

Grade 6, 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 5 and 6, students begin to develop the concept of a fair test. This includes developing a prediction/hypothesis that identifies a cause and effect relationship; controlling variables; repeating measurements to increase accuracy and reliability; and drawing conclusions that support or reject their initial predictions/hypotheses. In the design process, students continue to identify and address practical problems through the construction of a prototype. Increasingly sophisticated criteria are used to analyze a prototype, including use of recycled materials, cost, and reliability. Students begin to apply their problem-solving skills in the evaluation of consumer products based on identified criteria in order to determine the best product for a specific purpose. For example, in choosing between pre-packaged pizzas, the various factors of cost, nutritional value, and packaging may influence students' evaluation of the product.

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	<p>6-0-1a Formulate specific questions that lead to investigations. Include: rephrase questions to a testable form; focus research questions. GLO: A1, C2 (ELA Grade 6, 3.1.2; Math: SP-I.1.6)</p> <p>6-0-1b Identify various methods for finding the answer to a specific question and select one to implement. Examples: generating experimental data; accessing information from a variety of sources... GLO: C2 (ELA Grade 6, 3.2.2; Math: SP-I.2.6, SP-II.1.6)</p>	<p>6-0-1c Identify practical problems to solve. Examples: How can I make a hot-air balloon? Which type of light bulb should I buy?... GLO: C3</p> <p>6-0-1d Identify various methods to solve a practical problem, and select and justify one to implement. Examples: constructing and testing a prototype; evaluating consumer products; accessing information from a variety of sources... GLO: C3 (Math: SP-I.2.6, SP-II.1.6)</p>
Researching	<p>6-0-2a Access information using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMs, Internet... GLO: C6 (ELA Grade 6, 3.2.2; Math: SP-II.1.6; TFS 2.2.1)</p> <p>6-0-2b Review information to determine its usefulness, using predetermined criteria. GLO: C6, C8 (ELA Grade 6, 3.2.3)</p> <p>6-0-2c Make notes on a topic, combining information from more than one source and referencing sources appropriately. GLO: C6 (ELA Grade 6, 3.3.2)</p>	

	Scientific Inquiry	Design Process
Planning	<p>6-0-3a Formulate a prediction/hypothesis that identifies a cause and effect relationship. GLO: A2, C2 (Math: SP-I.1.6)</p> <p>6-0-3b Identify variables that might have an impact on their experiments, and variables to hold constant to ensure a fair test. GLO: A2, C22</p> <p>6-0-3c Create a written plan to answer a specific question. Include: apparatus, materials, safety considerations, steps to follow. GLO: C1, C2 (ELA Grade 6, 3.1.4)</p>	<p>6-0-3d Develop criteria to evaluate a prototype or consumer product. Include: function, aesthetics, use of recycled materials, cost, reliability. GLO: C3</p> <p>6-0-3e Create a written plan to solve a problem. Include: materials, safety considerations, labelled diagrams of top and side views, steps to follow. GLO: C1, C3, C6</p>
	<p>6-0-4a Carry out procedures that comprise a fair test. Include: controlling variables; repeating measurements to increase accuracy and reliability. GLO: C2</p> <p>6-0-4c Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise. GLO: C7 (ELA Grade 6, 5.2.2)</p> <p>6-0-4d Assume various roles to achieve group goals. GLO: C7 (ELA Grade 6, 5.2.2)</p> <p>6-0-4e Use tools and materials in a manner that ensures personal safety and the safety of others. Include: keeping an uncluttered workspace; putting equipment away after its use; handling glassware with care. GLO: C1</p>	<p>6-0-4b Construct a prototype. GLO: C3</p>

