Outline of Course of Study

Faculty of Engineering Secondary School
Department of Engineering
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Course development date: September and October 2023
Course reviser: Julie Olivier
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Course title: Digital Technology and Innovations in the Changing World
Grade: 10
Type: Open
Ministry Course Code: ICD2O
Credit value: 1.0 credit
Ministry curriculum policy documents:

- The Ontario Curriculum, Grades 10 to 12: Computer Studies, 2008 (revised)
- Ontario Schools, Kindergarten to Grade 12: Policy and Program Requirements, 2018
- Growing Success: Assessment, Evaluation, and Reporting in Ontario's Schools, Kindergarten to Grade 12, 2010

Prerequisites and corequisites: none

Course Description

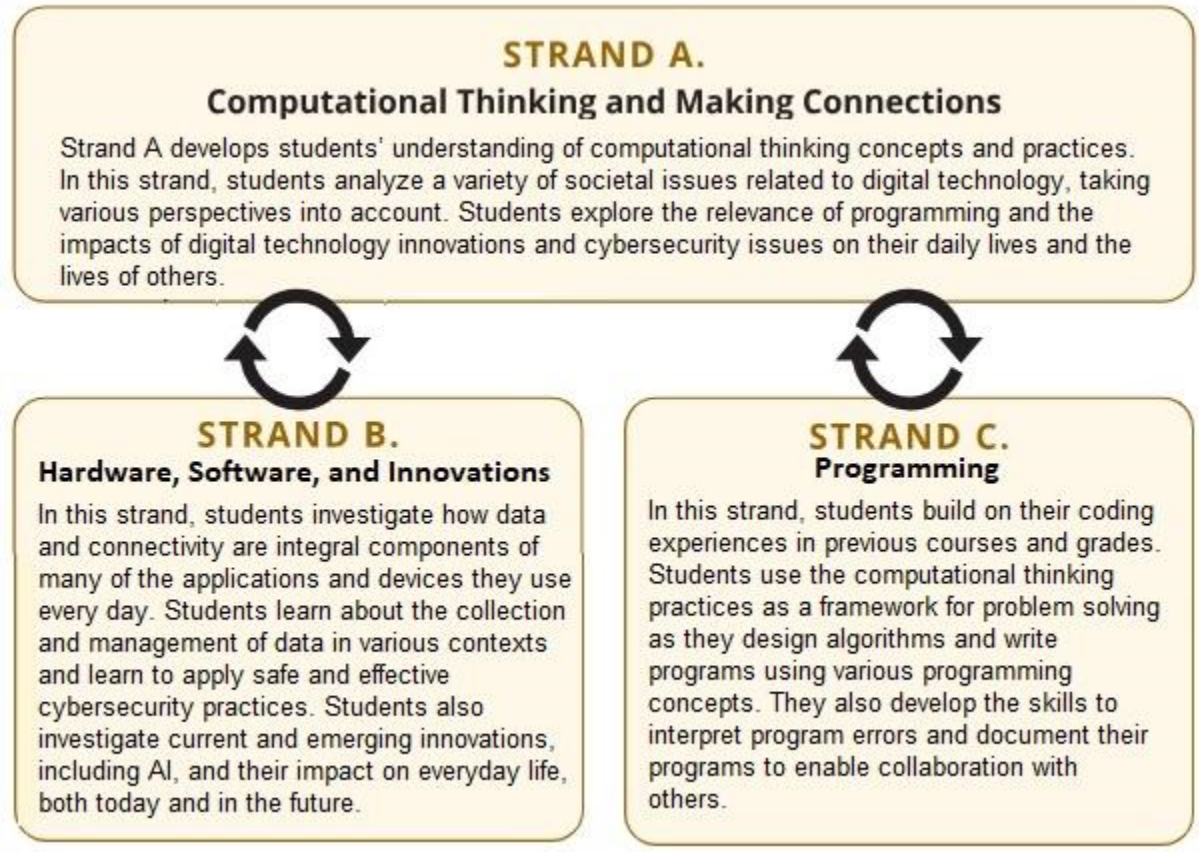
The Digital Technology and Innovations in the Changing World course (ICD2O), 2023, replaces the previous Introduction to Computer Studies (ICS2O) course from 2008. It is designed to provide students with opportunities to appreciate, explore and discover the power of digital technology and computer programming. Students live in a world where digital technologies inform us, connect us, entertain us and protect us. As these technologies have become powerful aspects in our lives, this course helps students develop cutting-edge digital technology and computer programming skills that will support them in contributing to and leading the global economic, scientific and societal innovations of tomorrow. Students will learn and apply coding concepts and skills to build hands-on projects and investigate artificial intelligence, cybersecurity, and other emerging digital technologies that connect to a wide range of fields and careers.

