hands-on
science
and Technology
An Inquiry Approach

Grade 1

Series Editor
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Hands-On Science and Technology, Grade 1
An Inquiry Approach

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Introduction to Hands-On Science and Technology

Program Introduction

Hands-On Science and Technology helps develop students' scientific and technological literacy through active inquiry, problem solving, and decision making. With each activity in the program, students are encouraged to explore, investigate, and ask questions as a means of heightening their own curiosity about the world around them. Students solve problems through firsthand experiences, and by observing and examining objects within their environment. In order for young students to develop scientific and technological literacy, concrete experience is of utmost importance—in fact, it is essential.

The Inquiry Approach to Science and Technology

As students explore science and technology concepts, they should be encouraged to ask questions to guide their own learning. The inquiry model 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 model, the teacher becomes the facilitator of the learning process, and students initiate questions; gather, organize, interpret, and analyze information; evaluate findings and draw conclusions; and communicate their learning. As such, the process focuses on students' self-reflections as they ask questions, discover answers, and communicate their understanding.

Using an inquiry approach involves beginning with more structured inquiry, and moving to guided inquiry and, finally, open inquiry.

- In structured inquiry, the teacher may provide the initial question and structure the procedures to answer that question. Students follow the given procedures and draw conclusions to answer the given question.
- In guided inquiry, the teacher provides the research question, but students are involved in designing ways to answer the question and communicate their findings.
- In open inquiry, students formulate their own question(s), design and follow through with a developed procedure, and communicate their findings and results. 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."

In implementing an inquiry approach to science and technology, questions and ideas form the foundation of the teaching and learning process. The following excerpt from the Ontario Literacy and Numeracy Secretariat 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,

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> students work hard to continuously improve the quality, coherence and utility of ideas—both individually and collectively (Scardamalia 2002).

21st Century Teaching and Learning

In this rapidly changing and globalized world, it is more important than ever to prepare students to lead fulfilling lives, be productive contributors, and thrive in our society. Educators are responding to this challenge through evolving practice that challenges students in engaging and meaningful ways. The **Hands-On Science and Technology** program responds to this challenge by ensuring it reflects best practices that focus on 21st Century Competencies. According to Michael Fullan (2013), these competencies are:

- **Critical thinking:** Critical thinking is the ability to explore problems, weigh alternate solutions, and arrive at solutions. It also involves problem solving and making effective decisions, and applying them to real-world contexts.
- **Communication:** Communication refers to the ability to communicate effectively through reading, writing, speaking, listening, viewing, and representing. It also involves the ability to use a variety of information sources and digital tools.
- **Collaboration:** Collaboration requires the ability to work in teams, learning from and contributing to the learning of others.
- **Creativity:** Creativity involves exploring new ideas, being innovative, and thinking outside the box. Being creative also means looking at novel ideas and finding ways to put ideas into action.
- **Citizenship:** Citizenship involves thinking like a local and a global citizen, considering the values and world-views of others, and having a genuine interest in solving complex real-world problems that affect human and environmental sustainability.
- **Character:** Character involves specific traits such as perseverance, resilience, and being a life-long learner.

These competencies are the foundation of the inquiry-based approach used in **Hands-On Science and Technology**. As such, teachers take on a facilitation role as students use these skills to explore, investigate, research, design, create, and solve problems in the world around them. To provide a connection between science and technology activities and 21st Century Competencies, each lesson in ***Hands-On Science and Technology, Grade 1*** identifies one or more competencies that teachers may focus on during the activity. This provides teachers with the opportunity to make ongoing links between the science and technology curriculum and 21st-century classroom teaching and learning.

The Goals of the Science and Technology Program

Science and technology play fundamental roles in the lives of Canadians. In the introduction to *The Ontario Curriculum, Grades 1–8: Science and Technology* (2007, 3), the Ministry of Education states:

> During the twentieth century, science and technology played an increasingly important role in the lives of all Canadians. Science and technology underpin much of what we take for granted, including clean water, the places in which we live and work, and the ways in which we communicate with others. The impact of science and technology on our lives will continue to grow. Consequently, scientific and technological literacy for all has become the overarching objective of science and technology education throughout the world.

