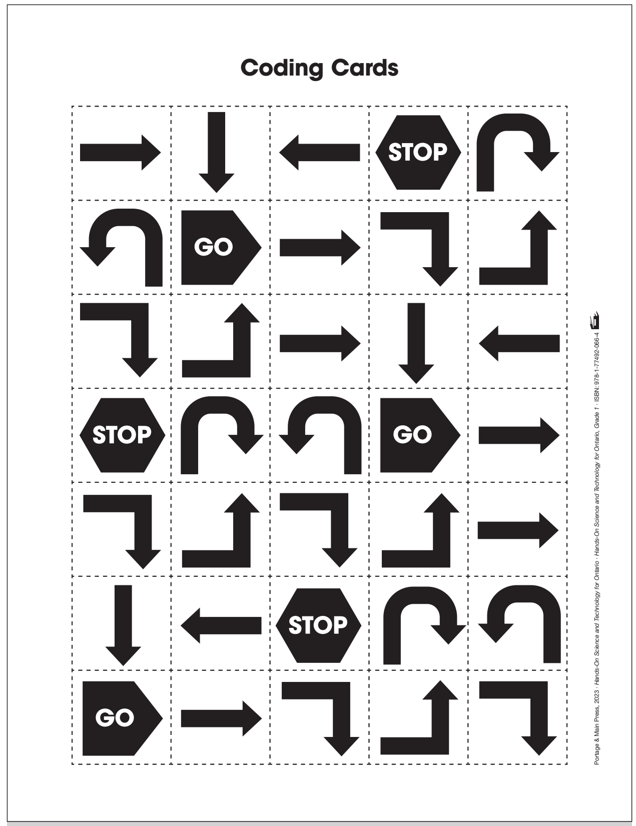


Image Cards: Living Things

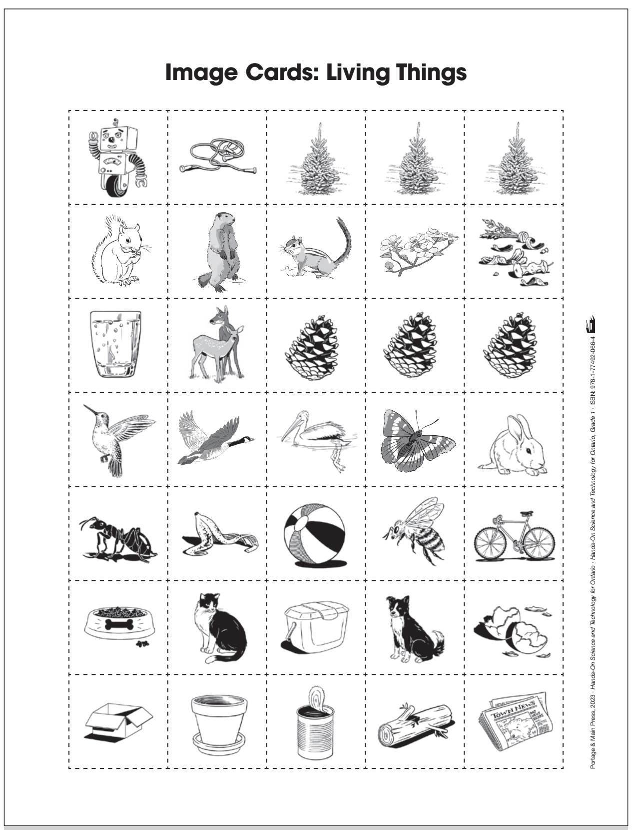
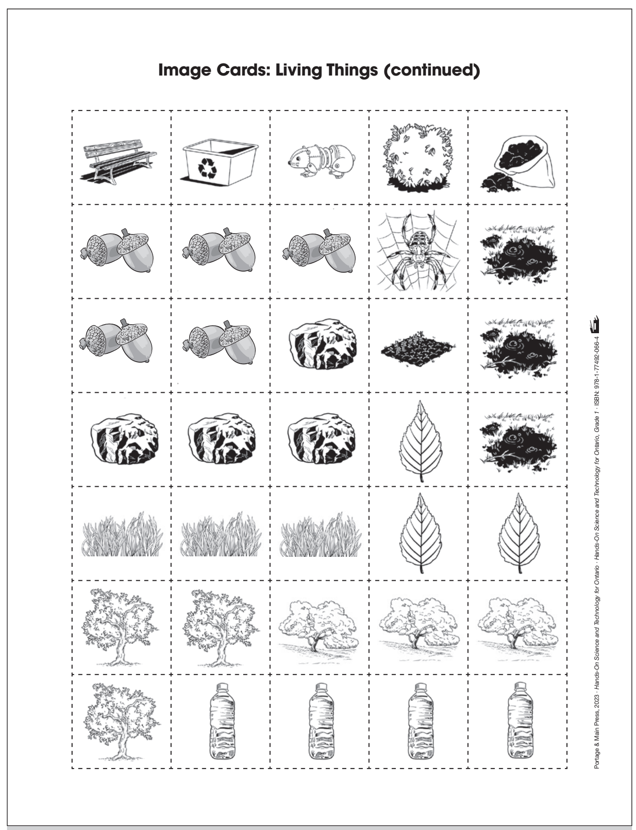
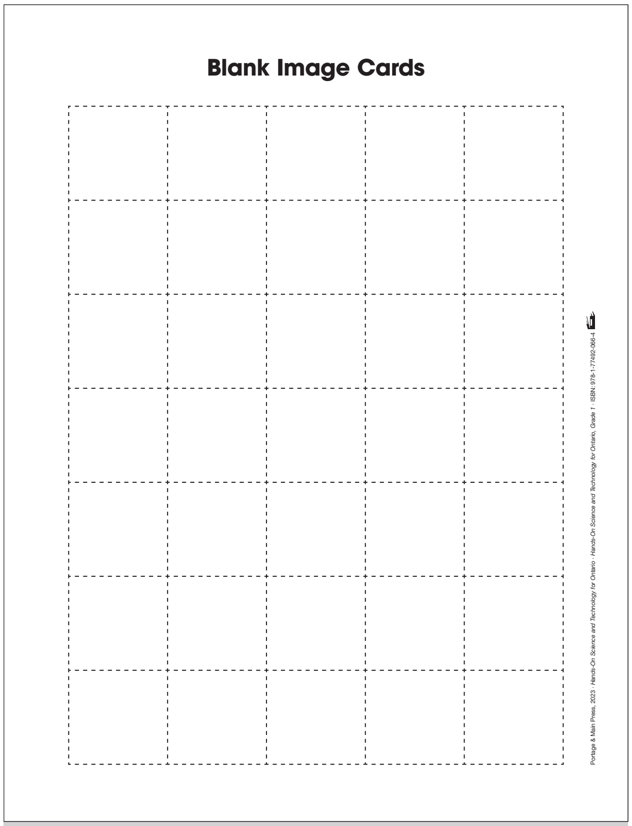


