Computational Thinking in Mathematics and Science Education,
(Intermediate/Senior) 5467, 0.5
Blended Learning Course Set-Up
Section 001, Mondays – On-Site 10:30-12:30, Room 2046
and Online (asynchronous)

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*The best way to contact me is through my Western email account. I am happy to set-up appointments by request.

Calendar Course Description:

A critical introduction to the role of computer coding and digital making as ways of teaching mathematics and science concepts and relationships. The history, current trends, future possibilities of computational thinking in mathematics and science education are situated within the broader context of mathematics, science, and technology education.

Learning Outcomes:

By the end of this course, students will be able to:

- Explore, share, and reflect on the mathematical and scientific learning through computational thinking tasks (both coding and unplugged)
- Describe how computational thinking may be used to develop mathematics and science concepts
- Describe the affordances and challenges of teaching mathematics and science with computational thinking including the areas of planning, implementation, and assessment
- Explore, share, and reflect on coding environments for computational thinking in mathematics and science education
• Build connections between curriculum expectations, both within a specific grade/course as well as across grades/courses to create a more connected and relevant mathematics and/or science program for themselves, their students, and their colleagues
• Review, discuss reflect on, and critically evaluate theory and research on computational thinking in mathematics and science education
• Identify opportunities to use computational thinking to develop deeper, more connected understandings within mathematics and/or science programs
• Identify opportunities to connect research to practice to support teacher professional practice decisions
• Discuss and reflect on theoretical research concerning the use of computational thinking in mathematics and science education
• Communicate with education stakeholders, with specificity and clarity, the affordances and issues of implementing computational thinking in mathematics and science education
• Recognize how changing perspectives (e.g., environmental; stewardship), current research from fields outside of mathematics (e.g., cognitive science), and technology may generate a need for change in areas of mathematics education
• Demonstrate initiative, responsibility, accountability, thoughtful decision-making, reflective practice, ethical behaviour, academic integrity, and responsible conduct of research that is in compliance with policy and procedural guidelines.

Course Content:

Topics include:
Coding in mathematics (geometry, patterns, probability, linear relations), Coding in science, Effective use of digital tangibles, Exploring sensors, STEM across the curriculum

Platforms and Digital Devices that will be explored (depending on availability of each device):
Scratch, Python, Sphero, Arduino, Makey Makey, Micro:bit, electronic stickers, other online coding platforms and applications

Course Materials:

Suggested materials, including digital devices will be recommended throughout the course. All readings will be available online.

Assignments and Other Course Requirements:

*If you wish to propose an alternate assignment, please discuss with your instructor

1 – Reflection on Critical Analysis Tool for a Digital Device/Application (30 %)
Due Date: October 6th, 2017

In class, students will use a co-created Critical Analysis Tool designed to determine which devices (presented by students) are best for teaching STEM concepts.

Students will then submit a reflection discussing the effectiveness of their co-created Critical Analysis Tool.

What students submit for assessment:

Samples of completed Critical Analysis Tools (based on the information from the in-class presentations) and a reflection that includes:

✓ The best device for teaching math/science concepts based on the tool (depending on the end-goals), along with an explanation

✓ A reflection that explains what could be adjusted on the Critical Analysis Tool to ensure that it will be an effective tool for teachers in making pedagogical decisions on what types of devices/applications they will implement in their classrooms

✓ The paper should be submitted as a Word document, not as a pdf. It should be written using Times New Roman 12-font, have 1.5 line spacing, have “portrait” orientation, and be sized as 8.5 x 11. APA formatting for references is required. It is to be a maximum of 500 words excluding the sample tools and an (optional) bibliography.

2 – COMPUTATIONAL THINKING TASK for teaching Math/Science/STEM (40 %) – Due Date: November 10th, 2017

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<tr>
<th>OPTION 1 - Teach and reflect on a computational thinking + math/science task</th>
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<tr>
<td>Select/Design and then teach a math/science/STEM task (plugged or unplugged) through Computational Thinking based on the readings and in-class activities presented in this course.</td>
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Requirements:

✓ Indicate a math/science strand and/or big idea that will be addressed and the grade levels (two to three grade levels) the task could be extended to

✓ Teach the math/science task to an intermediate or senior math/science class*

✓ The task should not take-up more than 75 minutes of class time (there is no minimum time requirement)

✓ Provide a brief summary/description of the task selected/designed (250 words)

✓ Write a reflection on how it went – include an explanation of how the learning of math/science/STEM was enhanced through the use of Computational Thinking (500 words)
**OPTION 2 – Analyze a Computational Thinking + Math Lesson Plan/Task**

Find a CT + math lesson plan (not discussed in the course), analyze it using criteria/themes from our course, suggest revisions for improvement and possible extensions.

- Provide a brief summary/description of the selected task (250 words)
- Write an analysis (500 words)

Provide a list of all resources used in the creation of this task (use APA formatting)

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**3 – ONLINE CONTRIBUTION (30 %) See Expectations in OWL.**

Students will participate in a variety of weekly online activities that may include: discussions, mind mapping, reflecting, tutorials.