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The Ontario Curriculum identifies three goals that form the foundation of the science and technology program. In keeping with this focus on scientific and technological literacy, these goals are the bases for the lessons in the **Hands-On Science and Technology** program:

Goal 1
to relate science and technology to society and the environment

Goal 2
to develop the skills, strategies, and habits of mind required for scientific inquiry and technological problem solving

Goal 3
to understand the basic concepts of science and technology

Hands-On Science and Technology Strands and Expectations

The Ontario science and technology curriculum for all grade levels is organized into four strands, as follows:

1. Understanding Life Systems
2. Understanding Structures and Mechanisms
3. Understanding Matter and Energy
4. Understanding 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 that students are expected to demonstrate by the end of each grade. There are three overall expectations for each strand in each grade in science and technology.

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

NOTE: The overall and specific expectations must all be accounted for in instruction and assessment, but evaluation focuses on the three overall expectations (Ontario Ministry of Education 2010, 38).

The overall and specific expectations for each strand are presented in chart format in the introduction to each unit. Alongside each specific expectation, corresponding lessons are identified.

Hands-On Science and Technology Fundamental Concepts and Big Ideas

Fundamental concepts are key ideas that provide a framework for the acquisition of all scientific and technological knowledge. These concepts also help students to integrate scientific and technological knowledge with knowledge in other subject areas, such as mathematics and social studies. The fundamental concepts addressed in the curriculum for science and technology are:

- matter
- energy
- systems and interactions
- structure and function
- sustainability and stewardship
- change and continuity

Big ideas are the enduring understandings that students carry with them into the future. Big ideas are often transferable to other subjects and to real-life experiences.

The fundamental concepts and big ideas for each grade and strand can be found in a chart in the introduction to each unit of the **Hands-On Science and Technology** program.

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Hands-On Science and Technology Program Principles

- Effective science and technology programs involve hands-on inquiry, problem solving, and decision making.
- The development of students' skills, attitudes, knowledge, and understanding of Science, Technology, Society, and the Environment (STSE) issues form the foundation of the science and technology program.
- 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, 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 by just listening. Instead of simply telling, the teacher, therefore, should focus on formulating and asking questions, setting the conditions so that students ask their own questions, and helping students to 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.
- The science and technology program 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.
- The science and technology program should be infused with knowledge and world-views of Indigenous peoples, as well as with 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 carried out throughout each unit of study.

Infusing Indigenous Perspectives

Indigenous peoples are central to the Canadian context, and it is important to infuse their knowledge into the learning experiences of all students. The intentional integration of Indigenous knowledge in the **Hands-On Science and Technology** series helps to address the Calls to Action of the Truth and Reconciliation Commission of Canada (2015), particularly the call to "integrate Indigenous knowledge and teaching methods into classrooms" (clause 62) and the call for "building student capacity for intercultural understanding, empathy, and mutual respect" (clause 63).

Indigenous peoples of the past depended on the natural environment to survive. The environment shaped their way of life: geography, vegetation, climate, and natural resources of the land determined the ways they survived. By observing the land and its animal inhabitants, the environment also taught them to survive. The traditional territories of the First Nations and Métis peoples cover Ontario, and many Inuit have moved to urban centres in the province. The world-views of these peoples and their approaches and contributions to science and technology are now being acknowledged and incorporated into educational programs. It is also important to recognize the diversity of Ontario's Indigenous peoples and to focus

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on both the traditions and contemporary lives of the Indigenous communities in your area. Contact personnel in your school district—Indigenous consultants and/or those responsible for Indigenous education—to find out what resources (e.g., people, books, videos) are available to you and your students.

In incorporating Indigenous perspectives, it is important to value Traditional Ecological Knowledge (TEK). TEK has been defined as:

> …the knowledge base acquired by indigenous and local people over many hundreds of years through direct contact with the environment. It includes an intimate and detailed knowledge of plants, animals, and natural phenomena, the development and use of appropriate technologies for hunting, fishing, trapping, agriculture, and forestry and a holistic knowledge, or "worldview" which parallels the scientific disciplines of ecology (Inglis 1993).

Indigenous peoples developed technologies and survived on this land for millennia because, in part, they were good scientists. They used observation and experimentation to refine their technologies such as building canoes and tipis and discovering food-preservation techniques. As such, TEK serves as an invaluable resource for students and teachers of science and technology.