Image Cards: Living Things



Blank Image Cards



Blank Image Cards

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Curriculum Correlation Chart

Overall Expectation	Specific Expectation	Lesson									
		1	2	3	4	5	6	7	8	9	10
B1. Relating Science and Technology to Our Changing World: assess the importance of a healthy environment for living and nonliving things, and the responsibilities of humans in contributing to a healthy environment	**B1.1** describe changes or problems that could result from the loss of living and nonliving things that are part of everyday life, while taking different perspectives into consideration										√
	B1.2 identify actions that can be taken to contribute to a healthy environment										√
B2. Exploring and Understanding Concepts: demonstrate an understanding of the basic needs and characteristics of living things, including humans	**B2.1** demonstrate an understanding of the natural environment as a place where living and non-living things are interconnected	√	√					√		√	√
	B2.2 identify the basic needs of living things, including the need for air, water, food, heat, shelter, and space	√	√				√	√	√	√	
	B2.3 identify the physical characteristics of various plants and animals, including humans, and explain how these characteristics help the plants and animals meet their basic needs			√	√	√	√	√			
	B2.4 identify the location and the function of various parts of the human body, including sensory organs			√	√	√					
	B2.5 describe the characteristics of a healthy environment, including clean air and water and nutritious food, and how a healthy environment enables living things to meet their needs										√
	B2.6 describe ways in which living things provide for the needs of other living things						√	√	√	√	

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Resources for Students

NOTE: Resources marked with an asterisk are considered authentic resources. This means that traditional stories reference the Indigenous community they came from, they state the individual that shared the story and gave permission for the story to be used publicly, and the person who originally shared the story is Indigenous. Stories that are works of fiction were written by an Indigenous author. For more information, please see *Authentic First Peoples Resources* at <http://www.fnesc.ca/>.

Books

Living Things Need Food, Karen Aleo (Pebble, 2020).

What I See, Alex Appleby (Gareth Stevens Publishing, 2015).

What I Taste, Alex Appleby (Gareth Stevens Publishing, 2015).

What I Touch, Alex Appleby (Gareth Stevens Publishing, 2015).

The Amazing Life Cycle of Butterflies, Kay Barnham (Barron's Educational Series, 2018).

The Amazing Life Cycle of Plants, Kay Barnham (Barron's Educational Series, 2018).

