WERKLUND SCHOOL OF EDUCATION
UNDERGRADUATE PROGRAMS IN EDUCATION

AB

EDUC 427.04: STEM Education (K-12)
Summer 2024

Class Dates: Monday through Friday, July 8, 2024-July 19, 2024

Last Day to Add/Drop/Swap: Due to the non-standard dates associated with this program, please check your Student Centre for the important dates pertaining to your section.

Pre-requisite: Due to the multiple pathways in the Bachelor of Education, please consult Undergraduate Programs in Education for questions related to pre-requisite courses.

Office Hours: By appointment only

Email: Students are required to use a University of Calgary (@ucalgary.ca) email address for all correspondence.

Course Description

EDUC 427 STEM Education provides an introduction to key elements of Science, Technology, Engineering, and Mathematics (STEM) pedagogy and curriculum. The intent of the course is to foster an understanding of how STEM informs and shapes interdisciplinary, design-focused, inquiry-based teaching and learning and the role of STEM in culture and society.

Learning Outcomes

Course participants will:

1) Develop a foundational understanding of the nature of discourse in STEM disciplines;
2) Understand and appreciate the STEM processes of mathematics, science, and computational thinking, and the engineering design process that contribute to teaching and learning of mathematics and science;
3) Develop pedagogical knowledge through the work of *relearning* mathematics curriculum content. The *relearning* of a math concept is a method for developing mathematical thinking and understanding math for teaching and learning;
4) Design learning environments in STEM; and,
5) Apply introductory literature related to the teaching of STEM with an emphasis on mathematics, the implementation of resources, the classroom environment, diverse and innovative methods of teaching within STEM, and an introduction to the Alberta Programs of Study.

Course Design and Delivery

The course is delivered through a design-based and inquiry-focused approach where learning intent, expectations and assessment processes are made visible and transparent. Participation is crucial to the knowledge building in this course.

After the *course is completed*, you may be invited to participate in research involved in this course. The instructors will not know whether you will be participating in the research.

Required Readings: [on D2L]

Alberta Education (2022). *Mathematics Kindergarten to Grade 6 Curriculum.* Learn Alberta: Government of Alberta. https://curriculum.learnalberta.ca/printable-curriculum/en/home

Alberta Education (2022). *Science Kindergarten to Grade 6 Curriculum.* Learn Alberta: Government of Alberta. https://curriculum.learnalberta.ca/printable-curriculum/en/home

Alberta Education (2014). *Program of Study: Mathematics Kindergarten to Grade 9*. Edmonton: Government of Alberta. https://education.alberta.ca/media/3115252/2016_k_to_9_math_pos.pdf

Alberta Education (2008). *Program of Study: Mathematics Grade 10 to Grade 12*. Edmonton: Government of Alberta. https://education.alberta.ca/media/564028/math10to12.pdf

Alberta Education (2003/2009/2014). *Program of Study: Sciences Grades 7-8-9.* Edmonton: Government of Alberta. https://education.alberta.ca/media/3069389/pos_science_7_9.pdf

Boaler, J. (2016). Chapter 2: The power of mistakes and struggle. *Mathematical Mindsets*, (pp. 11-20). Jossey-Bass. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=4444210

Clements, D., & Sarama, J. (2023). Rethinking STEM in the elementary grades: Honoring the special role of math in cognitive development. *American Educator. 47*(1), 16-21. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=162608765&site=ehost-live

Davis, B., Francis, K., & Friesen, S. (2019). STEM Education by Design. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=5763030

Fry, K, & English, L. (2023). How big is a leaf? Mathematical modeling through STEM inquiry. *Mathematics Teacher: Learning and Teaching PK-12, 116*(2), 99-107. DOI: 10.5951/MTLT.2022.0219

S01- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22802980600004336?auth=SAML
S02- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816884360004336?auth=SAML
S03- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816889560004336?auth=SAML
S04 – https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816901230004336?auth=SAML

National Council of Teachers of Mathematics (n.d.). *Building STEM Education on a Sound Mathematical Foundation.* Retrieved from https://www.nctm.org/Standards-and-Positions/Position-Statements/Building-STEM-Education-on-a-Sound-Mathematical-Foundation/