Throughout the **Hands-On Science and Technology** program, there are many opportunities to incorporate culturally appropriate teaching methodologies from Indigenous world-views. First Peoples Pedagogy indicates that making connections to the local community is central to learning (First Nations Education Steering Committee 2016). As one example, both Elders and Métis Senators offer a wealth of knowledge that can be shared with students. Consider inviting an Elder or a Métis Senator as a guest into the classroom in connection with specific topics being studied (as identified within the given lessons throughout the unit). An Elder or a Métis Senator can guide a nature walk, share stories and experiences, share traditional technologies, and help students understand Indigenous peoples' perspectives of the natural world. Elders and Métis Senators will provide guidance for learners and opportunities to build bridges between the school and the community. Here are a few suggestions about working with Elders and Métis Senators:

- Some Indigenous keepers of knowledge are more comfortable being called "Knowledge Keepers" than "Elders" or "Métis Senators." Be sensitive to their preference.
- It is important to properly acknowledge any visiting (or visited) Elders and Métis Senators and their knowledge, as they have traditionally been and are recognized within Indigenous communities as highly esteemed individuals. There are certain protocols that should be followed when inviting an Elder or a Métis Senator into your classroom. The Lakehead District School Board has protocols available at: <https://www.lakeheadschools.ca/aboriginal-education/>.
- It is especially important to connect with Indigenous peoples and Elders and Métis Senators in your local area, and to study local issues related to Indigenous peoples in Ontario. Consider contacting Indigenous education consultants within your local school district or with the Ontario Ministry of Education to access referrals. Also, consider contacting local Indigenous organizations for referrals to Elders and Métis Senators, and other knowledge keepers. Such organizations may also be able to offer resources and opportunities for field trips and land-based learning.

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Cultural Connections

To acknowledge and celebrate the cultural diversity represented in Canadian classrooms, 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 these diverse cultures by making connections to curricular outcomes. In the same way, it is important to explore other cultures represented in the community and beyond, to encourage intercultural understanding and harmony.

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

NOTE: Although some cultural connections are found in the Enhance section of lessons in *Hands-On Science and Technology, Grade 1*, teachers should not regard this content as supplementary. First and foremost, the central science and technology outcomes are focused on in the Activate and Action sections of each lesson, while curricular connections such as literature, art, and culture may be featured in the Enhance section.

Land-Based Learning

Land-based learning replaces the classroom walls with the natural land. For all students, land-based learning offers firsthand 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, Grade 1*** incorporate land-based learning activities, whether it be a casual walk around the neighbourhood to examine trees or a more involved exploration of local waterways. When land-based learning connections are made in ***Hands-On Science and Technology, Grade 1*** lessons, the following icon is used:

Technology

Digital learning, or learning with information and communication technology (LwICT), is an important component of any classroom. As such, technological supports available in schools—including digital cameras, computers/tablets, interactive whiteboards (IWB), projectors, document cameras, audio-recording devices, and even calculators—can be used with and by students to enhance their learning experiences. When technology connections are made in ***Hands-On Science and Technology, Grade 1*** lessons, the following icon is used:

Sustainability

The **Hands-On Science and Technology** program 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 world-views about respecting and caring for the Earth. The three pillars of sustainability are the environment, society, and the economy. When sustainability links are made in ***Hands-On Science and Technology, Grade 1*** lessons, any or all of the sustainability pillars may be the focus of this connection, and are identified by the following icon:

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The Hands-On Science and Technology Assessment Plan

The **Hands-On Science and Technology** program provides a variety of assessment tools that enable teachers to build a comprehensive and authentic daily assessment plan for students. Based on current research about the value of quality classroom assessment (Davies 2011), suggestions are provided 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* (see: <www.edu.gov.on.ca/eng/policyfunding/success.html>). The document (2010) outlines a fundamental shift in the roles of teachers and students in the learning 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.

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 their next steps in learning, and reflect on their learning. Assessment *of* learning is summative in nature and is intended to identify student progress in relation to learning expectations. The challenge for educators is to integrate assessment seamlessly with other learning goals. The Ontario assessment model uses the following process:

- **Establish learning goals from curriculum expectations.** Lessons include learning goals in student-friendly language that have been developed from curriculum expectations. These learning goals are shared with students and used to guide instruction.
- **Develop success criteria.** These descriptors are written in student-friendly language to help students understand what successful learning looks like. Criteria can be established by the teacher, using assessment task exemplars of student work, or by using the Achievement Chart from *The Ontario Curriculum, Grades 1–8: Science and Technology* (2007, 26–27). Success criteria can also be determined in collaboration with students.
- **Provide descriptive feedback.** In conversations with students, identify what criteria they have and have not met, and provide any needed instruction. At this stage, teachers work with students to identify next steps to determine how students may improve. This may include differentiating instruction.
- **Use information for peer and self-assessment.** Students assess their own work and the work of others to determine what still needs to be done.
- **Establish individual goals.** Students determine what they need to learn next and how to get there.

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The **Hands-On Science and Technology** program provides assessment suggestions, rubrics, and templates for use during the teaching/learning process. These suggestions include tasks related to assessment *for* learning, assessment *as* learning, and assessment *of* learning.

