Science 8
Beyond Earth: Human presence in the solar system

2021

New Nouveau Brunswick

Science 8 *<u>Beyond Earth: Human presence in the solar system</u>*

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Website References

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1. Introduction

1.1 Mission and Vision of Educational System

The New Brunswick Department of Education and Early Childhood Development is dedicated to providing the best public education system possible, wherein all students have a chance to achieve their academic best. The mission statement for New Brunswick schools is:

Each student will develop the attributes needed to be a lifelong learner, to achieve personal fulfillment and to contribute to a productive, just and democratic society.

1.2 New Brunswick Global Competencies

New Brunswick Global Competencies provide a consistent vision for the development of a coherent and relevant curriculum. The statements offer students clear goals and a powerful rationale for school work. They help ensure that provincial education systems' missions are met by design and intention. The New Brunswick Global Competencies statements are supported by curriculum outcomes.

New Brunswick Global Competencies are statements describing the knowledge, skills and attitudes expected of all students who graduate high school. Achievement of the New Brunswick Global Competencies prepares students to continue to learn throughout their lives. These Competencies describe expectations not in terms of individual school subjects but in terms of knowledge, skills and attitudes developed throughout the curriculum. They confirm that students need to make connections and develop abilities across subject boundaries if they are to be ready to meet the shifting and ongoing demands of life, work and study today and in the future.

See Appendix 6.1.

1.3 Teaching for Scientific Literacy

The emergence of a highly competitive and integrated global economy, rapid technological innovation, and a growing knowledge base will continue to have a profound impact on people's lives. Advancements in science and technology play an increasingly significant role in everyday life. Science education will be a key element in developing scientific literacy and in building a strong future for New Brunswick's young people.

Science education for the future requires that students learn more than just the basic concepts of science. It should equip students with the skills which enable them to use scientific knowledge to identify questions, draw evidence-based conclusions, and understand and make decisions about the natural world. Students come to understand the characteristic features of science (*Nature of Science)* as a form of human knowledge and inquiry and are aware of the many ways science and technology shape the world. Lastly, scientifically literate students possess attitudes and values that enable them to participate in science-related issues as an ethical citizen.

A strong foundation in scientific knowledge and practices will include the development of reasoning and analytical skills, decision and problem-solving skills, flexibility to respond to different contexts and inspire students at all grade levels to develop a critical sense of wonder about scientific and technological endeavours. A foundation in scientific literacy will prepare students to address science-related societal, economic, ethical, and environmental challenges. These are skills and competencies that are aligned to the New Brunswick Global Competencies.

1.4 Education for Sustainable Development (ESD)

Science, Technology, and Innovation (STI) are recognized as the key drivers behind economic growth and prosperity. STI plays a central role for achieving sustainable development. To become sustainability changemakers learners must engage with sustainability issues. Science education therefore is vital for the achievement of sustainable development.

Reorienting science education to support the development of sustainability mindsets require teaching and learning about knowledge, skills, perspectives, and values that will guide and motivate young people to pursue sustainable livelihoods, to participate in a democratic society, and to live in a sustainable manner. By connecting learning and living to the SDGs, teachers present real-world contexts for students to help them become globally competent citizens. The scientific content and concepts outlined in Section 4: Curriculum Outcomes, are situated in the four SDGs identified above by the darkened boxes

Guiding Principles for Science in the Sustainable Development Goals (SDGs)

The SDGs activate science at multiple levels and across disciplines to gather and create the necessary knowledge to lay the foundations for practices, innovations, and technologies that address local challenges. Teaching and learning for sustainable futures in science is guided by the following principles:

- Strengthen science education to increase science literacy and capacity-building in science at all levels.
- Recognize science as a universal public good that helps in laying the foundation for a sustainable world.

- Enhance diversity in science for sustainable development by realizing gender equity in science and by building on the entire spectrum of society, including under-represented groups and minorities
- Promote an integrated scientific approach that addresses the environmental, social, and economic dimensions of sustainability respecting the diversity of knowledge systems.

In Grade 8 students explore and investigate topics related to goals: SDG 3 – Good Health and Well-being; SDG 9 – Industry, Innovation and Infrastructure; SDG 13 – Climate Action; and SDG 17 – Partnership for the Goals. The goals framing the Grade 8 program of study appear in Section 4: Curriculum Organizers and Outcomes and are hyperlinked to the corresponding Global Goals webpage.

