Science and Technology Elementary Curriculum – Revised 2022
Long Range Plans – Overview

Background to Revised Curriculum 2022

The Ontario Curriculum, Grades 1–8: Science and Technology, 2022 focuses on fundamental science and technology concepts and on science, technology, engineering, and mathematics (STEM) skills. It supports students in making connections between skills and concepts, the practical applications of science and technology in their lives, and in learning about life systems, structures and mechanisms, matter and energy, and earth and space systems. This curriculum is designed to help students prepare for deeper levels of science and technology learning in secondary school and beyond.

The three main goals of the curriculum are for students to:

- Develop the skills and make the connections needed for scientific and technological investigation
- Relate science and technology to society and the environment
- Explore and understand science and technology concepts

The expectations in the science and technology curriculum are organized into five distinct but related strands. Strand A is an overarching strand that focuses on the foundational STEM skills and connections that will enable students to investigate concepts and integrate knowledge from each of the other strands and make practical connections between science and technology and other subject areas. In Strands B through E, students integrate Strand A expectations as they develop their understanding of strand-specific concepts, investigate phenomena, and make meaningful connections to the real world.

In all grades, learning related to the expectations in Strand A occurs in the context of learning related to the other four strands. Revised components in the new curriculum include:

- **STEM Skills and Connections:** Perspectives and approaches that provide opportunities for students to investigate and apply concepts and skills from all areas of learning.
- **Research and Experimentation Processes:** Provides students with the scientific literacy skills needed to approach scientific questions that are becoming a part of everyday life.
- **Engineering Design Process:** Provides students with support to plan and build solutions to problems or address needs that connect to the curriculum and the world around them.
- **Hands-on, Experiential Learning:** Includes hands-on, experiential learning opportunities to support classroom activities that encourage curiosity.
- **Coding:** Allows students to explore a wide variety of science and technology concepts and contexts through coding, while also learning valuable skills related to the automation and control of systems.

- **Emerging Technology:** Ensures that students are aware of exciting and innovative solutions in science and technology that are being implemented today and that may be introduced in the future.
- **Skilled Trades:** Students consider the practical application of skills and concepts within the skilled trades and related occupations.
- **Contributions to Science and Technology**: Showcases the important contributions made to science and technology by people with diverse lived experiences. Students also explore real-world issues by connecting scientific and technological knowledge systems and perspectives from various cultures, including connecting Indigenous sciences and technologies and Western science and technology.
- **Climate Change:** Students will develop the skills and knowledge needed to understand the causes and potential solutions and mitigation strategies related to climate change and other environmental issues, and how they can make the most environmentally responsible decisions possible, given the choices they have.
- **Food Literacy:** Skills and knowledge related to food literacy: from students developing an understanding of where food comes from and how it is grown and prepared to students investigating the importance of biodiversity in agriculture

Long-Range Plans – Introduction to Resources

Long-range plan resources have been developed to assist Ontario teachers in implementing the revised Elementary Science and Technology 2022 curriculum. There are two models for these long range plans to provide teachers with a variety of opportunities to create appropriate learning experiences for their students. Curriculum resources for each grade have also been created to support these long range plans.

What is a long range plan and why is it important?

A long range plan outlines a year-long plan for teaching and learning science and technology. It is a living document that is revised as educators become increasingly aware of the abilities, strengths, needs, and interests of their students. A thoughtfully developed long range plan:

- ensures a teacher knows where they are going and how to get there
- includes meaningful cross-curricular connections
- recognizes various amounts of time will be required to prepare for certain lessons or projects
- ensures that inquiry and hands-on learning experiences are woven throughout the year
- is anchored in the STEM skills as presented in Strand A
- ensures that instruction is sequenced in a manner that considers seasons, weather, and the natural environment
- connects expectations to other content areas, in order to deepen student learning
- allocates the appropriate time for concepts and skills so that students have multiple opportunities to focus on the overall expectations within the grade

- ensures that all specific expectations are addressed at least once within the school year
- recognizes that some expectations need to be revisited several times throughout the year
- includes differentiated instruction and ensures learning opportunities for all levels of ability as well as with students with high needs

Note: These sample long range plans outline possible sequences of instruction for the school year. There are many ways to structure an effective plan for learning.

Assessment and Evaluation

To ensure that assessment, evaluation, and reporting are valid and reliable and that they lead to the improvement of learning for all students, teachers use practices and procedures that:

- are fair, transparent, and equitable
- support all students
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students
- are communicated clearly to students and parents at the beginning of the school year or course and at other appropriate points throughout the school year or course
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement; develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan the next steps for their learning.

Growing Success, (p.6) and as described in the ***Assessment and Evaluation*** tab of the Curriculum and Resources page of the Ministry of Education website.

Long-Range Planning Considerations in Revised Elementary Science and Technology Curriculum

- These sample plans include all overall and specific expectations from strands A-E for each grade level.

- The overall and specific expectations from Strand A of STEM Skills and Connections (STEM Investigation and Communication Skills; Coding and Emerging Technologies;

and Applications, Connections, and Contributions) are taught explicitly and incorporated into daily activities to coincide with the implementation of the other strands throughout the school year.

- In the development of these long range and daily plans, considerations should be given to provide multiple opportunities to teach **(*STEM Investigation and Communication Skills, Coding, Applications, and Connections)***, as well as transferable skills, in order to help students develop confidence, problem-solving skills, and resiliency through regular academic challenges and critical-thinking opportunities. This will in turn assist students in developing a positive identity as ***active*** science and technology learners.
- STEM Investigation and Communication Skills (specific expectations A1.1 through A1.5) provide opportunities for students to authentically engage in learning with everyday situations that involve science and technology. Learning that *can be explored using investigation, experimentation, engineering design processes, and scientific communication in a safe way* can be strategically situated throughout the year to support students in making connections among scientific and technological concepts, strands, and disciplines, and to provide opportunities for assessing the integration and application of learning.
- Coding (Science and Technology A2.1) can be used to solve problems and help deepen students' understandings of scientific and technological concepts and processes; coding skills should be strategically addressed and assessed throughout the year, as appropriate.
- The processes of science and technology require ongoing attention so that students can develop proficiency in science and technology concepts and can in turn explore these concepts to create deep, lasting learning. *The investigation, experimentation, engineering design processes, and scientific communication are built into the instruction of the other strands to provide an understanding that science and technical knowledge are developed through these processes.*

Additional Considerations for Planning

Within each set of learning experiences or units, expectations do not need to be uncovered in sequential order. Educators should plan lessons in a progression that makes sense to them and responds to students' interests and learning needs. Teachers are also encouraged to connect science and technology expectations to real-world events and natural phenomena whenever these opportunities are presented. This makes learning more meaningful for students.

Safety: All activities in this (and any other) long range plan must be conducted in a safe manner. Detailed information about health and safety can be found in the *Science and Technology 2022 Curriculum*. Safety considerations are also included in these long range plans to assist teachers with planning.

How to Foster Inquiry in STEM

Inquiry and curiosity are important characteristics to foster in all learning environments. Engagement and motivation increase when students are given the opportunity to explore curriculum content in ways that are meaningful to them.

STEM education encourages students to foster their curiosity and to pursue questions and wonderings through a hands-on, constructivist approach to learning. Student learning is driven by their need to explore questions and discover answers using STEM as a springboard for inquiry. Teachers can foster inquiry-based learning through the implementation of STEM skills.

Creating a learning environment in which students feel safe, supported, and valued will help them voice their questions and ideas. There are many ways that educators can create such an environment, including:

- Honouring students' background knowledge and inviting them to share what they know
- Becoming a co-learner with students when uncovering content guided by students' wonderings
- Encouraging students to ask driving, inquiry-based questions that provide multiple opportunities to discover answers and/or solutions
- Supporting students as they carry out the scientific and engineering design processes

Reflective Questions When Planning

- What key concepts and skills do students need more time to develop?
- What prior learning is required for other expectations to be addressed?
- What expectations are assumed for other expectations to be addressed?
- How can educators create opportunities for students to practice and consolidate their existing knowledge and understanding of science and technology concepts when they are engaged in new learning?
- How might I revisit expectations at various times throughout the year?
- How can I create opportunities for students to continue to practise and consolidate learning when they are engaged in new learning?
- How have multiple opportunities for hands-on inquiry been incorporated into the plan?
- How are students engaged in STEM and engineering activities that connect to the big ideas?
- How can the expectations be connected to issues being faced in the world today?
- How could students explore various career and education pathways while engaging in these lessons?
- How will I use formative assessment to guide daily lessons?
- What materials, tools, and resources will be needed for each unit?
- How will I ensure equity, inclusion, and modifications needed for exceptional students?
    - Teachers and staff are highly encouraged to be mindful of students' and families' accessibility to materials outside of the classroom. Every classroom and every school is different, therefore it is highly recommended to be as inclusive as possible and to speak to your administrative team about how the plan will benefit all students in your classroom to support the learning goals.
    - Accommodations or Modifications for exceptional students:
        - Many of these lessons or projects allow teachers and educators to approach the guiding questions with differentiated instructions. Teachers and educators can recognize the levels of background knowledge and learning interest to prepare responsively.
        - Educators are encouraged to be flexible with time and support students who require accommodations with assistive technology, especially since many of these lessons or projects require access to technology for research and emerging technologies. Speak and reach out to your Learning Support team at your school for further assistance and guidance for your students with accommodations and/or modifications.
        - Teachers and educators are encouraged to always review these documents
        - Learning For All: A Guide to Effective Assessment And Instruction For All

Students, Kindergarten To Grade 12
- Growing Success

Scientific and Engineering Design Processes

In addition to developing knowledge related to specific concepts, the study of science and technology offers students varied opportunities to learn skills that are relevant to their everyday world.

Strand A is focused on such skills, and refers to the following three processes:

- scientific research process
- scientific experimentation process
- engineering design process

The skills associated with these processes include:

- initiating and planning (e.g., asking questions, clarifying problems, planning procedures)
- performing and recording (e.g., following procedures, accessing information, recording
- observations and findings)
- analysing and interpreting (e.g., organizing data, reflecting on the effectiveness of actions performed, drawing conclusions)
- communicating (e.g., using appropriate vocabulary, communicating findings in a variety of ways)

Strand A – STEM Skills and Connections

Strand A focuses on the STEM skills that will enable students to explore and investigate concepts. This is the overarching strand for all activities in the science and technology curriculum.

Students apply these skills as they integrate knowledge from the other four strands and as they make connections between these skills and knowledge and real-world issues in science and technology as well as other subject areas.

In this strand, students use scientific research, scientific experimentation, and engineering design processes to carry out formal investigations, design solutions to problems, and communicate their findings. Students also learn how to follow established health and safety procedures.

Students gain an understanding of the technology they use every day and use coding in investigations and to model science and technology concepts. In addition to using coding, students assess the impact of coding and of emerging technologies on everyday life and in STEM-related fields.

Students can learn about Indigenous sciences and technologies, and make connections to First Nations, Métis, and Inuit knowledge systems and perspectives, helping them assess the impacts of discoveries and innovations on First Nations, Métis, and Inuit communities. They can also investigate the scientific and technological knowledge systems and perspectives of various cultures, analyze the contributions of people with diverse experiences, and describe practical applications of science and technology.

How Are These long range Plans Structured?

Deep learning occurs when specific expectations are connected, are continuously expanded upon, and are revisited in a variety of contexts throughout the year. The two models for long range plans are described.

Model 1

Model 1 is intended to support an integrated and Big Ideas-based pedagogy, with a focus on developing key science and technology skills as foundational concepts for student learning. The science and technology Strands B-E are presented in a manner that considers seasons, weather, and the natural environment. The strands are woven together so that all strands are investigated each term, and 'Big Ideas' incorporate more than one strand in a suggested timeframe of a 6-week period or month. There are also opportunities for connections to other content areas, which will deepen the learning for students. A wide variety of activities is included so that teachers can choose activities that will meet the needs of their students within the constraints of the materials they have available, and so that teachers can choose activities that are meaningful and relevant to their students' interests, needs, and the local community. Teachers do not need to complete all activities suggested to include all required expectations.

- The first column in Model 1 outlines a suggested timeline on a per-term basis, to be determined by the needs of the learners, local resources, and climate considerations, and can be facilitated accordingly.
- The second column supports an inquiry stance by offering big ideas and guiding questions for the unit of study.
- The third column highlights activity suggestions through the use of STEM skill instruction (Strand A).
- The other strands and expectations are found in subsequent columns.
- The final two columns in Model 1 outline suggestions for subject integration, including suggestions for combined grade instruction and optional resources to support learning

Model 2

Model 2 is intended to support a holistic approach to teaching the science and technology curriculum. In this model, the science and technology Strands B-E are presented in a manner that also considers seasons, weather, and the natural environment. Each strand is presented as a "unit", or set of learning experiences with most units occurring at distinct times of the year. Opportunities for spiraling and strengthening student understanding throughout the year are presented through connections to other content areas. Additional suggestions for revisiting science and technology content at various points during the year are offered. A wide variety of activities is included so that teachers can choose activities that will meet the needs of their students within the constraints of the materials they have available, and so that teachers can choose activities that are meaningful and relevant to their students' interests, needs, and the local community. Teachers do not need to complete all activities suggested to include all required expectations.

- A suggested timeline is given in the first column to assist with the pacing of the curriculum.
- The second column, "STEM Skills and Connections," lists numerous examples of learning activities and investigations that help to address specific expectations.
- The third column, "Guiding Questions" helps educators to facilitate and guide inquiry-based learning throughout the school year.
- The next column outlines suggestions for subject integration.
- The "Resources" column provides a suggested list of examples for lesson plans, websites, and other helpful items that support the STEM activities previously outlined.
- The final column, "First and Next Steps," offers a solid starting point to plan for materials, identify supports, and recruit volunteers and field experts that will bolster students' opportunities to fully engage with the science and technology curriculum.

Each science and technology strand consists of 2 overall expectations, which comprise the 'Big Ideas' of each unit. All lessons, activities, and cross-curricular connections should help students develop a deeper understanding of these overarching concepts.

The suggested duration for each unit is specified, but there should be room for flexibility. Educators should make adjustments to timing if additional days are required to address student learning needs that emerge as the plan is implemented.

Curriculum Resources to Support Long-Range Plans

A series of learning experiences have been developed for each grade to support these long-range plans.