Assessment *for* Learning

It is important for teachers to assess students' understanding before, during, and after a lesson. The information gathered helps teachers determine students' needs and then plan the next steps in instruction. Students may come into class with misconceptions about science and technology concepts. By identifying what they already know, teachers can help students make connections and address any challenging issues.

To assess students as they work, use the assessment *for* learning suggestions provided with many of the activities.

While observing and conversing with students, teachers may use the **Anecdotal Record** template and/or the **Individual Student Observations** template to record assessment *for* learning data.

- **Anecdotal Record:** To gain an authentic view of a student's progress, it is critical to record observations *during* lessons. The **Anecdotal Record** template, on page 26, provides the teacher with a format for recording individual or group observations.
- **Individual Student Observations:** When teachers wish to focus more on individual students for a longer period of time, consider using the **Individual Student Observations** template, on page 27. This template provides more space for comments and is especially useful during conferences, interviews, or individual student performance tasks.

Assessment *as* Learning

It is important for students to reflect on their own learning in relation to science and technology. For this purpose, teachers will find a **Student Self-Assessment** template, on page 31, as well as a **Student Reflections** template on page 32.

In addition, the **Science and Technology Journal**, on page 28, will encourage students to reflect on their own learning. Teachers can copy several sheets for each student, cut the sheets in half, add a cover, and bind the sheets together. Students can then create their own title pages for their journals. For variety, you may also 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: This Science and Technology Journal template is provided as a suggestion, but journals can also be made from simple notebooks or recycled paper.

Another component of assessment *as* learning involves opportunities for students to reflect on their use of 21st Century Competencies. During each lesson, teachers should spend time discussing and reflecting on the competencies being focused on. The intent here is to enhance students' understanding of how and when

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Unit 1

Needs and Characteristics of Living Things

Introduction

This unit of ***Hands-On Science and Technology, 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., the needs for food, oxygen, and water). Students will investigate the characteristics of animals and plants, and they will gain growing 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, teachers will need to collect a wide variety of pictures of living things. Teachers may consider sending a letter home to students' families to request help with this project. Some good sources for pictures of animals and plants are:
  - wall calendars
  - magazines (e.g., *Canadian Geographic, National Geographic, Chickadee, Owl, Chirp*)
  - Google Images (prescreen any Google Image searches you expect students to carry out)
- Contact local nature centres, zoos, garden clubs, pet shelters, and other similar government or nongovernmental organizations. These organizations can often provide materials (and other services) about animals and plants in your community. Teachers are also encouraged to put feelers out into the broader school community to find any "resident experts" within the school community in one of these areas. This is a great way to expand resources and make connections in the community.
- Put together a variety of reading materials at a range of reading levels appropriate for your class. Include fiction and nonfiction resources. If possible, also arrange time for students to visit animal and plant websites. Always preview any website you expect students to use.
- Collect shoeboxes, which will be required in lesson 5, for students to create dioramas of animal habitats. Teachers may wish to send home a letter to students' families in advance to ask for help collecting the boxes.
- Collect various materials related to and including the Canada Food Guide ("Eating Well With Canada's Food Guide"). Posters, brochures, and individual copies of the food guide are available from Health Canada. (See: <https://www.canada.ca/en/health-canada/services/canada-food-guides.html/>.)

NOTE: Health Canada also offers a version of the Canada Food Guide tailored specifically to Indigenous peoples (see "Canada's Food Guide for First Nations, Inuit and Métis"), including both traditional and store-bought foods. As well, the guide is translated into several other languages, including French, Farsi, and Tagalog. See: <www.hc-sc.gc.ca/fn-an/food-guide-aliment/order-commander/guide_trans-trad-eng.php>.

- Throughout the unit, as you conclude a lesson and move on to the next one, be sure to keep all charts and displays created during the lesson, as well as activity sheets and other work done. Often, these are referred to again in subsequent lessons, and all charts and other materials created throughout the unit are used in the concluding lesson, which is a final inquiry project.
- Consider recording the guided inquiry question (e.g., on a sentence strip) for display throughout related investigations.
- Develop a Makerspace centre. Classroom Makerspaces are usually designed as

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centres where students learn together and collaborate on do-it-yourself projects. Students are given the opportunity to work with a variety of age-appropriate tools, as well as with everyday and recycled materials. Additionally, arts-and-crafts are often integrated into Makerspace offerings.

