Grade 7, Cluster 0: Overall Skills and Attitudes

Overview

Cluster 0* comprises nine categories of specific student learning outcomes (SLOs) that describe the skills and attitudes involved in scientific inquiry, the design process, or both.

In scientific inquiry at Grades 7 and 8, students build on the concept of a fair test developed in Grades 5 and 6. This includes developing a prediction/hypothesis that identifies a cause and effect relationship between dependent and independent variables; repeating experiments to increase accuracy and reliability; looking for alternative explanations for observations; recognizing strengths and weaknesses of different methods of collecting and displaying data; and determining potential sources of error. In the design process, students construct prototypes to solve practical problems and analyze them according to criteria such as cost, efficiency, and environmental considerations. Students continue to apply their problem-solving skills in the evaluation of consumer products in order to determine the best product for a particular purpose. This involves identifying priorities. For example, in choosing a brand of sunscreen, to what extent do cost, effectiveness, and the environmental track record of the company affect the decision?

Although the thematic clusters (Clusters 1 to 4) include certain skills and attitudes, Cluster 0 fully defines scientific inquiry and design process skills and attitudes at each grade. Teachers should select appropriate contexts to introduce and reinforce Cluster 0 SLOs over the course of the school year. To assist in planning and to facilitate curricular integration, many SLOs within Cluster 0 are accompanied by links to SLOs 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 are also presented as part of a Grades 5 to 8 chart (separate attachment).

Students will...

	Scientific Inquiry	Design Process
Initiating	**7-0-1a ⊂ Formulate specific questions that lead to investigations.** **Include: rephrase questions to a testable form; focus research questions.** **GLO: A1, C2** **(ELA Grade 7, 3.1.2; Math: SP-I.1.7)**	**7-0-1c Identify practical problems to solve.** ***Examples: How can I keep my soup hot? Which type of sunscreen should I buy?...*** **GLO: C3**
	7-0-1b Select and justify a method to be used in finding the answer to a specific question. **GLO: C2** **(ELA Grade 7, 3.2.3; Math: SP-II.1.7)**	**7-0-1d Select and justify a method to be used in finding a solution to a practical problem.** **GLO: C3** **(Math: SP-II.1.7)**
Researching	**7-0-2a ⊂ Access information using a variety of sources.** ***Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet...*** **GLO: C6** **(ELA Grade 7, 3.2.2; TFS 2.2.1)**	
	7-0-2b Evaluate the usefulness, currency, and reliability of information, using predetermined criteria. **GLO: C6, C8** **(ELA Grade 7, 3.2.3; TFS 2.2.2)**	
	7-0-2c Make notes using headings and subheadings or graphic organizers appropriate to a topic and reference sources. **GLO: C6** **(ELA Grade 7, 3.3.2)**	

	Scientific Inquiry	Design Process
Planning	**7-0-3a Formulate a prediction/hypothesis that identifies a cause and effect relationship between the dependent and independent variables.** **GLO: A2, C2** **(Math: SP-I.1.7)**	**7-0-3d Develop criteria to evaluate a prototype or consumer product.** **Include: function, aesthetics, environmental considerations, cost, efficiency.** **GLO: C3**
	7-0-3b Identify with guidance the independent and dependent variables in an exeriment. **GLO: A2, C2**	
	7-0-3c Create a written plan to answer a specific question. **Include: apparatus, materials, safety considerations, steps to follow, and variables to control.** **GLO: C2** **(ELA Grade 7, 3.1.4)**	**7-0-3e Create a written plan to solve a problem.** **Include: materials required, three-dimensional sketches, steps to follow.** **GLO: C1, C3, C6**

	Scientific Inquiry	Design Process
Implementing a Plan	**7-0-4a Carry out procedures that comprise a fair test.** **Include: controlling variables, repeating experiments to increase accuracy and reliability.** **GLO: C2**	**7-0-4b ⊂ Construct a prototype.** **GLO: C3**
	7-0-4c ⊂ Work cooperatively with team members to carry out a plan, and troubleshoot problems as they arise. **GLO: C7** **(ELA Grade 7, 5.2.1)**	
	7-0-4d ⊂ Assume various roles to achieve group goals. **GLO: C7** **(ELA Grade 7, 5.2.2)**	
	7-0-4e Demonstrate work habits that ensure personal safety, the safety of others, and consideration for the environment. **Include: keeping an uncluttered workspace; putting equipment away after use; handling glassware with care; wearing goggles when required; disposing of materials safely and responsibly.** **GLO: C1**	
	7-0-4f Identify WHMIS hazard symbols that provide information on the safety of substances. **GLO: C1**	

Students will...

