Western Education

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EDUC 5465
Introduction to STEM Education

Instructor:

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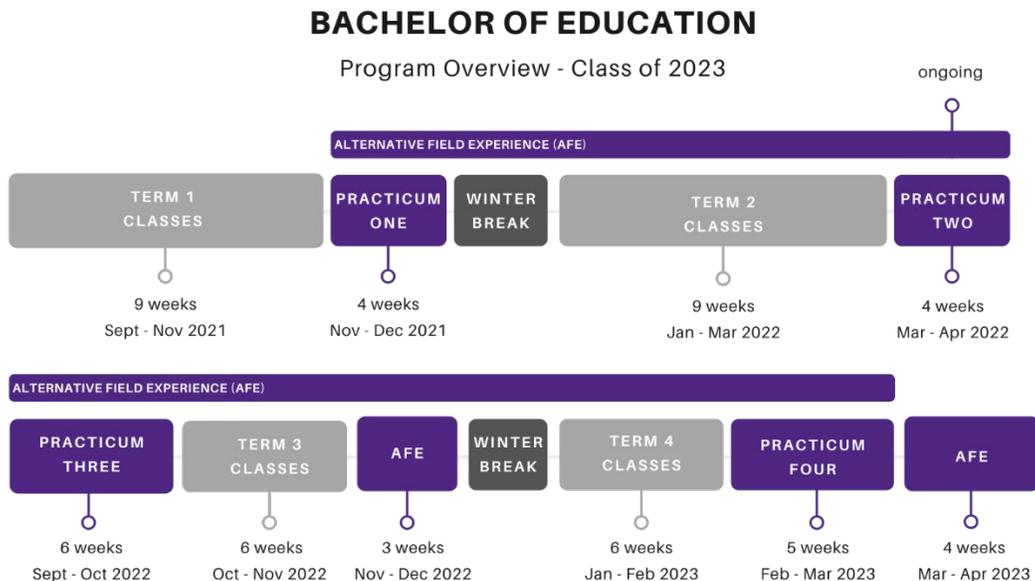**Office Hours:** by appointment

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Schedule:

Section 001:   Tues 10:30AM-12:30PM,
Room: 2036

Program Context:

This is a **Elective Course** taken by Teacher Candidates during **Year 1, Full Year** of the Bachelor of Education.

BACHELOR OF EDUCATION

Program Overview - Class of 2023

ongoing

ALTERNATIVE FIELD EXPERIENCE (AFE)

TERM 1 CLASSES	PRACTICUM ONE	WINTER BREAK	TERM 2 CLASSES	PRACTICUM TWO
9 weeks	4 weeks		9 weeks	4 weeks
Sept - Nov 2021	Nov - Dec 2021		Jan - Mar 2022	Mar - Apr 2022

ALTERNATIVE FIELD EXPERIENCE (AFE)

PRACTICUM THREE	TERM 3 CLASSES	AFE	WINTER BREAK	TERM 4 CLASSES	PRACTICUM FOUR	AFE
6 weeks	6 weeks	3 weeks		6 weeks	5 weeks	4 weeks
Sept - Oct 2022	Oct - Nov 2022	Nov - Dec 2022		Jan - Feb 2023	Feb - Mar 2023	Mar - Apr 2023

Introduction to STEM Education (EDUC 5465)

An introduction to the nature and value of integrated and multi-disciplinary collaborations in Science, Technology, Engineering and Mathematics education. Teacher Candidates develop critical perspectives and explore issues in STEM education in terms of policy and practice. 2 hours per week, full year, .5 credit.

This course provides an introduction to the nature and value of integrated and multi-disciplinary collaborations in intermediate/senior Science, Technology, Engineering, and Mathematics (STEM) education. Topics addressed, but not limited to, will include: STEM in the Ontario Science Curriculum, the nature and structure of STEM, embedding STEM, STEM pedagogy, the STEM learning environment, STEM curriculum planning, STEM assessment and evaluation, equity and inclusiveness in STEM and STEM activities.