	Scientific Inquiry	Design Process
Observing, Measuring, Recording	<p>6-0-5a Make observations that are relevant to a specific question. GLO: A1, A2, C2</p>	<p>6-0-5b Test a prototype or consumer product, using predetermined criteria. GLO: C3, C5</p>
	<p>6-0-5c Select and use tools and instruments to observe, measure, and construct. <i>Examples: hand lens, telescope, binoculars...</i> GLO: C2, C3, C5</p> <p>6-0-5d Evaluate the appropriateness of units and measuring tools in practical contexts. GLO: C2, C5 (Math: SS-I.1.6)</p> <p>6-0-5e Estimate and measure accurately using SI and other standard units. GLO: C2, C5 (Math: SS-IV.1.6, SS-III.1.5, SS-I.1.5)</p> <p>6-0-5f Record and organize observations in a variety of ways. <i>Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets...</i> GLO: C2, C6 (ELA Grade 6, 3.3.1; Math: SP-III.2.6)</p>	

Students will...

	Scientific Inquiry	Design Process	Scientific Inquiry	Design Process	
Analyzing and Interpreting	<p>6-0-6a Construct graphs to display data, and interpret and evaluate these and other graphs. <i>Examples: frequency tallies, histograms, double-bar graphs, stem-and-leaf plots...</i> GLO: C2, C6 (ELA Grade 6, 3.3.1; Math: SP-II.2.5, SP-III.2.6, SP-IV.1.6; TFS: 4.2.2—4.2.6)</p> <p>6-0-6c Identify and suggest explanations for patterns and discrepancies in data. GLO: A1, A2, C2, C5</p>	<p>6-0-6d Identify and make improvements to a prototype, and explain the rationale for the changes. GLO: C3, C4</p> <p>6-0-6e Evaluate the strengths and weaknesses of a consumer product, based on predetermined criteria. GLO: C3, C4</p>	Concluding and Applying	<p>6-0-7a Draw a conclusion that explains investigation results. Include: explaining patterns in data; supporting or rejecting a prediction/hypothesis. GLO: A1, A2, C2 (ELA Grade 6, 3.3.4)</p> <p>6-0-7b Base conclusions on evidence rather than pre-conceived ideas or hunches. GLO: C2, C4</p> <p>6-0-7c Identify a new prediction/hypothesis based on investigation results. GLO: A1, C2 (ELA Grade 6, 3.3.4)</p>	<p>6-0-7d Propose and justify a solution to the initial problem. GLO: C3</p> <p>6-0-7e Identify new practical problems to solve. GLO: C3</p>
	<p>6-0-6f Evaluate the methods used to answer a question or solve a problem. GLO: C2, C3 (ELA Grade 6, 3.3.4)</p>			<p>6-0-7f Reflect on prior knowledge and experiences to construct new understanding, and apply this new knowledge in other contexts. GLO: A2, C4 (ELA Grade 6, 1.2.1)</p> <p>6-0-7g Communicate methods, results, conclusions, and new knowledge in a variety of ways. <i>Examples: oral, written, multimedia presentations...</i> GLO: C6 (ELA Grade 6, 4.4.1; TFS: 3.2.2, 3.2.3)</p> <p>6-0-7h Identify potential applications of investigation results. GLO: C4</p>	

	Scientific Inquiry	Design Process
Reflecting on Science and Technology	<p>6-0-8a ☉ Recognize that science is a way of answering questions about the world, and that there are questions that science cannot answer. GLO: A1, A3</p> <p>6-0-8b ☉ Identify examples of scientific knowledge that have developed as a result of the gradual accumulation of evidence. GLO: A2</p>	<p>6-0-8c ☉ Recognize that technology is a way of solving problems in response to human needs. GLO: A3, B2</p> <p>6-0-8d ☉ Provide examples of technologies from the past and describe how they have evolved over time. GLO: B1</p>
	<p>6-0-8e ☉ Describe hobbies and careers related to science and technology. GLO: B4</p> <p>6-0-8f ☉ Recognize that science is organized into specialized disciplines. GLO: A1, B4</p> <p>6-0-8g ☉ Describe positive and negative effects of scientific and technological endeavours. Include: effects on themselves, society, the environment, and the economy. GLO: A1, B1, B3, B5</p>	