Morning on the Lake, Jan Bourdeau Waboose (Kids Can Press, 2021).*

A Day With Yayah, Nicola I. Campbell (Tradewind Books, 2017).*

Stand Like a Cedar, Nicola I. Campbell (HighWater Press, 2020).*

Creation Story: Sky Woman, Michelle Corneau (Strong Nations Publishing, 2016).*

Beth the Butterfly Pollinates, Rebecca Donnelly (Jump!, 2022).

And Then the Seed Grew, Marianne Dubuc (Kids Can Press, 2019).

Living or Nonliving?, Abbie Dunne (Capstone Press, 2017).

Animal Homes, Shira Evans (National Geographic Kids, 2018).

The Best Part of Me: Children Talk About Their Bodies in Pictures and Words, Wendy Ewald (Little, Brown, 2002).

Bodies Are Cool, Tyler Feder (Dial Books for Young Readers, 2021).

Squirrel's Family Tree, Beth Ferry (Orchard Books, 2019).

Wild Berries, Julie Flett (Simply Read Books, 2013).*

Taking Care of Mother Earth, Leanne Flett Kruger (Theytus Books, 2018).*

Growing Plants, Lois Fortuna (Gareth Stevens Publishing, 2016).

The Bear's Medicine, Clayton Gauthier (Theytus Books, 2019).*

What About Ladybugs?, Celia Godkin (Fitzhenry and Whiteside, 2015).

Amazing Pop-Up Human Body, Marie Greenwood (DK Children, 2016).

A Walk on the Tundra, Rebecca Hainnu (Inhabit Media Inc., 2011).*

A Tree Is a Home, Pamela Hickman (Kids Can Press, 2021).

Blueprint for a Bladder, Kirsty Holmes (Enslow Publishing, 2020).

Build a Brain, Kirsty Holmes (Enslow Publishing, 2021).

Lay Out the Lungs, Kirsty Holmes (Enslow Publishing, 2021).

Parts of a Heart, Kirsty Holmes (Enslow Publishing, 2021).

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Set Up the Skeleton, Kirsty Holmes (Enslow Publishing, 2021).

Shape of a Stomach, Kirsty Holmes (Enslow Publishing, 2020).

Zoe and the Fawn, Catherine Jameson (Theytus Books, 2019).*

Caterpillar and Bean, Martin Jenkins (Candlewick Press, 2019).

Homes in the Wild: Where Baby Animals and Their Parents Live, Lita Judge (Roaring Brook Press, 2019).

Sweetest Kulu, Celina Kalluk (Inhabit Media, 2018).*

Living Things and Nonliving Things: A Compare and Contrast Book, Kevin Kurtz (Arbordale Publishing, 2017).

My City Speaks, Darren Lebeuf (Kids Can Press, 2021).

The Eagle Feather, Kevin Locke (Medicine Wheel Education, 2019).*

The Mess That We Made, Michelle Lord (Flashlight Press, 2020).

My Five Senses, Terri Mack (Strong Nations Publishing, 2016).

Listen, Holly M. McGhee (Roaring Brook Press, 2019).

Nanabosho series, Joe McLellan (Pemmican Publications, 1989–2015).

Treasure, Mireille Messier (Orca Book Publishers, 2019).

Only a Tree Knows How to Be a Tree, Mary Murphy (Candlewick Press, 2020).

Welcome Home Bear: A Book of Animal Habitats, Il Sung Na (Alfred A. Knopf, 2015).

Hike, Pete Oswald (Candlewick Press, 2020).

How Things Came to Be: Inuit Stories of Creation, Rachel and Sean Qitsualik-Tinsley (Inhabit Media, 2019).*

Watch It Grow: Backyard Life Cycles, Barbara Reid (North Winds Press, 2020).

Something Wonderful, Matt Ritter (Pacific Street Publishing, 2020).

On Our Nature Walk: Our First Talk About Our Impact on the Environment, Jillian Roberts (Orca Book Publishers, 2020).

The Water Walker, Joanne Robertson (Second Story Press, 2017).*

Animal Architects, Libby Romero (National Geographic Kids, 2019).

Tuktu's Journey, Rachel Rupke (Arvaaq Books, 2020).

A Seed Is the Start, Melissa Stewart (National Geographic Kids, 2018).

If Animals Built Your House, Bill Wise (Dawn Publications, 2021).

Websites

- **www.canadiangeographic.ca/kids**
  Canadian Geographic—Animal Facts: Student-friendly facts about various animals.
- **www.crickweb.co.uk/ks1science.html#bodypart**
  Crickweb: Science games, interactive resources, activities, and facts about animals, materials, sound, the water cycle, the human body, and weather.