	Scientific Inquiry	Design Process
Observing, Measuring, Recording	7-0-5a ⊂ Make observations that are relevant to a specific question. GLO: A1, A2, C2	7-0-5b ⊂ Test a prototype or consumer product, using predetermined criteria. GLO: C3, C5
	7-0-5c Select and use tools to observe, measure, and construct. Include: microscopes, a variety of thermometers, graduated cylinders, glassware, balance. GLO: C2, C3, C5 7-0-5d Make conversions among commonly used SI units. GLO: C2, C3 (Math: SS-IV.3.6, SS-I.3.6, SS-III.3.6) 7-0-5e Estimate and measure accurately using SI and other standard units. Include: determining volume by displacement of water. GLO: C2, C5 (Math: SS-IV.1.6, SS-III.1.5, SS-III.1.6, SS-I.1.5) 7-0-5f Record, compile, and display observations and data, using an appropriate format. GLO: C2, C6 (ELA Grade 7, 3.3.1; Math: SP-III.2.7)	

	Scientific Inquiry	Design Process
Analyzing and Interpreting	7-0-6a Construct graphs to display data, and interpret and evaluate these and other graphs. *Examples: frequency tallies, histograms, double-bar graphs, stem-and-leaf plots...* GLO: C2, C6 (ELA Grade 7, 3.3.1; Math: SP-III.2.6; TFS: 4.2.2– 4.2.6) 7-0-6b Interpret patterns and trends in data, and infer and explain relationships. GLO: A1, A2, C2, C5 7-0-6c Identify strengths and weaknesses of different methods of collecting and displaying data, and potential sources of error. GLO: A1, A2, C2, C5 (ELA Grade 7, 3.3.3)	7-0-6d ⊂ Identify and make improvements to a prototype, and explain the rationale for the changes. GLO: C3, C4 7-0-6e ⊂ Evaluate the strengths and weaknesses of a consumer product, based on predetermined criteria. GLO: C3, C4
	7-0-6f Identify how the original plan evolved and justify the changes. GLO: C2, C3 (ELA Grade 7, 3.3.4)	

	Scientific Inquiry	Design Process
Concluding and Applying	**7-0-7a Draw a conclusion that explains investigation results.** **Include: explaining the cause and effect relationship between the dependent and independent variables; identifying alternative explanations for observations; supporting or rejecting a prediction/hypothesis.** **GLO: A1, A2, C2** **(ELA Grade 7, 3.3.4)** **7-0-7b Critically evaluate conclusions, basing arguments on fact rather than opinion.** **GLO: C2, C4** **7-0-7c ⊂ Identify a new prediction/hypothesis based on investigation results.** **GLO: A1, C2** **(ELA Grade 7, 3.3.4)**	**7-0-7d ⊂ Propose and justify a solution to the initial problem.** **GLO: C3** **7-0-7e ⊂ Identify new practical problems to solve.** **GLO: C3**
	7-0-7f ⊂ Reflect on prior knowledge and experiences to construct new understanding and apply this new knowledge in other contexts. **GLO: A2, C4** **(ELA Grade 7, 1.2.1)** **7-0-7g ⊂ Communicate methods, results, conclusions, and new knowledge in a variety of ways.** ***Examples: oral, written, multimedia presentations...*** **GLO: C6 (ELA Grade 7, 4.4.1)** **7-0-7h Identify and evaluate potential applications of investigation results.** **GLO: C4**	

	Scientific Inquiry	Design Process
Reflecting on Science and Technology	**7-0-8a Distinguish between science and technology.** **Include: purpose, procedures, products.** **GLO: A3** **7-0-8b Describe examples of how scientific knowledge has evolved in light of new evidence, and the role of technology in this evolution.** **GLO: A2, A5, B1** **7-0-8d Describe examples of how technologies have evolved over time in response to changing needs and scientific advances.** **GLO: A5, B1, B2** **7-0-8e Provide examples of Canadian institutions and individuals who have contributed to science and technology, and describe their contributions.** **GLO: A1, A4, B1, B4** **7-0-8f Relate personal activities in formal and informal settings to specific scientific disciplines.** **GLO: A1, B4** **7-0-8g Discuss societal, environmental, and economic impacts of scientific and technological endeavours.** **Include: local and global impacts.** **GLO: A1, B1, B3, B5**	

	Scientific Inquiry / Design Process
Demonstrating Scientific and Technological Attitudes	**7-0-9a Appreciate and respect that science has evolved from different views held by women and men from a variety of societies and cultural backgrounds.** **GLO: A4** **7-0-9b Express interest in a broad scope of science and technology related fields and issues.** **GLO: B4** **7-0-9c ⊂ Demonstrate confidence in their ability to carry out investigations.** **GLO: C5** **7-0-9d Value skepticism, accuracy, precision, and open-mindedness as scientific and technological habits of mind.** **GLO: C5** **7-0-9e Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment.** **GLO: B5** **7-0-9f Consider both immediate and long-term effects of their actions.** **GLO: B5, C4, E3**

Notes

Grade 7, Cluster 1: Interactions Within Ecosystems

Overview

In this cluster, students investigate the complex interactions between organisms and their environment. Students identify biotic and abiotic components of ecosystems, and analyze the cycling of matter that takes place within them. This includes an investigation of the transfer of energy that occurs at various consumer levels, the implications of the loss of producers and consumers to the transfer of energy, and the potential for bio-accumulation within an ecosystem. Students explore ecological succession and assess the positive and negative impacts of human interventions on this natural process. Students discuss environmental, social, and economic factors that should be considered in the management and preservation of ecosystems. They propose a course of action that would help protect the habitat of a particular organism. Students observe micro-organisms with microscopes and discuss their beneficial and harmful roles. Students consider how knowledge of micro-organisms has improved food production and preservation techniques.

Students will…

7-1-01 Use appropriate vocabulary related to their investigations of interactions within ecosystems.

Include: ecosystem, biosphere, abiotic, biotic, organisms, ecological succession, photosynthesis, cellular respiration, ecological pyramid, bioaccumulation, scavengers, decomposers, micro-organisms.

GLO: C6, D2

7-1-02 Define ecosystem, and describe various examples that range from the microscopic to the entire biosphere.

Include: a place on Earth where living things interact with other living things as well as non-living things.

GLO: D2, E2

7-1-03 Identify abiotic and biotic components of ecosystems that allow particular organisms to survive.

GLO: D1, D2, E2

7-1-04 Describe ecological succession and identify signs of succession in a variety of ecosystems.

Include: the natural process whereby some species are replaced by other species in a predictable pattern.

GLO: D2, E2, E3

7-1-05 Identify and describe positive and negative examples of human interventions that have an impact on ecological succession or the makeup of ecosystems.

Examples: positive — protecting habitats, reintroducing species; negative — preventing natural fires, introducing non-indigenous species, draining wetlands for agriculture or housing...

GLO: B5, D2, E2, E3

7-1-06 Identify environmental, social, and economic factors that should be considered in the management and preservation of ecosystems.

Examples: habitat preservation, recreation, employment, industrial growth, resource development...

GLO: B1, B5, D2, E2

7-1-07 Propose a course of action to protect the habitat of a particular organism within an ecosystem.

Examples: protect the nesting habitat of a given bird in a local wetland...

GLO: B5, C3, D2, E2

7-1-08 Compare photosynthesis to cellular respiration, and explain how both are part of the cycling of matter and the transfer of energy in ecosystems.

Include: photosynthesis: water + carbon dioxide + light energy = sugar + oxygen in the presence of chlorophyll; cellular respiration: sugar + oxygen = water + carbon dioxide + energy.

GLO: A2, C6, D2, E4

7-1-09 Analyze food webs, using ecological pyramids, to show energy gained or lost at various consumer levels.