National Science Teaching Association (n.d.). *STEM Education Teaching and Learning.* Retrieved from https://www.nsta.org/nstas-official-positions/stem-education-teaching-and-learning

Next Generation Science Standards-NGSS (n.d.). *Engineering design.* Retrieved from https://www.nextgenscience.org/topic-arrangement/msengineering-design

Maiorca, C. & Roberts, T. (2022). Problem-solving by design: The integrated STEM practices. *Elementary STEM Journal, 27*(5), 20-21. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=158676077&site=ehost-live

Roberts, T. & Maiorca, C. (2023). Revisiting the integrated STEM practices. *Elementary STEM Journal,27*(4), 19-20. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=163577231&site=ehost-live

Swecker, M. (2020). Coding in the primary classroom. *Elementary STEM Journal, 25*(1), 26-27. [See D2L]

Taylor, C. & Lee, J. (2021). Ready, set, launch!- The engineering cycle for productive struggle. *Mathematics Teacher: Learning and Teaching PK-12, 114* (2), 117-124. DOI: 10.5951/MTLT.2019.0218
S01 – https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22803093480004336?auth=SAML
S02 – https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816884420004336?auth=SAML
S03 – https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816889620004336?auth=SAML
S04 – https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816901290004336?auth=SAML

Watson, L.A., Bonnesen, C.T., & Strayer, J.F. (2021). The nature of mathematics: Let's talk about it. *Mathematics Teacher: Learning & Teaching PK-12. 114*(5), 352-361. DOI: 10.5951/MTLT.2020.0226
S01- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22803093480004336?auth=SAML
S02- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816884430004336?auth=SAML
S03- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816889630004336?auth=SAML
S04- https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/citation/22816901300004336?auth=SAML

Wilcox, J., & Lake, A. (2018). Teaching the Nature of Science to Elementary Students. *Science & Children, 55*(5), 78–85. https://doi-org.ezproxy.lib.ucalgary.ca/10.2505/4/sc18_055_05_78

Wilcox, J., Kruse, J., & Decker, S. (2021). Exploring the STEM landscape: Integrating the natures of STEM to elementary Earth science. *Science and Children, 58*(6), 30-37. DOI: 10/1080/19434812.2021.12291692 https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=151165800&site=ehost-live

Williams, K. (2023). Problem-based learning in computer science. *Elementary STEM Journal, 27*(4), 6-8. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=163577226&site=ehost-live

Wing, J.M. (2006). Computational Thinking. *Communications of the ACM, 24*(3), 33. 10.1145/1118178.1118215 https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/abs/10.1145/1118178.1118215

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 1: Teaching and learning mathematics in the twenty-first century. (pp. 1-4, 8-13). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [see D2L]

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 2: Exploring what it means to know and do mathematics. (pp. 24-31). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [see D2L]

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 9: Developing basic fact fluency. (pp. 184-189). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [see D2L]

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 12: Developing strategies for multiplication and division computation. (pp. 268-284). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [see D2L]

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 13: Algebraic thinking, equations, and functions. (pp. 293, 298-305, 310-322, 326-327) *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [see D2L]

Readings and Resources that may be helpful for the Learning Tasks:

To find e-books in the library, enter the title in the *search box* on the library's home page at http://library.ucalgary.ca/

Alberta Regional Professional Development Consortium (2024). *Curriculum Resources: Mathematics.* Retrieved from https://arpdc.ab.ca/focuses/math/?site_language=english

Alberta Regional Professional Development Consortium (2024). *Curriculum Resources: Science.* Retrieved from https://arpdc.ab.ca/focuses/science/?site_language=english

Alonso Yanez, G., Thumlert, K., de Castell, S., & Jenson, J. (2019). Toward a production pedagogy model for critical sciences and technology interventions. In P. Sengupta., M.-C. Shanahan., & B. Kim (Eds.). *Critical, transdisciplinary and embodied approaches in STEM education* (pp. 41–60). Springer. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=6000776&ppg=57

Boaler, J. (2016). Chapter 3: The creativity and beauty in mathematics. *Mathematical Mindsets*, (pp. 11-20). Jossey-Bass. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=4444210

Finkle, Dan (2016 February). *Five Principles of Extraordinary Math Teaching* [Video]. Ted Talks. https://www.ted.com/talks/dan_finkel_5_ways_to_share_math_with_kids?language=en

Hour of Code. (n.d.) https://hourofcode.com/ca/learn

Posamentier, A. (2003). *Math Wonders to Inspire Teachers and Students.* ASCD. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=3002073

Small, M. (2013). *Eyes on Math: A Visual Approach to Teaching Math Concepts.* Nelson.

