

Grade 4, Cluster 0: Overall Skills and Attitudes

Students will...

Scientific Inquiry

Design Process

Overview

Cluster “0” comprises nine categories of specific learning outcomes related to skills and attitudes* involved in scientific inquiry, the design process, or both. In Grades 3 and 4 students develop scientific inquiry skills and attitudes as they plan and conduct simple experiments. They refine their design process skills as they progress through the grades, gradually behaving more independently in designing, constructing, and testing objects, and devices. Students also acquire key attitudes, an increased awareness of the nature of science, and other skills related to research, communication, the use of information technology, and cooperative learning.

Teachers should select appropriate contexts to introduce and reinforce the scientific inquiry and design-process skills and attitudes within the thematic clusters (Clusters 1 to 4) over the course of the school year. For example, students in one Grade 4 class may be introduced to graphing skills during a study of deer populations, and develop them further while graphing sound frequency. In contrast, students in another Grade 4 class may have opportunities to acquire and practise these skills in other clusters. To assist in planning and to facilitate curricular integration, many learning outcomes within this cluster are accompanied by links to specific learning outcomes in other subject areas, specifically English Language Arts (ELA) and Mathematics (Math). There are also links to Technology as a Foundation Skill Area (TFS).

* Cluster 0, Overall Skills and Attitudes specific learning outcomes for this grade are also presented as part of a Kindergarten to Grade 4 chart (separate attachment). The purpose of this chart is to provide support related to the tracking of the development of skills and attitudes across several grades.

| | Scientific Inquiry | Design Process |
|----------------------------|--|--|
| Initiating | <p>4-0-1a. Ask questions that lead to investigations of living things, objects, and events in the local environment. (ELA 1.2.4, 3.1.2) GLO: A1, C2, C5</p> <p>4-0-1b. Make and justify predictions based on observed patterns, collected data, or data provided from other sources. <i>Examples: graph, chart...</i> (ELA 1.1.1, 1.2.1; Math PR-III.1.4) GLO: A1, C2</p> | <p>4-0-1c. Identify practical problems to solve in the local environment. GLO: C3</p> |
| Researching | <p>4-0-2a. Access information using a variety of sources. <i>Examples: school libraries, videos, traditional knowledge, CD-ROMs, Internet...</i> (ELA 3.2.2, 3.2.4, TFS 2.1.1) GLO: C6</p> <p>4-0-2b. Review information to determine its usefulness to inquiry or research needs. (ELA 3.2.3, 3.3.3) GLO: C6, C8</p> | |
| Planning | <p>4-0-3a. Brainstorm, in small groups, one or more methods of finding the answer to a given question, and reach consensus on which method to implement. GLO: C2, C7</p> <p>4-0-3b. Identify, in small groups, variables that have an impact on an investigation. GLO: A1, A2, C2, C7</p> <p>4-0-3c. Create, in small groups, a plan to answer a given question. (ELA 3.1.4; Math SP-V.2.4) GLO: C2</p> | <p>4-0-3d. Brainstorm possible solutions to a practical problem, and identify and justify which solution to implement. (ELA 1.2.3) GLO: C3</p> <p>4-0-3e. Create a written plan to solve a problem or meet a need. Include: identify steps to follow, prepare a labelled diagram. GLO: C3</p> <p>4-0-3f. Develop criteria to evaluate an object, device, or system based on its function, aesthetics, and other considerations such as materials, and cost. GLO: C3</p> |
| Implementing a Plan | <p>4-0-4a. Carry out a plan, and describe the purpose of the steps followed. (Math SP-V.2.4) GLO: C2</p> | <p>4-0-4b. Construct an object, device, or system to solve a problem or meet a need. GLO: C3</p> <p>4-0-4c. Test an object, device, or system with respect to pre-determined criteria. GLO: C3, C5</p> <p>4-0-4d. Identify and make improvements to an object, device, or system, and explain the rationale for the changes. GLO: C3</p> |