Include: producers; primary, secondary, and tertiary consumers.

GLO: C2, C8, D2, E4

7-1-10 Analyze, using ecological pyramids, the implications of the loss of producers and consumers to the transfer of energy within an ecosystem.

GLO: C2, C8, D2, E4

7-1-11 Explain, using ecological pyramids, the potential for bioaccumulation within an ecosystem.

GLO: D2, E2, E4

7-1-12 Provide examples of scavengers and decomposers, and describe their role in cycling matter in an ecosystem.

Include: micro-organisms.

GLO: D2, E1, E2, E3

7-1-13 Demonstrate proper use and care of the microscope to observe micro-organisms.

Include: preparing wet mounts beginning with the least powerful lens; focussing; drawing specimens; indicating magnification.

GLO: C1, C2, C7

(continued)

7-1-14 Identify beneficial and harmful roles played by micro-organisms.

Examples: beneficial — aid in digestion, composting, food and vaccine production; harmful — cause disease, food spoilage...

GLO: B3, C2, D2

7-1-15 Research and describe human food production or preservation techniques that apply a knowledge of micro-organisms.

Examples: bread and yogourt making, food drying, sterilization, refrigeration...

GLO: A5, B2, B3, D1

Notes

Grade 7, Cluster 2: Particle Theory of Matter

Overview

In this cluster, students explore the nature of science by examining the development of scientific theories. One theory, the particle theory of matter, is investigated in detail. Students use the particle theory to describe changes of state, to differentiate between pure substances and mixtures, and to describe characteristics of solutions. An important distinction is made between heat and temperature. Students demonstrate how heat is transmitted by way of conduction, convection, and radiation. They plan and conduct experiments to identify substances that are good insulators and conductors of heat. They apply this knowledge through the design and construction of a prototype that controls the transfer of heat energy. Students also identify different forms of energy that can be transformed into heat energy, and recognize that heat is the most common by-product of other energy transformations. Students classify substances used in daily life as pure substances, mechanical mixtures, and solutions. They demonstrate different methods of separating the components of mixtures. Students experiment to determine factors that affect solubility. They describe the concentration of solutions in qualitative and quantitative terms, and demonstrate the differences between saturated and unsaturated solutions. The potential harmful effects of some substances on the environment are discussed, and methods to ensure safe use and disposal are identified.

Students will…

7-2-01 Use appropriate vocabulary related to their investigations of the particle theory of matter.

Include: boiling and melting points, pure substance, scientific theory, particle theory of matter, temperature, heat, conduction, convection, radiation, mixture, solution, mechanical mixture, homogeneous, heterogeneous, solutes, solvents, solubility, concentration, dilute, concentrated, saturated, unsaturated, terms related to forms of energy.

GLO: C6, D3, E4

7-2-02 Evaluate different types of thermometers using the design process.

Examples: materials used, range, sensitivity, durability, scale, cost...

GLO: C1, C3

7-2-03 Demonstrate the effects of heating and cooling on the volume of solids, liquids, and gases, and give examples from daily life.

GLO: A2, C1, D3, E4

7-2-04 Compare the boiling and melting points of a variety of substances and recognize that boiling and melting points are properties of pure substances.

Include: water.

GLO: C2, D3, E3, E4

7-2-05 Explain what scientific theories are, and provide some examples.

Include: a scientific theory helps to explain an observation; when this explanation has been repeatedly tested and shown to be consistent it is generally accepted in the scientific world.

GLO: A1, A2

7-2-06 Describe the particle theory of matter and use it to explain changes of state.

GLO: A2, C6, D3, D4

7-2-07 Differentiate between the concept of temperature and the concept of heat.

GLO: D3, D4, E4

7-2-08 Demonstrate how heat can be transmitted through solids, liquids, and gases.

Include: conduction, convection, radiation.

GLO: C1, D3, D4, E4

7-2-09 Plan an experiment to identify materials that are good heat insulators and good heat conductors, and describe some uses of these materials.

GLO: B1, D3, D4

7-2-10 Use the design process to construct a prototype that controls the transfer of heat energy.