There is no required textbook or prescribed readings for evaluation for this course. All outside class readings will arise from class discussions/interactions based on need for further reflection, understanding and to foster follow-up discussion in the subsequent class(es). These short, current, topical readings will be posted 1-3 classes in advance (depending on perceived class needs) along with a tentative course schedule on OWL.

Number of Credits : 0.5

Number of Weeks: 18

Week 1: Introduction to STEM

- Introduction and general overview of the course.

- STEM and STSE are compared.

- The value and nature of embedded STEM and separate STEM courses is explored.

- Connecting STEM courses to Ministry Science Curriculum and learning outcomes is explored.

Learning Activities

Type	Name	Description
Discussion	Week 1 Discussion	Outlining why STEM is a unique and enriching learning opportunity. Connecting the STEM to the Ontario Senior Science Curriculum. Curriculum. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 1 Materials & Readings	The Value of STEM Education Articles. The Ontario Senior Science Curriculum.

Week 2: The Nature of STEM and Establishing STEM

- Proper identification of potential Ministry Curriculum plays an essential role in establishing STEM.

- Developing STEM is rooted in the framework of STSE.

- Exploration of the framework of STEM education to create effective learning environments in embedded and interdisciplinary STEM.

Learning Activities

Type	Name	Description
Discussion	Week 2 Discussion	Exploration of essential STEM aspects and connections to Ministry Curriculum. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 2 Materials & Readings	STEM Framework Articles.

Week 3: The STEM Framework and Approach

- Many perceived challenges of STEM education interfere with proper implementation.

- The key framework components of STEM drive success.

- A problem-based approach is pivotal for successful STEM education.

Learning Activities

Type	Name	Description
Discussion	Week 3 Discussion	Identification and strategies to manage the perceived challenges of developing STEM education. Analysis of the key framework components of STEM education. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 3 Materials & Readings	Authentic and Problem-based Education Articles.

Week 4: Introduction to STEM Pedagogy

- Establishing a relevant authentic problem-based approach to STEM ensures student engagement and develops learning within a discovery and constructivist context.

- An introductory examination of key pedagogical strategies utilized in establishing and maintaining an engaging STEM learning environment while also ensuring student accountability.

- Establishing effective cooperative learning is vital for STEM success.

Learning Activities

Type	Name	Description
Discussion	Week 4 Discussion	Outlining integration of a problem-based approach in STEM projects. Establishing STEM pedagogy and Ministry Curriculum expectations. Class participation, discussions, and ad-hoc reflection exercises.

Learning Activities

Type	Name	Description
Reading	Week 4 Materials & Readings	Cooperative Learning and STEM Pedagogy Articles.

Week 5: The T in Stem

- An examination of the technology emphasis within the STEM framework including the need for embedded technology learning, a curriculum-focused approach and essential/key aspects for successful implementation.

- STEM technology examples and issues will also be explored.

- Integrating technology into STEM is multi-faceted.

Learning Activities

Type	Name	Description
Discussion	Week 5 Discussion	An exploration of the importance and various roles of technology in STEM education. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 5 Materials & Readings	Incorporating Technology in STEM Articles.

Week 6: The E in STEM

- An engineering approach to STEM education ensures cooperative learning is optimized.

- An examination of the engineering emphasis within the STEM framework including the distinctive role of engineering, a curriculum-related approach and essential/key aspects for successful implementation.

- STEM engineering examples and issues will also be explored.

- Engineering in STEM is multi-faceted.

Learning Activities

Type	Name	Description
Discussion	Week 6 Discussion	An exploration of the importance and roles of engineering in STEM education. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 6 Materials & Readings	Engineering as a Component of STEM Articles.

Week 7: The M in STEM

- An examination of the mathematical emphasis within the STEM framework including the need for embedded mathematical learning, a curriculum-focused approach and essential/key aspects for successful implementation.