- **https://www.lakeheadschools.ca/wp-content/uploads/2021/10/Elder-Senator-Protocol.pdf**
  Elder/Senator/Knowledge Keeper Protocol for Schools—Lakehead Public Schools: Guide to ensure consistent practice when working with an Elder, Senator, or Knowledge Keeper in a school capacity.
- **www.NatureNorth.com**
  NatureNorth—Manitoba's Online Nature Magazine: Scroll down to Dragonflies of Manitoba for information about dragonflies.
- **https://kids.nationalgeographic.com/animals**
  National Geographic Kids Animals Page: Includes information articles about many different types of animals.
- **www.mynoise.net/NoiseMachines/oceanNoiseGenerator.php**
  Unreal Ocean: Students can hear the energy created by wind by listening to the sounds of waves crashing on a beach.
- **http://www.soundsnap.com/tags/seagulls**
  Seagull Sounds: This site provides 52 recordings of seagulls.
- **https://www.historymuseum.ca/history-hall/traditional-and-creation-stories/**
  Canadian Museum of History—Traditional Stories and Creation Stories: Recordings of oral histories told by six Indigenous storytellers from communities across Canada.
- **https://www.uniteforliteracy.com/**
  Unite for Literacy: Various e-books about animals, plants, and the senses.
- **https://universal-soundbank.com/en/index.htm**
  Universal Soundbank: Visit this site for royalty-free recordings of sounds that include animals, vehicles, machines, laughter, musical instruments (e.g., didgeridoo), and more.

Videos

- **https://www.youtube.com/watch?v=k4UDf3tF_O4**
  "The Needs of an Animal." Song by Harry Kindergarten Music (1:01).
- **https://www.youtube.com/watch?v=dUBIQ1fTRzI**
  "The Needs of a Plant." Song by Harry Kindergarten Music (1:02).
- **https://www.youtube.com/watch?v=Etn92Ms8plo**
  "The Ojibway Creation Story." FirstNationLiteracy (7:03).
- **https://www.youtube.com/watch?v=tYa3m_SXoAk&feature=fvwrel**
  "Our Surroundings: Living and Non Living Things for Kids." KidsClassroom (11:38).
- **https://www.tvokids.com/school-age/ravens-quest**
  TVO Kids Raven's Quest: Various episodes, each seven minutes long ("discovering the lives of Indigenous kids today").
- **https://www.tvokids.com/school-age/zamzooms-animal-adventures**
  TVO Kids Zamzoom's Animal Adventures: Various episodes, each four minutes long ("meet the animal kingdom through the eyes an of animated space animal, ZamZoom").

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Coding and STEM Resources

Coding

- **https://www.codemonkey.com/hour-of-code/beaver-achiever/**
  CodeMonkey—One Hour of Beaver Achiever: A block-based programming activity for children ages six and up where students help a beaver complete a series of tasks.
- **https://codespark.com/play/**
  CodeSpark Academy: An app that uses coding challenges and puzzles to teach children ages five and up about computer science.
- **https://codespark.com/educators**
  CodeSpark Academy—For Educators: Allows teachers to create a CodeSpark account and access helpful resources.
- **https://www.scratchjr.org/**
  ScratchJr: A block-based programming game that introduces students to coding. In ScratchJr, programming blocks are used to create interactive animations.
- **https://www.scratchjr.org/learn/interface**
  ScratchJr—Learn: Explains ScratchJr's interface, paint editor, and block descriptions, and offers helpful tips and hints.
- **https://www.tynker.com/mobile/apps/tynker-junior**
  Tynker Junior—Ocean Odyssey: A programming logic (sequencing) activity where students meet a variety of ocean animals and help them navigate different mazes. Ocean Odyssey is available for free.

STEM

- **https://www.apple.com/ca/imovie/**
  iMovie: Free movie making and editing app compatible with Apple devices.
- **https://nestwatch.org/learn/all-about-birdhouses/features-of-a-good-birdhouse/**
  Features of a Good Birdhouse—Cornell Lab of Ornithology: Clearly describes (with illustrations) how to build a safe and successful home for birds.
- **https://nestwatch.org/learn/all-about-birdhouses/right-bird-right-house/**
  Right Bird, Right House—Cornell Lab of Ornithology: Provides plans for appropriate birdhouses (including kid-friendly plans) based on users' location and habitat type.
- **https://www.cateater.com/try.html**
  Stop Motion Studio: Free app for creating stopmotion animations.
- **https://www.wevideo.com/**
  WeVideo: Online video editor that provides features such as a green screen editor.

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2 How Are Living and Nonliving Things Different?

