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Hands-On Science and Technology
Grade 1
Ontario, revised edition

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Program Principles

1. Effective science programs involve hands-on inquiry, problem solving, and decision making.

2. The development of students’ skills, attitudes, knowledge, and understanding of Science, Technology, Society, and the Environment (STSE) issues form the foundation of the science program.

3. Children have a natural curiosity about science and the world around them. This curiosity must be maintained, fostered, and enhanced through active learning.

4. Science activities must be meaningful, worthwhile, and relate to real-life experiences.

5. The teacher’s role in science education is to facilitate activities and encourage critical thinking and reflection. Children learn best by doing, rather than by just listening. The teacher, therefore, should focus on formulating and asking questions rather than simply telling.

6. Science should be taught in correlation with other school subjects. Themes and topics of study should integrate ideas and skills from several core areas whenever possible.

7. The science program should encompass, and draw on, a wide range of educational resources, including literature, nonfiction research material, audio-visual resources, technology, as well as people and places in the local community.

8. Assessment of student learning in science should be designed to focus on performance and understanding, and should be conducted through meaningful assessment techniques carried on throughout the unit of study.

Program Implementation

Program Resources

*Hands-On Science and Technology* is arranged in a format that makes it easy for teachers to plan and implement.

Units are the selected topics of study for the grade level. The units relate directly to the learning expectations outlined in *The Ontario Curriculum, Grades 1–8: Science and Technology*, 2007 document. The units are organized into several lessons. Each unit also includes books for children, a list of annotated websites, and references for teachers (all of these are found at the end of the book and are organized by unit).

The introduction to each unit summarizes the general goals for the unit. The introduction provides background information for teachers, and a complete list of materials that will be required for the unit. This includes classroom and household materials, equipment, visuals, reading materials, and various other supplies.

Each unit is organized into lessons, based on the curricular expectations. The lessons are arranged in the following format:

**Expectations:** Included are the curricular expectations addressed in the lesson. Some expectations, such as those related to safety, are general, ongoing themes throughout the unit, and are not identified specifically at the beginning of a lesson.

**Science Background Information for Teachers:** Some topics provide teachers with the basic scientific knowledge they will need to present the activities. This information is offered in a clear, concise format, and focuses specifically on the topic of study.
**Materials:** A complete list of materials required to conduct the main activity is given. 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. Many of the identified items are for the teacher to use for display purposes, or for making charts for recording students’ ideas. In some cases, visual materials—large pictures, sample charts, and diagrams—have been included with the activity to assist the teacher in presenting ideas and questions, and to encourage discussion. You may wish to reproduce these visuals, mount them on sturdy paper, and laminate them so they can be used for years to come.

**Activity:** This section details a step-by-step procedure, including higher-level questioning techniques and suggestions, for encouraging exploration and investigation.

**Activity Sheet:** The reproducible activity sheets are designed to correlate with the expectations of the activity. Often, the activity sheets are to be used during the activity to record results of investigations. At other times, they are to be used as a follow-up to the activities. Students may work independently on the activity sheets, in small groups, or you may choose to read through the sheets together and complete them in a large-group setting. Activity sheets can also be made into overheads or large experience charts. Since it is important for students to learn to construct their own charts and recording formats, you may want to use the activity sheets as examples of ways to record and communicate ideas about an activity. Students can then create their own sheets rather than use the ones provided.

**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 lesson itself or the sole assessment for the lesson.

**Extension:** Included are optional activities to extend, enrich, and reinforce the expectations.

**Activity Centre:** Included are independent student activities that focus on the expectations.

**Assessment Suggestions:** Often, suggestions are made for assessing student learning. These assessment strategies focus specifically on the expectations of a particular activity topic (assessment is dealt with in detail on pages 15–16). Keep in mind that the suggestions made within the activities are merely ideas to consider—you may use your own assessment techniques, or refer to the other assessment strategies on pages 15–16.

**Classroom Environment**

The classroom setting is an important aspect of any learning process. An active environment, one that gently hums with the purposeful conversations and activities of students, indicates that meaningful learning is taking place. When studying a specific topic, you should display related objects and materials, student work, pictures and posters, graphs and charts made during activities, and anchor charts of important concepts taught and learned. An active environment reinforces concepts and skills that have been stressed during science activities.

**Timelines**

No two groups of students will cover topics and materials at the same rate. Planning the duration of units is the responsibility of the teacher. In some cases, the activities will not be completed.
during one block of time and will have to be carried over. In other cases, students may be especially interested in one topic and may want to expand upon it. The individual needs of the class should be considered; there are no strict time lines involved in *Hands-On Science and Technology*. It is important, however, to spend time on every unit in the program so that students focus on all of the curriculum expectations established for their grade level.

**Classroom Management**

Although hands-on activities are emphasized throughout this program, the manner in which these experiences are handled is up to you. In some cases, you may have all students manipulating materials individually; in others, you may choose to use small-group settings. Small groups encourage the development of social skills, enable all students to be active in the learning process, and mean less cost in terms of materials and equipment.

Occasionally, especially when safety concerns are an issue, you may decide to demonstrate an activity, while still encouraging as much student interaction as possible. Again, classroom management is up to you, since it is the teacher who ultimately determines how the students in his or her care function best in the learning environment.

**Science Skills: Guidelines for Teachers**

While involved in the activities of *Hands-On Science and Technology*, students will use a variety of skills as they answer questions, solve problems, and make decisions. These skills are not unique to science, but they are integral to students' acquisition of scientific literacy. The skills include initiating and planning, performing and recording, analyzing and interpreting, as well as communicating and the ability to work in teams. In the early years, basic skills should focus on science inquiry. Although the wide variety of skills are not all presented here, the following guidelines provide a framework to use to encourage students' skill development in specific areas.