	Scientific Inquiry	Design Process
Demonstrating Scientific and Technological Attitudes and Habits of Mind	<p>6-0-9a ☉ Appreciate that women and men of diverse cultural backgrounds can contribute equally to science. GLO: A4</p> <p>6-0-9b ☉ Show interest in the activities of individuals working in scientific and technological fields. GLO: B4</p> <p>6-0-9c ☉ Demonstrate confidence in their ability to carry out investigations. GLO: C5</p> <p>6-0-9d ☉ Appreciate the importance of creativity, accuracy, honesty, and perseverance as scientific and technological habits of mind. GLO: C5</p> <p>6-0-9e ☉ Be sensitive to and develop a sense of responsibility for the welfare of other humans, other living things, and the environment. GLO: B5</p> <p>6-0-9f ☉ Frequently and thoughtfully evaluate the potential consequences of their actions. GLO: B5, C4</p>	

Grade 6, Cluster 1: Diversity of Living Things

Overview

In this cluster, students develop an appreciation of the diversity of living things. Students study a variety of classification systems, and construct and use their own as well as those developed by others. In doing so, they recognize the advantages and disadvantages of classification systems in organizing information. The animal kingdom provides a specific focus with students investigating different types of animals to understand where they fit in the classification of living things. Students compare and contrast the adaptations of closely related vertebrates living in different habitats, and the adaptations of vertebrates living today with those that lived in the past. Students learn about the contributions of individual scientists who have increased our understanding of the diversity of living things.

Students will...

- 6-1-01 Use appropriate vocabulary related to their investigations of the diversity of living things.
Include: classification system, classification key, paleontologist, terms related to names of kingdoms and types of vertebrates and invertebrates.
GLO: C6, D1
- 6-1-02 Describe various kinds of classification systems used in everyday life, and identify related advantages and disadvantages.
Examples: organization of phone numbers in a phone book, books in a library, groceries in a supermarket...
GLO: B1, B2, E1, E2
- 6-1-03 Develop a system to classify common objects or living things into groups and subgroups, and explain the reasoning used in the system's development.
GLO: A1, C2, E1, E2
- 6-1-04 Identify living things using an existing classification key, and explain the rationale used.
Examples: identification of birds, butterflies, animal tracks, winter twigs...
GLO: A1, C2, D1, E2
- 6-1-05 Identify advantages and disadvantages of having a common classification system for living things, and recognize that the system changes as new evidence comes to light.
GLO: A1, A2, D1, E2

- 6-1-06 Identify the five kingdoms commonly used for the classification of living things, and provide examples of organisms from each to illustrate the diversity of living things.
Include: monerans, protists, fungi, plants, animals.
GLO: A1, D1, E1, E2
- 6-1-07 Recognize that many living things are difficult to see with the unaided eye, and observe and describe some examples.
GLO: C2, D1, E1
- 6-1-08 Observe and describe the diversity of living things within the local environment.
Include: fungi, plants, animals.
GLO: A1, C2, D1, E1
- 6-1-09 Recognize that the animal kingdom is divided into two groups, vertebrates and invertebrates, and differentiate between the two.
Include: vertebrates have backbones, invertebrates do not.
GLO: D1, E1
- 6-1-10 Provide examples of a variety of invertebrates to illustrate their diversity.
Include: sponges, worms, molluscs, arthropods.
GLO: D1, E1
- 6-1-11 Compare and contrast adaptations of common arthropods, and describe how these adaptations enable them to live in particular habitats.
GLO: D1, D2, E1
- 6-1-12 Classify vertebrates as fishes, amphibians, reptiles, birds, and mammals, and provide examples to illustrate the diversity within each group.
GLO: D1, E1
- 6-1-13 Compare and contrast the adaptations of closely related vertebrates living in different habitats, and suggest reasons that explain these adaptations.
GLO: D1, D2, E1
- 6-1-14 Identify, based on evidence gathered by paleontologists, similarities and differences in animals living today and those that lived in the past.
Examples: archaeopteryx and modern birds...
GLO: A1, A2, E1, E3
- 6-1-15 Identify and describe contributions of scientists and naturalists who have increased our understanding of the diversity of living things.
GLO: A2, A4, B4, D1