| | Scientific Inquiry | Design Process |
|------------------------------|--|----------------|
| Implementing a Plan (cont'd) | <p>4-0-4e. Identify problems as they arise, and work with others to find solutions. GLO: C3, C7</p> <p>4-0-4f. Assume roles, and share responsibilities as group members. (ELA 5.2.2) GLO: C7</p> <p>4-0-4g. Communicate questions, ideas and intentions, and listen effectively to others during classroom-learning experiences. GLO: C6</p> <p>4-0-4h. Use tools and apparatus in a manner that ensures personal safety and the safety of others. GLO: C1</p> | |
| | <p>4-0-5a. Select and use tools to observe, measure, and construct. <i>Examples: tuning fork, prism, binoculars, measuring tape...</i> GLO: C2, C3, C5</p> <p>4-0-5b. Estimate and measure mass/weight, length, volume, area, and temperature using standard units. (Math SS-IV.1.4, SS-I.1.4, SS-III.1.4, SS-II.1.4) GLO: C2, C3, C5</p> <p>4-0-5c. Record observations in a variety of ways. <i>Examples: point-form notes, sentences, labelled diagrams, charts...</i> (ELA 2.1.1, 3.3.1, 4.1.1, 4.1.2; Math SP-1.2.4, SP-II.2.4) GLO: C2, C6</p> | |
| | <p>4-0-6a. Construct bar graphs and pictographs using many to one correspondence, and interpret these as well as graphs from other sources. (Math SP-III.2.4) GLO: C2, C6</p> <p>4-0-6b. Identify and suggest explanations for patterns and discrepancies in data. GLO: A1, A2, C2, C5</p> | |
| Analysing and Interpreting | <p>4-0-6c. Choose and identify relevant attributes for use in a classification system, and create a chart or diagram that shows the method of classifying. (Math PR-II.2.4) GLO: C2, C3, C5</p> <p>4-0-6d. Sort and classify according to an established classification system. (Math PR-II.2.4) GLO: C2, C3</p> <p>4-0-6e. Evaluate, with guidance, the methods used to answer a question or solve a problem. GLO: C2, C3</p> | |

| | Scientific Inquiry | Design Process |
|--|---|---|
| Concluding and Applying | <p>4-0-7a. Draw a conclusion based on evidence gathered through research and observation. GLO: A1, A2, C2</p> <p>7b. Identify new questions that arise from what was learned. (ELA 3.3.4) GLO: A1, C2, C3</p> | <p>4-0-7b. Propose a solution to the initial problem. GLO: C3</p> <p>4-0-7c. Identify new problems that arise. GLO: C3</p> |
| | <p>4-0-7d. Construct meaning in different contexts by connecting new experiences and information to prior experiences and knowledge. (ELA 1.2.1, 2.1.2) GLO: A2, C6</p> <p>4-0-7e. Communicate results and conclusions in a variety of ways. <i>Examples: point-form lists, sentences, graphs, labelled diagrams, charts...</i> (ELA 2.3.5, 4.2.5; Math SP-III.1.4, SP-III.2.4; TFS 2.1.4) GLO: C6</p> | |
| Reflecting on Science and Technology | <p>4-0-8a. Recognize that experimental results may vary slightly when carried out by different persons, or at different times or places; but that if the results of repeated experiments are very different, something must be wrong with the design of the experiment. GLO: A1, A2, C2</p> <p>4-0-8b. Recognize that scientists must support their explanations using evidence and scientific knowledge. GLO: A1, A2, C2</p> | <p>4-0-8c. Recognize that designing a solution to a simple problem may have considerations, such as cost, materials, time, and space. GLO: B2, C3</p> |
| | <p>4-0-9a. Respect alternative views of the world. (ELA 5.1.1) GLO: C5, C7</p> <p>4-0-9b. Demonstrate confidence in their ability to do science. GLO: C5</p> <p>4-0-9c. Report and record what is observed, not what they think they ought to observe, nor what they believe the teacher expects. GLO: C5</p> | |
| Demonstrating Scientific and Technological Attitudes | | |

Grade 4, Cluster 1: Habitats and Communities

Overview

As students in Grade 4 are familiar with the basic needs of plants and animals (see *Grade 2, Cluster 1: Growth and Changes in Animals*, and *Grade 3, Cluster 1, Growth and Changes in Plants*), they can begin to explore and compare ways in which plant and animal communities satisfy their needs in particular habitats. They begin to recognize the complex interactions that take place between plant and animal populations within a community. Through investigations, students study influences, both naturally occurring and human-caused, that can alter habitats and affect plant and animal populations. The cluster also addresses the role traditional knowledge and technology play in learning more about and caring for plant and animal populations.