1.5 Science as a Way of Knowing

An inclusive science program recognizes that Eurocentric science is not the only form of knowledge about the natural world and aims to broaden student understanding of traditional and local perspectives. The dialogue between scientists and traditional knowledge holders has an extensive history and continues to grow as researchers seek to better understand our complex world. The terms "traditional knowledge", and "Traditional Ecological Knowledge" are used by practitioners worldwide when referencing local knowledge systems which arise from Indigenous ways of knowing. Education researchers suggest that an enhanced science curriculum is one that supports both Indigenous Knowledge and scientific literacy, represents complementary, not separate realities, and broadens the purpose of science education to become *knowing-nature literacy*.

See Appendix 6.2.

Indigenous Ways of Knowing

Traditional knowledge is a cumulative body of knowledge, know-how, practices and representations maintained and developed by Indigenous Peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview (International Council for Science, 2002 as cited by Restoule, 2019).

As an oral culture, Indigenous Knowledge is not written down, contained in textbooks, or stored on shelves for future reference. Elders are the cultural experts and keepers of knowledge in the traditional stories, in the ceremonies, and in the practices; teaching is by mentoring and learning is by doing and application.

Scientific Knowledge

Although there are other ways of knowing that may be important in our personal and cultural lives, scientists rely on evidence and testing, rather than belief or speculation. Like Indigenous ways of knowing scientific knowledge is a cumulative body of knowledge, know-how, practices, and representations maintained and developed by scientists with extended histories of interaction with the natural environment.

Knowledge produced by scientists is open to change and is generalizable. Aikenhead (2011) suggests that it is this generalizability that affords scientists the power to predict and control. To study the natural world, scientists use methods that are empirical, which means that they are grounded in observations and experimentation and are not based on opinions or sentiments.

2. Pedagogical Components

2.1 Pedagogical Guidelines

Diverse Cultural Perspectives

It is important for teachers to recognize and honour the variety of cultures and experiences from which students are approaching their education and the world. It is also important for teachers to recognize their own biases and be careful not to assume levels of physical, social or academic competencies based on gender, culture, or socio-economic status.

Each student's culture will be unique, influenced by their community and family values, beliefs, and ways of viewing the world. Traditional aboriginal culture views the world in a much more holistic way than the dominant culture. Disciplines are taught as connected to one another in a practical context, and learning takes place through active participation, oral communication and experiences. Immigrant students may also be a source of alternate world views and cultural understandings. Cultural variation may arise from the differences between urban, rural and isolated communities. It may also arise from the different value that families may place on academics or athletics, books or media, theoretical or practical skills, or on community. Providing a variety of teaching and assessment strategies to build on this diversity will provide an opportunity to enrich learning experiences for all students.

English as an Additional Language Curriculum

Being the only official bilingual province, New Brunswick offers the opportunity for students to be educated in English and/or French through our public education system. The EECD provides leadership from K-12 to assist educators and many stakeholders in supporting newcomers to New Brunswick. English language learners have opportunities to receive a range of instructional support to improve their English language proficiency through an inclusive learning environment. EECD, in partnership with the educational and wider communities offer a solid, quality education to families with school-aged children.

Copyright Matters

Teacher must ensure that they respect the fair dealing provision when accessing and using course resources and materials for instructional purposes. The works of others should not be used without their permission unless the use is permitted by the *Copyright Act*. Teachers are expected to be aware of the copyright status of instructional materials in their possession. The *Copyright Act* permits use of a copyright-protected work without permission from the copyright owner or the payment of copyright royalties under specific conditions.

Consumable materials intended for one-time use in the classroom (i.e. workbooks and exercise sheets) are created with the understanding that each student is to have their own copy. Unless teachers have permission to copy a consumable, copying, scanning, or printing materials intended for one-time use is strictly prohibited. Copying from instructional materials intended for one-time use without permission exposes the teacher, the school, and the school board to liability for copyright infringement

To learn more about the fair dealing guidelines and the *Copyright Act* visit, the Council of Ministers of Education Canada website at <https://www.cmec.ca/140/Copyright_Matters!.html>.

2.2 Assessment Guidelines

Assessment Practices

Assessment is the systematic gathering of information about what students know and are able to do. Student performance is assessed using the information collected during the evaluation process. Teachers use their professional skills, insight, knowledge, and specific criteria that they establish to make judgments about student performance in relation to learning outcomes. Students are also encouraged to monitor their own progress through self-assessment strategies, such as goal setting and rubrics.

Research indicates that students benefit most when assessment is regular and ongoing and is used in the promotion of learning (Stiggins, 2008). This is often referred to as formative assessment. Evaluation is less effective if it is simply used at the end of a period of learning to determine a mark (summative evaluation).

