THE ONTARIO CURRICULUM

GRADES 9–12

Technological Education

Printed on 2024-08-28

PDF versions of a curriculum include the following information from the Curriculum and Resources website:

- the Program Planning and Assessment and Evaluation sections of the Curriculum and Resources website that apply to all Ontario curriculum, Grades 1–12;
- the Curriculum Context that is specific to a discipline;
- the strands of the curriculum; and
- glossaries and appendices as applicable.

The Ontario Curriculum Grades 9–12: Technological Education,

This curriculum policy supersedes *The Ontario Curriculum, Grades 9 and 10: Technological Education, 2009.* Beginning in the 2024–25 school year, all technological education courses for Grades 9 and 10 will be based on the expectations outlined in this curriculum. Technological education courses for Grades 11 and 12 will continue to be based on *The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009*. All references to Grades 9 and 10 that appear in that document have been superseded.

Version History:

Version Date	**Description**
May 29, 2024	New courses issued for Grades 9 and 10 – Technology and the Skilled Trades, Open (TAS1O and TAS2O). Beginning in the 2024–25 school year, Exploring Technologies, Grade 9 (TIJ1O) should not be offered, and the associated course code will be expired. Beginning in the 2024–25 school year, all Grade 9 and 10 broad-based technology (BBT) focus courses will be delivered using the TAS1O/TAS2O expectations.

Program Planning and Assessment and Evaluation Content

Last updated: June 2023

This content is part of official issued curriculum providing the most up-to-date information (i.e., front matter). This content is applicable to all curriculum documents, Grades 1 to 12. Educators must consider this information to guide the implementation of curriculum and in creating the environment in which it is taught.

This curriculum policy supersedes *The Ontario Curriculum, Grades 9 and 10: Technological Education, 2009.* Beginning in the 2024–25 school year, all technological education courses for Grades 9 and 10 will be based on the expectations outlined in this curriculum. Technological education courses for Grades 11 and 12 will continue to be based on *The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009*. All references to Grades 9 and 10 that appear in that document have been superseded.

Contents

Une publication équivalente est disponible en français sous le titre suivant : Le curriculum de l’Ontario, 9e et 10e année – Éducation technologique, 2024 et Le curriculum de l’Ontario, 11e et 12e année – Éducation technologique, 2009.

TAS1O - Technology and the Skilled Trades, Grade 9

Open

Issued: 2024

This hands-on course enables students to further explore the engineering design process and develop other technological knowledge and skills introduced in earlier grades. Students will design and safely create prototypes, products, and/or services, working with tools and technologies from various industries. As students develop their projects to address real-life problems, they will apply technological concepts such as precision measurement, as well as health and safety standards. Students will begin to explore job skills programs and education and training pathways, including skilled trades, that can lead to a variety of careers.

Broad-based technology focus courses

School boards may offer the following broad-based technology focus courses related to Grade 9 Technology and the Skilled Trades:

- TGJ1O – Communications Technology and the Skilled Trades
- TEJ1O – Computer Technology and the Skilled Trades
- TCJ1O – Construction Technology and the Skilled Trades
- THJ1O – Green Industries and the Skilled Trades
- TXJ1O – Hairstyling and Aesthetics and the Skilled Trades
- TPJ1O – Health Care Technology and the Skilled Trades
- TFJ1O – Hospitality and Tourism and the Skilled Trades
- TMJ1O – Manufacturing Technology and the Skilled Trades
- TDJ1O – Technological Design and the Skilled Trades
- TTJ1O – Transportation Technology and the Skilled Trades

Prerequisite: None

Introduction

Preface

This is the curriculum policy for technological education, Grades 9 and 10, 2024. It supersedes *The Ontario Curriculum, Grades 9 and 10: Technological Education, 2009.* Effective beginning in the 2024–25 school year, all technological education courses for Grades 9 and 10 will be based on the expectations outlined in this curriculum policy.

In addition to the considerations outlined in this curriculum context, all of the general "Program Planning" sections apply to this curriculum. Educators should review and implement these general sections, as well as the components that appear below.

Vision and Goals of Technological Education, Grades 9 and 10

The vision of the technological education program in Grades 9 and 10 is for all students to acquire and develop the skills and knowledge related to technological education that will support them in contributing to the global economic, scientific, and societal innovations of tomorrow. This learning will enhance their ability to achieve success in secondary school, the workplace, postsecondary education or training, and daily life. A central component of this curriculum is safe, practical, hands-on, experiential learning that will support students in becoming technologically literate citizens. That is, they are able to understand, work with, and benefit from a range of technologies – skills that are necessary given the power, reach, and rapid evolution of technology. To succeed in today's rapidly changing and technologically dependent society, students need to be effective problem solvers and critical thinkers, able to understand, question, anticipate, and respond to the implications of technological innovation. Students who pursue careers in technology will also need these high-level skills to develop solutions to technological challenges or to provide the services required in their chosen fields.

The goals of the technological education curriculum for Grades 9 and 10 are to enable students to:

- gain an understanding of the fundamental technological concepts underlying technological education through hands-on, project-based learning while developing technical skills;
- develop creative and flexible approaches to problem solving that will help them address challenges in various areas in everyday life;
- develop a level of technological proficiency that will allow them to be critical consumers and producers of technological solutions;
- explore the impact and development of technology, including emerging technological innovations;
- see themselves as capable and successful STEM (science, technology, engineering, and mathematics) learners and practitioners;
- explore career opportunities in technological fields and the skilled trades, and make connections that will help them take advantage of job skills programs and potential postsecondary pathways, including apprenticeship.

The Importance of Technological Education in the Curriculum

Technological innovation influences all areas of life, from the daily lives of individuals, to the work of business and government, to interactions on a global scale. It helps meet basic human needs and provides tools for improving people's lives and exploring new challenges.

Technological education promotes the integration of learning across subject disciplines. For example, when students design a product, they explore the social or human need that the product addresses (social science), the scientific principles involved in its design and construction (science), its dimensions and shape (mathematics), and the aesthetic qualities of its design (the arts). When students consider which materials to use to create their product, they must consider sustainability and material costs. When they assess the impact that technological innovations have had – or may have – on society and the environment, students are exploring historical or current events and scientific or geographic concepts. When they consider how various technologies affect physical and mental health and well-being, they are looking into aspects of health and physical education. They apply literacy skills to communicate design ideas, produce reports summarizing technological projects, and write instructions for the use of the products they create.

Technological education also helps students develop research skills and fosters creativity, critical thinking, and problem solving. In addition, in its emphasis on innovation to meet human needs, it encourages global citizenship and promotes social, economic, and environmental responsibility.

The Importance of Technological Education in STEM Education

STEM education is the cross-curricular study of science, technology, engineering, and mathematics (STEM), and the application of those subjects in real-world contexts. As students engage in STEM education, they develop the transferable skills that they need to meet the demands of today's global economy and society.

Skills developed through STEM education include those related to problem solving, innovation, and engineering design. These skills are in high demand in today's changing world, as technology continues to impact all areas of society. In these courses, students use an engineering design process and associated skills to design, create, and test products or services. (For more on this, see the subsection "Engineering Design Process" under "The Program in Technological Education".) They also connect these skills to broad-based technology areas[1] (see "Overview" in the

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[1] The technological education curriculum in Grades 9–12 encompasses ten broad-based technology (BBT) areas, as follows:

- Communications Technology
- Computer Technology
- Construction Technology
- Green Industries
- Hairstyling and Aesthetics
- Health Care
- Hospitality and Tourism
- Manufacturing Technology
- Technological Design
- Transportation Technology

same section) and to various careers, including the skilled trades, recognizing that skills developed in technological education have close connections to many areas of STEM.

Classroom activities focused on exploring solutions to real-world problems and on understanding practical applications of concepts can combine components from two or more STEM-related subjects and can include contexts related to the student's home and community or to various occupations, including the skilled trades. The integration of a number of STEM-related subjects can reinforce students' understanding of each subject and of the interrelationships among them. Similarly, reflecting on diverse perspectives engages students in a variety of creative and critical thinking processes that are essential for developing innovative, ethical, and effective responses to various needs.

The technological education curriculum for Grades 9 and 10 is designed to build on the foundation of knowledge and skills provided by the elementary science and technology curriculum. In this continuum, there is a similar emphasis on foundational knowledge and skills (fundamentals), engineering design, technological problem-solving skills and processes, and the relationship between technology, the environment, and society.

Learning by Doing: A Hands-On Approach to Technological Education

The core principle that underlies technological education is that *students learn best by doing*. This curriculum focuses on experiential, hands-on, project-driven approaches that involve students in problem solving as they develop knowledge and skills and gain experience in a variety of broad-based technology areas.