Resources

No textbook is required for this course. Students will be given access to all course material in class and will be given access to software for the course in order to continue their learning. Students will also be given access to any equipment required for the course.

Overall Curriculum Expectations

The expectations in this course are organized into three distinct but related strands. Strand A is an overarching strand focusing on the skills and considerations that will enable students to investigate concepts and integrate knowledge from the other two strands, and to make connections between computer studies and other disciplines. This strand also encourages students to examine various careers, including those in the skilled trades. In Strands B and C, students integrate Strand A expectations as they develop their understanding of strand-specific concepts; investigate hardware, software, and innovations; and use the concepts of programming and algorithms to design and create programs.



Specific Curriculum Expectations

STRAND A: Computational Thinking and Making Connections *Throughout this course, in connection with the learning in the other strands, students will:*	
A1. Computational Thinking, Planning, and Purpose: apply computational thinking concepts and practices, and use various tools and processes to plan and develop computational artifacts for a wide variety of contexts, users, and purposes.	
A1.1	apply computational thinking concepts and practices when planning and designing computational artifacts;
A1.2	use a variety of tools and processes to plan, design, and share algorithms and computational artifacts;
A1.3	develop computational artifacts for a variety of contexts and purposes that support the needs of diverse users and audiences.
A2. Digital Technology and Society: demonstrate an understanding of important social, cultural, economic, environmental, and ethical issues, as well as contributions and innovations involving diverse local and global communities, related to digital technology.	
A2.1	investigate current social, cultural, economic, environmental, and ethical issues related to digital technology that have personal, local, and global impacts, taking various perspectives into account;
A2.2	analyze personal and societal safety and cybersecurity issues related to digital technology, and identify measures and technologies that can help mitigate related concerns for individuals and communities;
A2.3	investigate contributions to innovations in digital technology and computing by people from diverse local, Canadian, and global communities, including Indigenous communities in Canada and around the world;
A2.4	investigate how to identify and address bias involving digital technology;
A2.5	analyze accessibility issues involving digital technology, and identify measures that can improve accessibility.
A3. Applications, Careers, and Connections: demonstrate an understanding of real-world applications of digital technology and programming, including within various industries and careers.	
A3.1	investigate how digital technology and programming skills can be used within a variety of disciplines in real-world applications;
A3.2	investigate ways in which various industries, including those that involve skilled trades, are changing as a result of digital technology and programming innovations;
A3.3	investigate various career options related to digital technology and programming, and ways to continue their learning in these areas.

STRAND B: Hardware, Software, and Innovations *By the end of this course, students will:*	
B1. Understanding Hardware and Software: demonstrate an understanding of the functions and features of the hardware and software they encounter in their everyday life.	
B1.1	describe the functions and features of various core components of hardware associated with digital technologies they encounter in their everyday life;
B1.2	describe the functions and features of various connected devices associated with digital technologies they encounter in their everyday life;
B1.3	describe the functions of various types of software they encounter in their everyday life.
B2. Using Hardware and Software: demonstrate an understanding of various ways to use hardware, software, and file management, and of research practices to support their own use of digital technology.	
B2.1	use file management techniques, including those related to local and cloud storage, to organize, edit, and share files;
B2.2	identify and use effective research practices and supports when learning to use new hardware or software;
B2.3	assess the hardware and software requirements for various users, contexts, and purposes in order to make recommendations for devices and programs.
B3. Cybersecurity and Data: demonstrate an understanding of safe and effective practices related to data and cybersecurity in various contexts.	
B3.1	apply safe and effective data practices when using digital technology in various contexts;
B3.2	apply safe and effective security practices, including practices to protect their privacy, when using digital technology in various contexts.
B4. Innovations in Digital Technology: investigate current and emerging innovations in digital technology, including automation and artificial intelligence, and assess their benefits and limitations.	
B4.1	investigate current innovations, including automation and artificial intelligence systems, and assess the impacts of these technologies on everyday life;
B4.2	investigate hardware and methods used to establish networks and connectivity, and assess the benefits and limitations of increased connectivity with reference to everyday life;
B4.3	investigate emerging innovations related to hardware and software and their possible benefits and limitations with reference to everyday life in the future.