Examples: insulated lunch bag, solar oven, home insulation...

GLO: A5, B2, C3, C4

7-2-11 Recognize that heat energy is the most common by-product of energy transformations, and describe some examples.

Examples: thermal pollution, body heat, friction...

GLO: B1, D4, E4

7-2-12 Identify different forms of energy that can be transformed into heat energy.

Include: mechanical, chemical, nuclear, electrical.

GLO: D4, E4

7-2-13 Differentiate between pure substances and mixtures by using the particle theory of matter.

Include: a pure substance is made up of one type of particle; a mixture is made up of two or more types of particles.

GLO: A2, D3, E1

7-2-14 Differentiate between the two types of mixtures, solutions and mechanical mixtures.

Include: solutions — homogeneous; mechanical mixtures — heterogeneous mixtures.

GLO: D3, E1

7-2-15 Classify a variety of substances used in daily life as pure substances, solutions, or mechanical mixtures.

Examples: distilled water, paint thinner, mouthwash, peanut butter, liquid soap, medicines, sunscreens...

GLO: B1, E1

(continued)

Grade 7, Cluster 2: Particle Theory of Matter (continued)

7-2-16 Identify solutes and solvents in common solid, liquid, and gaseous solutions.

GLO: D3

7-2-17 Describe solutions by using the particle theory of matter.

Include: particles have an attraction for each other; the attraction between the particles of solute and solvent keeps them in solution.

GLO: A1, D3, E1

7-2-18 Demonstrate different methods of separating the components of both solutions and mechanical mixtures.

Examples: distillation, chromatography, evaporation, sieving, dissolving, filtration, decanting, magnetism, sedimentation...

GLO: C1, C2

7-2-19 Identify a separation technique used in industry, and explain why it is appropriate.

GLO: B1, C4

7-2-20 Experiment to determine factors that affect solubility.

Include: agitation, surface area, temperature.

GLO: C2, D3

7-2-21 Describe the concentration of a solution in qualitative and quantitative terms, and give examples from daily life when the concentration of a solution influences its usefulness.

Include: dilute, concentrated, grams of solute per 100 mL.

GLO: C6, D3

7-2-22 Demonstrate the difference between saturated and unsaturated solutions.

GLO: C2, C6, D3

7-2-23 Discuss the potential harmful effects of some substances on the environment, and identify methods to ensure their safe use and disposal.

Examples: pollution of groundwater from improper disposal of paints and solvents; pollution of the atmosphere by car exhaust...

GLO: B1, B3, B5, C1

Notes

Grade 7, Cluster 3: Forces and Structures

Overview

In this cluster, students explore a variety of natural and human-built structures, and the forces that act on them. Students investigate internal and external forces acting on structures and recognize that these forces may affect structural strength and stability. Students identify common shapes used to increase strength and stability in structures, and methods used to enhance the strength of the materials used. The efficiency of a structure is assessed by comparing its mass with the mass of the load it supports. Students apply their understanding of forces and structures by evaluating the appropriateness of a specific structure's design, and by constructing a structure of their own that supports a given load and remains standing when a particular force is applied.

Students will…

7-3-01 Use appropriate vocabulary related to their investigations of forces and structures.

Include: frame, shell, solid, centre of gravity, stability, compression, tension, shear, torsion, internal and external forces, stress, structural fatigue, structural failure, load, magnitude, point and plane of application, efficiency.

GLO: C6, D4

7-3-02 Classify natural and human-built structures found locally and around the world.

Include: frame, shell, solid.

GLO: E1

7-3-03 Identify the centre of gravity in a model structure, and demonstrate that changes in the location of a structure's centre of gravity affect its stability.

GLO: C1, D4

7-3-04 Identify internal forces acting on a structure, and describe them using diagrams.

Include: compression, tension, shear, torsion.

GLO: D4, E4

7-3-05 Identify external forces acting on a structure, and describe them using diagrams.

Examples: snow on a rooftop, wind on a tent, water against a beaver dam...

GLO: C6, D4, E4

7-3-06 Recognize that internal and external forces apply stress to structures, and describe examples in which this stress has led to structural fatigue or structural failure.