For this unit, set up a Makerspace centre in your classroom that encourages informal learning about the needs and characteristics of plants and animals. Collect a variety of arts-and-crafts supplies and materials that reflect the challenges students might take on at the centre. Include general materials, such as those listed in the Introduction to ***Hands-On Science and Technology, Grade 1*** (see page 18), as well as unit-specific materials. For example, provide artifacts from animals (e.g., feathers, bones, teeth, fossils, shells, magnifiers, skeleton models). Also, collect plant samples (e.g., seeds, leaves, bark, live plants, products made from plants).

SAFETY NOTE: Engage in a discussion about safety and respect at the Makerspace with students before beginning this unit. Consider small parts, sharp devices, and potential hazards for students of all ages and abilities who will have access to the Makerspace area. At this age, this exploration needs to be supervised.

Do-it-yourself projects may include anything related to the concepts in this unit. Students may create anything from a model or mosaic to a field guide or collection. Projects they might initiate include (but are not limited to) the following:

- create a model of a plant, tree, or animal
- design and create a device that helps maintain a healthy environment (e.g., recycling bin, tin can crusher, self-watering device for plants)
- design and construct a device that helps clean air or water
- create a pot/planter (waterproof, with proper drainage)
- make a mosaic using plant parts
- develop a field guide for specific plants or animals
- create and display a collection of items representative of specific living things (e.g., insects, feathers, pine cones, leaves)
- plan a garden, and make a scale model
- design and construct an Earth loom

A literacy connection that might inspire projects is:

- *Muncha! Muncha! Muncha!* by Candace Fleming. In the book, Mr. McGreely is having problems keeping the rabbits out of his garden. He tries to build something bigger and better to keep them out. This could be a challenge for students.

As inquiry questions are posed with each lesson, you will find these questions inspire other do-it-yourself projects related to the unit. Students may determine solutions to these questions through the creating they do at the Makerspace centre. Remember to not direct the learning here; simply create the conditions for the learning to happen.

For more information about Makerspace centres, see page 18 of the Introduction to ***Hands-On Science and Technology, Grade 1***.

Indigenous World-Views

Teachers are reminded of the value of incorporating Indigenous perspectives and world-views into lessons whenever possible. These include having the following:

- a respectful relationship with nature, with an intention to sustain natural resources for generations to come
- the belief that all life—plants, animals, and humans—is equal and that all living things depend upon one another for survival

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- the idea that humans have special relationships with animals, which are seen as teachers, guides, and companions, and are key to human survival
- the cyclical nature of life. Plants and animals (e.g., insects, amphibians, fish, birds, reptiles, mammals) have daily, annual, and multi-year cycles.

Science and Technology Vocabulary

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

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

Teachers should also consider infusing vocabulary related to scientific inquiry skills into daily lessons. This vocabulary could be displayed in the classroom throughout the year, as it relates to all science and technology units. Students could then brainstorm which skills they are being asked to use as they work in particular lessons. They could also discuss what the skill looks and sounds like as they 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, students start a "pictionary"—a picture dictionary in which they record new vocabulary introduced throughout the unit.

NOTE: The pictionary presents an excellent opportunity to celebrate cultural diversity by having students include words in other languages. For example, students may include terms in Indigenous languages, or English-language learners may include terminology in languages they speak at home. These words can be printed in the first box, along with the original English-language term.

Also in lesson 1, teachers create a science and technology word wall for the unit. The word wall can be created on a bulletin board or simply on a sheet of poster or chart paper. Record new vocabulary on the bulletin board or poster as it is introduced during the unit. Ensure the word wall is placed in a location in the classroom where all students can see it and refer to the words during activities and discussion.

NOTE: Include terminology in other languages on the class word wall. This is a way of acknowledging and respecting students' cultural backgrounds, while enhancing learning for all students.

NOTE: A variety of online dictionaries may be used as a source for translations. For example:

- ojibwe.lib.umn.edu/
- www.freelang.net/online/mohawk.php/

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

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Unit Overview

Fundamental Concepts	Big Ideas
Sustainability and Stewardship	■ Living things grow, take in food to create energy, make waste, and reproduce. ■ Plants and animals, including people, are living things. ■ Living things have basic needs (air, water, food, and shelter) that are met from the environment. ■ Different kinds of living things behave in different ways. ■ All living things are important and should be treated with care and respect.

Overall Expectations

By the end of Grade 1, students will:

1. Assess the role of humans in maintaining a healthy environment.
2. Investigate needs and characteristics of plants and animals, including humans.
3. Demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans.

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2 How Are Living and Nonliving Things Different?