Experiential learning that takes place in the community, including job shadowing, job twinning, work experience, and cooperative education, provides students with the opportunity to enhance their learning. These experiences also support students by helping them make successful transitions to an initial postsecondary destination, including apprenticeship. There can also be significant benefits to communities in providing experiential learning opportunities for students. Community partners can take pride in contributing to the education of children and youth and in helping to develop Ontario's future workforce.

Teachers are encouraged to provide valuable experiential learning opportunities by connecting students with role models with diverse experiences. This may include presentations given by guest speakers, particularly from populations that are underrepresented in technological education and the skilled trades.

High schools across Ontario offer job skills programs to help young people recognize career paths in technological fields and the skilled trades. Examples of these job skills programs include Specialist High Skills Majors (SHSM), dual credit programs, the Ontario Youth Apprenticeship Program (OYAP) and

Focused Apprenticeship Skills Training (OYAP-FAST), and cooperative education courses. For more information, see the “Program Planning” section on experiential learning.

Fundamental Technological Concepts

This curriculum identifies fundamental technological concepts that inform design and production in various areas of technology. To address technological challenges and solve problems effectively, students need to take the full range of these concepts into account. As they progress through the technological education courses, students will come to understand these concepts more deeply, and to work with them creatively as they confront new challenges.

Definitions of Fundamental Technological Concepts

Aesthetics	The aspects of a product, process, or service that make it pleasing to the human senses.
Control	The means by which a device or process is activated or regulated. This includes automation, which involves using technology to make a device or process run on its own.
Environmental sustainability	The creation of products or services and use of resources in a way that allows present needs to be met without compromising the ability of future generations to meet their needs. An important related concept is that of *environmental stewardship* – the responsibility for the sustainable use and treatment of natural resources.
Ergonomics	The design of a product, process, or service in a way that takes the user’s well-being with respect to its use or delivery into account – that is, in a way that minimizes discomfort, risk of injury, and expenditure of energy.
Creation	The act or process of assembling components and/or materials and resources to fabricate/build/create a product or service.
Function	The use for which a product, process, or service is developed.
Innovation	Original and creative thinking resulting in the effective design of a product or service.
Material	Any substance or item used in the creation of a product or delivery of a service.
Mechanism	A system of connected parts that allows a product to work or function.
Power and energy	The resource that enables a mechanism to perform work.
Safety	The care and consideration required to ensure that the product, process, or service will not cause harm.
Structure	The essential physical or conceptual parts of a product, process, or service, including the way in which the parts are constructed or organized.
Systems	The combinations of interrelated parts that make up a whole and that may be connected with other systems.

Project Management

While building technological concepts and skills, students will develop project management skills that will equip them to set goals, establish performance or evaluation criteria, assess risks, select and manage resources, organize and assign tasks, distribute responsibilities, manage deadlines and progress, and lead others through the design process. Developing these skills supports their success in many broad-based technology areas and disciplines. Project management skills will support students in succeeding in any career path and help them thrive in a rapidly evolving and fast-paced world to become the proficient leaders of tomorrow.

The Program in Technological Education

Overview

The technological education curriculum in Grades 9–12 encompasses ten broad-based technology areas, as follows:

- Communications Technology
- Computer Technology
- Construction Technology
- Green Industries
- Hairstyling and Aesthetics
- Health Care
- Hospitality and Tourism
- Manufacturing Technology
- Technological Design
- Transportation Technology

To support educators in planning for learning in the context of the various broad-based technology areas, a separate resource table has been created that provides a sampling of industry-specific concepts and topics, skills and applications, and careers.

Starting with students entering Grade 9 in the 2024–25 school year, students are required to earn one compulsory credit in Grade 9 or 10 technological education (TAS1O, TAS2O, or a focus course) towards their Ontario Secondary School Diploma.

Any Grade 9 and 10 technological education course may be delivered as a half-credit course (see below), but may not be planned as a multiple-credit course.

Courses in Technological Education, Grades 9 to 12

The course information that appears below is in effect starting in the 2024–25 school year. *The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009* remains in effect for those grades. All references to Grades 9 and 10 in *The Ontario Curriculum, Grades 11 and 12: Technological Education, 2009* have been superseded by the 2024 curriculum.