Information for Teachers

All living things do the following:

- use energy from food
- use air and water
- grow
- reproduce*
- die

***NOTE:** **With young students, it is acceptable to use the term** *have babies* **to explain the meaning of the word** *reproduce* **when talking about animals (but not about plants).**

Materials

- various living things (e.g., plants, pets [hamster, fish] if possible)
- various nonliving things (e.g., ruler, shoe, cellphone)
- Image Bank: Living Things (Use these images in subsequent lessons when pictures of living things are needed. Print or project the images as needed.)
- Image Bank: Nonliving Things (Use these images in subsequent lessons when pictures of nonliving things are needed. Print or project the images as needed.)
- projector (optional)
- chart paper (optional)
- markers
- writing paper
- Activity Sheet: Sharing Stories Interview Guide (1.2.1) (one for each student)
- KWHL chart (from lesson 1)
- Pictionary (1.1.1)

Activate

Display a variety of living and nonliving things and pictures of living and nonliving things from Image Bank: Living Things and Image Bank: Nonliving Things for students to observe, sort, manipulate, and discuss. When students have had time to examine the objects and pictures, ask:

- Which objects are living?
- How do you know they are living?
- Which objects are not living?
- How do you know they are not living?

As a class, sort the objects and pictures into living and nonliving groups.

Then remove the nonliving objects and pictures, and have students examine the living things.

Challenge students to sort the living things into groups. Model this approach with a few pictures or objects first, and then have students determine a rule for sorting the objects. If they are having difficulty thinking of sorting rules, make suggestions:

- animals and plants
- humans, other animals, and plants
- things with legs and things with no legs
- things that move and things that do not move
- things with hair and things with no hair
- things with eyes and things with no eyes

Introduce the guided inquiry question: **How are living and nonliving things different?**

Assessment for Learning (AfL)

While students are classifying objects in the Activate activity (above), observe their ability to group and explain sorting rules. This skill is used throughout the unit and applies to other subjects. Use the ANECDOTAL RECORD template (page 30) to record observations.

Action: Part One

Have students share their sorting rules. Encourage them to discuss what they know about living things. Ask:

- What is the same about all these things? (e.g., they all grow)

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- What does a living thing need to stay alive?
- Does a living thing always stay the same size?
- Will it live forever?
- What will happen to all living things some day?
- Where does a chicken come from?
- Where does a tree come from?
- What does this tell you about living things? (e.g., they can reproduce or have babies)

These questions will encourage students to infer, predict, and interpret what they observe.

During the activity and subsequent discussion, record students' responses in the "What do we know" column of the KWHL chart created in lesson 1 using a different colour of marker. Use this opportunity to expand discussion about what students "want to know" and "how" they will discover this information.

Introduce the term *reproduce* to students and discuss the word in broader terms. Mention, for example, that animals (including humans) have babies; birds and most reptiles lay eggs that hatch into young; plants produce seeds that grow into new plants. Use the term *reproduce* often in subsequent lessons so the word becomes part of students' vocabulary. As mentioned earlier, it is also acceptable for young students to refer to the reproduction of living things (other than plants) as "having babies" or "having young."

Provide students with writing paper and give the following instructions:

- Think of a picture to go with what you have written.
- Check the "What do we know" column of the chart for ideas.
- Draw a picture to go with what you have written.

NOTE: Consider modelling an example of this task on chart paper.

Action: Part Two

Storytelling is an integral learning technique in Indigenous cultures, as well as in many other cultures. Have students interview family members and ask them to share stories about living things. Make sure students know to clearly ask permission to share the story publicly.

Stories about living things might include:

- family pets
- animals and plants in students' own yards or community
- living things observed on a camping trip, vacation, or canoe trip
- living things observed on a hunting or fishing trip
- plants and animals from other countries

Have students create their own interview questions or have them use the Activity Sheet: Sharing Stories Interview Guide (1.2.1).

Provide students with the following directions:

- Use the sheet to guide your interview with a family member. Fill out the sheet together, then bring it back to class to share.

NOTE: Review the activity sheet with students before they take it home, so that they are familiar with the questions. Family members may help students complete the activity sheet.

When students have completed the activity sheet, have them share the stories with the class. During discussion, have students do the following:

- tell the class about the person they interviewed
- provide a summary of the story

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- explain how they know the story is about a living thing

NOTE: Based on these interviews, students may be interested in inviting guests to share other stories about living things. Family members, Elders and Knowledge Keepers, school staff, community members, and staff of local organizations who work with plants and animals may be accessed to share stories about living things.

STEM Makerspace

- In addition to the materials available at the Makerspace, provide cameras, small objects, Plasticine, and art supplies (e.g., drawing paper, scissors, markers, pencil crayons).
- Set up a stop motion animation studio at the Makerspace. Stop motion animation is a technique used to make objects come to life using a series of photographs. The basic technique of stop motion animation is to photograph an object, move it a little bit, photograph it again, and so on.
- Challenge students to create short animations to show how living and nonliving things can be sorted. Have students photograph an assortment of objects (e.g., toys, models built out of Plasticine, cut-out drawings) and animate the objects travelling to their sorting area.