STRAND C: PROGRAMMING *By the end of this course, students will:*	
C1. Programming Concepts and Algorithms: explain fundamental programming concepts and algorithms.	
C1.1	use appropriate terminology to describe programming concepts and algorithms;
C1.2	describe simple algorithms that are encountered in everyday situations;
C1.3	identify various types of data and explain how they are used within programs;
C1.4	determine the appropriate expressions and instructions to use in a programming statement, taking into account the order of operations;
C1.5	identify and explain situations in which conditional and repeating structures are required.
C2. Writing Programs: use fundamental programming concepts to write simple programs.	
C2.1	use variables, constants, expressions, and assignment statements to store and manipulate numbers and text in a program;
C2.2	write programs that use and generate data involving various sources and formats;
C2.3	write programs that include single and nested conditional statements;
C2.4	write programs that include sequential, selection, and repeating events;
C2.5	write programs that include the use of Boolean operators, comparison operators, text operators, and arithmetic operators;
C2.6	interpret program errors and implement strategies to resolve them;
C2.7	write clear internal documentation and use coding standards to improve code readability.
C3. Modularity and Modification: demonstrate an understanding of program components and modules.	
C3.1	analyze existing code to understand the components and outcomes of the code;
C3.2	modify an existing program, or components of a program, to enable it to complete a different task;
C3.3	write subprograms, and use existing subprograms, to complete program components;

C3.4	write programs that make use of external or add-on modules or libraries;
C3.5	explain the components of a computational artifact they have created, including considerations for reuse by others.

ref: https://www.dcp.edu.gov.on.ca/en/curriculum/computer-studies/courses/icd2o

The Achievement Chart

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, and teachers in elementary and secondary schools across the province.

The Achievement Chart for the Grade 10 Computer Studies Course identifies four categories of knowledge and skills and four levels of achievement in the Grade 10 course, Digital Technologies and Innovations in the Changing World. (For important background, see "Content Standards and Performance Standards" in the general "Assessment and Evaluation" section that applies to all curricula.). The achievement chart is a standard province-wide guide to be used by teachers. It enables teachers to make professional judgements about student work that are based on clear performance standards and on a body of evidence collected over time.

ACHIEVEMENT CHART FOR THE GRADE 10 COMPUTER STUDIES COURSE

Category	50–59% (Level1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Knowledge and Understanding – Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
	The Student:			
Knowledge of content *(e.g., facts, technical terminology, computational thinking concepts*, programming concepts)*	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., processes, concepts, tools, computational thinking practices*)*	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content

Category	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Thinking – The use of critical and creative thinking skills and/or processes				
	The Student:			
Use of planning skills *(e.g., identifying a need or problem, gathering information, selecting strategies and tools, setting goals, developing timelines)*	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 a need or problem, carrying out a plan to create programs)*	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., problem solving, research and inquiry)*	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

Category	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Communication – The conveying of meaning through various forms				
	The Student:			
Expression and organization of ideas and information *(e.g., clear expression, logical organization)* **in oral, visual, and/or written forms** *(e.g., demonstrations, interviews, presentations, reports, flowcharts, pseudocode, code)*	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, users)* **and purposes** *(e.g., to inform, to persuade, to solve problems, to collaborate)* **in oral, visual, and/or written 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, vocabulary, and terminology of the discipline in oral, visual, and/or written forms *(e.g., terms, programming language syntax, coding standards)*	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

Category	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Application – The use of knowledge and skills to make connections within and between various contexts				
	The Student:			
Application of knowledge and skills *(e.g., tools, computational thinking concepts, programming concepts and strategies)* **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., tools, computational thinking concepts, programming concepts and strategies)* **to**	transfers knowledge and skills to new contexts with limited	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable	transfers knowledge and skills to new contexts with a high degree of

new contexts	effectiveness		effectiveness	effectiveness
Making connections within and between various contexts (*e.g., connections to everyday personal situations; connections to social, cultural, economic, environmental, and ethical issues; connections between computer studies and other STEM [science, technology, engineering, and mathematics] subjects; connections to potential careers)*	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

Note: A student whose achievement is below 50% at the end of a course will not obtain a credit for the course.

Strategies for Assessment & Evaluation of Student Performance

Assessment, evaluation, and reporting of student achievement will be based on the policies and practices outlined in the following Ministry's policy document Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010.

Students will be evaluated based on the overall expectations of the course through the achievement charts in The Ontario Curriculum, Grades 10 to 12: Computer Studies, 2008 (revised), as outlined in this document

The Ministry of Education's document Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools outlines policies for measuring and communicating achievement. Levels of achievement are defined as follows:

Level	Percentage	Achievement
Level 1	50—59%	Represents achievement that falls much below the provincial standard. The student demonstrates the specified knowledge and skills with limited effectiveness. Students must work at significantly improving learning in specific areas, as necessary, if they are to be successful in the next grade/course
Level 2	60—69%	Represents achievement that approaches the provincial standard. The student demonstrates the specified knowledge and skills with some effectiveness. Students performing at this level need to work on identified learning gaps to ensure future success
Level 3	70—79%	Represents the provincial standard for achievement. The student demonstrates the specified knowledge and skills with considerable effectiveness. Parents of students achieving at level 3 can be confident that their children will be prepared for work in subsequent grades/courses.
Level 4	80—100%	Identifies achievement that surpasses the provincial standard. The student demonstrates the specified knowledge and skills with a high degree of effectiveness. However, achievement at level 4 does not mean that the student has achieved expectations beyond those specified for the grade/course.