Small, M. (2015). *Making Math Meaningful to Canadian Students, K-8* (3rd Ed.). Nelson. [Doucette Library]

Small, M. (2014). *Uncomplicating Fractions to Meet Common Core Standards in Math, K-7*. Teachers College Press. [Doucette Library]

Truesdell, P. (2014). The engineering design process. In *Engineering essentials for STEM instruction: How do I infuse real-world problem solving into science, technology, and math?* (p. 7-15) Alexandria, VA: ASCD. [library e-version available] http://ebookcentral.proquest.com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?ppg=12&docID=1709532&tm=1500497319721

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022c). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [Doucette Library – multiple editions available]

Software:

- *Desmos* Open Software: https://desmos.com
- *Scratch* Open Software: https://scratch.mit.edu/
- *Hour of Code* Open Software: hourofcode.com
- *CS Unplugged* https://csunplugged.org/en/
- *Makerspaces* https://library.ucalgary.ca/services/makerspace
- *Minecraft* Open Software: https://education.minecraft.net/hour-of-code

Learning Tasks Overview

Completion of all assigned tasks is required for a passing grade in the course. All tasks should follow the American Psychology Association (APA) style 7th Edition for in-text citations and references.

Regular and active participation is an essential aspect of any community knowledge building. Participation means interacting during class conversations and discussions, engaging in class tasks and activities.

You are expected to engage fully in the knowledge building community, demonstrating that you have reviewed the assigned weekly readings, reflected critically on what you have read and what you have contributed to knowledge building, and that you are engaging with peers in a collaborative and supportive dialogue.

Note: Each instructor will bring different sets of expertise to this course and therefore each course might be enacted slightly differently. Please refer to instruction from your course instructor on specific enactment of the learning tasks and activities for your section, including engagement with generative AI.

LEARNING TASK	DESCRIPTION OF LEARNING TASK	PERCENT OF FINAL GRADE
LT1	***LT1 – Building Understanding of STEM Disciplines and STEM Interdisciplinary Problem Solving*** **Part A: Journal Entry: Initial Thoughts** **Part B: Journal Entry: End of Course Understandings** **Due: July 11 and 19 in D2L Dropbox**	30%
LT2	***LT2 – Building Understanding of the M in STEM through Relearning a Key Math Concept. [35%]*** **Due: July 16 in Dropbox**	35%
LT3	***LT3 – Building Understanding of STEM concepts through Engineering Design [Team work]*** **Due July 19 in D2L Dropbox**	35%

Schedule

STEM: Interdisciplinary Problem Solving and the M in STEM

	Topics/Themes	**Readings and Assignments**
Day 1	Introduction to STEM Education **Big Ideas**: Discuss the STEM processes within each discipline. What are some distinctions and connections?	Wilcox et al. (2021) Explaining the STEM Landscape Wing (2006) Computational Thinking Davis et al., (2019) Chapter 5: Engineering *or* NGSS: Engineering Design Work on **LT1**
Day 2	STEM Processes and Mathematics	**Readings**: Van de Walle et al., (2022). Chapter 1 (pp. 1-4, 8-13) Van de Walle et al., (2022). Chapter 2 (pp. 24-31) Boaler (2016) Chapter 2: Power of Mistakes