Information for Teachers

All living things can do the following:

- Use energy, water, and oxygen
- 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).**

21st Century Competencies

Critical Thinking: Students will use critical-thinking skills to compare and contrast living and nonliving things, and to identify differences between the two.

Materials

- variety of living things such as plants, pets (e.g., hamster, fish), if possible
- variety of nonliving things (e.g., ruler, shoe, cellphone)
- variety of pictures of living things, including humans, other animals, and plants (Use classroom resources and student photos from nature walk from lesson 1.)
- variety of pictures of nonliving things (e.g., toys, cars, household items)
- projector (optional)
- chart paper
- markers
- scissors
- glue
- drawing paper
- crayons
- Activity Sheet A: Living Things (1.2.1)
- Activity Sheet B: Sharing Stories Interview Guide (1.2.2)
- Learning-Centre Task Card: What Have I Learned About Living and Nonliving Things? (1.2.3)
- KWHL chart (from lesson 1)
- Pictionary (1.1.1)

Activate

Display a variety of living and nonliving things and a variety of pictures of living and nonliving things for students to observe, sort, manipulate, and discuss. Ask students:

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

Have students sort the objects and pictures into living and nonliving groups.

Now, 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 first, and then have students determine a rule for sorting the objects. If they are having difficulty thinking of sorting rules, you may suggest:

- 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, as well. Use the Anecdotal Record sheet, on page 26, to record observations.

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Action: Part One

Have students share the ways they have sorted their pictures. Now, encourage them to discuss what they know about living things. Ask:

- What is the same about all of 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?
- 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, and add to the "What do we know" column of the KWHL chart created in lesson 1, using a different colour of marker than you used in lesson 1. Take 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, which hatch into young; plants produce seeds, which grow into new plants. Use the term *reproduce* often in subsequent lessons so that 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."

Give each student a copy of Activity Sheet: Living Things (1.2.1), and have students complete it.

Activity Sheet A
Directions to students:
Think of one thing you know about all living things, and print it on your activity sheet. Check the list on chart paper for ideas. Draw a picture to go with what you have written (1.2.1).

NOTE: Consider completing a copy of the activity sheet ahead of time to project as a model for students as they complete their own activity sheets.

Action: Part Two

Have students interview family members and ask them to share stories about living things. Storytelling is an integral learning technique in Indigenous cultures, as well as in many other cultures. Themes of stories might include:

- family pets
- animals and plants in your own yard 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

Distribute a copy of Activity Sheet B: Sharing Stories Interview Guide (1.2.2) to each student. Have students complete the activity sheet.

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

As students bring their activity sheets back to class, have them share stories with the class. During discussion, have students do the following:

- Tell the class about the person you interviewed.
- Provide a summary of the story.
- Explain how you know that the story was about a living thing.

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

Activity Sheet B

Directions to students:

Use the sheet to guide your interview with a family member. Fill out the sheet together, and bring it back to class to share (1.2.2).

Learning Centre

At the learning centre, display a variety of living things, nonliving objects, and pictures of both, as well as a copy of Learning-Centre Task Card: What Have I Learned About Living and Nonliving Things? (1.2.3), chart paper, and markers.

Have students classify the objects and pictures and discuss their sorting rules.

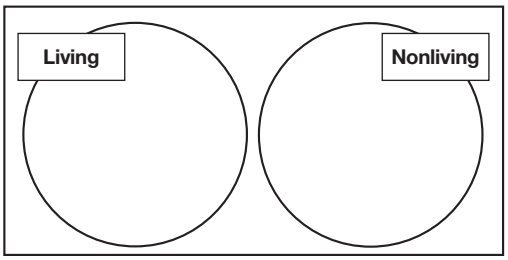
Consolidate and Debrief

- Revisit the guided inquiry question: **How are living and nonliving things different?** Have students share their knowledge, provide examples, and ask further inquiry questions.
- 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. Also, include the words in other languages, 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 other languages, including Indigenous languages, reflective of the classroom population.

Enhance

- 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



- Students can also use a program such as Kidspiration to make the sorting mat.
- In pairs, have students play What Is My Rule? Give a copy of Enhance Activity Sheet: What Is My Rule? (1.2.4) to each student. Display a set of pictures of living things. Have one student in the pair select (but not reveal) a rule for sorting pictures (e.g., has fur/has no fur). Once he or she has sorted the pictures, ask the other student to 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, and 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 slide show presentations or live animals.

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- 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 hunt, encourage students to explain the rationale behind their choices (justification for what they collected and why they think the objects are examples of living and nonliving things).