GLO: D4, E3

7-3-07 Investigate to determine that the effect of a force on a structure depends on its magnitude, direction, and point and plane of application.

GLO: D4

7-3-08 Describe, using diagrams, how common structural shapes and components can increase the strength and stability of a structure.

Examples: a triangle distributes the downward force of a load evenly between its two vertices...

GLO: C6, D3, D4

7-3-09 Describe and demonstrate methods to increase the strength of materials.

Examples: corrugation of surfaces, lamination of adjacent members, alteration of the shape of components...

GLO: C2, C3, D3, E3

7-3-10 Determine the efficiency of a structure by comparing its mass with the mass of the load it supports.

GLO: C1, C5

7-3-11 Evaluate a structure to determine the appropriateness of its design, using the design process.

Examples: jacket, foot stool, local building...

GLO: C3, C4, C8, D4

7-3-12 Use the design process to construct a structure that will withstand the application of an external force.

Examples: a tower that will remain standing during a simulated earthquake...

GLO: C3, D3, D4

Grade 7, Cluster 4: Earth's Crust

Overview

In this cluster, students investigate Earth's geology, including rock and mineral formation, changes in the landscape over time, and human use of geological resources. Students describe processes involved in the location, extraction, processing, and recycling of geological resources found in Manitoba and Canada. Students recognize that soil is an important natural resource and they discuss the importance of soil conservation. Students identify environmental, social, and economic factors that should be considered in making informed decisions about land use. They examine theories explaining the Earth's geology, and recognize the role of technology in the development of new scientific theories. Specialized careers involving the science and technology of the Earth's crust are also explored.

Students will…

7-4-01 Use appropriate vocabulary related to their investigations of the Earth's crust.

Include: crust, mantle, outer core, inner core, weathering (physical, biological, and chemical), erosion, rock cycle, fossil fuel, geothermal energy, continental drift theory, theory of plate tectonics.

GLO: C6, D5

7-4-02 Describe the Earth's structure.

Include: crust, mantle, outer core, inner core.

GLO: C6, D5

7-4-03 Describe the geological processes involved in rock and mineral formation, and classify rocks and minerals by their method of formation.

GLO: D3, D5, E3

7-4-04 Investigate and describe the processes of weathering and erosion, and recognize that they cause changes in the landscape over time.

Include: physical, biological, and chemical weathering.

GLO: D3, D5, E3

7-4-05 Explain how rocks on the Earth constantly undergo a slow process of change through the rock cycle.

GLO: D5, E3

7-4-06 Identify geological resources that are used by humans as sources of energy, and describe their method of formation.

Include: fossil fuels, geothermal energy.

GLO: D4, D5, E3

7-4-07 Identify geological resources that are present in Manitoba and Canada, and describe the processes involved in their location, extraction, processing, and recycling.

Include: fossil fuels, minerals.

GLO: A5, B5, D3, D5

7-4-08 Identify environmental impacts of geological resource extraction, and describe techniques used to address these.

GLO: B1, B5, C1, C3

7-4-09 Recognize that soil is a natural resource, and explain how the characteristics of soil determine its use.

GLO: D5, E1

7-4-10 Describe methods used to control soil erosion, and recognize the importance of soil conservation.

Examples: economically important to the agri-food industry, important for controlling the flow of water, necessary for plant growth...

GLO: A5, B2, B5, E3

7-4-11 Identify environmental, social, and economic factors that should be considered in making informed decisions about land use.

GLO: B1, B5, D5

7-4-12 Describe evidence used to support the continental drift theory, and explain why this theory was not generally accepted by scientists.

GLO: A1, A2, A4, D5

7-4-13 Describe evidence used to support the theory of plate tectonics, the role technology has played in the development of this theory, and reasons why it is generally accepted by scientists.

GLO: A1, A2, A5, D5

7-4-14 Explain geological processes and events using the theory of plate tectonics.

Include: mountain formation, earthquakes, volcanoes.

GLO: A1, A2, D5, E3

7-4-15 Identify specialized careers involving the study of the Earth's crust or the utilization of geological resources, and give examples of technologies used in each.

Examples: geophysicist, seismologist, volcanologist, farmer...

GLO: A5, B4