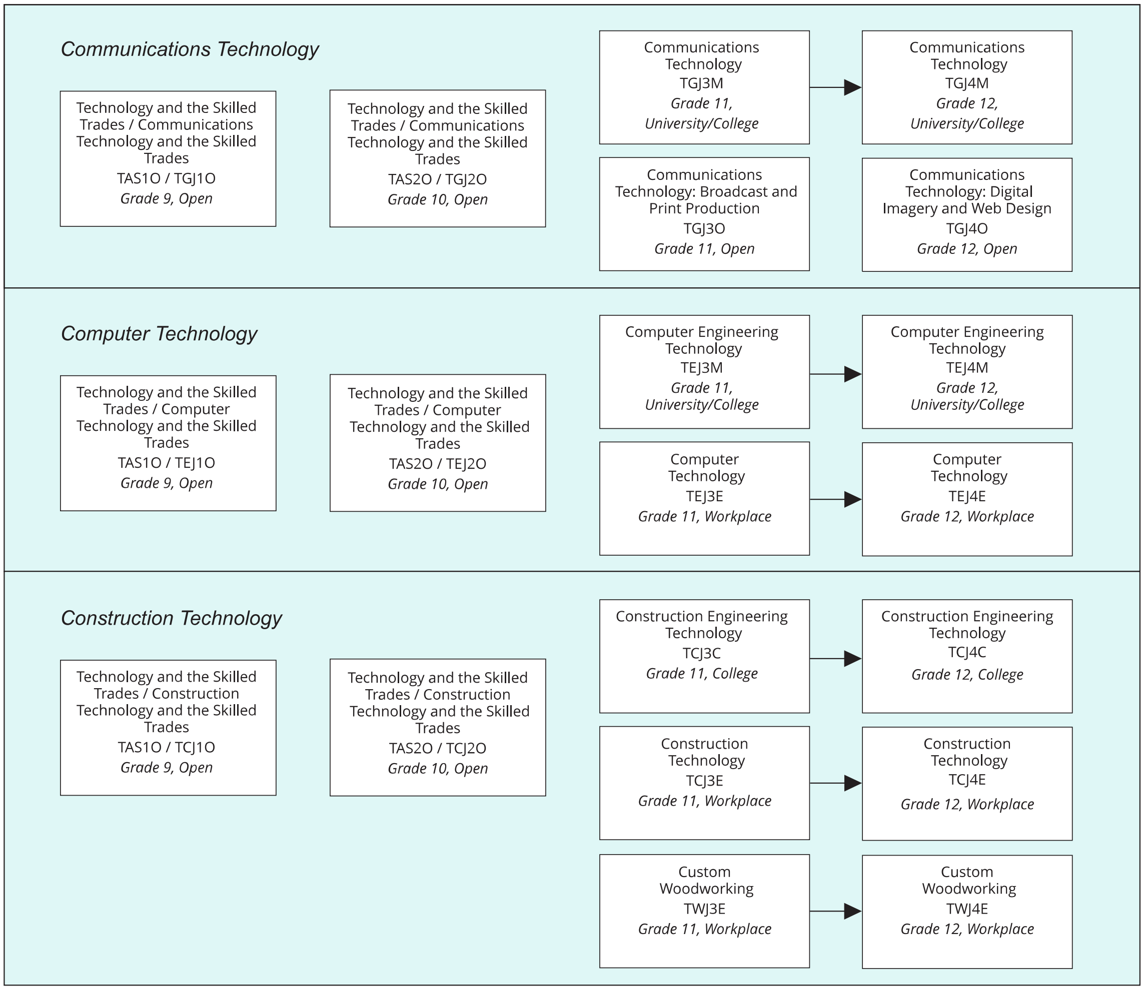
Grades 9 and 10

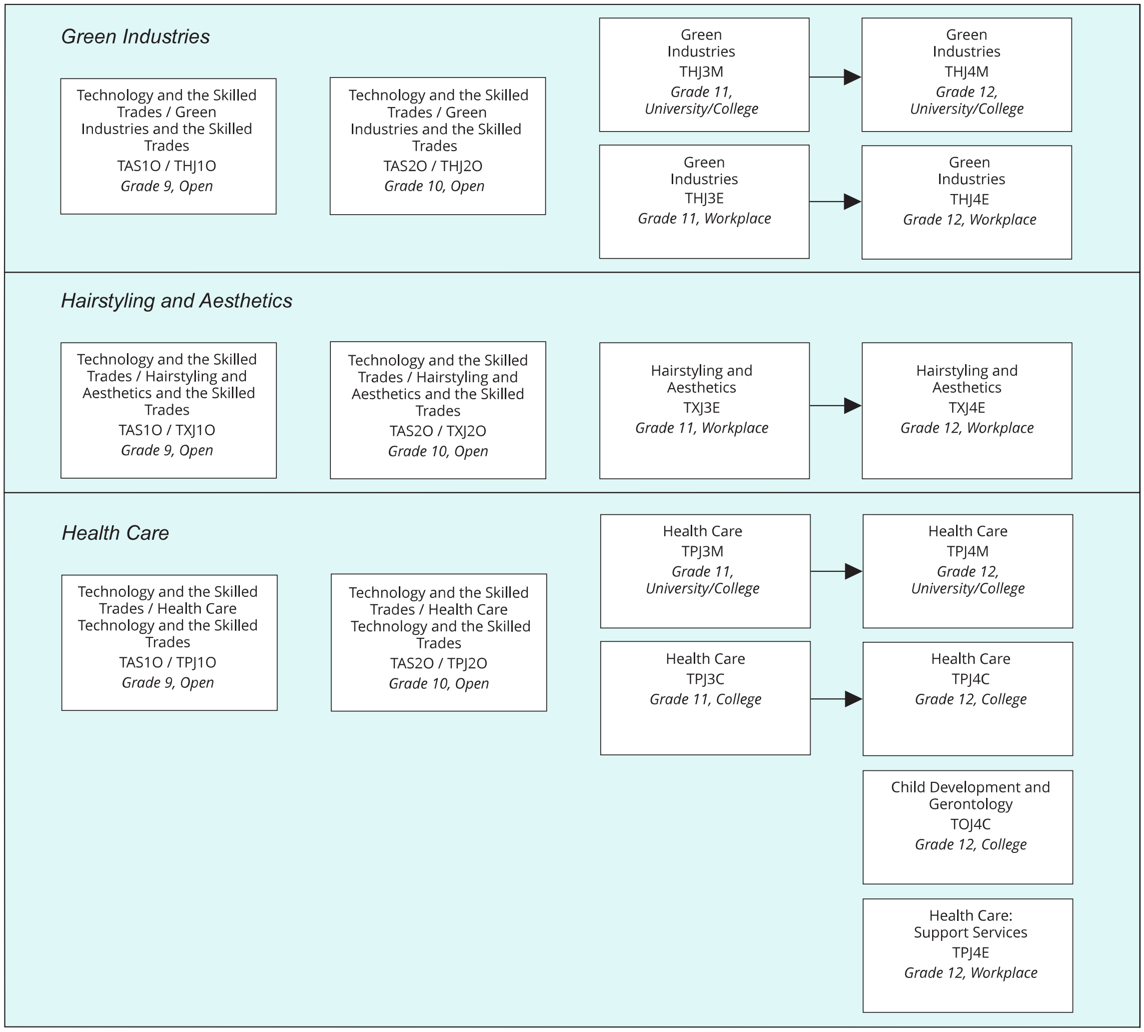
Grade	Course Name	Course Type	Course Code	Prerequisite
9	Technology and the Skilled Trades	Open	TAS1O	None
10	Technology and the Skilled Trades	Open	TAS2O	None

Note: Each of the courses listed above is worth one credit.

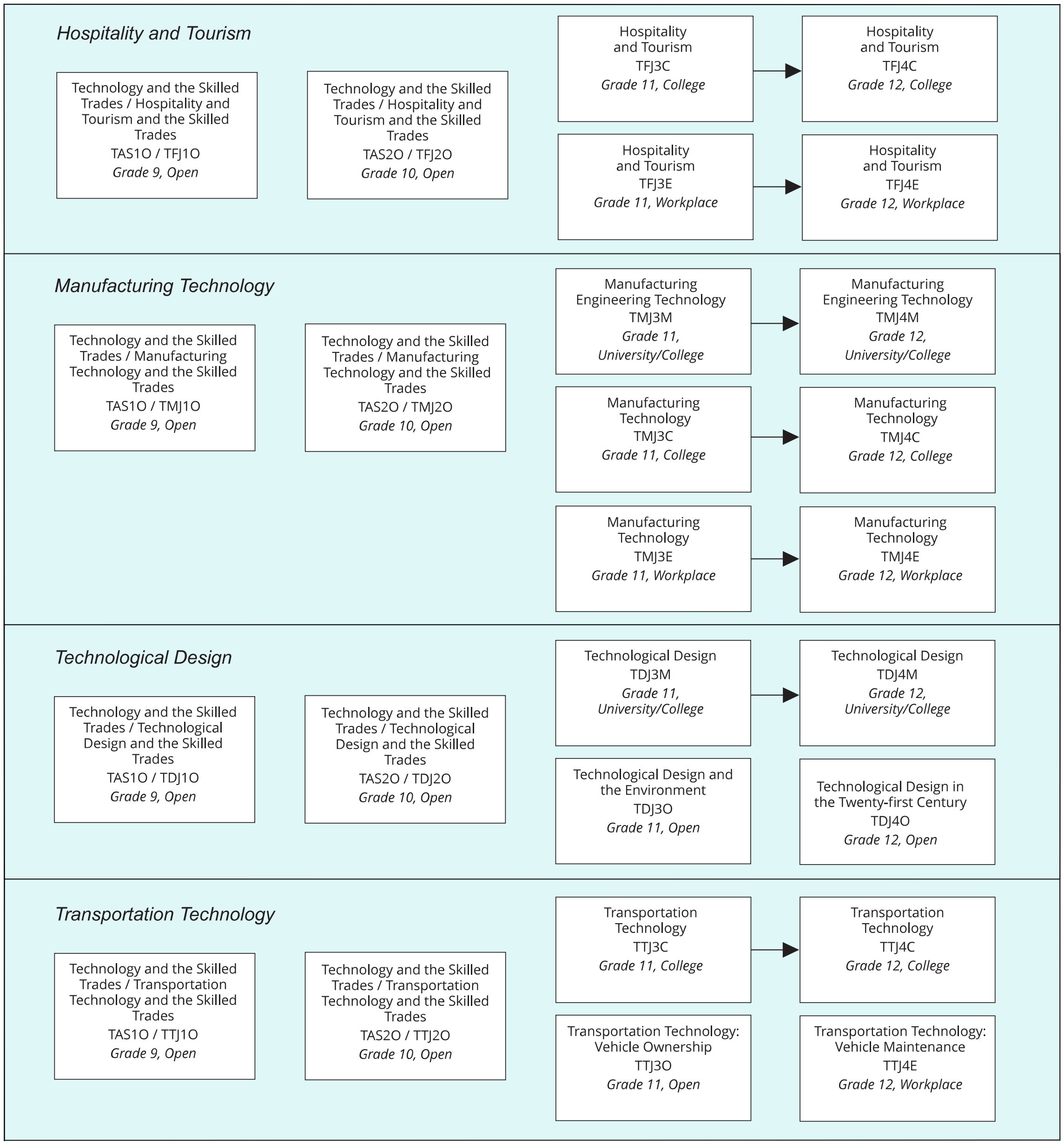
The Grade 9 and 10 courses may be adapted to create an additional course or courses that focus on any one of the broad-based technology areas listed above. For more information, see the section on focus courses below.

Prerequisite Charts for Technological Education, Grades 9–12


Communications Technology
Technology and the Skilled Trades / Communications Technology and the Skilled Trades TAS1O / TGJ1O Grade 9, Open
Technology and the Skilled Trades / Communications Technology and the Skilled Trades TAS2O / TGJ2O Grade 10, Open
Communications Technology TGJ3M Grade 11, University/College
Communications Technology TGJ4M Grade 12, University/College
Communications Technology: Broadcast and Print Production TGJ3O Grade 11, Open
Communications Technology: Digital Imagery and Web Design TGJ4O Grade 12, Open
Computer Technology
Technology and the Skilled Trades / Computer Technology and the Skilled Trades TAS1O / TEJ1O Grade 9, Open
Technology and the Skilled Trades / Computer Technology and the Skilled Trades TAS2O / TEJ2O Grade 10, Open
Computer Engineering Technology TEJ3M Grade 11, University/College
Computer Engineering Technology TEJ4M Grade 12, University/College
Computer Technology TEJ3E Grade 11, Workplace
Computer Technology TEJ4E Grade 12, Workplace
Construction Technology
Technology and the Skilled Trades / Construction Technology and the Skilled Trades TAS1O / TCJ1O Grade 9, Open
Technology and the Skilled Trades / Construction Technology and the Skilled Trades TAS2O / TCJ2O Grade 10, Open
Construction Engineering Technology TCJ3C Grade 11, College
Construction Engineering Technology TCJ4C Grade 12, College
Construction Technology TCJ3E Grade 11, Workplace
Construction Technology TCJ4E Grade 12, Workplace
Custom Woodworking TWJ3E Grade 11, Workplace
Custom Woodworking TWJ4E Grade 12, Workplace



Green Industries
Technology and the Skilled Trades / Green Industries and the Skilled Trades
TAS1O / THJ1O
Grade 9, Open
Technology and the Skilled Trades / Green Industries and the Skilled Trades
TAS2O / THJ2O
Grade 10, Open
Green Industries
THJ3M
Grade 11, University/College
Green Industries
THJ4M
Grade 12, University/College
Green Industries
THJ3E
Grade 11, Workplace
Green Industries
THJ4E
Grade 12, Workplace
Hairstyling and Aesthetics
Technology and the Skilled Trades / Hairstyling and Aesthetics and the Skilled Trades
TAS1O / TXJ1O
Grade 9, Open
Technology and the Skilled Trades / Hairstyling and Aesthetics and the Skilled Trades
TAS2O / TXJ2O
Grade 10, Open
Hairstyling and Aesthetics
TXJ3E
Grade 11, Workplace
Hairstyling and Aesthetics
TXJ4E
Grade 12, Workplace
Health Care
Technology and the Skilled Trades / Health Care Technology and the Skilled Trades
TAS1O / TPJ1O
Grade 9, Open
Technology and the Skilled Trades / Health Care Technology and the Skilled Trades
TAS2O / TPJ2O
Grade 10, Open
Health Care
TPJ3M
Grade 11, University/College
Health Care
TPJ4M
Grade 12, University/College
Health Care
TPJ3C
Grade 11, College
Health Care
TPJ4C
Grade 12, College
Child Development and Gerontology
TOJ4C
Grade 12, College
Health Care: Support Services
TPJ4E
Grade 12, Workplace



Technology and the Skilled Trades Courses (TAS1O and TAS2O)

The Grade 9 and 10 Technology and the Skilled Trades courses (TAS1O and TAS2O) build on the elementary science and technology and mathematics curricula and complement the Grade 9 and 10 science and mathematics courses. They are intended to introduce students to technological education in general, exposing them to a range of broad-based technology areas. Students in these courses work on projects that can encompass several different technological areas, using a range of equipment and resources suited to the various broad-based technology areas and learning environments.

Focus Courses

Schools may offer one or more focus courses in Grade 9 and/or 10 to explore groups of related occupations and industry sectors, including industry-specific concepts and skills, within a particular broad-based technology area. For example, focus courses in construction technology enable students to acquire knowledge and skills related to carpentry, electrical/network cabling, heating and cooling, masonry, and plumbing.

School boards may offer the following broad-based technology focus courses related to Grade 9 Technology and the Skilled Trades:

- TGJ1O – Communications Technology and the Skilled Trades
- TEJ1O – Computer Technology and the Skilled Trades
- TCJ1O – Construction Technology and the Skilled Trades
- THJ1O – Green Industries and the Skilled Trades
- TXJ1O – Hairstyling and Aesthetics and the Skilled Trades
- TPJ1O – Health Care Technology and the Skilled Trades
- TFJ1O – Hospitality and Tourism and the Skilled Trades
- TMJ1O – Manufacturing Technology and the Skilled Trades
- TDJ1O – Technological Design and the Skilled Trades
- TTJ1O – Transportation Technology and the Skilled Trades

School boards may offer the following broad-based technology focus courses related to Grade 10 Technology and the Skilled Trades:

- TGJ2O – Communications Technology and the Skilled Trades
- TEJ2O – Computer Technology and the Skilled Trades
- TCJ2O – Construction Technology and the Skilled Trades
- THJ2O – Green Industries and the Skilled Trades
- TXJ2O – Hairstyling and Aesthetics and the Skilled Trades
- TPJ2O – Health Care Technology and the Skilled Trades
- TFJ2O – Hospitality and Tourism and the Skilled Trades
- TMJ2O – Manufacturing Technology and the Skilled Trades
- TDJ2O – Technological Design and the Skilled Trades
- TTJ2O – Transportation Technology and the Skilled Trades

The additional course(s) must be developed on the basis of the expectations outlined in this curriculum for Technology and the Skilled Trades, Grade 9 (TAS1O) and/or Technology and the Skilled Trades, Grade 10 (TAS2O), and must be assigned a specified name and course code as described above. For example, a Grade 9 course could be developed to focus on communications technology (TGJ1O), or a Grade 10 course could be developed to focus on construction technology (TCJ2O).

Regardless of the particular broad-based technology area on which a course is focused, students must be given the opportunity to achieve all of the expectations of the course outlined in this curriculum.

Students may take, and earn credit for, more than one technological education course in Grades 9 and 10. For example, a student could take two courses in Grade 10: Technology and the Skilled Trades (TAS2O) and Construction Technology and the Skilled Trades (TCJ2O), earning one credit for each.

Half-Credit Courses

The courses outlined in this curriculum are designed to be offered as full-credit courses. However, they may also be delivered as half-credit courses. Half-credit courses, which require a minimum of fifty-five hours of scheduled instructional time, must adhere to the following conditions:

- The two half-credit courses created from a full course must together contain all of the expectations of the full course.
- Students must successfully complete both parts of the course if it is to be used as a prerequisite for another course.
- The title of each half-credit course must include the designation Part 1 or Part 2. A half credit (0.5) will be recorded in the credit-value column of both the report card and the Ontario Student Transcript.

Boards will report all half-credit courses to the ministry annually in the School October Report.

Curriculum Expectations

The expectations identified for each course describe the skills and knowledge that students are expected to acquire, demonstrate, and apply in their projects and in various other activities on which their achievement is assessed and evaluated.

Mandatory learning is described in the overall and specific expectations of the curriculum.

Two sets of expectations – overall expectations and specific expectations – are listed for each *strand*, or broad area of the curriculum. In Grades 9 and 10, there are two strands: Strand A: Design Processes and Related Skills and Strand B: Technological Development, Impacts, and Careers. *Taken together, the overall and specific expectations represent the mandated curriculum.*

The *overall expectations* describe in general terms the skills and knowledge that students are expected to demonstrate by the end of the course. The *specific expectations* describe the expected skills and knowledge in greater detail. The specific expectations are organized under numbered subheadings, each of which indicates the strand and the overall expectation to which the group of specific expectations corresponds (e.g., “B2” indicates that the group relates to overall expectation 2 in Strand B). This organization is not meant to imply that the expectations in any one group are achieved independently of the expectations in the other groups, nor is it intended to imply that the learning associated with the expectations happens in a linear, sequential way. The numbered headings are used merely as an organizational structure to help teachers focus on particular aspects of knowledge, concepts, and skills as they develop various lessons and learning activities for students.

Teacher Supports

Specific expectations are accompanied by supports such as examples, teacher prompts, and/or instructional tips.[2] Examples are meant to clarify the requirement specified in the expectation, illustrating the kind of skill or knowledge, the specific area of learning, the depth of learning, and/or the level of complexity that the expectation entails. Teacher prompts are sample guiding questions and considerations that can lead to discussions and promote deeper understanding. Instructional tips suggest instructional strategies and authentic contexts for the effective modelling, practice, and application of technological education concepts.

Teacher supports, such as examples, teacher prompts, and instructional tips, are optional supports that educators can draw on to support teaching and learning, in addition to developing their own supports that reflect a similar level of complexity. Facilitating learning towards the achievement of the specific expectations must always be responsive to the diversity of the learners in the classroom. Universal Design for Learning that removes barriers for students, differentiated instruction, and flexible strategies are intended to support learners towards the successful demonstration of the expectations.

Strands in the Technological Education Curriculum for Grades 9 and 10

The overall and specific expectations for each course in the technological education curriculum for Grades 9 and 10 are organized in two distinct but related strands. As students move up through the grades, the expectations within these strands will increase in complexity and depth. These strands are as follows:

- **Strand A: Design Processes and Related Skills** focuses on hands-on and project-based learning to build foundational skills, including: the acquisition and application of fundamental technological skills; various design processes, including the engineering design process; the creation of prototypes for products or services; and health and safety practices.
- **Strand B: Technological Development, Impacts, and Careers** focuses on foundational learning related to the nature of technology and innovation, including: transferable skills; cross-curricular STEM connections; the impact of technology; contributions to technological innovations made by members of diverse groups and communities in Canada; and opportunities and careers, including skilled trades.

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[2] The teacher supports will be made available at a later date, after the issuing of the curriculum expectations and the curriculum context.

Engineering Design Process

In many technological fields, open-ended problem-solving processes that involve the full cycle of planning and developing products or services to meet identified needs are often referred to as “design processes”. A design process is an iterative process that may involve revisiting a prior stage as new information is acquired about the problem being investigated, or as a better understanding is developed of the person or people for whom a solution is being designed. The entire process may even be restarted, or repeated, when one approach proves unsuccessful.