- STEM math examples and issues will also be explored.

- Integrating math into STEM is multi-faceted.

Learning Activities

Type	Name	Description
Discussion	Week 7 Discussion	An exploration of the importance and various roles of math in STEM education. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 7 Materials & Readings	Embedding and Encouraging Math in STEM Articles. Complete the Rough Draft of the First Assignment.

Week 8: STEM Small Activity Lesson Plan Sharing

- Consolidation and refinement of education concepts demonstrated in a specific embedded STEM Science small activity lesson plan.

- Lesson plans will be informally shared for peer review to enable growth and enhancement.

Learning Activities

Type	Name	Description
Discussion	Week 8 Discussion	Present your draft lesson plan to facilitate group collaboration.
Reading	Week 8 Materials & Readings	Complete the First Assignment.

Week 9: STEM Small Activity Lesson Plan Presentations

- Consolidation of education concepts demonstrated in a specific embedded STEM Science small activity lesson plan.

- Final examination of STEM components and key pedagogical strategies.

Learning Activities

Type	Name	Description
Discussion	Week 9 Discussion	Present your group lesson plan.
Reading	Week 9 Materials & Readings	Optimizing STEM Articles.

Week 10: Progressing the STEM Learning Environment

- Final examination of STEM components and key pedagogical strategies.

- Maintaining and progressing the STEM learning environment is a careful balance among proper facilitation, collaboration, questioning techniques interspersed with teaching and learning emphasis,

- Curriculum planning and mapping are essential for success STEM education.

Learning Activities

Type	Name	Description
Discussion	Week 10 Discussion	Outlining how to maintain student engagement to create a robust thriving STEM learning environment. Class participation, discussions, and ad-hoc reflection exercises.

Learning Activities

Type	Name	Description
Reading	Week 10 Materials & Readings	Curriculum planning and mapping are essential for success STEM education. Enhancing STEM Engagement Articles. Using Feedback to Progress Competencies.

Week 11: Curriculum Planning for STEM

- An introduction to mapping overall/specific curriculum expectations across specific STEM disciplines with emphasis on integration and timing.

- Managing sustained versus dispersive STEM education while dealing with curriculum-dependency and overload will be explored.

- Maintaining optimal student engagement and growth requires careful corrective feedback and well-planned peer and teacher collaboration.

Learning Activities

Type	Name	Description
Discussion	Week 11 Discussion	Summarizing how to successfully manage the integration of Ministry expectations, student learning needs and STEM education. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 11 Materials & Readings	Maintaining optimal student engagement and growth requires careful corrective feedback and well-planned peer and teacher collaboration.

Week 12: Student Learning in STEM

- Facilitation of the STEM learning environment requires carefully planned student-teacher interactions and feedback.

- Ensuring a growth mind-set learning environment must be direct, purposeful and encompass a process/learning-centered approach in terms of student work and expected learning outcomes.

- The STEM learning environment must also be flexible to emphasis both individual and group work.

- The STEM learning environment is greatly enhanced by effective assessment and evaluation.

Learning Activities

Type	Name	Description
Discussion	Week 12 Discussion	An analysis of strategies to ensure the STEM learning environment is constructive and nurturing for all students. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 12 Materials & Readings	STEM Assessment and Evaluation Articles.

Week 13: STEM Assessment and Evaluation

- Different types of assessment and evaluation enhance STEM teaching and learning.

- Assessment, evaluation, and reporting practices must be fair, transparent, and equitable for all students, and are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning.

- With the STEM growth-centered environment, emphasis must be given to evidence of learning, triangulation and methods of measurement.

- Utilizing assessment and evaluation technology to document and facilitate incremental growth and learning capacity.

- Assessment and evaluation must also reflect optimal equity and inclusion of the STEM learning environment.