NOTE: The idea of this activity is for students to understand the basic concept of how a series of photos can be linked together to create an animation. Don't worry about how smooth the animation is. Many free apps and programs are available for creating stop motion animations:

- **Stop Motion Studio <https://www.cateater.com/try.html>**
- **iMovie <https://apps.apple.com/us/app/imovie/id377298193>**

Coding Connections

NOTE: See page 4 for more detailed information on coding, including plugged and unplugged coding.

PLUGGED: Help a Beaver Fix Its Dam in CodeMonkey

- Provide students with tablets, Chromebooks, or computers.
- Challenge students to complete the Beaver Achiever Hour of Code Mini Course using the free coding website CodeMonkey: <https://www.codemonkey.com/hour-of-code/beaver-achiever/>. Students will use block coding to help a beaver with tasks.
- After students complete the course, ask:
  - How did the beaver use energy? (He used energy to do his work: dropping logs, chopping wood.)
  - How did the beaver help the monkey and rabbit get energy? (He made them smoothies [food gives living things energy].)
  - What living things did you see? (e.g., beaver, monkey, rabbit, trees)
  - What nonliving things did you see? (e.g., logs, mountains, blender)

UNPLUGGED: Help Your Robot Friend Navigate Around Living and Nonliving Things

- Provide students with a grid and coding cards.
- Challenge students to create and execute a code that helps their robot friend bring water to living things and navigate around nonliving things. Students will use coding cards to create a sequence of arrows that, when followed, will guide the robot friend to travel around a grid. For example, their robot friend might move to the right two spaces, pick up some water, move right two spaces, give

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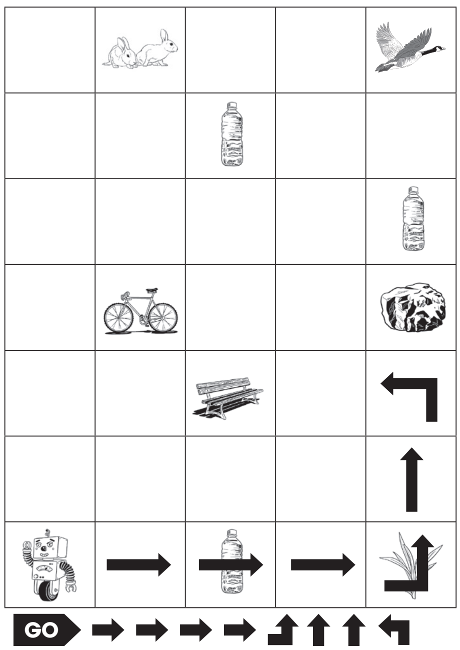
water to a plant, turn left, move forward two spaces, turn left to avoid the rocks, etc.

Help Robot Water the Plants



- Remind students that their robot friend cannot think for itself and can only do exactly what it is told to do through their code. If their robot friend has any problems with the code they've created, students will need to debug their code (find errors and fix them) and try again.

NOTE: This activity can also be completed using materials from an unplugged coding kit or using real objects with students playing the role of the robot friend.

Talking Circle

Revisit the guided inquiry question: **How are living and nonliving things different?** Have students share their knowledge, provide examples, and ask further inquiry questions.

Consolidate and Debrief

- Add to the KWHL chart as students learn new concepts, answer some of their own inquiry questions, and ask new inquiry questions.
- Add new words, including the term *reproduce*, illustrations, and examples to the class word wall. Include the words in languages other than English, as appropriate.
- Have students add new terms, including the word *reproduce*, and (labelled) pictures (e.g., a mother animal and her young) to their Pictionary (1.1.1). When possible, encourage them to add words and examples in languages other than English, including Indigenous languages, reflective of the classroom population.

Enhance

- **Family Connection**: Provide students with the following sentence starters:
  - Some living things in our home are _____.
  - Some nonliving things in our home are _____.

  Have students record the sentence starter in their science journal or agenda and complete it at home. Family members can help students draw and write about this topic. Have students share their completed sentences with the class.

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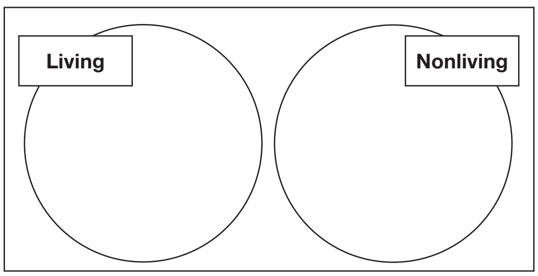
- Have students cut out pictures (from magazines or printed from the internet) of living and nonliving things to glue onto a sorting mat. If students have not used sorting mats before, introduce this graphic organizer and model the process with a few pictures of living and nonliving things. For example:

Sorting Living and Nonliving Things



NOTE: Students can also use a program such as Kidspiration to make the sorting mat.