Since students will be seeking solutions to problems that will impact others, ethical considerations as well as the perspectives and needs of a variety of individuals and communities should be considered throughout the process. Students can conduct interviews with end-users, or they can research individuals or communities that may be affected by potential solutions. Their approach should be empathetic, and students should consider various perspectives, as well as factors such as environmental sustainability and usability, throughout the process.

The engineering design process described below involves students initiating and planning solutions, and “performing” or carrying out their plan by designing and creating prototypes of their solutions. A prototype is a functional model of a product or service that can be used to demonstrate the solution and obtain feedback from the prospective end-user. This information is used to test and validate design choices that students have made. Students analyze and refine their prototypes based on the information they have collected. Communication and documentation occur throughout the process, using appropriate vocabulary and forms for a variety of purposes. The end product of the engineering design process might not be a tangible object; it might instead be a technological process or service.

There is no single design process, but rather a range of practices and design processes that are followed when designing solutions or developing projects. The engineering design process in technological education is similar to the process described in elementary science and technology and Grade 9 science, with a particular focus on students’ thinking critically about *how* they will be creating their prototype. At the secondary level, technological education students should be considering the methods, approaches, and techniques they will use in creating their prototype, as well as time constraints, environmental impact, cost of materials and resources, and tools and materials required. These considerations inform the development of the process or method by which they will create their prototype.

Communication and documentation are areas of focus throughout the engineering design process in technological education. Actively engaging in technical documentation and communication allows students to record, reflect, and communicate throughout the development process of their projects. These skills extend beyond secondary technological education as students explore careers and postsecondary pathways in technological fields, including the skilled trades.

Students and teachers may find the need to emphasize specific aspects of the engineering design process provided, or to make substitutions with components of processes that they may find elsewhere.

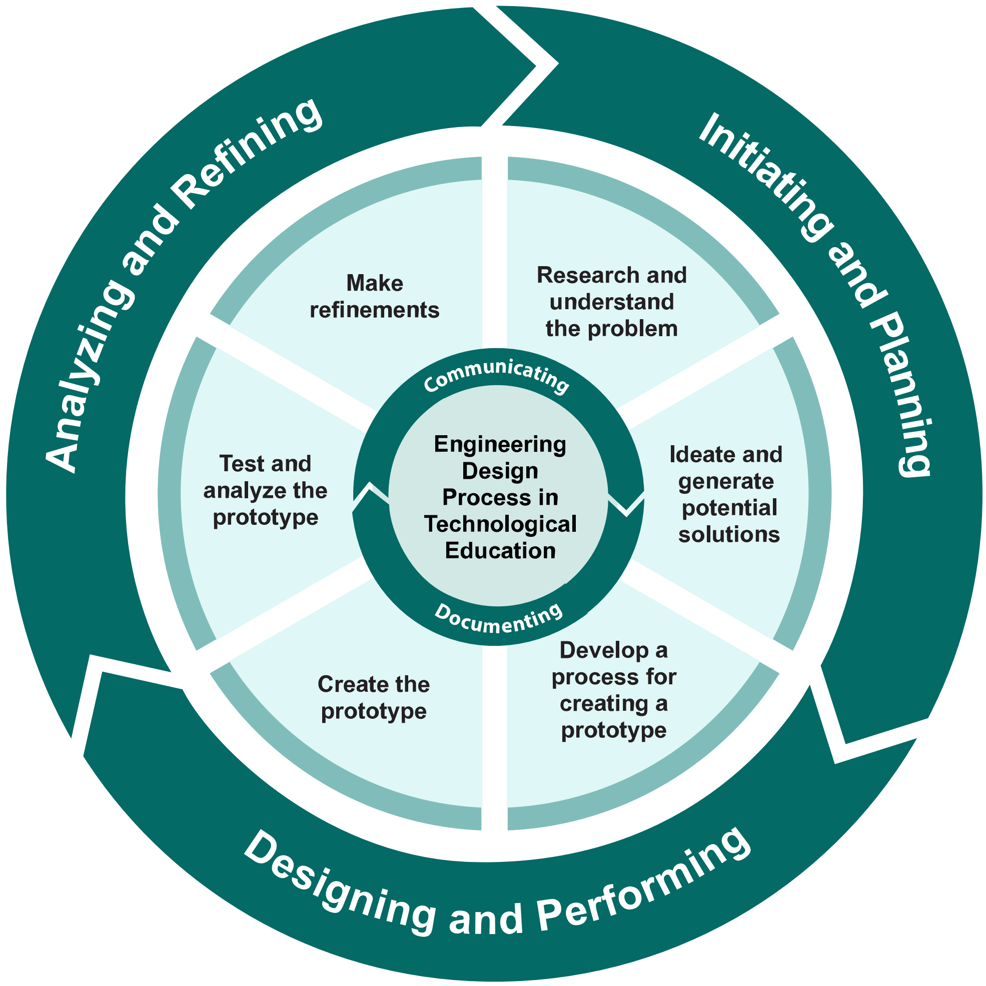
Students and teachers may even find other engineering design processes that they may want to work with, and a comparison of various processes may prove beneficial for students and teachers.

Appropriate entry points into the engineering design process and the specific components of the process that are focused on may depend on student readiness. Prior experience and knowledge, as well as access to resources, the context of the learning, and the amount of time available, may also be factors; therefore, educators may need to provide multiple entry points to engage all students in the learning.

The engineering design process provided here allows students to engage with important technological concepts and skills within curriculum expectations as they develop the transferable skills and cross-curricular concepts that embody STEM education.

The following diagram summarizes the engineering design process in technological education and shows how its components relate to the skills of *initiating and planning; designing and performing; analyzing and refining;* and *communicating and documenting*. The components are described in more detail below.

Engineering Design Process in Technological Education



Initiating and Planning

Research and understand the problem

- Analyze the context and clearly define the problem or challenge.
- Identify the users affected by the problem.
- Listen closely to those affected by the problem and use empathy to understand their experiences, perspectives, and concerns.
- Conduct research to determine design considerations, financial or other constraints, and availability or suitability of materials.
- Review related problems and solutions to these problems.
- Identify issues related to sustainability and to health and safety.

Ideate and generate potential solutions

- Brainstorm several ideas and potential solutions.

- Review potential solutions, considering related research, problems, and solutions.
- Develop specific evaluation criteria and constraints, and evaluate potential solutions based on these criteria and constraints.
- Consider the end-users and those impacted by potential solutions, taking into consideration their experiences, perspectives, and concerns.
- Consider applying related and existing solutions (or some aspects of them) to the identified problem.
- Consider developing new solutions that are different from existing solutions.
- Refine or combine potential solutions.
- Select the most appropriate solution, based on established criteria.

Designing and Performing

Develop a process for creating a prototype

- Plan the design of the solution, considering the required stages and available materials and other resources.
- Consider the economic, environmental, ethical, and health and safety concerns related to the potential design.
- Consider the key components of the design, and ensure that they can be effectively produced.

Create the prototype

- Select the tools and equipment required to create the prototype safely.
- Carry out their plan to create the model or prototype.
- Review the steps and criteria from the plan and modify as needed.
- Document the modifications made.

Analyzing and Refining

Test and analyze the prototype

- Develop tests to evaluate the solution using developed evaluation criteria.
- Conduct tests in a variety of contexts, including in controlled and in real-world environments and with various potential end-users.
- Obtain feedback on the prototype from potential end-user(s) and others, including teachers, classmates, friends, family members, and/or community members.
- Record observations and data.

Make refinements

- Analyze results from testing to determine what changes should be made to the prototype to enhance the end-user experience.
- Considering the results of testing, review initial resources, existing knowledge, and other brainstormed ideas to improve upon the design.
- Consider additional components, materials, equipment, or time needed.
- Taking into account all information, refine the prototype and develop a finished product or service.

Communicating and Documenting[3]

- Document the development process.
- Describe challenges encountered in the development process and possible ways to address these challenges.
- Choose a form or medium for communication that is appropriate for the intended audience.
- Identify the important information and components of the solution or project to share, and develop a draft or plan for the presentation or demonstration, using appropriate vocabulary.
- Present or demonstrate the final prototype, finished product, or service to users and/or stakeholders.

Problem Solving in Technological Education

An approach to learning that emphasizes problem solving is the best way to prepare students for the challenges they will face in the world beyond school. Projects or tasks may not always be clearly defined or have prescribed solutions. Students who have a strong background in problem solving will be more confident and better equipped to address new challenges in a variety of contexts.

Learning through problem solving will help students appreciate that all challenges – whether large or small, complex or simple – are most effectively resolved when approached systematically, using a simple method or a more comprehensive process, depending on the nature of the problem.

The range of challenges students encounter in technological education is wide and varied. At one end are simple problems for which there is likely to be only one solution – for example, substituting a part to fix an obvious fault. At the other end are complex challenges – for example, developing a solution to an identified human need – for which there could be various solutions and which call for a detailed process that may involve consultations with stakeholders to clearly define the problem and determine criteria for its solution, and the design and testing of several potential solutions. In many cases, the nature of

[3] Communication and documentation are done throughout the engineering design process.

the problem, and the problem-solving process required to solve it, fall somewhere between these two extremes.

Teachers can guide students through problem solving by helping them understand the nature and scope of a problem and the type of approach or method best suited to address it. They can also remind students that there is often more than one solution, give them the freedom to explore ideas, and encourage them to retrace steps and persist in their efforts when they encounter obstacles.

Problem-Solving Methods and Approaches

Problem-solving processes share at least some of a number of systematic steps – for example, identifying the problem, analyzing the situation, considering possible solutions, selecting the best solution, testing and evaluating the effectiveness of the solution, and reviewing or repeating steps as necessary to improve the solution. Among the various problem-solving methods and approaches that may be employed to address the range of problems students will encounter in technological education are those listed below. This list is not comprehensive, and may be supplemented by various other methods in the learning environment.

Diagnostics

An example of a diagnostic problem-solving method is troubleshooting an engine fault in an automobile. After identifying the general problem, the technician would run tests to pinpoint the fault. The test results would be used either as a guide for further testing or for replacement of a part, which would also need to be tested. This process continues until the solution is found and the car is running properly.

Reverse Engineering

"Reverse engineering" is the process of carefully tracing the workings of a product or process and identifying its fundamental component.

Extreme Cases

Considering "extreme cases" – envisioning the problem in a greatly exaggerated or greatly simplified form, or testing using an extreme condition – can often help to pinpoint a problem. An example of the extreme-case method is purposely inputting an extremely high number to test a computer program.

Divide and Conquer

"Divide and conquer" is the technique of breaking down a problem into subproblems, then breaking the subproblems down even further until each of them is simple enough to be solved. Divide and conquer may be applied to allow groups of students to tackle subproblems of a larger problem, or when a problem is so large that its solution cannot be visualized without breaking it down into smaller components.

Parts Substitution

Perhaps the most basic of all the problem-solving methods, “parts substitution” simply requires that parts be substituted until the problem is solved. Although it is not the most efficient method of problem solving, there may be no other alternative if tests do not indicate what could be causing the problem.

Trial and Error

The trial-and-error method involves trying different approaches until a solution is found. It is often used as a last resort when other methods have been exhausted.

Program Planning and Cross-Curricular and Integrated Learning

Educators consider many factors when planning a technological education program that cultivates the best possible environment in which all students can maximize their learning. This section highlights important areas of focus that educators should consider, including areas of cross-curricular and integrated learning, as they plan effective, inclusive, and accessible technological education programs. In addition, all of the general “Program Planning” sections on the Curriculum and Resources website apply to this curriculum.

Instructional Approaches in Technological Education

Technological education involves knowing and doing, and teaching and learning strategies should address both areas, with an emphasis on doing. Teachers should use projects as a means of achieving course expectations, and students should be provided with a combination of information and hands-on experiences that will prepare them to make informed choices about the use of various technologies, to use technology safely and effectively, and to solve technological problems.

Students learn best when they are engaged in learning in a variety of ways. When students are engaged in active and experiential learning strategies, they tend to retain knowledge for longer periods and to develop, acquire, and integrate key skills more completely. Technological education courses lend themselves to a wide range of strategies in that they require students to discuss issues, conduct research, solve problems, plan solutions, develop and create products and/or services, think critically, and work cooperatively.

Programs in technological education are based on hands-on activities and should involve an open and collaborative approach to teaching that reflects students’ interests and aspirations. Activities should be designed to include both individual and team approaches, as technological projects in the workplace often require individuals to work collaboratively while undertaking a variety of roles, tasks, and responsibilities. Students should be given opportunities to work both independently and with teacher direction, and to learn through the study of examples followed by practice. There is no single correct way to teach or to learn, and the strategies used in the learning environment should vary according to the curriculum expectations and the needs of the students. Problem solving and/or an engineering design process are essential tools in broad-based technological education. Teachers should work collaboratively with colleagues to plan and deliver the technological education curriculum. Individual teachers can contribute their expertise in particular areas of technology to ensure the successful implementation of the curriculum.

Some of the teaching and learning strategies that are suitable to material taught in technological education employ scaffolding. Scaffolding is an instructional approach that involves breaking down tasks so that students can concentrate on specific, manageable objectives and gradually build understanding and skill, with the aid of modelling by the teacher and ample opportunity for practice. Scaffolding provides students with a supportive structure within which to learn.

When students work collaboratively, they often accomplish more than when they work individually. Group activities, when used in a structured way, can enhance learning and foster positive attitudes. When working in a team, each student should have a specific role and be actively involved in the task. It is important to give students opportunities to take on different roles, from one project to another or in the course of a large project.

Students' attitudes towards technological education can have a significant effect on their achievement of expectations. Teaching methods and learning activities that encourage students to recognize the value and relevance of what they are learning for work and their lives beyond school will go a long way towards motivating students to work and learn effectively.

The study of current events related to technologies in various industries, including emerging technologies, should inform the technological education curriculum, enhancing both the relevance and the immediacy of the program. Discussion of current events related to various technologies and inclusion of these topics in daily lessons will stimulate students' interest and curiosity and also help them connect what they are learning in class with real-world events or situations. The study of events in industrial sectors and technological developments in the world needs to be thought of not as a separate topic removed from the program but as an effective instructional strategy for implementing many of the applicable expectations found in the curriculum.

Universal Design for Learning (UDL) and Differentiated Instruction (DI) in Technological Education

Students in every classroom, including in technological education, vary in their identities, experiences, personal interests, learning profiles, and readiness to learn new concepts and skills. Universal Design for Learning (UDL) and differentiated instruction (DI) are robust and powerful approaches to designing assessment and instruction to engage all students in technological education tasks that develop conceptual understanding. UDL and DI can be used in combination to help teachers respond effectively to the strengths and needs of all students.

The aim of the UDL framework is to assist teachers in designing technological education learning opportunities and environments that provide all students with inclusive, flexible, and equitable access to the curriculum. Teachers of technological education take into account students' diverse learner profiles to design lessons and tasks that offer individual choice, ensuring relevance and authenticity, providing individual choice and graduated levels of challenge, and fostering collaboration in the learning environment. Teachers also represent technological concepts and information in multiple ways to help students become resourceful and knowledgeable learners. Technological education teachers can use a variety of media presentation or demonstration methods to ensure that within each lesson, students are provided with alternatives for auditory and visual information. For example, when students are learning how to use a tool in the classroom, teachers can share a video that outlines its proper use, conduct an in-person demonstration of its use, and allow students to demonstrate their understanding of its use.

Students have a diverse set of learning needs and a range of cultural experiences and identities. Teachers incorporate culturally relevant teaching, centring students' cultural backgrounds, into learning experiences to ensure that learning is authentic, meaningful, and relevant to students. For example, teachers could use UDL principles to make space for First Nations, Métis, and Inuit perspectives and contributions in the learning for *all* students, including Indigenous students. These planned opportunities facilitate the exploration of various meaningful and engaging forms of resources, including audio recordings, digital archives, virtual exhibits, or interviews with First Nations, Métis, and Inuit community members.

Designing technological education assignments and tasks through UDL from the start enables students to find their own entry point to the learning. Teachers use a tiered approach to ensure responsive, timely, and effective instruction that improves student learning while maintaining high expectations and rigour for all students. To support learners as they focus strategically on their learning goals, teachers create an environment in which learners can express themselves using a range of strengths. For example, teachers can vary ways in which students can respond and demonstrate their understanding of technological concepts, such as creating a video, doing a demonstration, or creating a set of instructions to illustrate the use of a technique. Teachers can also support students in developing and demonstrating project management skills related to their learning in technological education.

While UDL provides teachers with broad principles for planning instruction and learning experiences in technological education for a diverse group of students, differentiated instruction (DI) allows them to address specific skills and learning needs on a case-by-case basis. DI is student centred and involves a strategic blend of whole-class, small-group, and individual learning activities to suit students' differing strengths, interests, and levels of readiness to learn.

Attending to students' varied readiness for learning in technological education is an important aspect of differentiated instruction. Students need support in aiming higher, developing belief in excellence, and co-creating problem-based tasks of increasing complexity. To make some concepts more accessible, teachers can employ strategies such as offering students choice and providing open-ended problems that are based on situations relevant to their everyday lives.

Universal Design for Learning and differentiated instruction are integral aspects of an inclusive technological education program with the goal of achieving equity in technological education. More information on these approaches can be found in the ministry publication *Learning for All: A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12* (2013).

Health and Safety in Technological Education

In Ontario, various laws, including the Education Act, the Occupational Health and Safety Act (OHSA), Ryan's Law (Ensuring Asthma Friendly Schools), 2015, and Sabrina's Law, 2005, collectively ensure that school boards provide a safe and productive learning and work environment for both students and employees. Under the Education Act, teachers are required to ensure that all reasonable safety procedures are carried out in the programs and activities for which they are responsible. Teachers should always model safe practices; communicate safety requirements to students in accordance with school board policies, Ministry of Education policies, and any applicable laws; and encourage students to assume responsibility for their own safety and the safety of others.

Concern for safety must be an integral part of instructional planning and implementation. Teachers are encouraged to review:

- their responsibilities under the Education Act;
- their rights and responsibilities under the Occupational Health and Safety Act;
- their school board's health and safety policy for employees;
- their school board's policies and procedures relating to student health and safety (e.g., those related to concussions; prevalent medical conditions such as anaphylaxis, asthma, diabetes, and/or epilepsy; outdoor education excursions);
- relevant provincial subject association guidelines and standards for student health and safety;
- any additional mandatory requirements, particularly for higher-risk activities (e.g., field trips, workplaces), including requirements for approvals (e.g., from the supervisory officer), permissions (e.g., from parents[4]), and/or qualifications.

Wherever possible, potential risks should be identified and procedures developed to prevent or minimize, and respond to, incidents and injuries. School boards provide and maintain safe equipment, facilities, materials, and tools as well as providing qualified instruction. In safe learning environments, teachers will:

- be aware of up-to-date safety information;
- plan activities with safety as a primary consideration;
- inform students and parents of risks involved in activities;
- observe students to ensure that they are following safe practices, including the wearing of personal protective equipment;
- have a plan in case of emergency;
- show foresight by taking reasonable precautions to prevent health and safety accidents;

[4] The word *parent(s)* is used on this website to refer to parent(s) and guardian(s). It may also be taken to include caregivers or close family members who are responsible for raising the child.

- act quickly.

To carry out their responsibilities with regard to safety, it is important not only that teachers have concern for their own safety and that of students, but also that they have:

- the knowledge necessary to safely use the materials and tools and follow the procedures involved in technological education;
- the skills needed to perform tasks safely.

Students should be made aware that health and safety is everyone’s responsibility – at home; at school; in the community, including in the natural environment; and while visiting, and participating in experiential learning in, workplace settings. Teachers should ensure that students have the knowledge and skills needed for safe participation in all learning activities. Students must be able to demonstrate knowledge of the equipment, facilities, materials, and tools being used and the procedures necessary for their safe use.

Students demonstrate that they have the knowledge, skills, and safety mindset required for participation in technological education activities when they:

- maintain a well-organized and uncluttered workspace;
- follow established safety procedures;
- identify possible safety concerns and report them to the teacher;
- suggest and implement appropriate safety procedures;
- carefully follow the instructions and example of the teacher;
- focus on the task at hand, eliminating possible distractions;
- consistently show care and concern for their safety and that of others.

An important part of the technological education program is that students select appropriate equipment, materials, and tools for their projects. Schools and boards should collaborate to ensure that students have access to the necessary facilities, equipment, materials, tools, and appropriate safety training to support their learning and maintain a safe learning environment.

Learning outside the classroom, such as on field trips, can provide a meaningful and authentic dimension to students’ learning experiences. Teachers must plan these activities carefully in accordance with their school board’s relevant policies and procedures and in collaboration with other school board staff (e.g., the principal, board lead, supervisory officer) to ensure students’ health and safety.

The information provided in this section is not exhaustive.

All aspects of the learning environment must comply with relevant school board, municipal, provincial, or federal health and safety legislation, including the following:

- the Ontario Occupational Health and Safety Act
- the Ontario Workplace Safety and Insurance Act
- the Workplace Hazardous Materials Information System (WHMIS 2015)

- the Food and Drugs Act
- the Ontario Health Protection and Promotion Act
- the Ontario Building Code
- local by-laws

Teachers should make use of all available and relevant resources to make students sufficiently aware of the importance of health and safety.

Innovations and Emerging Technology

A central focus of Strand B of these courses is learning related to innovations and emerging technologies, including the social, cultural, economic, environmental, and ethical issues related to their development and use. These can be engaging topics that capture the imagination of students as they consider exciting innovations in technology and imagine themselves playing a role in the development and application of these innovations, contributing to a hopeful and exciting future.

Students also analyze contributions to, and innovations in, technology by people from various communities, including First Nations, Métis, and Inuit communities in Canada. As students engage with this learning, they are empowered to consider that they can help shape the future in a positive way, potentially contributing to the development of future innovations by pursuing careers or further education in technological education or other STEM-related areas, including skilled trades.

Skilled Trades

A *skilled trade* is a career path that requires a particular skill set and specialty knowledge and training, and is usually hands-on. There are more than 140 skilled trades in Ontario. Many skilled trades workers apply STEM-related concepts as they construct buildings; build and maintain infrastructure for transportation, communications, and utilities; or provide a range of professional services.

Throughout this curriculum, students will investigate how fundamental technological concepts and skills can be used in other disciplines and in real-world applications. Students also explore ways in which various industries are changing as a result of technological innovations. Career-related expectations provide opportunities for students to connect concepts and skills associated with this curriculum to potential postsecondary education and career pathways, including in the skilled trades.

Assessment and Evaluation of Student Achievement

Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, First Edition, Covering Grades 1 to 12, 2010 sets out the Ministry of Education's assessment, evaluation, and reporting policy. The policy aims to maintain high standards, improve student learning, and benefit all students, parents[5], and teachers in elementary and secondary schools across the province. Successful implementation of this policy depends on the professional judgement of teachers at all levels as well as their high expectations of all students, and on their ability to work together and to build trust and confidence among parents and students.

Major aspects of assessment, evaluation, and reporting policy are summarized in the general "Assessment and Evaluation" section that applies to all curricula. The key tool for assessment and evaluation in technological education, Grades 9 and 10 – the achievement chart – is provided below.

The Achievement Chart for Technological Education, Grades 9 and 10

The achievement chart identifies four categories of knowledge and skills and four levels of achievement in technological education, Grades 9 and 10. (For important background, see "Content Standards and Performance Standards" in the general Assessment and Evaluation section.)

Knowledge and Understanding – Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
Categories	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
	The student:			
Knowledge of content *(e.g., facts; use and function of equipment and tools; technical terminology; materials; concepts, processes, safety procedures)*	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Understanding of content *(e.g., safety procedures, fundamental technological concepts, processes, industry standards)*	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content
Thinking – The use of critical and creative thinking skills and/or processes				
Categories	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
	The student:			

[5] The word *parent(s)* is used on this website to refer to parent(s) and guardian(s). It may also be taken to include caregivers or close family members who are responsible for raising the child.

Use of planning skills *(e.g., identifying a need or problem; generating and evaluating ideas; selecting strategies, tools, and resources; scheduling; budgeting)*	uses planning skills with limited effectiveness	uses planning skills with some effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
Use of processing skills *(e.g., analyzing and interpreting information, forming conclusions)*	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes *(e.g., engineering design, service design, problem-solving, decision-making, diagnostic, and quality assurance processes)*	uses critical/ creative thinking processes with limited effectiveness	uses critical/ creative thinking processes with some effectiveness	uses critical/ creative thinking processes with considerable effectiveness	uses critical/ creative thinking processes with a high degree of effectiveness
Communication – The conveying of meaning through various forms				
Categories	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
	The student:			
Expression and organization of ideas and information *(e.g., clarity, logic, coherence)* **in oral, non-verbal, visual, and/or written forms, including digital and media forms** *(e.g., demonstrations, technical descriptions/instructions, presentations, reports, flowcharts)*	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
Communication for different audiences *(e.g., peers, clients, suppliers, colleagues, supervisors, the public)* **and purposes** *(e.g., to inform, to persuade, to collaborate)* **in oral, non-verbal, visual, and/or written forms, including digital and media forms**	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness

Use of conventions *(e.g., standards, symbols, units of measurement, acronyms)*, **industry-related vocabulary, and terminology of the discipline in oral, non-verbal, visual, and/or written forms, including digital and media forms**	uses conventions, vocabulary, and terminology with limited effectiveness	uses conventions, vocabulary, and terminology with some effectiveness	uses conventions, vocabulary, and terminology with considerable effectiveness	uses conventions, vocabulary, and terminology with a high degree of effectiveness
Application – The use of knowledge and skills to make connections within and between various contexts				
Categories	**50–59% (Level 1)**	**60–69% (Level 2)**	**70–79% (Level 3)**	**80–100% (Level 4)**
	The student:			
Application of knowledge and skills *(e.g., manipulation of materials; application of concepts and processes; safe use of tools, equipment, technology, and techniques)* **in familiar contexts**	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
Transfer of knowledge and skills *(e.g., manipulation of materials; application of concepts and processes; safe use of tools, equipment, technology, and techniques)* **to new contexts**	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness
Making connections within and between various contexts (*e.g., connections to everyday personal situations; connections to social, economic, environmental, ethical, and cultural issues; connections between technological education and other disciplines; connections to potential careers and related postsecondary pathways, including apprenticeship)*	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness

Criteria and Descriptors for Technological Education, Grades 9 and 10

To guide teachers in their assessment and evaluation of student learning, the achievement chart provides “criteria” and “descriptors” within each of the four categories of knowledge and skills.

A set of criteria is identified for each category in the achievement chart. The criteria are subsets of the knowledge and skills that define the category. The criteria identify the aspects of student performance that are assessed and/or evaluated, and they serve as a guide to what teachers look for. In Technological Education, Grades 9 and 10, the criteria for each category are as follows:

Knowledge and Understanding

- knowledge of content (e.g., facts; use and function of equipment and tools; technical terminology; materials; concepts, processes, safety procedures)
- understanding of content (e.g., safety procedures, fundamental technological concepts, processes, industry standards)

Thinking

- use of planning skills (e.g., identifying a need or problem; generating and evaluating ideas; selecting strategies, tools, and resources; scheduling; budgeting)
- use of processing skills (e.g., analyzing and interpreting information, forming conclusions)
- use of critical/creative thinking processes (e.g., engineering design, service design, problem-solving, decision-making, diagnostic, and quality assurance processes)

Communication

- expression and organization of ideas and information (e.g., clarity, logic, coherence) in oral, non-verbal, visual, and/or written forms, including digital and media forms (e.g., demonstrations, technical descriptions/instructions, presentations, reports, flowcharts)
- communication for different audiences (e.g., peers, clients, suppliers, colleagues, supervisors, the public) and purposes (e.g., to inform, to persuade, to collaborate) in oral, non-verbal, visual, and/or written forms, including digital and media forms
- use of conventions (e.g., standards, symbols, units of measurement, acronyms), industry-related vocabulary, and terminology of the discipline in oral, non-verbal, visual, and/or written forms, including digital and media forms

Application

- application of knowledge and skills (e.g., manipulation of materials; application of concepts and processes; safe use of tools, equipment, technology, and techniques) in familiar contexts
- transfer of knowledge and skills (e.g., manipulation of materials; application of concepts and processes; safe use of tools, equipment, technology, and techniques) to new contexts

- making connections within and between various contexts (e.g., connections to everyday personal situations; connections to social, economic, environmental, ethical, and cultural issues; connections between technological education and other disciplines; connections to potential careers and related postsecondary pathways, including apprenticeship)

Descriptors indicate the characteristics of the student’s performance, with respect to a particular criterion, on which assessment or evaluation is focused. *Effectiveness* is the descriptor used for each criterion in the Thinking, Communication, and Application categories. What constitutes effectiveness in any given performance task will vary with the particular criterion being considered. Assessment of effectiveness may therefore focus on a quality such as appropriateness, clarity, accuracy, precision, logic, relevance, significance, fluency, flexibility, depth, or breadth, as appropriate for the particular criterion.

Expectations by strand
A. Design Processes and Related Skills

Students engage in an
engineering design process throughout this strand.

Overall expectations

By the end of this course, students will:

A1. Initiating and Planning

demonstrate an understanding of fundamental technological concepts and related skills by initiating and planning projects

Specific expectations

By the end of this course, students will:

A1.1 investigate and describe fundamental technological concepts, and explain how they are relevant to developing products and/or services in a variety of broad-based technology areas

A1.2 apply an understanding of fundamental technological concepts, design considerations, and science, technology, engineering, and mathematics (STEM) concepts as appropriate in developing projects involving the creation of products and/or services

A1.3 investigate and describe design considerations, including accessibility requirements, that are relevant to developing projects involving products and/or services for a specific user or community

A1.4 communicate design ideas for various purposes and audiences, using appropriate industry terminology

A1.5 establish evaluation criteria for products and/or services being developed, including qualitative and/or quantitative measures, making connections to relevant fundamental technological concepts

A1.6 investigate and describe project management skills and approaches that are relevant to developing products and/or services, and identify skills they will use in their own projects

A1.7 collect and synthesize information from a variety of sources, including people with diverse perspectives and from various communities, such as First Nations, Métis, and Inuit, to inform their projects

A2. Designing and Performing

develop projects that involve creating products and/or services, using a variety of resources and techniques, and record the development of their projects

Specific expectations

By the end of this course, students will:

A2.1 use project management skills to develop a process to create a product and/or service

A2.2 identify factors that could impact the development of their projects and apply appropriate strategies to increase the probability of a positive outcome

A2.3 describe properties and characteristics, including sustainability, of materials, and justify the selection of the materials and other resources they are using in the creation of products and/or services

A2.4 select, use, and maintain tools and equipment appropriately as part of creating products and/or delivering services

A2.5 use a variety of industry-related documents to guide the creation of products and/or the delivery of services as part of their projects

A2.6 create products and/or deliver services, documenting their development process using appropriate industry terminology

A2.7 select appropriate units of measure and tools to make accurate measurements using relevant measurement systems, such as the metric and imperial systems

A3. Analyzing and Refining

evaluate and refine processes, products, and/or services

Specific expectations

By the end of this course, students will:

A3.1 identify challenges they encounter in the process of developing their projects and apply critical thinking skills to address these challenges

A3.2 analyze the performance of products and/or service delivery using appropriate criteria

A3.3 identify potential refinements to the design of products and/or services based on an analysis of data collected throughout the development process

A3.4 communicate project-related challenges, performance analyses, and proposals for refinements for a specific audience, using appropriate formats and terminology

A4. Following Health and Safety Practices

apply an understanding of health and safety practices and procedures when using materials, tools, and equipment

Specific expectations

By the end of this course, students will:

A4.1 describe relevant health and safety regulations for the classroom and workplace, including mandated roles and responsibilities

A4.2 identify hazards in their environment, and apply strategies to minimize risks

A4.3 use tools and equipment safely, including using personal protective equipment and safety devices as appropriate

A4.4 follow practices that support physical and mental health and well-being

A4.5 follow proper procedures for the safe handling, storage, and disposal of materials and waste products

A4.6 demonstrate a safety mindset by making safety a priority at all times and by engaging in industry-specific safety procedures

B. Technological Development, Impacts, and Careers

Overall expectations

By the end of this course, students will:

B1. Fundamentals of Technological Development

demonstrate an understanding of how various needs and underlying social, economic, and environmental factors drive the evolution of technology

Specific expectations

By the end of this course, students will:

B1.1 investigate and describe interrelationships between user needs and the development of various technological solutions

B1.2 analyze how the development and application of technologies are impacted by legal, ethical, social, economic, and environmental considerations

B1.3 investigate and identify contributions to technological innovations made by Canadians, including women, and members of diverse groups and communities in Canada, including First Nations, Métis, and Inuit

B1.4 describe ways in which diverse communities, including First Nations, Métis, and Inuit, have applied their understandings, practices, beliefs, and experiences in their approach to technological problem solving

B2. Impacts of Technology

analyze impacts of various technologies on individuals, society, the economy, and the environment

Specific expectations

By the end of this course, students will:

B2.1 identify short-term and long-term impacts of various technological innovations on individuals and societies, including the impact on everyday life

B2.2 explain local and global impacts of various technological innovations on the environment and the economy, including the labour market

B2.3 evaluate how positive and negative impacts of various technologies can influence technological evolution, including emerging technologies

B3. Careers and Pathways in Technology and the Skilled Trades

explore and describe careers in technological fields and the skilled trades, and pathways for entering them

Specific expectations

By the end of this course, students will:

B3.1 explore a variety of roles, responsibilities, and opportunities related to current and emerging careers in technological fields, including a variety of broad-based technology areas, and the skilled trades

B3.2 research and identify programs, including in-school job skills programs and community-based programs, related to pathways and careers in technological fields and the skilled trades

B3.3 investigate and describe a variety of pathways leading to careers in technological fields and the skilled trades, including their structure and the educational and financial requirements for them

B3.4 evaluate the transferable skills they are developing and analyze how these skills relate to current and emerging careers in technological fields and the skilled trades

Information for parents

A parent's guide to Technology and the Skilled Trades, Grades 9 and 10 (2024)For informational purposes only, not part of official issued curriculum. The Government of Ontario is not responsible for content on other websites, and cannot guarantee the accessibility of other websites.
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Resources

Broad-Based Technology Subject Areas – Concepts and Topics, Skills and Applications, and Careers

Key Changes – Technology and the Skilled Trades (TAS1O and TAS2O)

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