Note: A student whose achievement is below 50% at the end of a course will not obtain a credit for the course.

Seventy percent (70%) of the evaluation is based on daily classroom work and will be determined through a variety of methods, as outlined in the table below. Thirty percent (30%) of the evaluation will be based on a final design project which follows the Engineering Design Process, includes a prototype and a presentation. This final evaluation allows the student the opportunity to demonstrate comprehensive achievement of the overall expectations of the course.

Our teachers use “assessment for learning” and “assessment as learning” practices to help students identify where they are in relation to the curriculum’s learning goals and what next steps they need to take to achieve the goals. This ongoing feedback helps prepare students for “assessment of learning”; the process of collecting and interpreting evidence for the purpose of summarizing learning at a given point in time, to make judgments about the quality of student learning on the basis of established criteria, and to assign a value to represent that quality.

Outline of Course Content

Unit 1: Hardware, Software, interconnected devices, and Cybersecurity	**12 hours**
Students describe the functions and features of various core components of hardware, software and different interconnected devices associated with digital technologies. Students identify various ways to use hardware, software, file management techniques, and research practices to support their own use of digital technology. Students learn how to apply safe and effective data and security practices in various contexts when using digital technology to protect their privacy. (STRAND B; B1, B2, and B3) <u>Assessment of Learning:</u> Cumulative task. What do I need? Do I really need the most advanced/expensive stuff? Following a roadmap provided by the teacher, students prepare a slide deck/presentation justifying the different requirements needed by various users, in different contexts and purposes, to make appropriate recommendations for devices and programs, including how to keep their data/privacy secure from unauthorized access.	
Unit 2: Networks, Innovations and Artificial Intelligence.	**10 hours**
Students investigate current and emerging innovations in digital technology, including automation and artificial intelligence (AI) to assess their benefits and limitations. Students investigate hardware and methods used to establish networks and connectivity. Students assess the benefits and limitations of increased connectivity with reference to everyday life. (STRAND B; B4) <u>Assessment of Learning:</u> Quiz and also incorporated within unit 3	
Unit 3: Mobile App development - in collaboration with Technovation	**50 hours**
Students investigate current social, cultural, economic, environmental, and ethical issues related to digital technology that have personal, local, and global impacts, taking various perspectives into account. (STRAND A; A2.1) Students are introduced to the Engineering Design Process to build a business plan for a computational artifact (a mobile app).	

Students develop mobile apps by applying the computational thinking concepts and practices to plan, code and how to properly document written code. Students develop mobile apps for a wide variety of contexts, users, and purposes.
(STRAND A; A1) (STRAND C)

Assessment of Learning
Assignments and a cumulative task using a Differentiated Assessment Strategy: following a roadmap provided by the teacher, students launch their own mobile app and make a presentation outlining their learning journey.

Unit 4: Programming	**28 hours**

Students learn appropriate terminology to explain fundamental programming concepts and algorithms. Using the computational thinking concept, students then write simple programs that:

1. use and generate data involving various sources and formats;
2. store and manipulate numbers and text in a program;
3. use variables, constants, expressions, boolean and comparison operators;
4. include single and nested conditional statements;
5. include sequential, selection, and repeating events.

Students then deepen their programming knowledge by writing subprograms and/or use existing subprograms to complete program components, and write programs that make use of external or add-on modules or libraries
(STRAND C)

Assessment of Learning:
Quizzes and assignments demonstrating appropriate knowledge of terminology, writing different programs of increasing difficulties. Also incorporated within unit 3.

Unit 5: Digital Technology, Society, and Careers	**10 hours**

What's out there?
Students investigate contributions to innovations in digital technology and computing by people from diverse local, Canadian, and global communities, including Indigenous communities in Canada and around the world.
(STRAND A; A2.3)

Students investigate how real-world applications of digital technology and programming are used within various careers, industries, including skilled trades. Students analyze ways in which these various careers/industries are changing as a result of digital technology and programming innovations

(STRAND A, A3)
Assessment of Learning
Cumulative task using a Differentiated Assessment Strategy: following a roadmap provided by the teacher, students choose a topic which they need to research and analyze. Students demonstrate their learning by producing either a vlog, a news segment, an artistic performance (song or music video), publishing an interview, or making a documentary.