SAFETY NOTE: Prior to the nature walk, review safety issues with students, such as not picking up dangerous items (and what some of these dangerous items might be). You may wish to have students use gloves for this activity. Also, discuss what they can and cannot remove from the natural environment.

- 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 play dough or clay. Encourage them to mix colours to get appropriate animal colours.
- Encourage students to take pictures of living or nonliving things and bring them to school.
- Access the interactive activity, Sorting Living and Non-living Things, in the Grade 1, Unit 1 folder of the ***Hands-On Interactive for Science and Technology, Grade 1*** download. Find this download at: <www.portageandmainpress.com/product/hands-on-interactive-for-science-and-technology-grade-1/>.
- Have students continue their do-it-yourself projects at the Makerspace centre.

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Date: _____ **Name:** _____

Living Things

One thing I know about all living things:

_____

_____

_____

_____

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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?

_____

_____

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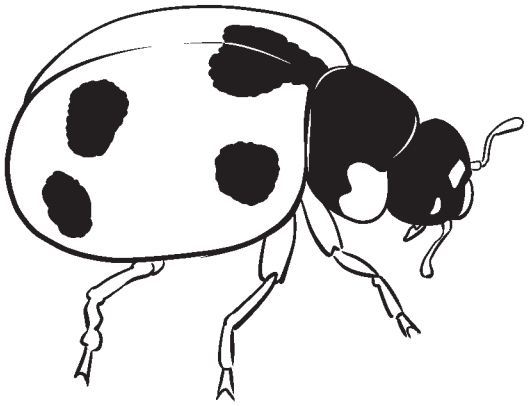
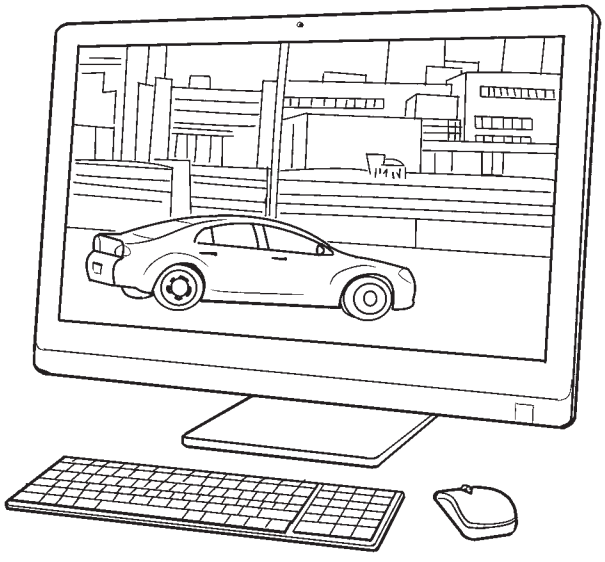
What Have I Learned About Living and Nonliving Things?

1. **Observe and examine the objects and pictures of objects.**
2. **Sort the objects and pictures, and classify them into living and nonliving groups.**
   - **What is the same about the objects in each group?**
3. **Find a way to record and label your sorting.**