Students will...

- 4-1-01 Use appropriate vocabulary related to their investigations of habitats and communities.
Include: habitat, physical adaptation, behavioural adaptation, traditional knowledge, technological development, population, community, food chain, food web, organism, producer, consumer, herbivore, omnivore, carnivore, predator, prey, scavenger, endangerment, extinction, conservation.
GLO: C6, D2
- 4-1-02 Recognize that each plant and animal depends on a specific habitat to meet its needs.
GLO: D2
- 4-1-03 Identify the components of an animal habitat.
Include: food, water, living space, cover/shelter.
GLO: D2, E2
- 4-1-04 Identify physical and behavioural adaptations of animals and plants, and infer how these adaptations help them to survive in a specific habitat.
Examples: ducks' webbed feet and waterproof feathers help them dive for food in the marsh...
GLO: D1, D2
- 4-1-05 Investigate alternate explanations of plant or animal adaptations based on traditional knowledge from a variety of cultures.
GLO: A1, A4, C8

- 4-1-06 Investigate how technological developments often mirror physical adaptations.
Examples: fishnet — spider web, diving fins — webbed feet...
GLO: A5, E1
- 4-1-07 Investigate and describe a variety of local and regional habitats and their associated populations of plants and animals.
GLO: D2, E2
- 4-1-08 Predict and test to determine an appropriate method for measuring a plant population within a given habitat.
GLO: A2, C2, C3, C5
- 4-1-09 Recognize that plant and animal populations interact within a community.
GLO: D2
- 4-1-10 Recognize that the food chain is a system in which some of the energy from the Sun is transferred eventually to animals.
GLO: D2, D4, E2
- 4-1-11 Construct food chains and food webs, and classify organisms according to their roles.
Include: producer, consumer, herbivore, omnivore, carnivore, predator, prey, scavenger.
GLO: D2, E2
- 4-1-12 Use the design process to construct a model of a local or regional habitat and its associated populations of plants and animals
GLO: C3, D4
- 4-1-13 Predict, based on their investigations, how the removal of a plant or animal population may affect the rest of the community.
Examples: if the wolves were removed from a community, the deer population may increase rapidly...
GLO: D2, E2, E3
- 4-1-14 Investigate natural and human-caused changes to habitats, and identify resulting effects on plant and animal populations.
Include: endangerment, extinction.
GLO: B1, B5, D2, E3
- 4-1-15 Describe how their actions can help conserve plant and animal populations and their habitats.
Examples: clean up a local stream to improve fish and bird habitat...
GLO: B5
- 4-1-16 Describe how specific technological developments have enabled humans to increase their knowledge about plant and animal populations.
Examples: radio collar tracking, timelapse photography...
GLO: A2, A3, A5
- 4-1-17 Recognize and appreciate how traditional knowledge contributes to our understanding of plant and animal populations and interactions.
GLO: A1, A2, A4, C8

Grade 4, Cluster 2: Light

Overview

In previous grades, students had an informal introduction to energy. In this cluster, students begin to examine in more depth one form of energy they encounter on a daily basis — light. In *Grade 4, Cluster 3: Sound*, students study another aspect of energy — sound. Whether these clusters are addressed separately or as part of a combined unit, the emphasis is on building an understanding of energy. Students become familiar with the properties of light by investigating and observing how light interacts with various objects in the environment. From these observations, students come to recognize that light travels in a straight line, knowledge which they will apply, along with their design-process skills, to the construction of simple optical devices.

Students will...

- 4-2-01 Use appropriate vocabulary related to their investigations of light.
Include: energy, reflect, absorb, transmit, artificial, light beam, transparent, translucent, opaque, technological development, science, brightness.
GLO: A5, B1, C6, D4
- 4-2-02 Give examples of various forms of energy.
Include: light, heat, food, sound.
GLO: D4, E4
- 4-2-03 Recognize that energy is an integral part of daily life.
GLO: B1, D4, E4
- 4-2-04 Demonstrate that white light can be separated into colours.
GLO: C2, D4
- 4-2-05 Distinguish between objects that produce their own light and those that reflect light from another source.
Examples: the Sun emits its own light, the Moon reflects light from the Sun...
GLO: A1, A2, D4
- 4-2-06 Identify a variety of natural and artificial light sources.
Examples: Sun, candle, light bulb, firefly, lightning, aurora borealis, lasers...
GLO: D4