Course Schedule

Date(s)	Times	Location	Hrs	Curriculum
Introduction				
Monday Jan 8, 2024	6:30-8:30 pm	Online synchronous	2	**Welcome to UOttawa!** - Course overview (Intro to ICD20 and computational thinking), my expectations, academic integrity - A few words about yourself! - Intro to Brightspace, file management. Quiz. Submit quiz in Brightspace
Saturday, Jan 13, 2024	No classes			
Week 1				
Monday Jan 15, 2024	6:30-8:30 pm	Online synchronous	2	Unit 1 lesson
Week 1	flexible	asynchronous	4	Unit 1 individual work
Saturday, Jan 20, 2024	9:00-12:00 pm	In Person (at Carleton)	2	Workshop 1 – Kick-Off Event: Introduction, Overview, Team Formation, Researching Problems
Monday Jan 22, 2024	No classes - high school exams			
Wed, Jan 24, 2024				
Week 2				
Monday Jan 29, 2024	6:30-8:30 pm	Online synchronous	2	Unit 1 lesson
Week 2	flexible	asynchronous	4	Unit 1 individual work By Sunday Jan 30: submit cumulative task.
Wednesday Jan 31, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 2 - Select a Problem, Plan Your Project
Week 3				
Monday Feb 05, 2024	6:30-8:30 pm	Online synchronous	2	Unit 2 lesson
Week 3	flexible	asynchronous	4	Workshop 2 / Unit 2 individual work
Wednesday, Feb 07, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 3 - Mobile App Examples, MVP, Paper & Cardboard Prototypes
Week 4				
Monday Feb 12, 2024	6:30-8:30 pm	Online synchronous	2	Unit 2 lesson

Week 4	flexible	asynchronous	2	Unit 2 individual work. By Sunday Feb 11: submit quizz
Wednesday, Feb 14, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 4/unit 3 - Different App Types, App designing
Week 5				
Monday Feb 19, 2024	No classes - Family Day			
Week 5	flexible	asynchronous	4	Unit 3 individual work
Wednesday, Feb 21, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 5/unit 3 - Coding General - Types of Blocks, Conditionals.
Week 6				
Monday Feb 26, 2024	6:30-8:30 pm	Online synchronous	2	Unit 3 lesson
Week 6	flexible	asynchronous	2	Workshop 5/unit 3 individual work
Wednesday, Feb 28, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 6/unit 3 - Debugging, Lists, APIs
Week 6	flexible	asynchronous	4	Workshop 6/unit 3 individual work
Week 7				
Monday March 4, 2024	6:30-8:30 pm	Online synchronous	2	Unit 3 lesson
Week 7	flexible	asynchronous	2	Workshop 6/unit 3 individual work
Wednesday, March 6, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 7/unit 3 - Market Research, Business & Mission Statement, Marketing Your Product
Week 7	flexible	asynchronous	4	Workshop 7/unit 3 individual work
Monday March 11, 2024 Wed, March 13, 2024	No classes - March Break			
Week 8				
Monday March 18, 2024	6:30-8:30 pm	Online synchronous	2	Unit 3 lesson
Week 8	flexible	asynchronous	2	Workshop 7/unit 3 individual work
Wednesday, March 20, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 8 - Business Plan, User Adoption Plan, Operating Costs, Calculating Your Revenue
Week 8	flexible	asynchronous	4	Workshop 8/unit 3 individual work
Week 9				
Monday March 25, 2024	6:30-8:30 pm	Online synchronous	2	Unit 3 lesson
Week 9	flexible	asynchronous	2	Workshop 8/unit 3 individual work
Wednesday, March 27, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 9 - Pitch Video/Technical Video Intro, Recording Videos
Week 9	flexible	asynchronous	3	Workshop 9/unit 3 individual work
Week 10				
Monday, April 1, 2024	No classes - Easter Monday			