Summative evaluation is usually required in the form of an overall mark for a course of study, and rubrics are recommended for this task. Sample rubrics templates are referenced in this document, acknowledging teachers may have alternative measures they will apply to evaluate student progress.

Some examples of current assessment practices include:

• Questioning	• Projects
• Observation	• Investigations
• Conferences	• Checklists/Rubrics
• Demonstrations	• Responses to texts/activities
• Presentations	• Reflective Journals
• Role plays	• Self and peer assessment
• Technology Applications	• Career Portfolios

Formative Assessment

Research indicates that students benefit most when assessment is ongoing and is used in the promotion of learning (Stiggins, 2008). Formative assessment is a teaching and learning process that is frequent and interactive. A key component of formative assessment is providing ongoing feedback to learners on their understanding and progress. Throughout the process adjustments are made to teaching and learning.

Students should be encouraged to monitor their own progress through goal setting, co-constructing criteria and other self-and peer-assessment strategies. As students become more involved in the assessment process, they are more engaged and motivated in their learning.

Additional details can be found in the Formative Assessment document on the Portal ONE site.

Summative Assessment

Summative evaluation is used to inform the overall achievement for a reporting period for a course of study. Rubrics are recommended to assist in this process. Sample rubrics templates referenced in curriculum documents acknowledge teachers may have alternative measures they will apply to evaluate student progress.

Guidelines for *Assessing, Evaluating and Reporting Grades K–8* and *Assessing, Evaluating and Reporting Grades 9-12* provide additional information about assessment and evaluation. These can be accessed on the Portal ONE site.

3. Subject Specific Guidelines

3.1 Rationale

Students in middle school continue to progress in their understanding of core ideas in the disciplines of Physical Sciences, Earth and Space Sciences and Life Science. Their conceptual knowledge and inquiry skills build on Grades 6 and 7 concepts and capabilities extending their understanding of qualitative and quantitative data to interpret patterns, propose hypotheses and draw conclusions. Students continue to develop scientific and technological problem-solving skills as they explore **Newton's Laws of Motion** and grow in their understanding of the importance of distributed responsibility and collaboration in the field of science.

Course Description

As students in **Grade 8** investigate the relationship between forces acting on an object and the motion of that object, they examine how the physical sciences, specifically theories of physics operate in everyday life. With an emphasis on a systems approach and the use of modelling students discover how scientists have come to know about Earth's place in the universe. There is also a strong connection to engineering through the instruments and technologies that allowed scientists to explore celestial objects in the solar system, obtain the data to support theories about the formation and evolution of the universe, and explain the changes to Earth's global climate system.

The unifying ideas energy, equilibrium, matter, models and systems serve to organize concepts and support students' sensemaking of phenomena related to principles of motion, extraterrestrial travel and how space exploration is connected to life on Earth. Through hands-on inquiry students transfer science and technological understandings to real-world contexts via the Sustainable Development Goals: 3 - Good Health and Well-being, 9 - Industry Innovation and Infrastructure; 13 - Climate Action and 17 - Partnership for the Goals.

An interdisciplinary approach that integrates contemporary Physical Sciences, Earth and Space Sciences and Life Science supported by scientific inquiry provide students with opportunities to demonstrate proficiency in asking questions, developing and using models, planning and conducting investigations, analyzing and interpreting data, designing solutions, and engaging in argument from evidence. Communication of experimental findings which involve creative multi-modal forms of presentation are encouraged.

3.2 Curriculum Organizers

Organizers

Students at all grade levels and in every domain of science should have the opportunity to use scientific inquiry and technological design skills and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations, using appropriate tools and technologies to gather data, thinking critically and logically about relationships between evidence and explanation, constructing and analyzing alternative explanations, and communicating scientific arguments (NSTA, 2008).

The **Science 8** curriculum has been developed with scientific literacy and the nature of science in mind. Students can be considered scientifically literate when they are familiar with, and able to engage in, the following processes within a science context: inquiry, problem-solving, and decision making. Each strand consists of learning outcomes that share a common focus.

Inquiry

Scientific inquiry involves posing questions and developing explanations for phenomena. While there is general agreement there is no such thing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging in science. These activities provide students with opportunities to practise the process of theory development in science and understand the nature of science.

Problem-Solving

The process of problem-solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are inherently important and provide a relevant context for engaging in scientific inquiry and/or problem-solving.