Grade 6, Cluster 2: Flight

Overview

In this cluster, a study of the properties of fluids helps students to understand how flight can be achieved. Through the testing of models, students explore how the forces of thrust, drag, lift, and gravity act on living things or devices that fly through the air. They learn how specific adaptations or modifications can alter lift or drag. Different means of propulsion are compared and the use of unbalanced forces to steer aircraft and spacecraft are described. Students apply their understanding of forces and flight through the construction of a prototype that flies and meets specific performance criteria. Students also examine the history of the development of air travel and identify its impact on the way people work and live.

Students will...

- 6-2-01 Use appropriate vocabulary related to their investigations of flight.
Include: fluid, pressure, lift, gravity, thrust, drag, Bernoulli's Principle, propulsion, unbalanced forces.
GLO: C6, D4
- 6-2-02 Describe properties of fluids using air and water as examples, and identify manifestations of these properties in daily life.
Include: air and water flow and exert pressure; objects can flow through air and water; warm air and water rise.
GLO: B1, D3, E1
- 6-2-03 Identify adaptations that enable living things to propel themselves through air, water, or to be transported by the wind.
Examples: the streamlined shape of dolphins and barn swallows, the helicopter-like motion of the winged fruit of maple trees, the parachute-shaped fruit of dandelions...
GLO: D1, D4, E1
- 6-2-04 Recognize that in order for devices or living things to fly they must have sufficient lift to overcome the downward force of gravity, and that the force of gravity increases as mass increases.
GLO: D4

- 6-2-05 Describe how “lighter-than-air flying devices” are able to achieve lift.
Include: hot-air balloons, helium balloons.
GLO: D4
- 6-2-06 Test models of aircraft to observe Bernoulli’s Principle.
Include: the shape of a wing affects the speed of airflow, creating lift in a “heavier-than-air flying device.”
GLO: C2, C3, D3, D4
- 6-2-07 Explain how Bernoulli’s Principle is applied in a device other than an aircraft.
Examples: paint sprayer, perfume mister...
GLO: A5, B1, D4
- 6-2-08 Provide examples of design features or adaptations that enhance or reduce lift, and explain how they work.
Examples: race car spoilers reduce lift; bird wing shapes enhance lift...
GLO: A5, B1, D1, D4
- 6-2-09 Provide examples of design features or adaptations that enhance or reduce drag, and explain how they work.
Examples: pilots use flaps to increase drag when landing aircraft; birds tuck their wings to decrease drag when diving...
GLO: A5, B1, D1, D4
- 6-2-10 Identify and diagram the four forces that act on living things or devices that fly through the air.
Include: lift, gravity, thrust, drag.
GLO: C6, D4
- 6-2-11 Compare a variety of propulsion methods that are used to produce thrust in animals and flying devices.
Examples: rockets for spacecraft, propellers, or jet engines for aircraft, wings for flying animals...
GLO: B1, D1, D4, E4
- 6-2-12 Describe how unbalanced forces are used to steer aircraft and spacecraft.
GLO: A5, D4, D6
- 6-2-13 Explain why the design of aircraft and spacecraft differs.
GLO: B1, C3, D4, D6
- 6-2-14 Identify milestones in the history of air travel and describe their impacts on daily life.
GLO: A4, B1, B2, D4
- 6-2-15 Use the design process to construct a prototype that can fly and meet specific performance criteria.
Examples: a glider that can loop; a hot-air balloon that can stay aloft for a given time...
GLO: C3, D4

Grade 6, Cluster 3: Electricity

Overview

In this cluster, students explore current and static electricity and compare and contrast the characteristics of each. These explorations help students identify and appreciate the importance of electricity in everyday life including the need for safe practices when using electricity. Students have the opportunity to apply their knowledge of series and parallel circuits in the construction of a prototype that performs a specific function. They demonstrate how electricity can be transformed into motion, and motion into electricity. Students also identify other types of transformations that can take place. Students discuss advantages and disadvantages of various renewable and non-renewable sources of electrical energy, and recognize the importance of energy conservation. The creation of an action plan to help reduce electrical energy consumption helps students understand the impacts they can make.