- 4-2-07 Observe and describe properties of light.
Include: travels in a straight path, bends as it passes from one medium to another, can be reflected, can be different colours.
GLO: C2, D4
- 4-2-08 Explore to determine effects different materials and objects have on a light beam.
Examples: prisms and water bend light; some lenses intensify light, whereas others disperse light...
GLO: C2, D3, D4
- 4-2-09 Recognize that most objects that produce light also give off heat, and identify objects that produce light but give off little or no heat.
GLO: D4
- 4-2-10 Classify materials as transparent, translucent, or opaque.
GLO: D3, E1
- 4-2-11 Evaluate the usefulness of a material for a particular task based on its ability to transmit, reflect, or absorb light.
Examples: usefulness of coloured glass to preserve food and drink by protecting them from light...
GLO: A5, B1, D3
- 4-2-12 Predict the location, shape, and size of a shadow based on the position of a light source relative to an object.
GLO: C2, D4
- 4-2-13 Identify technological developments that extend our ability to see, and recognize their impact on science.
Examples: the telescope allows astronomers to obtain new information...
GLO: A5, B1
- 4-2-14 Use the design process to construct a device that transmits and reflects light.
Examples: periscope, kaleidoscope...
GLO: B1, C3
- 4-2-15 Describe practices that help ensure protection of eyes and sight.
Examples: direct mirrors away from the eyes when reflecting intense light sources...
GLO: B3, C1
- 4-2-16 Identify different uses of light at home, at school, and in the community, and explain how the brightness and colour of the light are appropriate for each use.
Examples: vivid neon lights for advertising, blue lights for snow removal vehicles...
GLO: B1, B3, C1

Grade 4, Cluster 3: Sound

Overview

In this cluster, students expand their concept of energy by examining sound. This cluster complements the study of another common form of energy – light, which is addressed in *Grade 4, Cluster 2: Light*. Sound is a phenomenon that can be observed, measured, and controlled in various ways. Understanding that sound is caused by vibrations helps students when they explore how sound travels, how the human ear is designed to detect sound, and how certain factors can modify the sound produced. The varying abilities of humans and other animals to detect sound is also examined, which, in turn, leads to discussions about the necessity of protecting one's sense of hearing. By investigating materials to ascertain whether they transmit, absorb, or reflect sound, students learn how these characteristics influence a material's function. Students also explore the role of technology in extending one's ability to produce, transmit, and detect sound.

Students will...

- 4-3-01 Use appropriate vocabulary related to their investigations of sound.
Include: energy, sound, vibration, vocal cords, pitch, loudness, sound waves, outer ear, middle ear, inner ear, brain, transmit, absorb, reflect, detect.
GLO: B1, C6, D4
- 4-3-02 Recognize that sound is a form of energy.
GLO: D4, E4
- 4-3-03 Recognize that energy makes things happen and can be found all around us.
GLO: D4, E4
- 4-3-04 Identify and classify various sounds using student-generated criteria.
GLO: C2, D4
- 4-3-05 Recognize that sounds are caused by vibrations.
Include: the human voice relies on the vibrations of vocal cords.
GLO: D3, D4
- 4-3-06 Use the design process to create a musical instrument.
GLO: C3, C5, D4, E2

