UNIVERSITY OF WATERLOO | The CENTRE for EDUCATION in MATHEMATICS and COMPUTING

Summer Conference for Computer Studies and Mathematics Educators
Session Information – Computer Studies

You are welcome to choose any session from any "Selection" at any time.
You are not required to stay with the same column in the schedule for the entire conference.

Date and Time	Activity	Selection A	Selection B	Selection C
Tuesday, August 12				
9:00 a.m. - 10:30 a.m.	Welcome	*Think Think Think!* by Mark Modolo		
10:45 a.m. - 12:15 p.m.	Session 1	*CS and Society Resources* (Hands-on) by Sarah Chan	*Teaching TAS 1O/2O* (Lecture) by Rob Ceccato	*Model It! Prevent Coding Disasters with State Charts* (Lecture) by Dennis Cenic
1:15 p.m. - 2:45 p.m.	Session 2	*Introduction to Data Science* (Lab) by Carmen Bruni		*There is an Arduino for that! Arduinos for Everyone* (Lab) by Michael Chan
3:00 p.m. - 4:30 p.m.	Session 3			
Wednesday, August 13				
9:00 a.m. - 10:30 a.m.	Session 4	*How to Use Optical Illusions to Illustrate Mathematical and Coding Concepts* (Lab) by Catherine Leung	*Technology and the Skilled Trades - A Digital Approach (Coding, Electronics, and Design)* (Lab) by Grant Hutchison	*Build, Code, and Test - Arduino Made Easy with Tinkercad* (Lab) by Raj Nachimuthu
10:45 a.m. - 12:15 p.m.	Session 5			
1:15 p.m. - 2:45 p.m.	Session 6	*Using ChatGPT to Build Custom Chatbots for the Classroom* (Lab) by Peter Beens		*New Arduino, new tricks: from breadboard prototypes to advanced projects with the new Arduino Nano ESP32* (Lab) by John Rampelt
3:00 p.m. - 4:30 p.m.	Session 7	*Using CCC Problems to Teach Curriculum Concepts* (Lecture) by J.P. Pretti		

Date and Time	Activity	Selection A	Selection B	Selection C
Thursday, August 14				
9:00 a.m. - 10:30 a.m.	Session 8	*An Even Faster Workflow for Publishing Teaching Materials* (Lab) by Russell Gordon		*Arduinos with Hi-tech - Ideas and Challenges for the Advanced Level* (Lab) by Michael Chan
10:45 a.m. - 12:15 p.m.	Session 9			

Session Details:

Session 1

Selection A: CS and Society Resources
In this session you will be introduced to new resources created by the CEMC to support non-programming computer science curriculum. Resource topics are dedicated to social, economic, cultural, environmental, and ethical issues. You will take on the role of a student as we practice using select materials from the collection.

Selection B: Teaching TAS 1O/2O
This session will give you all the necessary resources needed for teaching basic electronics to students in either grade 9 or grade 10. We will quickly go over the unit on electronics (look at the resources and how they are laid out). I will then demonstrate how to use TinkerCad (a free online electronics workbench that runs on a web browser) and to give you a resource that you can share with your students so they can learn how to use TinkerCad. Finally, we will then take what we have learned and apply it to the TAS 1O and or TAS 2O curriculum. 3 Final TAS Curriculum related assessments will be shared that are related to the unit.

Selection C: Model It! Prevent Coding Disasters with State Charts
Coding without design leads to disaster! State Chart "Models" are used to facilitate a clear communication of software behavior before any coding takes place. In this workshop, we will review the basic features of state charts and show how these models can be implemented in Arduino sketches.

Session 2 & 3

Selection A: Introduction to Data Science
In this session we'll introduce the Python package *pandas* as a way to analyze data. We'll practice how to visualize and manipulate data within the *pandas* environment and see some visualizations of data as well.
Prior experience with Python is welcome but not strictly required. Having Jupyter Notebooks installed in advance would be a benefit but also not required.

Selection C: There is an Arduino for that! Arduinos for Everyone

Current curricula put great emphasis on practical applications and codings. Arduinos with its versatility, simplicity and low costs, serve as an ideal candidate for teachers to pick and choose the right level of illustrative applications to go with their lessons. From my experience, arduinos provide solutions to all my practical endeavours. Arduino projects could be as simple as a led on/off to demonstrate gate logics, or as sophisticated as performing AI decisions.

This workshop shows how easy and inexpensive it is using Arduinos to illustrate/explore (from grade 7 to grade 12 STEAM) curricula principles. Most likely you already have a class set of Arduinos in school. Teachers with no prior coding/technical experience, CS, Mathematics or Science, are encouraged to attend this 101 introductory workshop. See for yourself if you could share the fun, motivations and challenges of coding with arduino interfacing in your classes!

Session Topics:

- Intro to Arduino/What's an Arduino - overview of common Arduino boards (UNO, Nano) used for education, simple Arduino programs
- Applications for different disciplines (STEAM)
- Showcase of interesting projects
- Straightforward hands-on tutorials (Scratch & C++)

Session 4 & 5

Selection A: How to Use Optical Illusions to Illustrate Mathematical and Coding Concepts

In this hands-on session, we will explore the creation of optical illusions that involve repeating patterns and how these concepts can be applied to the teaching of both programming and mathematics. Some optical illusions are created with repeating patterns. These repeating patterns can be used to help students learn programming concepts such as iteration and selection. It can also help students understand ideas such.

Mathematical concepts:

- Shapes and geometry
- Coordinate systems
- Creation of algebraic equations to determine positions

Programming concepts:

- Iteration for repeating patterns
- Selection for exceptions
- JavaScript

This session will also demonstrate tech options for doing this with your students and pros and cons of each option allowing you to choose the best strategy for deploying coding components based on your technological comfort and needs.

Selection B: Technology and the Skilled Trades - A Digital Approach (Coding, Electronics, and Design)

In this 3-hour workshop attendees will have the opportunity to explore classroom resources (lessons, activities, and assessments) across multiple units of study. Each unit will include a student-centered Engineering Design Process (EDP) template that can be used with students.

The Computing Systems and Electronics unit will include an exploration of the fundamental components of computers and electronic systems. You will gain knowledge of various components. During this unit you will design and test circuits using simulators, breadboards, and also have an opportunity to build a permanent circuit (soldering).

The Computational Thinking (CT) and Coding unit will involve a scaffolded exploration of powerful block-based coding environments for robotics and control systems. We will use online robotics (FTCSim) and Micro:bit coding platforms. You will connect each new coding environment to CT concepts such as: pattern recognition, decomposition, algorithms, and abstractions. Attendees will apply the Engineering Design Process to various projects including security systems, motion analysis, and robotics using a highly extensible robotics platform.

Communication is an important element of many Technology and Skilled Trades professions. In this session we will be creating and reading: schematics (electronics), state diagrams (coding/control systems), and scaled architectural drawings (floor plans).

Selection C: Build, Code, and Test - Arduino Made Easy with Tinkercad

Introduce your students to electronics and programming through hands-on labs. Build Arduino circuits using Tinkercad Classroom without needing any physical components and tools. Tinkercad provides a virtual environment where students can design circuits, write code, and simulate their circuits. It is a browser-based tool that allows you to assign activities and monitor student progress. Ideal platform for developing critical STEAM skills.

Session Topics:

- Introduction to Tinkercad Circuits, Tinkercad Classroom.
- Beginner level Arduino circuits on Tinkercad: LEDs, Switches, Buzzers
- Interfacing with sensors: Light, Temperature, Distance
- Advanced circuits and programming: writing functions, using libraries

Session 6

Selection A: Using ChatGPT to Build Custom Chatbots for the Classroom

This session empowers educators to move beyond passive AI use by designing and building their own Custom GPTs—chatbots tailored to specific classroom tasks and aligned with curriculum goals. You'll explore real-world examples of Ontario-focused GPTs that support lesson planning, assessment design, student feedback, and differentiated instruction.

The session follows a structured design framework that can be adapted to any subject or grade level. You'll gain hands-on experience in creating Custom GPTs using ChatGPT, learning the essentials of prompt engineering, workflow design, and iterative testing. By the end of the session, you'll be equipped to confidently develop AI tools that serve your unique instructional needs.

You'll leave with:

- A clear understanding of what Custom GPTs are and how they support classroom practice
- A repeatable design process for creating GPTs tailored to your instructional goals

- Practical strategies to align AI tools with curriculum expectations and student needs
- Prompt engineering techniques that ensure clarity, relevance, and effectiveness

Session 6 & 7

Selection C: New Arduino, new tricks: from breadboard prototypes to advanced projects with the new Arduino Nano ESP32

This session is designed for teachers who have had some experience with Arduino and want to get more experience interfacing Arduino with different types of I/O devices. Participants will learn how to attach input circuits and connect output devices to the tiny, powerful, 3.3V Arduino Nano ESP32 circuit, explore its unique new features, and investigate more advanced Arduino programming and debugging techniques. It is recommended that participants bring their own computer with the Arduino IDE already installed.

Session Topics:

- Introducing Arduino Nano ESP32 (quick comparison w/UNO, Nano)
- Breadboard circuit review (internal connections, 5V/3.3V power, input circuits, output devices)
- The Arduino IDE (overview, setup and configuration for Arduino Nano ESP32)
- Arduino program basics (review: header, I/O configuration, setup(), loop(), other important and useful I/O functions - map(), pulseIn(), micros(), millis())
- Developing and debugging a program (planning techniques, numeric types, creating functions, debugging techniques, code optimization)
- Break
- Advanced topics – function libraries vs. creating functions, A/D, Servo, SONAR, NeoPixels, I2C, SPI, wireless communication (ESPNow, WiFi)
- Creating your own Arduino projects for education (overview of designing circuits, interfacing to higher voltage devices, designing custom PCBs, making multi-function PCBs)
- MicroPython on Arduino Nano ESP32

Session 7

Selection A: Using CCC Problems to Teach Curriculum Concepts

TBA

Session 8 & 9

Selection A: An Even Faster Workflow for Publishing Teaching Materials

Content management systems such as Edsby, Brightspace, Google Classroom… the list of third-party platforms we depend on as teachers to share information with our students is long. The user interfaces of these systems? Questionable, often requiring a time-consuming series of clicks and selections to publish even the simplest information. Further, it is often difficult to move your valuable content out of these systems. In this session, the presenter will share a pre-configured publishing system that you control, can take away from the conference, and then run on your own computer to build modern, standards-compliant class websites. In the session, optionally complete a series of “quests” to learn

how to use this publishing workflow and get assistance from the presenter in setting up your own website on the spot. You will learn how to use Markdown-formatted text files to quickly publish a deeply linked, searchable website, with pages that can include “pretty-print” mathematical formulae and equations, code snippets, diagrams, animations, images, videos, PDF files, or any other type of document.

NOTE: For those with good memories, this is an update of the 2023 session titled "A Rapid Workflow for Publishing CS Teaching Materials”, with new software, much less work involved to get a site up and running, and a better end-product. This new session is suitable for and useful for both mathematics and computer science teachers.

Selection C: Arduinos with Hi-tech - Ideas and Challenges for the Advanced Level
Arduinos technology has evolved since its birth in the 80s as a mere substitute for ports control. Ardunios nowadays equipped with all kinds of supporting accessories and circuitries become high processing units with Rfid, BT, Wifi, Spatial, Audio/visual (camera) communication powers. This workshop showcases some common arduino units and accessories available in the market and how they could be harnessed in the classroom providing inspirational adventures such as AI, VR, AR, IOT and RF/BT communications for your students. You do not have to be a rocket scientist nor a big spender to use these top-notched technologies. Don’t miss out this opportunity to experiment and to keep abreast of today’s innovations and development for your classes!

Session Topics:

- IOT, AI, CAM, SPATIAL, REIF.
- Examples, tutorials and hands-on activities & challenges