- Have students play What Is My Rule? Distribute a copy of the Enhance Activity Sheet: What Is My Rule? (1.2.2) to each student.

  Display a set of pictures of living things. Organize the class into pairs. Have one student in the pair select (but not reveal) a rule for sorting pictures (e.g., has fur/has no fur). When they have sorted the pictures, have the other student guess what rule was used to sort the pictures.
- Visit a local zoo, bird sanctuary, nature centre, pet store, or wildlife reserve with students. Many of these places offer winter programs, so the field trip need not be limited to the spring. Encourage students to use a combination of their senses, as appropriate, to make observations of living things. Have them record their observations using new terminology and adding illustrations.
- Invite a guest speaker from a local zoo, bird sanctuary, nature centre, pet store, or wildlife reserve to visit the class with a slide show presentation or live animals.
- Plan a nature walk with students. Give each student two paper bags. Have students label one bag "Living Things" and the other bag "Nonliving Things." Then have students collect objects that represent living and nonliving things for each bag. Remind students that they must not remove most living things from the environment. However, they can collect items such as fallen leaves, grass, feathers, and seeds. After the nature walk, encourage students to explain the rationale behind their choices (i.e., justification for the items they collected and why they think the items are examples of living and nonliving things).

SAFETY NOTE: Before the nature walk, review safety rules with students, such as not picking up dangerous items (and what some of these dangerous items might be). Consider having students use gloves for this activity. Also, discuss what they can and cannot remove from the natural environment. Review the anchor chart created in lesson 1.

- Select several pictures of living things and cut them into puzzle pieces. Challenge students to identify each living thing by observing just one puzzle piece. Then have students gather the other pieces for that living thing and put the puzzle together.
- Have students create animals from playdough or clay. Encourage them to mix colours to get appropriate animal colours.
- Encourage students to photograph living or nonliving things and bring the pictures to school.

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1.2.1

Date: ________ **Name:** ________________

Sharing Stories Interview Guide

1. Storyteller ____________________

2. Which living thing is the story about? __________

3. Draw a picture of their story.

4. How do you know that this is a living thing?

____

____

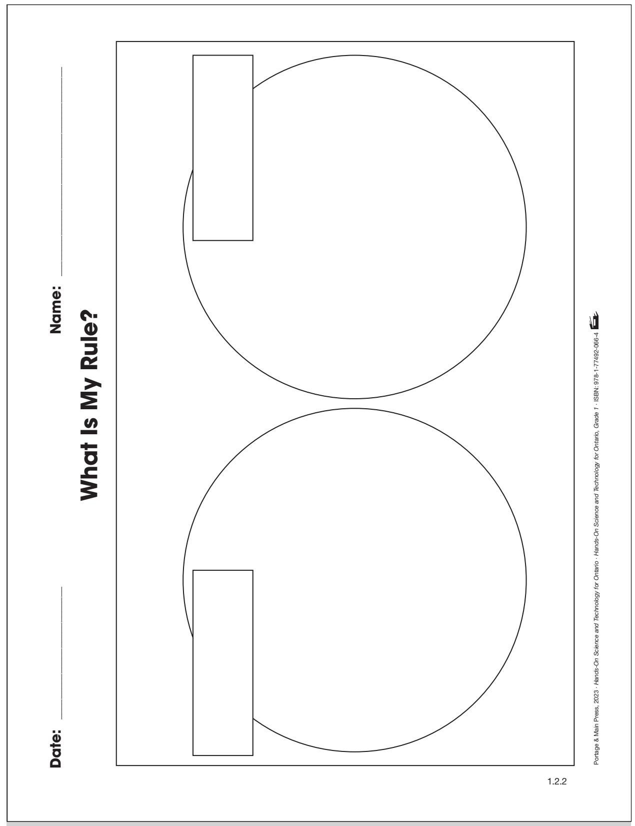
5. What else would you like to learn about this living thing?

____

____

1.2.1

1.2.2



Appendix: Image Banks

Images in this appendix are thumbnails from the Image Banks referenced in the lessons.

Corresponding full-page, high-resolution images can be printed or projected for the related lessons. Download the digital resources for this book, including the image banks and reproducibles, using the instructions below. You may return to this link to download the desired files until a new edition is available for pre-order.

1. Go to the Portage & Main Press website at <https://www.portageandmainpress.com/isbn/9781774920664>.

NOTE: The carets (< and >) are not part of the above URL.