Students will...

- 6-3-01 Use appropriate vocabulary related to their investigations of electricity.
Include: positive charge, negative charge, current electricity, static electricity, electrical circuit, insulator, conductor, switch, series circuit, parallel circuit, electromagnet, magnetic field, motor, generator, transformation, electrical energy, renewable, non-renewable, energy consumption.
GLO: C6, D4, E4
- 6-3-02 Explain the attraction and repulsion of electrostatically charged materials.
Include: negatively and positively charged materials attract one another; materials of like charge repel one another.
GLO: D4
- 6-3-03 Explain current electricity, and compare the characteristics of current and static electricity by using a model.
GLO: A2, D4
- 6-3-04 Identify dangers associated with static and current electricity, and demonstrate and describe appropriate safety precautions.
GLO: C1, D4

- 6-3-05 List electrical devices used at home, at school, and in the community, and identify the human needs that they fulfill.
Examples: heat, light, communication, movement...
GLO: B1, B2, D4
- 6-3-06 Develop a definition of an electrical circuit, based on classroom explorations.
Include: an electrical circuit is a continuous path for charges and must contain a power source and a conductor.
GLO: C2, D4
- 6-3-07 Experiment to classify a variety of materials as insulators or conductors.
GLO: C2, D3, D4, E1
- 6-3-08 Demonstrate and describe the function of switches in electrical circuits.
GLO: D4
- 6-3-09 Construct and diagram simple series circuits and simple parallel circuits.
GLO: C2, C6, D4, E1
- 6-3-10 Explore to determine factors that affect bulb brightness in simple series and parallel circuits.
Include: number of bulbs, number of batteries, placement of bulbs and batteries.
GLO: C2, D4
- 6-3-11 Use the design process to construct an electrical circuit that performs a useful function.
Examples: doorbell, alarm, motorized toy, game...
GLO: C3, D4
- 6-3-12 Demonstrate, using a simple electromagnet constructed in class, that an electric current can create a magnetic field.
GLO: C2, D4
- 6-3-13 Explore motors and generators to determine that electromagnets transform electricity into motion, and motion into electricity.
GLO: A5, D4, E2, E4
- 6-3-14 Identify forms of energy that may result from the transformation of electrical energy, and recognize that energy can only be changed from one form into another, not created or destroyed.
Include: light, heat, sound, motion.
GLO: D4, E4
- 6-3-15 Identify the two major sources of electrical energy, and provide examples of each.
Include: chemical sources such as batteries; electromagnetic sources such as turbine motion caused by wind, falling water, and steam.
GLO: B1, D4, E4

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Grade 6, Cluster 3: Electricity (continued)

- 6-3-16 Identify renewable and non-renewable sources of electrical energy, and discuss advantages and disadvantages of each.

Examples: renewable sources such as hydroelectric, wind, geothermal, solar; non-renewable sources such as fossil fuels, nuclear fission...

GLO: B5, E4

- 6-3-17 Evaluate an electrical device using the design process.

Examples: light bulbs, kitchen appliances...

GLO: B5, C4

- 6-3-18 Describe factors that affect the consumption of electrical energy, and outline an action plan to reduce electrical energy consumption at home, at school, or in the community.

GLO: B5, C4, E4

- 6-3-19 Describe the ways in which electricity has had an impact on daily life.