- 4-3-07 Demonstrate how the pitch and loudness of sounds can be modified.
Examples: differences in sound when plucking a loose rubber band vs. a stretched rubber band...
GLO: C2, D3, D4, E3
- 4-3-08 Observe and describe properties of sound.
Include: travels in waves in all directions.
GLO: C2, D4
- 4-3-09 Describe how the human ear is designed to detect sound vibrations.
Include: sound is transmitted from the outer ear to the middle ear and the inner ear, which relays messages to the brain.
GLO: D1, D4
- 4-3-10 Recognize that there is a range of sounds that humans can and cannot hear.
GLO: D1
- 4-3-11 Describe practices that help ensure protection of the ears and hearing.
Examples: use of ear plugs in situations involving excessive noise...
GLO: B3, C1
- 4-3-12 Describe harmful effects of high or sustained sound levels and identify potential sound hazards at home or in the community.
Examples: leaf blowing machines, snowblower, stereo, drone of machinery...
GLO: B1, B3, C1
- 4-3-13 Investigate to compare how vibrations travel differently through solids, liquids, and gases.
GLO: C2, D3, E1
- 4-3-14 Explore to determine the ability of materials to transmit or absorb sound.
GLO: C2, D3, E1
- 4-3-15 Describe how materials that absorb or reflect sound are used in different situations.
Examples: concrete sound barriers are placed beside highways to absorb sound...
GLO: B1, C1, D3
- 4-3-16 Describe devices that extend our ability to produce, transmit, and detect sound.
Examples: amplifier, hearing aids, megaphone, ear trumpet...
GLO: B1
- 4-3-17 Investigate to identify inventions related to sound, and describe their impacts on society.
Examples: radio, telephone, microphone...
GLO: A4, B1, B2
- 4-3-18 Describe the role of sound in different jobs and hobbies.
Examples: physician listens to a patient's heartbeat during a check-up, birders identify birds by their calls...
GLO: B4

Grade 4, Cluster 4: Rocks, Minerals, and Erosion

Overview

The study of rocks and minerals introduces students to geology. By examining various rocks and minerals found in the Earth's crust, students learn about their characteristics and properties. These characteristics and properties determine how these rocks and minerals are used by humans. Students discover the role rocks play in forming soil (see *Grade 3, Cluster 4: Soils in the Environment*) and in providing us with information about Earth's history. Students advance their understanding of the changing landscape by becoming aware of how wind, water, and ice continue to reshape it through erosion. This leads students to explore ways in which humans can adapt to and prevent or make changes in the landscape.

Students will...

- 4-4-01 Use appropriate vocabulary related to their investigations of rocks, minerals, and erosion.
Include: rock, mineral, characteristic, property, scratch test, streak test, igneous, sedimentary, metamorphic, fossil, organism, extinct, soil formation, erosion, natural phenomena.
GLO: C6, D5
- 4-4-02 Classify rocks and minerals according to student-generated criteria.
GLO: C2, D3, D5
- 4-4-03 Test to determine characteristics of rocks and properties of minerals, and classify accordingly.
Include: scratch test for hardness, streak test for colour.
GLO: A1, C2, D3, D5
- 4-4-04 Differentiate between minerals and rocks.
Include: minerals are composed of the same substance throughout, rocks are composed of two or more minerals..
GLO: D5
- 4-4-05 Compare rocks and minerals from the local environment with each other and with those from other geological areas.
GLO: C2, D5, E1

- 4-4-06 Give examples of products derived from rocks and minerals.
Examples: china, chalk, jewellery, pumice stone, drywall, talcum powder...
GLO: B1
- 4-4-07 Describe how characteristics of rocks and properties of minerals determine their uses.
Examples: soft soapstone is used for carving...
GLO: B1, D3, D5
- 4-4-08 Recognize that there are three types of rock, and describe how each is formed.
Include: igneous, sedimentary, metamorphic.
GLO: D5
- 4-4-09 Explain how fossils are formed.
GLO: D1, D5, E3
- 4-4-10 Describe how fossils help humans gain a better understanding of Earth's history, including identifying organisms that are now extinct.
GLO: A1, A2, D1, D5
- 4-4-11 Investigate and describe ways in which rock contributes to soil formation.
GLO: D5, E2, E3
- 4-4-12 Investigate and describe ways in which soil erosion is controlled or minimized in their community and in communities around the world.
Examples: windbreaks, retaining walls, terracing, cover crops, reforestation...
GLO: A5, B1, B5
- 4-4-13 Use the design process to determine an appropriate system for controlling soil erosion in a given situation.
GLO: B1, B5, C3, E3
- 4-4-14 Describe effects of wind, water, and ice on the landscape.
Examples: ice breaking rocks into soil, wind shaping sand dunes, waves polishing rocks on the shoreline...
GLO: D5, E3
- 4-4-15 Identify natural phenomena and human activities that cause significant changes in the landscape.
Examples: floods, avalanches, mud slides, hydroelectric dams, clearing land for agriculture, clear-cut forestry, forest fires...
GLO: B5, D5, E3