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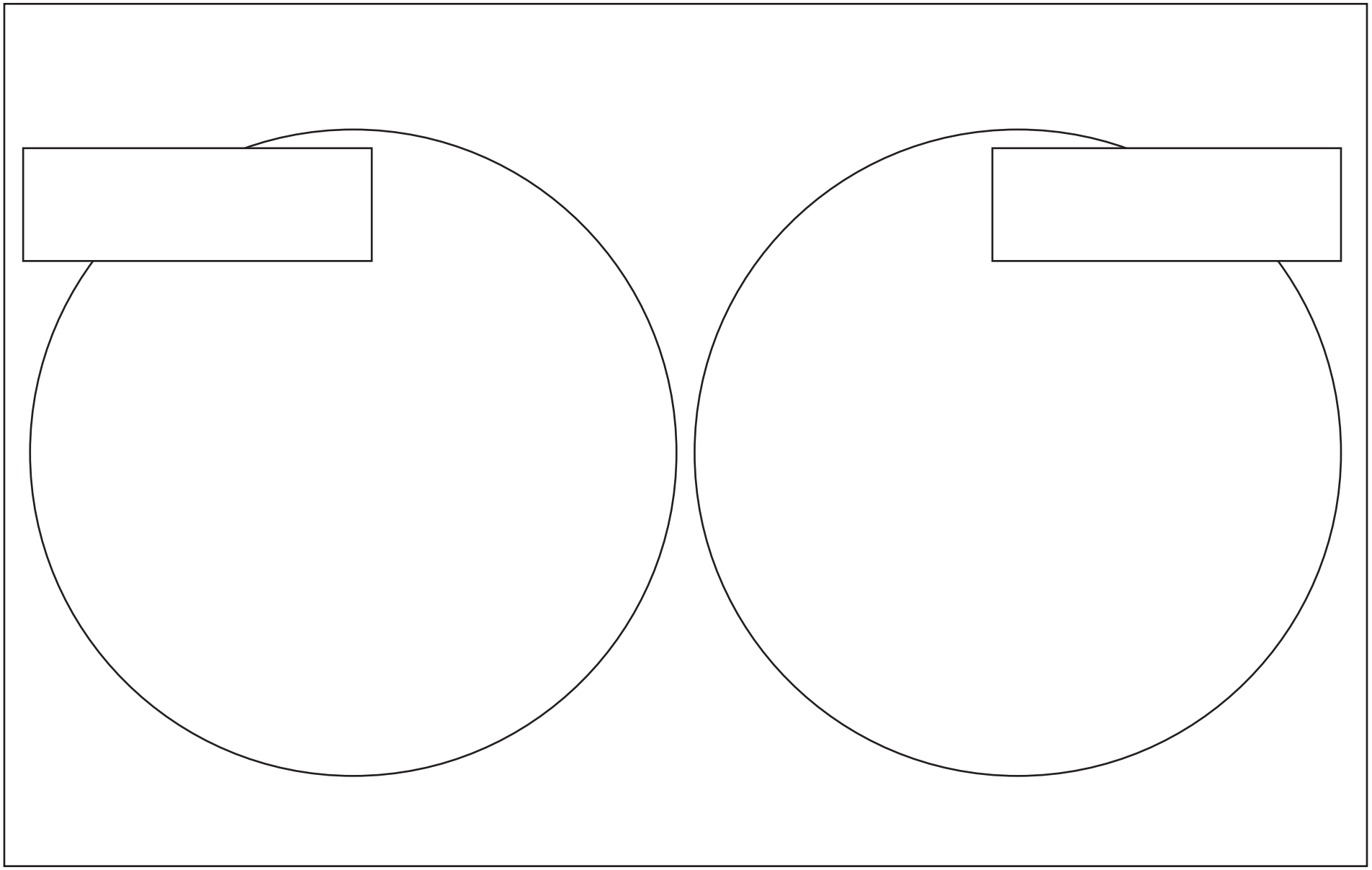
Date: _____ **Name:** _____

What Is My Rule?



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Appendix

Images in this appendix are for the Image Banks referenced in the lessons. Corresponding full-page, high-resolution images can be printed or projected for the related lessons, and are found on the Portage & Main Press website at: <www.portageandmainpress.com/product/HOSTBANKGR1/>. Use the password **21STCENTURY** to access the download for free.

Unit 1: Needs and Characteristics of Living Things

Lesson 11: How Do Animals Meet Their Needs in Their Local Environments?

Local Indigenous Art

1. Deer Clan - Waawaashkeshi Doodem

2. Catfish - Maanameg

3. Turtle - Mishiike

4. Snowy Owl and Polar Bears

Image Credits:

1 - Deer Clan - Waawaashkeshi Doodem by Donald Chretién donaldchretien.com.

2 - Catfish - Maanameg by Donald Chretién donaldchretien.com.

3 - Turtle - Mishiike by Donald Chretién donaldchretien.com.

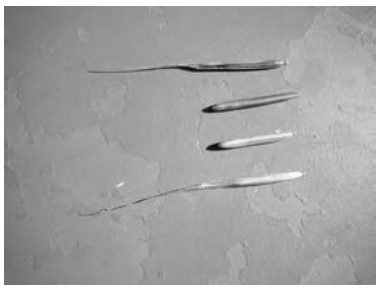
4 - Spirits of the North by William Monague www.williammonaguenativeart.com.

Lesson 13: How Do Plants and Animals Work Together in the Environment?

Indigenous Plants

1. Sweetgrass

2. Wild rice in the fall



3. Unripened wild rice

4. Wild rice plant from root to head

5. Wild rice ready to harvest

6. Smudging with sage

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About the Contributors

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Kevin Reed is the Indigenous Education Consultant for the Limestone District School Board in Kingston, Ontario. He is the the author of Aboriginal Peoples: Building for the Future and co-author of Aboriginal Peoples in Canada. He received a Prime Minister's Award for Teaching Excellence in 2008. He is a member of the Nacho Nyak Dun First Nation.

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