	Topics/Themes	Readings and Assignments
	Big Ideas: Invitation to Learn as Math Teacher; What does it mean to *do* and *learn* mathematics?	**LT2** Key Math concept from: Alberta Education (2022). Math K-6 curriculum Alberta Education (2014) Math 7-9 curriculum Alberta Education (2018) Math 10-12 curriculum **Work on LT1**
Day 3	STEM Processes and *Relearning* Mathematics for teaching **Big Ideas:** What does it mean to *learn* and *relearn* math content? Explore the difference between visuals, manipulatives, and symbolic mathematical representations.	Clements & Sarama (2023) Rethinking STEM in the elementary grades Van de Walle et al., (2020). Chapter 9: (pp. 184-189) Developing fact fluency Van de Walle et al., (2020) Chapter 12: (pp. 268-284) Developing strategies for multiplication and division computation. Work on LT2
Day 4	Mathematical and Computational Thinking **Big Ideas:** What are the connections between mathematical thinking and computational thinking?	Alberta Education (2022). Science K-6 Curriculum (Computational Thinking) -Handout on Mathematical Thinking [on D2L] Swecker (2020). Coding in the primary classroom Van de Walle et al. (2020). Chapter 13: (pp. 293, 298-305, 310-322, 326-327) Algebraic thinking, equations, and functions. **LT1: Part A Due (D2L Drop Box)**
Day 5	Technology: Plugged and Unplugged **Big Ideas:** What and how does technology support STEM interdisciplinary problem-solving?	Davis et al., (2019) Chapter 4: Technology CS Unplugged https://csunplugged.org/en/ Williams (2023). Problem-based learning in computer science *Instructor will decide on technology to be explored Work on LT2 and LT3
Day 6	STEM interdisciplinary problem solving and the nature of STEM disciplines	Watson, et al., (2021) The nature of mathematics Wilcox & Lake (2018) Teaching the nature of science

	Topics/Themes	Readings and Assignments
	Big Ideas: Understand the purpose of collaborative work and the relationships between STEM processes	Maiorca & Roberts (2022) Problem-solving by design: The integrated STEM practices Optional Reading (LT3) Fry & English (2017) How big is a leaf? Work on LT2 and LT3
Day 7	STEM Interdisciplinary Problem Solving and STEM design **Big Ideas:** Understand importance of Collaborative team work, STEM processes, STEM Education, and clearly identifying the math and science curriculum learning outcomes.	Davis et al., (2019) Chapter 7: STEM Education NCTM (n.d.) Building STEM Education on a Sound Math Foundation NSTA (n.d.) STEM Education **LT2 Due (D2L Dropbox)**, working on LT3
Day 8	STEM and Engineering Design Process **Big Ideas:** The importance and purpose of the engineering design process within STEM education.	Taylor & Lee (2017) Ready, set, launch! Work on LT3
Day 9	STEM Education **Big Ideas:** The importance of collaborative team work, and *relearning/unpacking* concepts for teaching.	Roberts & Maiorca (2023) Revisiting the integrated STEM practices Work on LT3
Day 10	STEM Education **Big Ideas:** Collaboration for teaching and learning	STEM LT3 Presentations **LT 1 Part B** and **LT3 Due**

- Schedule may change in accordance with course intent and expectations.

Learning Tasks

LT1 – Building Understanding of STEM Disciplines and STEM Interdisciplinary Problem Solving (35%)

This learning task has two parts. The intent is to capture your initial understandings and then reflect upon your growth of new insights about STEM education. *You may find that daily journal writing, photos, or videos of your thinking/work will support your knowledge development for LT1.*

Part A: Students will write an initial summary of their understanding about what the purpose of STEM Education and the nature of the STEM disciplines. This will be in the form of a journal narrative or essay format with a 500 word maximum.

Part B: Students will write about their new insights of STEM Education, nature of STEM disciplines, and how inquiry-based, problem-based STEM pedagogies will inform their future teaching practices. This work will be in the form of a journal narrative or essay format with a 500 word maximum.