Wednesday, April 3, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 10 - Editing Videos
Week 10	flexible	asynchronous	4	Workshop 10/unit 3 individual work
Week 11				
Monday, April 8, 2024	6:30-8:30 pm	Online synchronous	2	Unit 4 lesson
Week 11	flexible	asynchronous	3	unit 4 individual work
Wednesday, April 10, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 11/unit 4 - Learning Journey
Week 12				
Monday, April 15, 2024	6:30-8:30 pm	Online synchronous	2	Unit 4 lesson and quiz
Week 12	flexible	asynchronous	3	unit 4 individual work. Submit coding assignment
Wed, April 17, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 12/unit 4 - How to Submit & Final Touches
Week 13				
Monday April 22, 2024	6:30-8:30 pm	Online synchronous	2	Unit 4 lesson
Week 13	flexible	asynchronous	4	Unit 4 individual work.
Wednesday, April 24, 2024	6:30-8:30 pm	In Person (at Carleton)	2	Workshop 13/unit 4 - Pitch Practice
Saturday, April 27, 2024	TBD	In Person (at Carleton)	TBD	Pitch celebration event
Week 14				
Monday April 29, 2024	6:30-8:30 pm	Online synchronous	2	Unit 4 lesson
Week 14	flexible	asynchronous	4	unit 4 individual work. Submit coding assignment
Week 15				
Monday May 6, 2024	6:30-8:30 pm	Online synchronous	2	Unit 5 Lesson
Week 15	Flexible	asynchronous	3	Unit 5 individual work.
Monday, May 20, 2024	No classes - May long weekend			
Week 16				
Monday May 27, 2024	6:30-8:30 pm	Online synchronous	2	Unit 5 Lesson & finishing touches
Week 16	Flexible	asynchronous	3	Unit 5 individual work.Submit unit 5 assignment.
End of classes - Congratulations to you all!!!				

Teaching & Learning Strategies

This course is intended to give high school students a good understanding of software and hardware integration using industry standards. The students will be continuously engaged in hands-on learning as they navigate new development and hardware tools and environments. They will also take part in class discussions regarding the new technologies they will use to build applications. They will also take part in online discussions regarding the new technologies they will use to build applications.

The teacher will begin each course with a review of the previous day's lessons and then relate these topics to the new material to be covered. The students will be guided through many programming and hardware examples prior to practicing individually and in groups. This training will allow them to complete student-led assignments and projects required for the course. Their knowledge will be frequently evaluated through formative assessments of their code, hardware builds, and documentation.

App inventor and Thunkable will be the tools used to direct students as they move through their experiential learning of integration methodologies. The teacher will elaborate on professional development practices in order to deliver a learning environment consistent with industry standards. Students in this course will be able to develop a mobile application in order to develop their skills in software integration.

The final project of the course will aim to develop students' problem solving and project management skills as they will create a mobile application to solve a problem in their community.

Differentiated Instructions for different learners

Teachers at the University of Ottawa Faculty of Engineering Secondary School provide effective lesson design through differentiated instructional approaches. We plan our teaching in every subject and discipline to address the various needs of all our students and thrive for students to see themselves reflected in classroom resources and activities.

When planning instructional approaches, our priorities focus on helping our students achieve their full potential by providing a learning environment that supports not only their cognitive, emotional, social, and physical development but also promotes their healthy development, their sense of self, spirit, their mental health, and their resilience. Parents, guardians, and community partners all play critical roles in creating this educational experience.

Differentiated instruction is at the core of our curriculum planning. Differentiated instruction offers students a choice from a range of activities or allows them to select their own projects. By giving students the power to choose their own topic, they can select something that most

interests them and become more invested in the project. By assessing each individual student's abilities, background, interests and learning styles, we can design our lessons based on the needs of our diverse students. All our courses' contents (what is being taught), processes (how it is taught), and products (how students demonstrate their learning) are designed in relation to our students' needs.

Our effective lesson designs are student centered and involve a strategic blend of whole-class, small-group, and individual learning activities to suit students' differing strengths, interests, and levels of readiness to learn.

- **We use a variety of media** to ensure that students are provided with alternatives for auditory and visual information. To support learners as they focus strategically on their learning goals, we create an environment in which learners can express themselves using a range of kinesthetic, visual, and auditory strengths.
- **We vary ways in which students can respond and demonstrate their understanding of concepts**, and support students in goal-setting, planning, and time-management skills related to their learning.
- **We use an active learning approach**, such as live coding. Live coding is a demonstration by the teacher in which they explain each step of the problem-solving and programming processes as students engage with these processes in real time. We occasionally deliberately introduce errors to demonstrate how to respond to such difficulties. This approach provides opportunities for students to consolidate their understanding and further develop their Engineering Design Processes skills. We pace our live coding activities with care to ensure that all students can actively participate and have time to formulate and ask questions to clarify their understanding.
- **We design assignments that are "low floor, high ceiling"** – that is, all students are provided with the opportunity to find their own entry point to the learning. We support students working at their own pace and can provide further support as needed, while continuing to move student learning forward. We design tasks that are intentionally created to be low floor, high ceiling to provide opportunities for students to use varied approaches and to continue to be engaged in learning with varied levels of complexities and challenges. This is an inclusive scaffolding approach that is grounded in a growth mindset: the belief that every student can succeed.
- **We engage in peer instruction** by involving the use of targeted multiple-choice questions with distractors that are designed to expose possible misconceptions. This is an effective technique to check for understanding and to encourage student dialogue about course topics. Our peer instruction process involves the following steps:

