SAMPLE

hands-on science and Technology

Revised Edition

Grade 4

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PORTAGE & MAIN PRESS

Winnipeg • Manitoba • Canada
# Introduction to Hands-On Science and Technology

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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 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, the activity sheets are to be used as a follow-up to the activities. Students may work independently on the 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 activity 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.

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

Extensions: Included are optional activities to extend, enrich, and reinforce 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 material 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 timelines 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).
Food Chains

Expectations
- 2.2 Build food chains consisting of different plants and animals, including humans
- 2.5 Use appropriate science and technology vocabulary, including habitat, population, community, adaptation, and food chain, in oral and written communication
- 2.6 Use a variety of forms to communicate with different audiences and for a variety of purposes
- 3.2 Demonstrate an understanding of food chains as systems in which energy from the sun is transferred to producers (plants) and then to consumers (animals)

Science Background Information for Teachers
A food chain is an excellent way to illustrate the direct line of energy transferred from the sun to a plant (producer), to consumers, and to decomposers.

Materials
- 2 pictures illustrating food chains (included) (They can be copied onto overhead transparencies or used as is.) (1.9.1, 1.9.2)
- chart paper
- felt markers
- large sheets of art paper
- circle tracers (e.g., margarine tub lids, paper plates)
- art supplies (e.g., glue, scissors, pencil crayons, oil pastels)

Activity: Part One
Display the first picture, illustrating a food chain (1.9.1). Ask students:
- What do you think this diagram is describing?
- Which living thing in this picture is a producer?
- Which living thing is a first order consumer?
- Is the first order consumer a herbivore, omnivore, or carnivore?
- Which living thing is a second order consumer?
- Is the second order consumer a herbivore, omnivore, or carnivore?

Science Background Information for Teachers

Materials
- 2 pictures illustrating food chains (included) (They can be copied onto overhead transparencies or used as is.) (1.9.1, 1.9.2)
- chart paper
- felt markers
- large sheets of art paper
- circle tracers (e.g., margarine tub lids, paper plates)
- art supplies (e.g., glue, scissors, pencil crayons, oil pastels)

Activity: Part Two
Brainstorm other food chains, and list them on chart paper.

Have each student create a food chain: trace circles on a sheet of art paper, draw appropriate living things inside each circle, and connect the circles to show the relationships. Title the illustration “Food Chain.”
Have each student present his/her diagram to the class and describe the relationships illustrated.

**Activity Sheet A**

**Directions to students:**

Use the diagram provided to create a food chain. Label your food chain with producers and consumers. Read and answer the questions at the bottom of the page (1.9.3).

**Extension**

Provide numerous pictures of living things, and have students use the pictures to make food chains. This activity also works well at an activity centre, as it can be done independently.

**Assessment Suggestions**

- Evaluate the food-chain charts presented by the students. Break the evaluation down into two components: content (accuracy of the food chain, ability to answer questions asked), and presenting skills (voice quality, eye contact). Use the Individual Student Observations sheet, found on page 20, to record results.

- Have students complete the Student Self-Assessment sheet, found on page 26, to reflect on their own learning about food chains.
Food Chain 1
1. What would happen if the producer in your food chain died?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

2. How would this affect the first-order consumer in the food chain?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

3. What would happen if the population of the second-order consumer increased?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________