**Observing**

Students learn to perceive characteristics and changes through the use of all five senses. Students are encouraged to use sight, smell, touch, hearing, and taste (when safe) to gain information about objects and events. Observations may be qualitative (by properties such as texture or colour), or quantitative (such as size or number), or both. Observing includes:

- gaining information through the senses
- identifying similarities and differences, and making comparisons
- sequencing events or objects

**Exploring**

Students need ample opportunities to manipulate materials and equipment in order to discover and learn new ideas and concepts. During exploration, students need to be encouraged 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.

**Classifying**

This skill is used to group or sort objects and events. Classification is based on observable properties. For example, objects can be classified into living and nonliving groups, or into groups according to colour, shape, or size. One of the strategies used for sorting involves the use of Venn diagrams (either a double Venn or a triple Venn). Venn diagrams can involve distinct groups, or can intersect to show similar characteristics (please see next page).
Shadows and the Position of the Sun

Expectations

- **2.2** Investigate the changes in the amount of light from the sun that occur throughout the day and year
- **3.3** Describe changes in the amount of heat and light from the sun that occur throughout the day and the seasons

Science Background Information for Teachers

At the grade-one level, the focus of these activities should be on the observation of a shadow's change rather than on a scientific explanation as to why the change occurs. It is important to know that shadows are created by objects that block the sun's rays. As Earth rotates on its axis, the angle of the sun's rays on an object changes, causing changes in a shadow's length, width, and position.

Shadows can be measured and marked. Since Earth rotates counterclockwise, shadows are long, thin, and found west of the object early in the morning. As the sun moves higher in the sky, shadows become shorter and wider. Shadows are shortest at noon, when the sun is almost overhead. Later in the day, shadows lengthen again, and are found on the east side of the object.

Materials

- chalk
- yarn
- scissors
- chart paper
- tape
- markers

Activity

Note: Outdoor shadow activities must be done on sunny days. This activity should begin early in the school day.

Take students outside to the playground for a shadow walk. Ask them to observe the shadows cast by posts, basketball standards, flagpoles, buildings, and classmates. Then, have them look at their own shadows. Ask:

- Does your shadow move when you move?
- Can you jump on your own shadow?
- What are the biggest and smallest shadows you can make with your body?
- Can you make your shadow touch a friend's shadow without touching your bodies together?

Now, focus on shadows cast by still objects such as play structures and flagpoles. As you focus on each shadow, ask:

- What is the shape of the shadow?
- What causes a shadow?
- Where is the light coming from that makes the shadow?
- Do you think the shadow will change during the day?

Divide the class into working groups, and provide each group with yarn, chalk, and scissors. Have each student mark an X on the pavement, print his or her name under the X, then stand on that spot.

Have students use chalk to trace the shape of one another's shadows. Now, have them use the yarn to measure the length of the shadow, then cut the piece of yarn to that length. Ask:

- Do you think that the shadow will change if you come back to look at it later in the day?

Return to the classroom, and have students note the time of day. You do not have to use standard time measure; you can record times using intervals of the school day. For example, use the beginning of the day, before recess, before lunch, after lunch, and before home time.
Provide each group with a sheet of chart paper. Have students tape their pieces of yarn onto the paper and record the time that the shadow was measured.

Go outside several times during the day to observe the shadows and the position of the sun. Each time, have students use chalk to trace the new shadows and use yarn to measure the length of the shadows. Ask:

■ How have the shadows changed?
■ Are the shadows in different places?
■ Are the shadows shorter or longer?
■ Are the shadows bigger or smaller?
■ Why do you think the shadows have changed?

After each observation, return to the classroom, and in their groups have students tape their yarn onto the chart paper and record the time of day. At the end of the day, have the groups title their chart and present it to the class. During presentations, focus on students’ understanding of shadows. Ask:

■ What creates shadows?
■ Why do shadows change during the day?
■ Do you think you would see shadows clearly on a cloudy day?

In their groups, have students use their shoes (non-standard units) to measure the length of each piece of yarn. Ask students to record these measurements on chart paper. Students can then transfer them onto their activity sheets.

Repeat this activity several times throughout the school year, and have students compare their findings from season to season.

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**Activity Sheet A**

**Directions to students:**
For each shadow, record the time of day and the length of the shadow (number of shoes long) (4.7.1).

**Extensions**

■ **Butterflies in a net:** You will need: several butterfly shapes cut from dark paper, a butterfly net (or stretch a pair of pantyhose over a bent coat hanger frame, and tape the end of the hanger). Tape the butterflies in a bright, sunny window. The sun should project the shapes onto the floor. Have students use the net to capture (cover) the shadow butterflies. Ask them to leave the net in place on top of the butterflies. Check on the butterflies later. As the sun moves, students will be amazed to see the butterflies escaping from the net. Ask students to explain how this happened.

■ Use a globe to introduce the idea of Earth’s rotation. This will help students to understand how Earth’s position changes the position of shadows.

■ Have students make paper plate sundials. Push a pencil through the centre of an upside-down paper plate (as in the diagram below). Take the sundial outside, and push the pencil into the ground. The pencil will make a shadow on the plate. Students can mark the position of the shadow at this time, and several times during the day.
Play shadow tag in the morning and again in the afternoon. The object of the game is for students to try to touch one another’s shadows. Encourage students to explain how the game changed when they played it at two different times of day.
## Shadows

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