Instruction in science is inquiry-based with hand-on learning that is situated in authentic contexts enabling student to make connections to their own lives and the communities in which they live. Students will become excited and curious about the concepts and phenomena under study, and they then become motivated to learn. **See Appendix 6.3.**

Unifying Ideas[1]

There are numerous unifying ideas that represent a way of organising and connecting scientific knowledge. The organising ideas are not the exclusive domain of science for they apply as well in mathematics, technology, business, economics and other domains. After accumulating a wealth of learning experiences, students will begin to integrate these unifying ideas into their thinking. The following unifying ideas are the **primary concept organizers** for Science 8:

- **Energy:** All physical phenomena and interactions involve energy. It is the driving force of both movement and change within matter. Students will be able to analyse complex energy transformations and will understand energy transformation at the molecular level.

- **Equilibrium**: When opposing forces or processes are balanced in a static or dynamic way, the system is in a state of equilibrium. A system in which all process of change appear to have stopped displays *constancy or stability*. A system in which the rate of input into the system is balanced by the rate of output; making the system appear static, is in *dynamic equilibrium.* A system in which all processes of change have stopped –until something of enough magnitude is done to disturb and cause a change, is in *static equilibrium*.

- **Matter:** Organisms ae linked to one another and to their physical setting by the transfer and transformation of matter and energy. This basic concept connects the understandings from physical, Earth and biological sciences. The cycling of matter can be found at many levels of biological organisation, from molecules to ecosystems. Students will understand that recycling of matter involves the breakdown and reassembly of invisible units rather than the creation and destruction of matter.

- **Models**: Physical and conceptual models serve as useful tools to support student's learning about abstract ideas. Models, regardless of type, represent a simplification of an idea or process. Physical models use a hands-on approach while conceptual models consist of mathematical representations of essential components and their interactions. As student's understanding of phenomena improves, models become more refined.

[1] Atlantic Provinces Education Foundation. (1998). Science Foundation: Content for learning and teaching. Halifax, Nova Scotia. PP. 34-38.

- **Systems:** The natural and constructed world is made up of systems and the interactions that take place within and among them. Whether a system is regarded as a system or a subsystem is dependent upon the scale of observation. The ability of students to think about a whole in terms of its parts and alternatively, about the parts in terms of how they relate to one another is demonstrative of higher order thinking.

Essential Questions

Essential Questions can open doors to student understanding when used to frame instruction and guide learning (McTighe & Wiggins, 2013). By framing learning with Essential Questions (also called EQs) teachers can stimulate thought, provoke inquiry, and activate students' prior knowledge and transform instruction. EQs often begin with, "Why," "How" or "To What Extent" but may sometimes begin with other question stems. The EQs listed below will assist in *uncovering* the important ideas, processes and content so that students can make helpful connections and are equipped to transfer their learning in meaningful ways:

1. How can one describe physical interactions between objects and within systems of objects?
2. How does our place in the universe impact how forces are experienced?
3. Why is space a place to explore?
4. How do we know Earth's global climate is changing?
5. How does the challenges/constraints of living and working in space stimulate creativity?

4. Curriculum Outcomes and Learning Contexts

Curriculum Outcomes for Science

The New Brunswick Curriculum is stated in terms of general curriculum outcomes, specific curriculum outcomes and achievement indicators. The General and Specific Curriculum Outcomes in the 2021 Science curriculum are focused on students doing science.

General Curriculum Outcomes (GCO) are overarching statements about what students are expected to learn in each strand/sub-strand. The general curriculum outcome for each strand/sub-strand is the same throughout the grades.

There are two broad areas of focus: 1**. The Nature of Science** and 2. **Learning and Living Sustainably**. The *Nature of Science* involves students understanding the world through careful, systematic inquiry. Students discover that scientific knowledge produced through this process is both durable and subjected to change. *Learning and Living Sustainably* encompasses the students understanding that science affects and is affected by society. The achievement indicators for this GCO were previously categorized as Science, Technology, Society and the Environment (STSE).

Specific Curriculum Outcomes (SCO) are statements that identify specific concepts and related skills underpinned by the understanding and knowledge attained by students as required for a given grade.

Learning Contexts: Core Ideas and Concepts

The development of science skills is situated in learning contexts – core ideas and concepts; which provide learners opportunities to explore their understandings in multiple disciplines over time. The core ideas and concepts are stated after the outcomes. The goal is for students to develop scientific literacy while accumulating a body of knowledge framed within the boundaries of the human-built and natural environments.

GCO 1.0: Students will use scientific inquiry and technological design skills to solve practical problems, communicate scientific ideas and results, and make informed decisions while working collaboratively.