2. On the product page, select the button labelled Download Digital Resources. A new page will appear, requesting a password.
3. Type the password xxxxxxxxxxx into the password field. The password is case sensitive, so be sure to use the correct capitalization.
4. Select Submit. A new page will appear, listing the download options for this book.
5. Click Retrieve Your Download to download the digital resources, including the image banks and reproducibles for this book.
6. Save the file to the desired location on your computer.

NOTE: This is a large file. Download times will vary due to your internet speeds.

Lesson 2: How Are Living Things and Nonliving Things Different?

Living Things

1. Canadian Corn

2. Tobacco Plant in Bloom

3. Sunflowers

4. Squash

5. Rice

6. Wild Berries

7. Chanterelle Mushrooms

8. White Trillium

9. Red Maple Tree

10. Canada Goose

11. Caribou

12. Muskox

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13. Polar Bear


14. Canada Lynx


15. Groundhog


16. Wolf


17. Burrowing Owl


18. Inuit Couple


19. Korean Women


20. A Group of Indian Women


21. An Ethiopian Man with Friend


22. Filipino Girl with Her Tongue Out


23. Speakers at a conference


24. A Nigerian Woman on the Phone

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25. Teenager Smiling

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2 – “Tobacco Plant” by Flickr user Paul Miller. Used under CC by 2.0 licence.

3 – “Vancouver Meet Arizona” by Flickr user Alan Levine. Used under CC by 2.0 licence.

4 – “Squash” by Flickr user Jeremy Keith. Used under CC by 2.0 licence.

5 – “Rice” by Flickr user David Pursehouse. Used under CC by 2.0 licence.

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7 – “Chanterelles” by Flickr user Logan Ward. Used under CC by 2.0 licence.

8 – “White Trilliums” by Flickr user Christy Sich. Used under CC by 2.0.

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11 – “Caribou” by Flickr user Bering Land Bridge Preserve. USed under CC by 2.0 licence.

12 – “Muskox” by Flickr user Neil McIntosh. Used under CC by 2.0 licence.

13 – “Polar Bear Pose” by Flickr user Anita Ritenour. Used under CC by 2.0 licence.

14 – “Canada Lynx” by Flickr user Krystal Hamlin. Used under CC by 2.0 licence.

15 – “Groundhog” by Flickr user Shenandoah National Park. Used under Public Domain licence.

16 – “Wolf” by Flickr user pike JO. Used under CC by 2.0 licence.

17 – “Burrowing Owl” by Flickr user Renee Grayson. Used under CC by 2.0 licence.

18 – “Kulusuk, Inuit couple” by Flickr user Arian Zwegers. Used under CC by 2.0 licence.

19 – “Korean Food” by Flickr user Yosomono. Used under CC by 2.0 licence.

20 – “More Indian ladies” by Flickr user Fred Hsu. Used under CC by 2.0 licence

21 – “IMG_1917” by Flickr user Stijn Debrouwere. Used under CC by 2.0 licence.

22 – “Tongue Out” by Flickr user Jan Michael Dimayuga. Used under CC by 2.0 licence.

23 – “Diversity” by Flickr user Oregon Department of Transportation. Used under CC by 2.0 licence.

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About the Contributors

Jennifer E. Lawson, PhD, is the creator of the Hands-On series published by Portage & Main Press. As senior writer and editor for the series, she has contributed to more than 50 publications for teachers and students. Jennifer provides professional development workshops for educators locally, nationally, and virtually, and is a Workplace Wellness Advisor. Her most recent book is a collective effort called *Teacher, Take Care: A Guide to Well-Being and Workplace Wellness for Educators*. She is also one of the founders of Mission to Mexico, an organization that supports schools in some of the most impoverished communities in Puerto Vallarta, Mexico. Throughout her extensive career in education, Jennifer has worked as a classroom teacher, resource and special education teacher, consultant, principal, university instructor, and school trustee. She lives with her family in Winnipeg, Manitoba.

Kellie Ierullo (she, her, hers) has been an educator with the Toronto District School Board for over 20 years, including as a classroom teacher, special education teacher, and now as a teacher-librarian, technology chair, and science/STEM lead educator. Kellie is passionate about helping teachers engage students through meaningful coding and STEM activities and encouraging students to move beyond navigating technology to creating it for themselves. Kellie lives in Woodbridge, Ontario, with her family.

Jennifer H. Manitowabi is an Ojibway educator and PhD candidate. Throughout her career in education in both Canada and the United States, she has worked as a bus driver, classroom teacher, principal, and education director. Jennifer encourages all educators to incorporate Indigenous worldviews in their teaching and to find opportunities to build relationships with the First Nations of Turtle Island. She writes about the struggles that First Nations people have overcome and creates artwork that celebrates her culture.

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