Criteria For Assessment of Learning Task 1

Criteria	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory
Knowledge Development about STEM Education and disciplinary thinking processes. (50%)	Student can demonstrate a robust understanding of STEM Education and interdisciplinary problem-solving processes through meaningful reflections and references to course readings and learning experiences	Student demonstrates a good understanding of STEM Education and interdisciplinary problem-solving processes through course reflections and some meaningful references to course readings and learning experiences.	Student is still developing an understanding of STEM Education and interdisciplinary problem-solving processes from the course readings and course learning experiences.	Student is not demonstrating an understanding of STEM Education and problem-solving processes from the course readings and learning experiences.
Correct and meaningful citations of course readings and other resources (35%)	The references are meaningful and properly cited in APA 7th edition.	There are one to two mistake(s) found in the APA 7 references (e.g. missing comma, period, italics, etc.). Most of the citations are meaningful to the student's work.	There are three to four mistakes in the APA 7 references. Few of the citations are meaningful to the student's work.	There are more than four mistakes in the APA 7 reference list. Citations are not meaningful for the student's work.
Organization and Presentation Clarity (15%)	The student's journal writing of STEM learning is easy to follow, clarity in thoughts, and relatability to course readings and/or course learning experiences.	The student's journal writing of STEM learning has some key points, sections of work may lack clarity or relatability to the course readings and/or course learning experiences.	The student's journal writing of STEM learning is difficult to understand and does not present a progression of developing a deeper understanding of STEM education. Points lack clarity or relatability to course readings and/or learning experiences.	Student is unable to present a coherent demonstration of work and learning.

LT2 – Building Understanding of the M in STEM through *Relearning* a Key Math Concept

Students will:

- Explore multiple representations for a math concept from the Alberta Curriculum;
- Explain the difference between a math visual and manipulative;
- Discuss your role as a math learner and math teacher;
- Discuss what you learned through the *relearning* process and how this will inform your future teaching practice.

You may find that daily journal writing, photos, or videos of your thinking/work will support your knowledge development for LT2.

This learning task is a personal narrative to share your insights from this *relearning* process. This personal narrative will include a detailed description of the selected math concept, knowledge of the concept through definitions, visuals, manipulatives, and connections to other math concepts. Photos of your personal work with math visuals, manipulatives, and/or paper and pencil work will accompany your written descriptions. 500-1000 words for your responses to the above prompts. This can be composed through PowerPoint slides, Word document, or a medium acceptable by your instructor.

Criteria For Assessment of Learning Task 2

Criteria	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory
Knowledge Development through *relearning* of a Math Concept(s) **(30%)**	Student can demonstrate a robust understanding of a select mathematics concept. Multiple representations and/or connections to other mathematics concepts are accurately portrayed in student work.	Student demonstrates a good understanding of select mathematics concept(s). Minimal representations and/or connections to other mathematics concepts are portrayed in student work.	Student is still developing a conceptual understanding of the selected mathematics concept. Only one representation of the mathematics concept(s) is portrayed in student work.	Student is not demonstrating/sharing work evident of relearning or unpacking a math concept.
Relearning math concept with reflections on course readings **(25%)**	Student can demonstrate a robust understanding of their relearning/unpacking a math concept with excellent (meaningful) references to the course readings or resources that are specifically related to mathematics thinking, teaching and learning.	Student demonstrates a good understanding of course readings about mathematical thinking, learning and teaching. Moderate references made with meaningful connections to the student's work.	Student is still developing an understanding of the course readings regarding mathematical thinking, learning and teaching. Minimal references are made that have meaningful connections to the student's work.	Student does not understand the course readings regarding mathematics thinking, learning and teaching. No meaningful references are made regarding their work.
Correct citations of course readings and other resources **(15%)**	The references are properly cited in APA 7th edition.	There are one to two mistake(s) found in the APA 7 references (e.g. missing comma, period, italics, etc.).	There are three to four mistakes in the APA 7 references.	There are more than four mistakes in the APA 7 reference list.

Organization and Presentation Clarity **(15%)**	Students' presentation of mathematical learning is easy to follow (has a beginning, middle, end, and future considerations for mathematics learning and teaching).	Students' presentation of mathematical learning has some key points, sections of work may lack clarity or relatability to the course readings.	Students' presentation of mathematical learning is difficult to understand and does not present a progression of developing a deeper understanding of the mathematical concept.	Student is unable to present a coherent demonstration of work and learning.
Addressing Future Applications for the Mathematical Knowledge Learned and Presented in this Assignment **(15%)**	Student clearly articulates how (such as what grade or specific learning outcomes) their new mathematical knowledge can be used for the future work of teaching.	Student communicates some insight about how their new mathematical knowledge can be applied in their future work of teaching.	Student is still developing an understanding about how new mathematical understandings from relearning a math concept can assist their future work of teaching.	Student does not mention any future applications of their presented mathematical knowledge.

LT3: Building Understanding of STEM through the Engineering Design Process

* Instructor will have final decision on which technology may be used for the STEM design.

The group (maximum of 4 members) will design a STEM challenge that will clearly reflect the engineering design process, address a real-world problem, and state for whom this real-world design will benefit (purpose). The main curriculum content can include any disciplinary area (or multiple disciplinary areas) but must include specific mathematics content and science content (from Alberta Education Curriculum).

This design STEM challenge will:

- State a description of the STEM challenge;
- incorporate interdisciplinary problem solving through engaging the STEM processes (scientific inquiry, mathematical thinking, computational thinking, and engineering design process);
- engage students in collaborative team work;
- explicitly describe which learning outcomes from Alberta Education curriculum (including grade and discipline) and at least one math and science curriculum outcome being addressed in the STEM challenge, along with reasoning for why these learning outcomes were selected for this STEM challenge.

Presentation: The format for which the group will share the STEM challenge will be through an appropriate medium that is suitable for demonstrating the STEM challenge description, processes, and learning outcomes. This format will be discussed with the instructor.

Criteria For Assessment of Learning Task 3

Design challenge	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory
Challenge	Created an authentic, and inquiry-based STEM challenge, that centralizes the theme of *Real-World Problem.* There is clear communication about a real world *need* for this design and how (and whom) the design may benefit.	Created a STEM challenge that is authentic, that touches upon the theme of *Real-World Problem*. There is moderate communication about the real world *need* for this design and how (and for whom) this design may benefit.	Created a STEM challenge but does not accurately reflect the expectation for this challenge. May not have all needed information. There is no communication about the *need* for the design and how (whom) this design may benefit.	Did not create STEM challenge.
Concept Identifications Minimum to incorporate- Mathematics x 2 Science x 1	All concepts are clearly, accurately, and sufficiently identified and developed within the challenge. Direct connections are made to the Alberta curriculum.	Most concepts are accurately identified and developed within the challenge. Connections are made to the Alberta curriculum. More detail is required, or a concept is missing.	Concepts are insufficiently identified, underdeveloped, and/or missing.	Concepts are not stated and/or inaccurate.
Concept Explanations	Reasoning for why these concepts were selected for the challenge are clearly articulated. Strong ways the concepts connect to the challenge are clearly and accurately explained.	Reasoning for why the concepts were selected for the challenge lacks sufficient description. Concept connections to STEM challenge are explained. More detail is needed.	Reasoning for why the concepts were selected for the STEM challenge are not sufficient or underdeveloped. The ways the concepts are connected or addressed by the challenge are vague.	Reasoning for why the concepts were selected was not stated. Concept connections to the STEM challenge are not evident.

Engineering Design Process	Clearly articulates and illustrates how learners will recognize and apply the components of the engineering design process as found in the challenge.	Articulates how learners will recognize and apply the components of the engineering design process as found in the challenge.	Articulates an engineering design process that is generic and/or superficial to the challenge.	Does not articulate an engineering design process.
Presentation	Presentation of challenge is ready, easily accessible to understand the purpose and learning outcomes. STEM Education goals and processes are clearly articulated and evident.	Presentation of challenge is ready and mostly accessible to understand the purpose and learning outcomes. STEM Education goals and processes are somewhat evident and/or articulated.	Presentation of challenge is mostly ready. Group work is still developing in the purpose and clarity of the learning outcomes. STEM Education goals and processes are not clear or evident.	Presentation is not ready and/or does not provide the purpose or any connection to curricular learning outcomes.

THE EXPECTATION OF EXCELLENCE IN PROFESSIONAL WORK

Please review the Academic Calendar carefully. It describes the program and provides detailed schedules and important dates. It contains information on expectations for student work and professional conduct. In addition, procedures are described regarding concern about student performance in the program. Please pay especially careful attention to details and descriptions in the following topic areas:

- *The Importance of Attendance and Participation in Every Class*

As this is a professional program, experiences are designed with the expectation that all members will be fully involved in all classes and in all coursework experiences. As you are a member of a learning community your contribution is vital and highly valued, just as it will be when you take on the professional responsibilities of being a teacher. We expect that you will not be absent from class with the exception of documented instances of personal or family illness or for religious requirements.

- *Engagement in Class Discussion and Inquiry*

Another reason for the importance of attendance and participation in every class is that the course involves working with fellow students to share ideas and thinking. For example, each class you will work with a small group to engage fellow students in discussions on work being considered in class. You will also help other groups by providing ideas for scholarly inquiry in assignments. If you find that you are experiencing difficulties as a group collaborating, please inform the instructor.

EXPECTATIONS FOR WRITING

All written assignments (including, to a lesser extent, written exam responses) will be assessed at least partly on writing skills. Writing skills include not only surface correctness (grammar, punctuation, sentence structure, etc.) but also general clarity and organization. Sources used in research papers must be properly documented. If you need help with your writing, you may use the writing support services in the Learning Commons. For further information, please refer to the official online University of Calgary Calendar, Academic Regulations, E. Course Information, E.2: Writing Across the Curriculum: http://www.ucalgary.ca/pubs/calendar/current/e-2.html

LATE SUBMISSIONS

All late submissions of assignments must be discussed with the instructor **prior to the due date.** Students may be required to provide written documentation of extenuating circumstances (e.g. statutory declaration, doctor's note, note from the University of Calgary Wellness Centre, obituary notice). A deferral of up to 30 days may be granted at the discretion of the Associate Dean of Undergraduate Programs with accompanying written evidence.

ISSUES WITH GROUP TASKS

With respect to group work, if your group is having difficulty collaborating effectively, please contact the instructor immediately. If a group is unable to collaborate effectively or discuss course materials online in a timely manner, the instructor may re-assign members to different groups or assign individual work for completion.

GRADING

Grade	GPA Value	%	Description per U of C Calendar
A+	4.0	95-100	Outstanding
A	4.0	90-94	Excellent – Superior performance showing comprehensive understanding of the subject matter
A-	3.7	85-89	
B+	3.3	80-84	
B	3.0	75-79	Good - clearly above average performance with knowledge of subject matter generally complete
B-	2.7	70-74	
C+	2.3	65-69	
C	2.0	60-64	Satisfactory - basic understanding of the subject matter
C-	1.7	55-59	
D+	1.3	52-54	Minimal pass - Marginal performance
D	1.0	50-51	
F	0.0	49 and lower	Fail - Unsatisfactory performance

Students in the B.Ed. program must have an overall GPA of 2.5 in the semester to continue in the program without repeating courses.

Academic Accommodation
It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf. Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf. Students needing an accommodation in relation to their coursework based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to their Instructor.

Academic Misconduct
For information on academic misconduct and its consequences, please see the University of Calgary Calendar at http://www.ucalgary.ca/pubs/calendar/current/k.html

Attendance/ Prolonged Absence
Students may be asked to provide supporting documentation for an exemption/special request. This may include, but is not limited to, a prolonged absence from a course where participation is required, a missed course assessment, a deferred examination, or an appeal. Students are encouraged to submit documentation that will support their situation. Supporting documentation may be dependent on the reason noted in their personal statement/explanation provided to explain their situation. This could be medical certificate/documentation, references, police reports, invitation letter, third party letter of support or a statutory declaration etc. The decision to provide supporting documentation that best suits the situation is at the discretion of the student.

Falsification of any supporting documentation will be taken very seriously and may result in disciplinary action through the Academic Discipline regulations or the Student Non-Academic Misconduct policy.

https://www.ucalgary.ca/pubs/calendar/current/n-1.html

The Freedom of Information Protection of Privacy Act prevents instructors from placing assignments or examinations in a public place for pickup and prevents students from access to exams or assignments other than their own. Therefore, students and instructors may use one of the following options: return/collect assignments during class time or during instructors' office hours, students provide instructors with a self-addressed stamped envelope, or submit/return assignments as electronic files attached to private e-mail messages.

For additional resources including, but not limited to, those aimed at wellness and mental health, student success or to connect with the Student Ombuds Office, please visit https://www.ucalgary.ca/registrar/registration/course-outlines

Education Students Association (ESA) President for the academic year is Claire Gillis, esa@ucalgary.ca.

Werklund SU Representative is TBA, educrep@su.ucalgary.ca.