GLO: B1, B2, B5

Notes

Grade 6, Cluster 4: Exploring the Solar System

Overview

In this cluster, students develop an understanding of the Earth in space, the solar system, and the role of space research programs in increasing scientific knowledge. Positive and negative impacts arising from space research programs are addressed, and the contributions of Canadians to these programs are highlighted. Students develop an appreciation for the nature of science by examining the changing conceptions of the Earth's position in space and by differentiating between astronomy and astrology. Students investigate the causes of phenomena such as the cycle of day and night, the yearly cycle of the seasons, moon phases, eclipses, and the reasons why the apparent movements of celestial bodies in the night sky are regular and predictable. An important distinction is made between weight and mass.

Students will...

- 6-4-01 Use appropriate vocabulary related to their investigations of Earth and space.
Include: astronauts, communication and remote sensing satellites, solar system, inner and outer planets, asteroid belt, mass, weight, points of reference, apparent movement, celestial objects, astrology, astronomy, rotation, revolution, axis, moon phases, eclipses.
GLO: C6, D6
- 6-4-02 Identify technological developments that enable astronauts to meet their basic needs in space.
Examples: dehydrated foods, backpacks with an oxygen supply, hermetically sealed cabins with temperature and air controls...
GLO: B1, B2, D1, D6
- 6-4-03 Identify Canadians who have contributed to space science or space technology, and describe their achievements.
GLO: A4, A5, B1, B4
- 6-4-04 Investigate past and present space research programs involving astronauts, and explain the contributions to scientific knowledge.
Examples: Apollo, Mir, International Space Station...
GLO: A1, A2, A5, D6

- 6-4-05 Describe positive and negative impacts arising from space research programs.
Examples: advantages — increased knowledge about space and medicine, the development of technologies such as orange drink crystals and pocket calculators; disadvantages — space pollution and the high cost of research projects...
GLO: A1, B1, B5, D6
- 6-4-06 Identify technological devices placed in space that help humans learn more about the Earth and communicate more efficiently.
Include: communication and remote sensing satellites.
GLO: B1, B2, D6
- 6-4-07 Describe how the conception of the Earth and its position in space have been continuously questioned and how our understanding has evolved over time.
Include: from a flat Earth, to an Earth-centred system, to a Sun-centred system.
GLO: A1, A2, B2, C5
- 6-4-08 Recognize that the Sun is the centre of the solar system and it is the source of energy for all life on Earth.
GLO: D6, E2, E4
- 6-4-09 Identify the planets in the solar system and describe their size relative to the Earth and their position relative to the Sun.
GLO: D6, E1, E2
- 6-4-10 Classify planets as inner or outer planets, based on their position relative to the asteroid belt, and describe characteristics of each type.
Include: inner planets are small and rocky; outer planets (except Pluto) are giant balls of gas.
GLO: D6, E1
- 6-4-11 Recognize that mass is the amount of matter in an object, that weight is the force of gravity on the mass of an object, and that the force of gravity varies from planet to planet.
GLO: D3
- 6-4-12 Explain, using models and simulations, how the Earth's rotation causes the cycle of day and night, and how the Earth's tilt of axis and revolution cause the yearly cycle of seasons.
GLO: A2, D6, E2, E4
- 6-4-13 Use the design process to construct a prototype that tells the time of day or measures a time span.
GLO: C3, D6
- 6-4-14 Explain how the relative positions of the Earth, moon, and Sun are responsible for moon phases and eclipses.
GLO: D6, E2
- 6-4-15 Identify points of reference in the night sky and recognize that the apparent movement of celestial objects is regular, predictable, and related to the Earth's rotation and revolution.
Examples: planets, constellations...
GLO: D6, E2, E3

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Grade 6, Cluster 4: Exploring the Solar System (continued)

- 6-4-16 Identify and describe how people from various cultures, past and present, apply astronomy in daily life.

Examples: using celestial bodies to navigate; knowing when to plant crops...

GLO: A4, A5, B1, B2

- 6-4-17 Differentiate between astrology and astronomy, and explain why astrology is considered unscientific.

GLO: A1, A2, C5, C8

Notes