    1. Students investigate or practice using new concepts;

    2. The teacher poses a multiple-choice question, and students individually select their answers;

    3. Students discuss their choices with their peers, which enables them to explore the topic and possibly clarify their understanding;

4. The teacher poses the same question again and asks each student to reassess their answer;

5. The teacher facilitates a whole-group discussion of the topic under consideration.

- **We use the Engineering Design Process** - a model used by engineers to create something new or make something better.
- **Pair programming** - a technique in which two students (a driver and a navigator) work together using a single computer to solve a problem. The driver's role is to write the code, while the navigator provides advice and guidance as they jointly work towards achieving a common goal.
- **Individual work** - where students benefit from working individually to investigate algorithms and write software programs.
- **We teach the computational thinking model**- a model of thinking that is more about thinking than it is about computing. It is about designing and evaluating potential solutions to coding problems. The concepts of computational thinking include:
    1. decomposition (the breakdown of a problem or task into steps or pieces)

    2. pattern recognition (identification of other problems or items that are similar)

    3. abstraction (the reduction of a complex task to its essential components)

    4. algorithms (a set of instructions to follow to solve a problem)

When these concepts are applied, they are known as computational thinking practices.

- **We include current events in our lessons -** current events and emerging technologies stimulate student interest and thus, are embedded in our curriculum. They enhance the relevance of the curriculum and help students connect their in-class lessons with real-world events or situations. Embedding current events into our lessons is an effective instructional strategy for implementing many course expectations.

Considerations for Program Planning

Planning Computer Studies Programs for Students with Special Education Needs

Classroom teachers have a duty to ensure that all students in their class have the opportunity to learn and succeed regardless of their special education needs. *Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006* promotes a set of beliefs that should guide program planning for students with special education. These beliefs include:

- All students can succeed.
- Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students.
- Each student has his or her own unique patterns of learning.
- Classroom teachers need the support of the larger community to create a learning environment that supports students with special education needs.
- Fairness is not sameness.

Teachers are encouraged to develop their program plan in accordance to their students' diversity of strengths and abilities. This can be achieved through a myriad of ways including: assessing each student's prior knowledge and skills, providing ongoing assessment, and allowing for flexible groupings. By assessing each student's current achievement level and weighing that against the course expectations, the teacher can determine if the student will be requiring any combination of: accommodations, modified expectations, or alternative expectations. If the student requires accommodations, modified expectations, or both, the information must be recorded in their Individual Education Plan (IEP).

Students Requiring Accommodations Only

Accommodations that are required by students must be identified on their IEP. Differentiated instruction and universal design lend themselves well to providing accommodations for students. Students are still evaluated on the curriculum course expectations and achievement levels communicated by the Ministry.

There are three types of accommodations:

- Instructional accommodations: Teachers change the way in which lessons are taught including integrating technology and using different styles of presentation;
- Environmental accommodations: This includes a change in the learning environment whether it be classroom seating by location or group, or lighting;
- Assessment accommodations: These allow students to demonstrate their learning in a different way. For instance, they may be given the opportunity to

give oral answers to written questions or they may be given more time to complete an assignment or test.

Students Requiring Modified Expectations

Modified expectations that are required by students must be identified on their IEP. For the most part, these expectations will be based on the regular course expectations but the number and/or complexity will differ. Modified expectations are specific, realistic, and measurable achievements that the student can demonstrate independently, given assessment accommodations.

It is the principal who will decide whether the achievement of the modified expectations constitutes successful completion of the course and whether the student is eligible to receive a credit for the course; this decision must be communicated to the student and their parents.

When course expectations are not extensively modified and it is expected that the student can achieve most of them, the modified expectations should determine how the required knowledge and skills differ from those identified in the course expectations. In the case, if the student is working toward a credit for the course, the IEP box must be checked on the Provincial Report Card.

With extensive modifications to expectations such that achievement of them is not expected to result in a credit, the expectations should identify the precise requirements or tasks on which the student's performance will be evaluated and which will be used to determine the student's mark on the Provincial Report Card. The IEP box must be checked and the appropriate statement from the *Guide to the Provincial Report Card, Grades 9-12, 1999* (p. 8) must be added. Modified expectations must be reviewed in relation to the student's progress at least once each reporting period, and must be updated as necessary.