4.1 The Nature of Science

General and Specific Curriculum Outcomes

GCO 1	**Students will use scientific inquiry and technological design skills to solve practical problems, communicate scientific ideas and results, and make informed decisions while working collaboratively.**
SCO 1.1	**Students will ask questions about relationships between and among observable variables to plan investigations (scientific inquiry and technological problem-solving) to address those questions.**

Achievement indicators:

- Ask questions that arise from careful observation of phenomena, models or unexpected results.
- Determine variables (e.g. dependent, independent and control) to formulate a hypothesis.
- Define the problem.
- Select appropriate tools, materials and equipment to carry out a fair test or build a prototype.
- Develop (with guidance) investigation procedures for a fair test or designs a solution to a practical problem.

SCO 1.2	**Students will collect and represent data using tools and methods appropriate for the task.**

Achievement indicators:

Achievement indicators connected to safety concerning oneself, procedures and practices are noted in GCO 2.0 on page 28. Safety is a subset of sustainability.

- Perform a systematic experimental procedure to test a hypothesis or executes plan to build a prototype.
- Apply scientific ideas or technological principles to test a prototype.
- Use tools and equipment appropriately (proper handling, transport, etc.) in an investigation.
- Record qualitative and quantitative data using measurement tools as appropriate.
- Develop a model to show the relationships amongst variables.

GCO 1.0: Students will use scientific inquiry and technological design skills to solve practical problems, communicate scientific ideas and results, and make informed decisions while working collaboratively.

SCO 1.3	**Students will analyse and interpret qualitative and quantitative data to construct explanations.**
Achievement indicators: • Evaluate the accuracy of various methods for collecting data. • Identify possible sources of error. • Construct graphical displays (e.g., drawings, charts, maps, tables, and graphs). • Interpret maps, graphs and statistics across spatial and temporal scales. • Apply concepts of probability and statistics (e.g., mean, median, mode, and variability). • Iterate to improve the prototype (designed solution). • Draw a conclusion based on evidence gathered from scientific experiment or testing of the prototype.	
SCO 1.4	**Students will work collaboratively on investigations to communicate conclusions supported by data.**
Achievement indicators: • Work cooperatively to examine own knowledge or knowledge of peers. • Choose a format of communication appropriate to purpose (e.g., reports, data tables, scientific models, etc.). • Discuss[2] procedures, results and conclusions of investigations using appropriate scientific terminology. • Discuss the design process leading to the solution using appropriate technological terminology. • Communicate answers to questions or solutions to problem statement based on evidence.	

[2] Through scientific argumentation – The practice of argumentation –developing, exploring, analyzing, and refining lines of reasoning and explanation in evidence-based ways—is essential to the work of scientists and to scientific thinking and learning. See the Science Argumentation Toolkit http://www.argumentationtoolkit.org/intro.html for details.

GCO 1.0: Students will use scientific inquiry and technological design skills to solve practical problems, communicate scientific ideas and results, and make informed decisions while working collaboratively.

Learning Contexts

Students build an understanding of the nature of science through inquiry activities supported by core ideas and concepts connected to Physical Sciences, and Earth and Space Sciences. They also draw from personal learning experiences, funds of knowledge, cultural worldviews and science capital [3] they already possess.

The Nature of Science: Core ideas and contexts	
Motion & Stability	• Qualitative descriptions of motion: Direction of movement, time taken to travel a set distance, acceleration, rotation and revolution • Force as a physical property: Push-pull, area, and pressure • Forces and Interactions: Contact, gravitational, and muscular
Laws of Motion	• Definitions: Hypothesis, theory and law • Law of Gravity: force, 9.8 m/s/s • Newton's Laws: 1st Law: Inertia, net force, balanced and unbalanced forces; 2nd Law: Effects of force and mass on acceleration; and 3rd Law: Action-reaction, Forces in pairs
Space Exploration	• Solar System: Earth's place in the universe; Movement of celestial body e.g., rotation, revolution; types of celestial objects e.g. NEO, planets, moons, stars, etc. • Space Travel: Aeronautics – Rockets, propulsion, fuel, navigation and steering, and atmospheric drag; Spaceships – Design and construction, parts of a rocket, form and function e.g. the ISS modular design; and Propulsion – hydraulics, gravity, atmospheric drag, and friction • Living and working in space: Hazards, Zero-gravity, effect on human systems, etc.
Technological Applications	• Robotics: Canadarm (1 and 2) • Remote sensing; telescopes; RADARSTAT satellites; etc.

[3] Science capital – A holistic measure of young people's scientific identity, attitudes towards science, behaviours and contacts, culminating in a feeling of science being 'for them'. OECD. 2020. *PISA 2024: Strategic Vision and Direction for Science*. Pg. 14.

GCO 2.0: Students will demonstrate an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology (STSE).

4.2 Learning and Living Sustainably (STSE)

General and Specific Curriculum Outcomes

GCO 2	**Students will demonstrate an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology (STSE).**
SCO 2.1	**Students will consider factors that support responsible application of scientific and technological knowledge and demonstrate an understanding of sustainable practices.**

Achievement indicators:

- Follow guidelines for safe use of equipment to conduct a scientific experiment.
- Follow guidelines for safe use of tools to build a prototype of a solution.
- Use science and technological knowledge when considering issues of concern to me.
- Reflect on various aspects of an issue to make decisions about possible actions.
- Explore science- and technology-based career in Canada based on my interests.
- Analyse the benefits and drawback of human space exploration.
- Raise awareness about the importance of global partnership for sustainable development.
- Differentiate between adaptation and mitigation measures as solutions to climate change.

GCO 2.0: Students will demonstrate an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology (STSE).

Learning Contexts

Learning to live sustainably contributes to scientific literacy by supporting young people to solve complex interconnected problems related to socio-environmental systems and sustainability[4] in their communities. It also includes knowledge within the disciplinary subject areas.

Learning and Living Sustainably: Core ideas and contexts	
Safety	• Correct use of equipment and tools • Conducting field work and investigations safely • Space Hazards: Radiation, isolation, distance from Earth, gravity fields, hostile/closed environments
Sustainability  *Click on image to visit website.*	• Human Survival: wellness: mental and physical well-being; Zero-gravity: body systems and functions • History of space exploration: Successes, failures, and milestones, partnerships between Canadian and International space agencies e.g. NASA, ESA, and UN Space agency • Exosphere (space) traffic: Reusable rockets, space junk • Cost - benefit analysis of space exploration • Life and career pathways science literate citizen, astronaut, biomedical engineer, astrophysicist, computer/information systems scientist, science policy analyst, software engineer, project manager, space artist, etc. • Science and the UN Sustainable Development Goals: Good Health and Well-Being [SDG 3], Industry, Innovation and Infrastructure [SDG 9], Climate Action [SDG 13], and Partnership for the Goals [SDG 17]
Applied Technology	• Space technology and innovation used in every life: Memory foam, CAT scans, Water purification systems, scratch resistant eyeglass lenses, and more! • Space technologies and Climate Change: Earth observation techniques, global environment monitoring, and remote sensing

[4] OECD. 2020. *PISA 2024: Strategic Vision and Direction for Science*. Pg. 4.

5. Resources

GCO 1 – The Nature of Science: Core Ideas and Concepts

Resources for GCO 1		
Video	**Website**	**Document**
cK-12 Simulations | Middle School Physical Sciences cK-12 Simulations | Middle School Earth Science Crash Course Kids | Defining Gravity National Aeronautics & Space Administration (NASA) | Moon to Mars Video Library PBS Learning Media Interactive Lessons and Media | Physical Science: Forces and Motion; Newton's Laws and Gravitational Force TED-Ed | Newton's Laws of Motion, Misconceptions about Gravity Mark Rober (Former NASA Engineer) | Perseverance Mars Rover Landing – Inside Story, Drone Solar System Model – How far is Planet 9?, How do Astronauts Weigh Themselves? (Inertia & Newton's First Law)	Canadian Space Agency (CSA) | Junior Astronauts, Moving and Working in Space, Operate Canadaarm2 Simulator, RADARSTAT Constellation Mission: Earth Observation and RCM Game, Space in my Daily Life cK-12 FlexBook | Physical Sciences for Middle School : Objects in Motion (Chapter 9), Forces (Chapter 10) and Newton's Laws of Motion (Chapter11) cK-12 FlexBook | Earth Science for Middle School : Earth's History (16.2 & 16.3), The Solar System (22) and Beyond the Solar System Master Class by Chris Hadfield (**For Teachers)** | Teachers Space Exploration[$], Astronaut Training National Aeronautics & Space Administration (NASA) | Aerospace Activities and Lessons, Hazards of Human Space Flight, Space Flight, Solar System and Beyond Teach Engineering | Up, Up and Away Unit (Lift, Thrust & Drag) and Rockets Unit (Thrust, Weight, Control, & Navigation) TED-Ed | Science & Technology Lessons (Database)	Crichton, S., & Carter, D. (2013). | Taking Making into Classrooms Digital Mi'kmaq | Backyard Science: Finding Your Way - Observational Science and the Night Sky Earth: The operators manual Annotated Script HHMI BioInteractive | Climate Change Resources National Science Teachers Association. (2016). Teaching energy across the sciences, K-12 /edited by Jeffrey Nordine. Arlington, VA. [Book] Canadian Space Agency (CSA). (2019). RCM Paper Models

Resources for GCO 2		
Video	**Website**	**Document**
PBS Media | Where do physics majors end up? Col. Chris Hadfield | Videos by Canadian Astronaut Living in Space C-SPAN Classroom digital media | Planetary Exploration: Is space exploration worth the cost? Mark Rober (Former NASA Engineer) | Is NASA a waste of money?	CSA Biography | Canadian Astronauts Let's Talk Science | Career Resources Master Class by Chris Hadfield (**For Teachers)** | Teachers Space Exploration[$], Astronaut Training NASA | Featured Careers NASA Global Climate Change: Vital Signs of the Planet | Taking a global Perspective on Earth's Climate TED-Ed | Science & Technology Lesson2 (Database) United Nations | Sustainable Development Goals - Resources for Educators | Good Health and Well-being (SDG 3), Industry, Innovation and Infrastructure (SDG 9), Climate Action (SDG 13) and Partnership for the Goals (SDG 17) United Nations Office for Outer Space Affairs | Benefits of Space for Humankind	Crichton, S., & Carter, D. (2013). | Taking Making into Classrooms Digital Mi'kmaq | Backyard Science: Weather Wise & Climate Change Essential Principles of Climate Science. (2009). Climate Literacy National Science Teachers Association. Position Statement: Teaching of Climate Science. Sneideman, J., & Twamley, E. (2020). Climate Change: The science behind melting glaciers and warming oceans with hands-on science activities. Nomad Press, White River Junction, VT. [Book]

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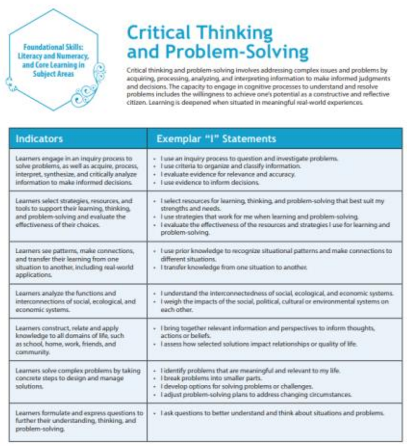
7. Appendices

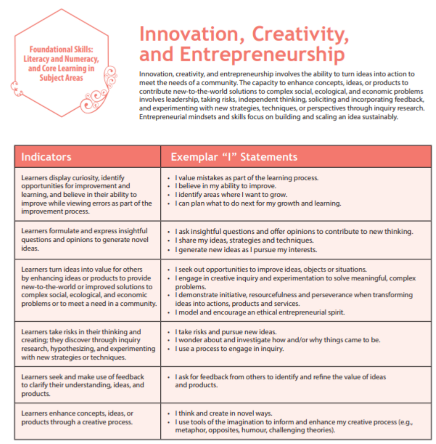
6.1 New Brunswick Global Competencies

Click on any of the images below to redirected to the web version of the document. Get the [poster].