Learning Activities

Type	Name	Description
Discussion	Week 13 Discussion	Outlining assessment and evaluation concerns and strategies related to STEM education. Outlining strategies and technology to enhance evaluation. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 13 Materials & Readings	Stem-related Equity, Diversity and Inclusion Articles.

Week 14: Equity and Inclusiveness in STEM

- Global Competencies encompass knowledge, skills and attitudes/values.

- Integration of learning technology expands and progresses student learning competencies.

- STEM education is built on a learning environment that is non-threatening, respectful, equitable and inclusive to nurture student diversity.

Learning Activities

Type	Name	Description
Discussion	Week 14 Discussion	Successful STEM education integrates and demonstrates these competencies in a non-threatening, respectful, equitable and inclusive learning environment that supports individual methods and outcomes of learning. Addressing how technology plays a prominent role in the learning environment. Class participation, discussions, and ad-hoc reflection exercises.
Reading	Week 14 Materials & Readings	Complete the Rough Draft of the Second Assignment.

Week 15: STEM Large Activity Lesson Plan Sharing

- Consolidation and refinement of education concepts demonstrated in an integrated STEM large activity lesson plan.

- Lesson plans will be informally shared for peer review to enable growth and enhancement.

Learning Activities

Type	Name	Description
Discussion	Week 15 Discussion	Present your draft lesson plan to facilitate group collaboration.
Reading	Week 15 Materials & Readings	Complete the Second Assignment.

Week 16: STEM Large Activity Lesson Plan Presentations

- Consolidation and refinement of education concepts demonstrated in an integrated STEM large activity lesson plan.

- STEM education typically integrates a large extent of Ministry curriculum ultimately resulting in dispersive interdisciplinary learning.

Learning Activities

Type	Name	Description
Discussion	Week 16 Discussion	Present your group lesson plan.
Reading	Week 16 Materials & Readings	Complete the Second Assignment.

Week 17: STEM Large Activity Lesson Plan Presentations

- Consolidation and refinement of education concepts demonstrated in an integrated STEM large activity lesson plan.

- STEM education typically integrates a large extent of Ministry curriculum ultimately resulting in dispersive interdisciplinary learning.

Learning Activities

Type	Name	Description
Discussion	Week 17 Discussion	Present your group lesson plan.
Reading	Week 17 Materials & Readings	Complete the Second Assignment.

Week 18: STEM Large Activity Lesson Plan Presentations

- Consolidation and refinement of education concepts demonstrated in an integrated STEM large activity lesson plan.

- STEM education typically integrates a large extent of Ministry curriculum ultimately resulting in dispersive interdisciplinary learning.

Learning Activities

Type	Name	Description
Discussion	Week 18 Discussion	Present your group lesson plan. A conclusion to concepts explored during the course.
Reading	Week 18 Materials & Readings	Contemporary STEM Issues Articles.

Assessment Activities

Type	Name	Description
Assignment	Ongoing: Class participation, discussions and ad-hoc reflection exercises.	Professionalism includes how well each candidate contributes to the learning of others. Teacher candidates are expected to demonstrate participation through diligent preparation, critical analysis, and thoughtful commentary on the material being discussed in each class. Periodically reflections based on class concepts/discussions may be due during class.
Summative Assessment	Due Week 9: Lesson Plan Report 1	Design a detailed lesson plan for a small activity (3-5 periods) integrates intermediate/senior Ontario curriculum addressing how it embeds all of the components of STEM and will be effectively delivered. This assignment is completed in groups (size will be determined during the course based on time needed). Groups will present this lesson plan peers for review/evaluation. The submitted lesson plan will only be evaluated by the instructor.
Summative Assessment	Due Weeks 16-18: Lesson Plan Report 2	Design a detailed lesson plan for a small activity (3-5 periods) integrates intermediate/senior Ontario curriculum addressing how it embeds all of the components of STEM and will be effectively delivered. This assignment is completed in groups (size will be determined during the course based on time needed). Groups will present this lesson plan peers for review/evaluation. The submitted lesson plan will only be evaluated by the instructor.