**Policy Statements:**

**Accessibility:** The University of Western Ontario is committed to recognizing the dignity and independence of all students and seeks to ensure that persons with disabilities have genuine, open and unhindered access to academic services. Please contact the course instructor if you require course materials in an alternative format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for information about requesting academic accommodation, or go to the following website: [http://www.edu.uwo.ca/teacher-education/docs/policies/Accessibility_Western.pdf](http://www.edu.uwo.ca/teacher-education/docs/policies/Accessibility_Western.pdf)

**ATTENDANCE:** The B.Ed. program is an intense and demanding programs of professional preparation. You are expected to demonstrate high levels of both academic and professional integrity. Such integrity is demonstrated in part by your commitment to and attendance at all classes, workshops, tutorials, and practicum activities. Read more about the Faculty’s attendance policy on-line at [http://www.edu.uwo.ca/teacher-education/docs/Attendance%20Policy%202016.pdf](http://www.edu.uwo.ca/teacher-education/docs/Attendance%20Policy%202016.pdf).

**EXCUSED ABSENCES:** If you are ill, require compassionate leave, or must miss classes for religious observance, your absence is excused; you will not be penalized but you are responsible for work missed.

**UNEXCUSED ABSENCES:** Any absence that is not a result of illness, bereavement, or religious observance is an unexcused absence. Three unexcused absences will result in you being referred...
to the Associate Dean and placed on academic probation. Any further unexcused absence will result in failure of the course and withdrawal from the program.

Language Proficiency: In accordance with regulations established by the Senate of the University, you must demonstrate the ability to write clearly and correctly. Work which lacks proficiency in the language of instruction is unacceptable for academic credit, and will either be failed or, at the discretion of the instructor, returned to you for revision to an acceptable level.

Late Penalties: Normally, the only acceptable reasons for late or missed assignments are illness (which you must report to the Teacher Education Office) or extreme compassionate circumstances.

Academic Offences: Scholastic offences are taken very seriously in this professional Faculty. You are, after all, going to be a teacher. Read about what constitutes a Scholastic Offence at the following Web site: http://www.edu.uwo.ca/teacher-education/docs/policies/WEB_ScholasticDiscipline.pdf

Plagiarism: Plagiarism means presenting someone else’s words or ideas as your own. The concept applies to all assignments, including lesson and unit plans, laboratory reports, diagrams, and computer projects. For further information, consult your instructors, the Associate Dean’s Office, and current style manuals. Advice about plagiarism and how to avoid it can also be found here: http://www.edu.uwo.ca/preservice/downloads/Plagiarism%20Policy.pdf

Plagiarism-Checking:

a. All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com) [j10] and [j11]
Use of Laptops & Notebooks in Class: Lap tops and other electronic devices may be used in a professional manner to facilitate your activities in the course, but out of courtesy to colleagues and the instructor, please do not engage in personal networking and non-course communication during class time – save it for before or after class, or for the break.

SUPPORT SERVICES

A variety of support services are available at Western.
If you need advice or assistance, do not hesitate to get in touch with any of these services.

FINANCIAL ASSISTANCE: Registrarial Services (http://www.registrar.uwo.ca)

WRITING SUPPORT: Student Development Centre (http://www.sdc.uwo.ca/)

LEARNING SKILLS SUPPORT: Student Development Centre (http://www.sdc.uwo.ca/)

INTERNATIONAL STUDENTS: Student Development Centre (http://www.sdc.uwo.ca/)

ABORIGINAL STUDENTS: Student Development Centre (http://www.sdc.uwo.ca/)

STUDENTS with DISABILITIES: Student Development Centre (http://www.sdc.uwo.ca/)

SOCIAL & CULTURAL ISSUES: University Students’ Council (http://westernusc.ca/services/).

EMOTIONAL or MENTAL DISTRESS: Students who are in emotional or mental distress should refer to Mental Health @ Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

B.Ed./Dip.Ed. PROGRAM ISSUES: zuber@uwo.ca, Teacher Education Office, room 1131

NEED HELP but not sure what to do: zuber@uwo.ca, Teacher Education Office, room 1131
**Additional Information:**

**About the Course:**

This course is organized in a blended learning fashion:

Each week, students are expected to participate in:

- A two hour in class session (Monday – 10:30 to 12:30, Room 2046)
- An two hour online component

For the online component, activities will be posted weekly within the OWL environment. Students will participate in online activities, forum discussions and mind-mapping.

**In-class requirements – criteria**

Please attend every class, be an active listener, participant in discussions/tasks.

**Online requirements – criteria**

Please log on regularly and actively participate throughout the week. As this course contains online and in-class components, your attendance will be monitored online (see Attendance Policy).

Ensure you contribute productively to discussions, by providing constructive feedback to your classmates, suggested extensions and next steps, and using effective critical thinking skills.

**Teaching Outline:**

To be posted in OWL

**Assignment Guidelines:**

Details to be posted in OWL.

**Required and Optional Readings (see OWL for details):**


https://doi.org/10.1145/2889160.2889179


http://researchideas.ca/mc/article-1-title-recent-issue/a-coding-story/


https://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf