Erin Spring

EDUC 427.02: STEM Education
Elementary
Fall, 2025

Land Acknowledgement: *The University of Calgary, located in the heart of Southern Alberta, both acknowledges and pays tribute to the traditional territories of the peoples of Treaty 7, which include the Blackfoot Confederacy (comprised of the Siksika, the Piikani, and the Kainai First Nations), the Tsuut'ina First Nation, and the Stoney Nakoda (including Chiniki, Bearspaw, and Goodstoney First Nations). The City of Calgary is also home to the Métis Nation of Alberta (Districts 5 and 6).*

Class Dates: September 2- December 5, 2025
Truth and Reconciliation Day: September 30, 2025
Term Break: November 10-14, 2025
Field Experience I: October 6-17, 2025

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): This course introduces key elements of Science, Technology, Engineering, and Mathematics (STEM) education, including curriculum, pedagogy, standards, and assessment. This interdisciplinary course is for all first-year education students. The intent of the course is to foster an understanding of how STEM can inform and be used to shape teaching and learning across grade levels and subject areas. In so doing, participants will attend to STEM's role in culture and society.

LEARNER OUTCOMES:

Course participants will:

1) Develop a foundational understanding of the nature of discourse in STEM disciplines;
2) 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;

3) Understand and appreciate the STEM disciplinary processes of mathematics, science, and computational thinking, and the engineering design process that contribute to teaching and learning of mathematics and science;
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 Curriculum and Programs of Study.

COURSE DESIGN AND DELIVERY: This course will be delivered face-to-face on campus with possible engagement in a D2L environment. The course will be 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. Students will require access to a computing device that contains current software and hardware capable of running D2L, creating documents for learning tasks, and ability to run free programming platform software such as Scratch. If you do not own a personal device, there are computer available for student use in the Doucette library and the Taylor Family Digital Library.

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 Text:

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2026). *Elementary and middle school mathematics: Teaching Developmentally (7th Canadian ed.).* Pearson.

Available at the UofC Bookstore or Pearson Education
https://www.pearson.com/en-ca/subject-catalog/p/elementary-and-middle-school-mathematics-canadian-edition/P200000012025/9780138305055

REQUIRED RESOURCES:

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

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

Brown, P. (2024). Activating Learning with Phenomena. *Science and Children*, *61*(5), 9–11. https://doi-org.ezproxy.lib.ucalgary.ca/10.1080/00368148.2024.2386972

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://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=7a07f98b-b228-3e3a-a0e0-1c9f7ba723b1

CS Unplugged (n.d.). What is computational thinking? CS Unplugged. https://csunplugged.org/en/ https://csunplugged.org/en/

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 [pdf in Leganto D2L]

Maiorca, C. & Roberts, T. (2022). Problem-solving by design: The integrated STEM practices. *Elementary STEM Journal, 27*(5), 20-21. https://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=ccc4cc0d-4c61-3cfd-b1f6-d910a2f325c7

National Council of Teachers of Mathematics-NCTM (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-NSTA (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

Nickels, M., Bush, S. B., Fralish, B., Karp, K., Taylor, M. S., Bush, S. R., & Karp, J. (2018). Computer programming: Algorithm for mathematics exploration! *Elementary STEM Journal*, *23*(2), 14–17. https://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=a5cc0d66-c51e-3b33-baf0-3130a98c096c

Roberts, T. & Maiorca, C. (2023). Revisiting the integrated STEM practices. *Elementary STEM Journal,27*(4), 19-20. https://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=09f4826d-fec7-3418-9d29-2e3ada1d7e30

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 [pdf in Leganto D2L]

Welty, K. (2021). Literature-Based STEM: Leveraging Children's Books to Teach Science, Technology, Engineering and Mathematics. *The Elementary STEM Journal*, *25*(4), 33–36. https://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=46136337-beaa-3906-80ac-2b9df02625f9

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://www-tandfonline-com.ezproxy.lib.ucalgary.ca/doi/abs/10.1080/19434812.2021.12291692

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 3: Math inquiry through rich tasks and classroom discourse (pp. 35-46). *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [pdf in Leganto D2L]

Van de Walle, J.A., Karp, K.S., Bay-Williams, J.M., & McGarvey, L.M. (2022). Chapter 13: Computational Thinking. (326-327) *Elementary and middle school mathematics: Teaching Developmentally (6th Canadian ed.).* Pearson Canada. [pdf in Leganto D2L]

Additional 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

Clements, D. H., & Sarama, J. (2016). Math, Science, and Technology in the Early Grades. *The Future of Children*, *26*(2), 75–94. https://muse-jhu-edu.ezproxy.lib.ucalgary.ca/article/641244

CS Unplugged https://csunplugged.org/en/

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

Langevin, N., Takeuchi, M.A., Yuen, J., & Jacques, S. (2021). Fostering geometric mathematical understanding through the early STEM classroom. *Delta-K: Journal of the Mathematics Council of the Alberta Teacher's Association, 57*(1), 29-34. https://prism.ucalgary.ca/bitstream/handle/1880/114415/Langevin,%20Takeuchi,%20Yuen%20and%20Jaques%202021.pdf?sequence=1

Piggott, J. (2014). *Rich tasks and contexts.* http://nrich.maths.org/5662

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

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

Swecker, M. (2020). Coding in the primary classroom. *Elementary STEM Journal, 25*(1), 26-27. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=145712727&site=ehost-live

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] https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=1709532&ppg=12

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

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

Example Activity for Linking Cubes:
https://nrich.maths.org/2283

Software and other resources that *might* be used in the course:

- *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/
- *Minecraft* Open Software**:** https://education.minecraft.net/hour-of-code
- *Makerspaces* https://library.ucalgary.ca/services/makerspace

- Makerspace UCalgary provides students and staff access to 3D printing, 3D Milling, Rasberry Pis, and Arduino board kits with laptops

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, including the **pace** for **Topics** and specifics from **Readings**. Each instructor may supplement weekly readings from the Additional Resource List. 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 (see AI statement for Learning Tasks below).

LEARNING TASK	DESCRIPTION OF LEARNING TASK	GROUP / INDIVIDUAL	WEIGHT	DUE DATE
LT1	***LT1 – Build Understanding of STEM Disciplines, STEM as Interdisciplinary Problem Solving, and Teaching STEM*** **(Reflective Learning)** **Part A: Journal Entry: Initial Thoughts** **Part B: Journal Entry: End of Course Understandings** Learning Outcomes 1, 2, 3, and 5	Individual	**Part A**: 15% **Part B:** 25%	**Part A**: Due **Sept. 15** in D2L Dropbox **Part B:** Due **Dec. 5** in D2L Dropbox
LT2	***LT2 – Building Understanding of the M in STEM through Relearning a Key Math Concept.*** Learning Outcome 1, 2, and 3	Individual	30%	Due: **Oct. 3** in D2L Dropbox
LT3	***LT3 – Building Understanding of STEM concepts through Engineering Design [Team work]*** Learning Outcome 4 and 5	Group	30%	Due: **Nov. 28** in D2L Dropbox

Further grading details on Learning Task Assessments are included in the Learning Task Rubrics.

STEM: Interdisciplinary Problem Solving and the M in STEM

WEEKLY COURSE SCHEDULE:

Date	Topic	**Readings and Tasks** (each section may vary with pace and pages assigned from readings)	Due Dates

Week 1 Sept. 2-5	Introduction to STEM Education **Big Ideas**: Discuss the disciplinary processes within STEM. What are some distinctions and connections?	NSTA (n.d.) STEM Education NCTM (n.d.) Building STEM Education on a Sound Math Foundation Optional/Additional: -Alberta Education (2022) Math: Subject Introduction (K-6) -Alberta Education (2022) Science: Subject Introduction (K-6)	
Week 2 Sept. 8-12	Mathematics in STEM **Big Ideas:** Invitation to Learn as Math Teacher; What does it mean to *do* and *learn* mathematics?	Van de Walle et al., (2026). Chapter 1 (pp. 2-4; pp.8-9 Math Processes; pp.10-12 Invitation to Learn and Grow): Welcome as a Math Learner Van de Walle et al., (2026). Chapter 2 (pp. 23-27: Math proficiency strands – different kinds of mathematics knowledge) Van de Walle et al. (2022): Ch. 3 (pp. 35-46) Math inquiry (science inquiry) and mathematical thinking. Clements & Sarama (2023) Rethinking STEM in the elementary grades **Note for LT2 – select an elementary math concept for *relearning*.** You may want to select from additional resources list to support your work for LT2	
Week 3 Sept. 15-19	*Relearning* Mathematics for teaching math and STEM **Big Ideas:** What does it mean to *learn* and *relearn* math content? Explore the difference between *visuals*, *manipulatives*, and *symbolic* **(numerical digits, operation symbols, and math expressions)** mathematical representations.	Instructor will select pages from the following chapters: Van de Walle et al. (2026) Chapter 7 (LO 7.4 Math and STEM) Van de Walle et al. (2026) Chapter 10 (place-value importance) Boaler (2016) Chapter 2: Power of Mistakes and Struggle Example: Why use linking cubes? https://nrich.maths.org/10061	**LT1: Part A Due September 15**
Week 4 Sept. 22-26	*Relearning* Mathematics for teaching math and STEM **Big Idea:** How does *relearning* a math concept in	Van de Walle et al., (2026) Chapter 12 Multiplication and Division	

	depth and breadth inform teaching pedagogy?	**Link LT2 math concept to learning outcomes:** Alberta Education (2022). Math K-6 curriculum	
Week 5 Sept. 29-Oct. 3 No class Sept. 30	Mathematical and Computational Thinking **Big Ideas:** What are the connections between mathematical thinking and computational thinking?	Van de Walle et al. (2026) Chapter 14 Algebraic Thinking in Elementary, equal sign, patterns. Nickels et al. (2018) computer programming : algorithm for math exploration! Van de Walle et al. (2022) Ch. 13 Computational Thinking (pp. 326-327)	LT2 Due October 3
Oct. 6-10		Field I – no STEM classes	
Oct. 13-17		Field I – no STEM classes	
Week 6 Oct. 20-24	Technology: Plugged and Unplugged **Big Ideas:** How does programming and unplugged activities assist in developing computational thinking?	Wing (2006) Computational Thinking Computational Thinking and CS Unplugged - CS Unplugged https://www.csunplugged.org/en/computational-thinking/ Davis et al. (2019) Ch. 4 Technology Alberta Education (2022) Science K-6: Computational Thinking *Instructor will decide on technology will be used in this course section.	
Week 7 Oct. 27-31	Science and Computational Thinking **Big Ideas:** Scientific inquiry, method, and computational thinking. How does Alberta Education incorporate these in K-6?	Alberta Education (2022) Science K-6 curriculum (Scientific Method/inquiry) Brown (2024) Activating Learning with Phenomena Fry & English (2023) How big is a leaf? (Math/measurement/science)	
Week 8 Nov. 3-7	STEM and Engineering Design Process **Big Ideas:** The importance and purpose of the engineering design process within STEM education.	Wilcox et al. (2021) Exploring the STEM Landscape Davis et al., (2019) Chapter 5: Engineering *or* NGSS: Engineering Design Make LT3 Groups	
Nov. 10-14		Fall Break	
Week 9	STEM Education	Watson, Bonnesen, & Strayer (2021) The nature of Math	

Nov. 17-21	**Big Ideas**: The importance of understanding the nature of science and math; as well as connections between math, science, and computational thinking for interdisciplinary problem solving	Wilcox & Lake (2018) Teaching the nature of science Roberts & Maiorca (2023) Revisiting the integrated STEM practices	
Week 10 Nov. 24-28	Interdisciplinary Problem Solving and STEM design **Big Ideas:** Understand importance of collaboration, team work, STEM education as a way to approach problem solving and culturally responsive pedagogy.	Davis et al., (2019) Chapter 7: STEM Education Van de Walle et al. (2026) Ch. 6 Equitable practices for all disciplines	LT3 Due
Week 11 Dec. 1- 5	STEM Education **Big Ideas:** Collaboration for teaching and learning	STEM LT3 Presentations	**LT1 Part B**: Due **December 5**

CHANGES TO SCHEDULE:

Please note that changes to the schedule may occur to meet the emerging needs and dynamics of the participants in the course.

LEARNING TASKS AND ASSESSMENT

Generative AI :

- AI tools can be used for creating assignment outlines or critiquing drafts, but the final work must be original.
- Students must not copy or paraphrase from AI applications for assignments
- AI tools will be prohibited for major assignments, or research papers but allowed for information gathering.
- All other considerations for AI use must be cleared with the instructor.

There are three required Learning Tasks for this course.

LT1 – Build Understanding of STEM Disciplines, STEM as Interdisciplinary Problem Solving, and Teaching STEM – Reflective Learning (40%)

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 within a range of 500-750 words.

Criteria For Assessment of Learning Task 1: Part A

Criteria	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory
STEM Education. (35%)	Student can demonstrate an honest statement of place in understanding of STEM Education through meaningful reflections and references to course readings and learning experiences	Student demonstrates a good understanding of their initial understanding of STEM Education through course reflections and some meaningful references to course readings and learning experiences.	Student is still developing an understanding of STEM Education and from the course readings and course learning experiences.	Student is not demonstrating an understanding of STEM Education from the course readings and learning experiences.
Developing knowledge about the nature of STEM disciplines. (35%)	Student can demonstrate an honest statement about current understandings regarding the nature of STEM disciplines through meaningful reflections and thoughts about excitements, and concerns about this knowledge.	Student demonstrates a reasonable statement of initial understandings regarding of the nature of STEM disciplines through course reflections and some meaningful references to course readings and learning experiences.	Student is still developing an understanding of the nature of STEM disciplines from the course readings and course learning experiences.	Student is not demonstrating an understanding of the nature of STEM disciplines from the course readings and learning experiences.
Correct and meaningful citations of course readings and other resources (15%)	The references are meaningful and properly cited in APA 7th edition.	Most of the citations are meaningful to the student's work. There are one to two mistake(s) found in the APA 7 references (e.g. missing comma, period, italics, etc.).	Few of the citations are meaningful to the student's work. There are three to four mistakes in the APA 7 references.	Citations are not meaningful for the student's work. There are more than four mistakes in the APA 7 reference list.
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.

Criteria For Assessment of Learning Task 1: Part B

Criteria	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory

Knowledge Development about STEM Education and disciplinary thinking processes. (30%) **Meaningful References (10%)**	Student can demonstrate a robust **understanding of STEM Education** and **disciplinary thinking processes** through **meaningful reflections** and references to course readings and learning experiences	Student demonstrates a good understanding of STEM Education and disciplinary thinking processes through course reflections and some meaningful references to course readings and learning experiences.	Student is still developing an understanding of STEM Education and disciplinary thinking processes from the course readings and course learning experiences.	Student is not demonstrating an understanding of STEM Education and disciplinary thinking processes from the course readings and learning experiences.
Reflection on how inquiry-based, problem-based pedagogies will inform future teaching practices. (25%) **Meaningful References (10%)**	Student can demonstrate a robust understanding of how STEM pedagogies will **inform their future teaching practices** through **meaningful reflections** and references to course readings and learning experiences	Student demonstrates a good understanding of STEM pedagogies will inform their future teaching practices through course reflections and some meaningful references to course readings and learning experiences.	Student is still developing an understanding of STEM pedagogies from the course readings and course learning experiences.	Student is not demonstrating an understanding of STEM pedagogies from the course readings and learning experiences.
Correct citations of course readings and other resources **APA 7 (10%)**	The references are meaningful and properly cited in APA 7th edition.	Most of the citations are meaningful to the student's work. There are one to two mistake(s) found in the APA 7 references (e.g. missing comma, period, italics, etc.).	Few of the citations are meaningful to the student's work. There are three to four mistakes in the APA 7 references.	Citations are not meaningful for the student's work. There are more than four mistakes in the APA 7 reference list.
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 (30%)

Students will:

- Select a math concept from the book *Elementary and Middle School Mathematics*, for developing deeper understanding of symbolic notation, operations, and/or contextual meanings (units and measurement); [Concepts: select from Chapters 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 22 with additional sources]
- Discuss and confirm math concept selection with your instructor (to avoid multiple overlaps);

- Explore multiple representations such as pictorial, visual in drawings, graphs drawn, or images created, manipulatives or other concrete materials, for the math concept and find the learning outcomes within the Alberta Curriculum that involve this math concept.
- 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.
- Prepare to share a highlight, ah-ha moment, short activity, or new insight you gained from your math work. This is informal sharing with the purpose of learning from one another (approx.. 2 minutes each in class and/or share on D2L).

You may find that daily journal writing, ***photos, and examples of your messy work,*** *or videos of your thinking/work (examples of your messy 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 development of the concept through definitions, visuals, manipulatives, context (units), 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. This can be composed through PowerPoint slides, Word document, or a medium acceptable by your instructor. As a guide for written text, please consider 500-1000 words for your written work.

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's personal engagement of the work.	Student demonstrates a good understanding of select mathematics concept(s). Minimal representations and/or connections to other mathematics concepts are portrayed in student's personal engagement of the 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's personal engagement of the work.	Student is not demonstrating/sharing work evident of relearning or unpacking a math concept.
Relearning math concept with *reflections* on course readings. **Personal insight gained through engaging in mathematical thinking/processes** **(30%)**	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. Students' reflections are clear with articulating new insights gained from the math work.	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. Students' reflections show some insight regarding personal insight gained.	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. Students' reflections show a developing stage of understanding how mathematical thinking and	Student does not understand the course readings regarding mathematics thinking, learning and teaching. No meaningful references are made regarding their work. Students' reflections are not insightful or relevant to the mathematics work presented in this learning task.

			relearning/unpacking a math concept informs teaching practice.	
Correct citations of course readings and other resources **(10%)**	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 **(10%)**	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 **(10%)**	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.
Informal sharing of a mathematical insight(s) gained from your mathematics work (10%)	Student is well prepared and shares a sample of learning that will benefit the collective. Clear communication/presentation of insight/activity/manipulative benefits the collective.	Student shares a sample of learning. Student is mostly prepared with clear communication/presentation of insight and/or material.	Student shares a sample of learning but lacks insight that can benefit the collective. Student is mostly prepared for sharing a sample of work for the collective.	Student does not share any learning insight that benefits the collective. Student does not clearly communicate/present insight in a manner that benefits the collective.

LT3: Building Understanding of STEM through the Engineering Design Process (30%)

* Instructor will have final decision on which technology may be used for the STEM design. The software list in the course resources are suggestions, if and when the instructor requires student use of such resources. Instructor may incorporate other software/hardware not included in that list.

The group (maximum of 4 members) will design a STEM challenge for *Making the World a Better Place.* This STEM challenge will clearly reflect the engineering design process, address an authentic 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) in conjunction with specific mathematics content and science content (from Alberta Education Curriculum). Students are expected to design this STEM challenge keeping in mind how this could be addressed/implemented in a grade school classroom. Keep a reflection record of the group's design process work for creating this STEM challenge, as this will be a part of the group assessment.

This design STEM challenge will:

- State a description of the STEM challenge;
- incorporate interdisciplinary problem solving through engaging the STEM disciplinary processes (scientific inquiry, mathematical processes, 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.

Group members will receive the same grade.

Criteria For Assessment of Learning Task 3

Design Challenge	Excellent (A+ to A)	Good (A- to B)	Satisfactory (B- to C)	Unsatisfactory
Challenge (30%)	-Created an authentic, and problem-based STEM challenge, that centralizes the theme of *Making the World a Better Place.* -There is clear communication about a real world *need* for this design and how (and whom) the design may benefit. -All of the interdisciplinary processes are clearly incorporated into the STEM challenge.	-Created a STEM challenge that is authentic, that touches upon the theme of *Making the World a Better Place*. -There is moderate communication about the real world *need* for this design and how (and for whom) this design may benefit. -Most of the interdisciplinary processes are evident in the STEM challenge.	-Created a STEM challenge but does not accurately reflect the expectation for this challenge. -There is no communication about the *need* for the design and how (whom) this design may benefit. -Only two processes are evident in the STEM challenge.	Did not create STEM challenge. It is not clear how interdisciplinary problem-solving is used in this challenge.

Concept Identifications and rationale. Minimum to incorporate- Mathematics x 2 Science x 1 (25%)	-All math and science learning outcomes are clearly, accurately, and sufficiently identified and developed within the challenge. -Direct connections are made to the Alberta curriculum. -Reasoning for why these math and science concepts were clearly articulated.	-Most concepts are accurately identified and developed within the challenge. -Connections are made to the Alberta curriculum. -More detail is required, or a learning outcome does not have a relevant connection for the work. - Reasoning for why the concepts were selected for the challenge lacks sufficient description.	-Concepts are insufficiently identified, underdeveloped, and/or missing. -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.	-Concepts are not stated and/or inaccurate. -Reasoning for why the concepts were selected was not stated. Concept connections to the STEM challenge are not evident.
Engineering Design Process (25%)	-Describe and reflect on the engineering design process that future students and yourselves engaged in for this STEM challenge. -Clearly articulated how this design process informed your learning as a future math/science teacher. -Clear sharing of the group's design messy work during the design process of creating the STEM challenge.	-Description of components for the engineering design process are described for the potential future students of this STEM challenge. -The group mentions how the design process will inform future teaching practices. -The group's messy work provides some insight into the design process.	-Components of the engineering design process are not included. -The group does not provide an in-depth or clear description of how the design process informs their future teaching practice. -The group's design messy work does not adequately reflect the process for creating this STEM challenge.	Does not articulate an engineering design process.
Presentation (in-class) (15%) APA 7 (5%)	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.

- *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: https://calendar.ucalgary.ca/pages/2c2d1ce47b8c4d008aec9cc3da49876e

MISSING OR LATE SUBMISSIONS

All late submissions of assignments must be discussed with the instructor **prior to the due date.** A deferral of up to 30 days may be granted at the discretion of the Associate Dean of Undergraduate Programs prior to the end of the course with accompanying written evidence. https://calendar.ucalgary.ca/pages/jyekfh6xwhoHwxcetCi1

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: https://calendar.ucalgary.ca/pages/fc4adb8643f84441ab32300237b80df1

Grade	GPA Value	%	Description
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

Academic Misconduct
Academic Misconduct refers to student behavior which compromises proper assessment of a student's academic activities and includes cheating; fabrication; falsification; plagiarism; unauthorized assistance; failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses; and failure to comply with exam regulations applied by the Registrar.

For information on the Student Academic Misconduct Policy and Procedure please visit:

https://www.ucalgary.ca/legal-services/university-policies-procedures/student-academic-misconduct-policy

https://www.ucalgary.ca/legal-services/university-policies-procedures/student-non-academic-misconduct-policy

Additional information is available on the Academic Integrity Website at: https://ucalgary.ca/student-services/student-success/learning/academic-integrity

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://ucalgary.ca/student-services/access/prospective-students/academic-accommodations.

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: https://www.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 or to fulfill requirements for a graduate degree based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the designated contact person in their faculty. The course outline should clearly list the appropriate Faculty contact person(s) and their contact details. For further information see E.1 C. Course Policies and Procedures https://calendar.ucalgary.ca/pages/a89ecfbf758841b5983c4b67746e7846

Research Ethics
Students are advised that any research with human participants – _including any interviewing (even with friends and family), opinion polling, or unobtrusive observation – _must have the approval of the Conjoint Faculties Research Ethics Board (https://research.ucalgary.ca/conduct-research/ethics-compliance/human-research-ethics/conjoint-faculties-research-ethics-board-cfreb) or the Conjoint Health Research Ethics Board https://research.ucalgary.ca/conduct-research/ethics-compliance/human-research-ethics/conjoint-health-research-ethics-board-chreb)

In completing course requirements, students must not undertake any human subjects research without discussing their plans with the instructor, to determine if ethics approval is required. Some courses will include assignments that involve conducting research with human participants; in these cases, the instructor will have applied for and received ethics approval for the course assignment. The instructor will discuss the ethical requirements for the assignment with the students.

For further information see E.5 Ethics of Human Studies
https://calendar.ucalgary.ca/pages/627ed88eb4b041b7a2e8155effac3501

Instructor Intellectual Property
Course materials created by instructors (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may NOT be reproduced, redistributed or copied without the explicit consent of the instructor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course at the same time may be allowed under fair dealing.

Freedom of Information and Protection of Privacy
Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary. For more information, please see: https://www.ucalgary.ca/legal-services/access-information-privacy

Copyright Legislation
All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy) and requirements of the copyright act (https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy https://www.ucalgary.ca/legal-services/university-policies-procedures/student-non-academic-misconduct-policy.

Sexual and Gender-Based Violence Policy
The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy

Other Important Information
Please visit the Registrar's website at: https://www.ucalgary.ca/registrar/registration/course-outlines for additional important information on the following:

- Wellness and Mental Health Resources
- Student Success
- Student Ombuds Office
- Student Union (SU) Information
- Graduate Students' Association (GSA) Information
- Emergency Evacuation/Assembly Points
- Safewalk

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 Tracy Dinh, esa@ucalgary.ca.

Werklund SU Representative is Siena Yee, educrep@su.ucalgary.ca