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

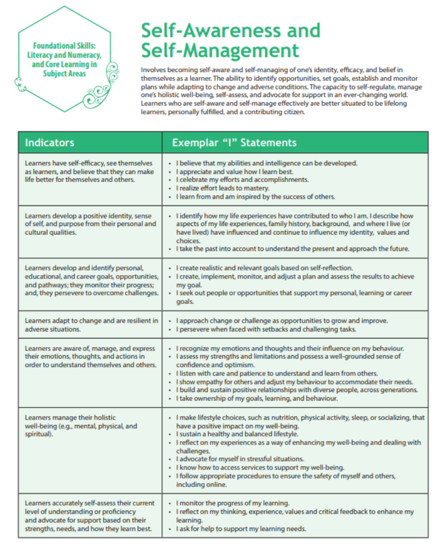
Critical Thinking and Problem-Solving

Indicators	Exemplar "I" Statements


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

Innovation, Creativity, and Entrepreneurship

Indicators	Exemplar "I" Statements


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

Self-Awareness and Self-Management

Indicators	Exemplar "I" Statements


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

Collaboration

Indicators	Exemplar "I" Statements


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

Communication

Indicators	Exemplar "I" Statements


Foundational Skills: Literacy and Numeracy, and Core Learning in Subject Areas

Sustainability and Global Citizenship

Indicators	Exemplar "I" Statements

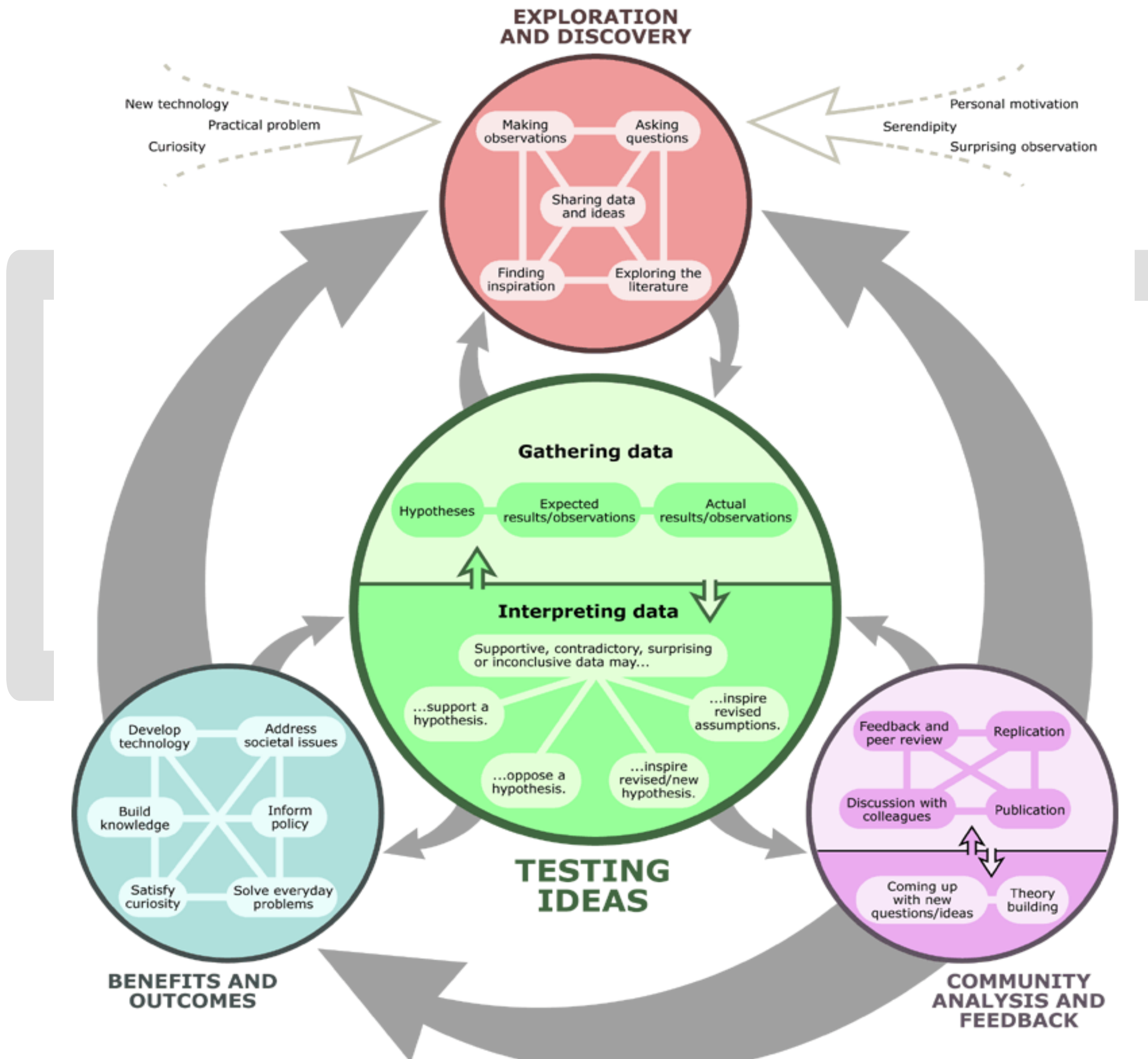
6.2 The Nature of Science

"Science know no country, because knowledge belong to humanity, and is the torch which illuminates the world." – Louis Pasteur

The Nature of Science

Empirical	Science is a process which relies heavily, on observation, experimental evidence, rational arguments and skepticism. Science becomes a tool to explain natural phenomena.
Tentative	Scientific understanding can change over time given new evidence or interpretations; however, scientific understanding is dependable.
Creative	Creativity and imagination play significant roles throughout scientific practices. Scientists use creativity and imagination to resolve problems, propose new approaches and consider what the results are telling them.
Socio-cultural	People from all cultures contribute to science. Personal, social and cultural influences shape science and the ways scientists interpret data and arrive at a conclusion.
Theory & Law	Theories and laws are unique representations of scientific understanding because theories explain complex phenomena while laws describe consistent regularities.
Scientific Models	Scientific models are based on data and inferences and are useful for understanding or predicting phenomena. They represent abstract ideas. Multiple models of the same content/context are possible and useful.

6.3 How Science Works (Grades 6-8)



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