This course meets the following Course Outcomes:

Understand Technological Development: Understand how rapid technological development has opened up incredible educational opportunities in all areas of education including STEM education.

Provide Instruction in STEM Education: Provide conscientious and effective instruction in STEM education that upholds and models the ethical standards of the teaching profession (Care, Trust, Respect, and Integrity).

Methodologies & Strategies: Develop, use, and critically evaluate methodologies and strategies for use in STEM programs.

Design, Use, & Evaluate All Resources: Design, use, and critically evaluate teaching, learning, assessment, and evaluation resources for use in STEM education.

Utilize Effective Strategies: Utilize effective strategies for fostering a safe, positive, and socially just and equitable learning environment in the context of teaching STEM.

Support Students in Technology: Support students in the use of STEM-related technology in the lab and classroom.

How to Protect Your Professional Integrity:

The Bachelor of Education is an intense and demanding program of professional preparation. Teacher Candidates are expected to demonstrate high levels of academic commitment and professional integrity that align with both Western University's Academic Rights and Responsibilities and the Professional Standards and Ethical Standards set by the Ontario College of Teachers. These expectations govern your time in class, in your Practicum, in your Alternative Field Experiences, and include the appropriate use of technology and social media.

The Teacher Education Office will only recommend teacher candidates for Ontario College of Teachers certification when candidates have demonstrated the knowledge of, and adherence to, the faculty polices throughout the two-year program.

To review the policies and practices that govern the Teacher Education program, including attendance, plagiarism, progression requirements, safe campus and more, visit: edu.uwo.ca/CSW/my-program/BEd/policies.html

Faculty of Education Pass/Fail Policy:

All courses and assignments in the Bachelor of Education are assessed as Pass/Fail.

Instructors will make the Success Criteria of the assignments clear, and refinements of the criteria may take place in class as a means of co-constructing details of the assignments in the first two weeks of a course. This will allow for differentiation of process, product and timeline depending upon student needs.

Success Criteria will

- Articulate what needs to occur to demonstrate learning outcomes for a course/assignment;
- Inform the instructional process so that teaching can be adapted to ensure students continue to remain on track to meet the criteria as needed and appropriate.
- Align with the assignments created to provide opportunities for students to demonstrate the knowledge, skills and abilities they are working toward;
- Establish clear descriptive language that allows Teacher Candidates to identify, clarify and apply the criteria to their work and to their engagement in peer feedback;
- Focus the feedback on progress toward meeting the overall and specific tasks/assignment goals for the course.

Participation:

Participation is essential to success in the Teacher Education program. As a professional school, you need to treat coming to class as showing up for work in the profession. If you are not in class, you cannot participate. Actively participating in discussions, peer reviews/feedback, group work and activities is integral to the development of your own learning and to the learning within your classroom community.

Given the varied experiences of Teacher Candidates in the program, you may engage with ideas/concepts or skills that are familiar or unfamiliar to you.

A Professional Teacher Candidate is one who:

- Arrives in class (virtual or online) on time, and prepared. This includes completing any readings, viewing assignments or tasks in advance of class as requested.
- Listens to others and contributes thoughtfully to discussions;
- Models respectful dialogue and openness to learn, monitors, self-assesses and reformulates one's prior beliefs and understandings in light of new information;
- Monitors and addresses their wellness, practices self-care, and seeks appropriate support when necessary.

Support Services & Resources:

Health and Wellness
uwo.ca/health

Peer Support
westernusc.ca

Learning Skills
uwo.ca/sdc/learning

Indigenous Services
Indigenous.uwo.ca

Student Accessibility Services
sdc/uwo.ca/ssd

Writing Support
writing.uwo.ca

Financial Assistance
registrar.uwo.ca

Not sure who to ask?
Contact the Teacher Education Office at eduwo@uwo.ca