Program Considerations for English Language Learners

Schools in Ontario have a very diverse and multicultural student population, such that 20% of students have a language other than English as their first language. These English language learners may be recent immigrants or refugees while others may be born in Canada into a family whose primary home language is either not English or is an English dialect differing significantly from the English taught in Ontario schools. Teachers must be mindful that many of these students are entering a new linguistic and cultural environment at school.

During their first few years in an Ontario school, English language learners pay receive support through English as a Second Language (ESL) programs or English Literacy Development (ELD) programs. ELD programs are primarily for newcomers who arrive with significant gaps in their education, often due to limited opportunities (in terms of education and literacy) in their home country.

It is important that teachers recognize the orientation process whereby English language learners adapt to a new social environment and language. Some may be very quiet at first, using body language rather than speech and/or limited verbal communication to convey their thoughts. These students thrive in a safe, supportive, and welcoming environment. As the students learn to speak English, it is important to note that oral fluency is not a good indicator of the student's literacy development and vocabulary.

It is the shared responsibility of the classroom teacher, the ESL/ELD teacher (where available), and other school staff to help in the development of students' English. Volunteers and peers may also provide significant support. Teachers are required to adapt their instruction to facilitate the success of their English language learner students. These adaptations may include:

- Modifying some or all course expectations such that they are challenging yet achievable given the student's English proficiency;
- Using a variety of instruction strategies, such as visual cues, pre-teaching vocabulary, offering peer tutoring;
- Using a variety of learning resources, such as bilingual dictionaries, visual material, simplified text;
- Modifying assessments, such as giving extra time, offering the choice of demonstrating skills/knowledge orally or in writing, assigning cloze sentences instead of essays.

When learning expectations are modified for an English language learner, it must be clearly indicated on their report card.

https://www.dcp.edu.gov.on.ca/en/program-planning/considerations-for-program-planning

Equity and Inclusive Education in Computer Studies

The Faculty of Engineering Secondary School abides by the University of Ottawa's Violence Prevention Policy and Prevention of Harassment and Discrimination Policy These policies encourage staff and students to show respect for diversity in the school and the wider society. The policies aim to provide a safe learning environment, free from violence, harassment, and discrimination.

The Ontario First Nation, Métis, Inuit Education Policy Framework

The Ontario First Nation, Métis, and Inuit Education Policy Framework is based on the vision that all First Nation, Métis and Inuit (FNMI) students in Ontario will have the knowledge, skills and confidence they need to successfully complete their secondary education to pursue postsecondary education or training and/or to enter the workforce. They will have the traditional and contemporary knowledge, skills, and attitudes required to be socially contributive, politically active, and economically prosperous citizens of the world. All students in Ontario will have knowledge and appreciation of contemporary and traditional First Nation, Métis, and Inuit traditions, cultures, and perspectives.

The Faculty of Engineering Secondary School abides by the goals stated in the Ontario First Nation, Métis, and Inuit Education Policy Framework to provide a supportive and safe environment for all FNMI students. These goals include:

- Increase the level of student achievement
- Reduce gaps in student achievement
- Increase the levels of public confidence

For example, the school will strive to develop awareness among teachers of the learning styles of First Nation, Métis, and Inuit students and instructional methods designed to enhance the learning of students, such as incorporating meaningful FNMI cultural perspectives and activities when planning instruction, and implementing strategies for developing critical and creative thinking.

The FNMI students will also have access to the support, activities and resources offered by the uOttawa Indigenous Resource Centre Mashkawazìwogaming. For example, students can have access to student mentoring from a university student, individual or group meeting with and Elder in residence, and social and cultural events to participate in, if they wish to.

The Faculty of Engineering Secondary School, as part as the University of Ottawa also supports the uOttawa Indigenous Action Plan Framework for 2019-2024 which is designed to facilitate the inclusion of FNMI students and support the specific needs of the indigenous community.

The Ontario Skills Passport and Essential Skills

The Ontario Skills Passport (OSP) is a web-based service that can track students' Essential Skills (such as reading, writing, and problem solving) and work habits (such as working safely and being reliable). These skills and work habits are easily transferable from school to work and are useful for employers looking to assess potential candidates for cooperative education placements. The OSP is also useful for students looking to assess, build, document, and track their skills through their educational, professional, and personal experiences. More information about the OSP can be found on the ministry website, http://skills.edu.gov.on.ca.

Career Education

In this era of technological innovation with rapidly evolving technologies, employers are always on the lookout for candidates with strong technical skills who can problem-solve effectively, think critically, and work collaboratively. At the University of Ottawa Secondary school, these are the exact skills our students develop through our courses.