EDUC 427: STEM Education

Early Childhood/Elementary

Fall, 2021

Sec.		Day/Time	Location	Instructor
S01	On-Campus	MF 11.00-12.20	EDT 01	Miwa Takeuchi Miwa.Takeuchi@ucalgary.ca
S02	On-Campus	TR 8.00-9.20	EDT 01	Miwa Takeuchi Miwa.Takeuchi@ucalgary.ca
S01	On-Campus	TR 9.30-10.50	EDT 01	Polly Knowlton Cockett plknowlt@ucalgary.ca
S04	On-Campus	MF 12.30-13.50	EDT 01	Krista Francis kfrancis@ucalgary.ca
S05	On-Campus	MF 8.00-9.20	EDT 01	Krista Francis kfrancis@ucalgary.ca
S06	On-Campus	MF 14.00-15.20	EDC 171	Doug Stretch TBA

Class Dates: September 7-December 9, 2021

Field Experience I: October 12-22, 2021

Term Break: November 7-13, 2021

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 directly with your instructor

COURSE DESCRIPTION:

EDUC 427 (STEM Education): This course provides an introduction to 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:

In this course, students will:

1) Develop a foundational understanding of the nature of discourse in STEM disciplines as related to teaching and learning, including STEM literacy, STEM identity, and transferring understandings across disciplines;
2) Understand and appreciate how the engineering design process can contribute to teaching and learning mathematics and science;
3) Design learning environments in STEM;
4) Identify concepts and make explicit the connections across disciplines; and,
5) Apply introductory literature related to the teaching of STEM with an emphasis on 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 consists of three modules for class work and assignments. Modules include readings, class projects and assignments. Further details follow, including readings, assignments with grading schemes, and any required additional information.

You may be invited to participate in research involved in this course. However, the instructors will not know whether you will be participating in the research until after the end of the course, when grades have been submitted.

READINGS:

Common Readings Across Sections

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

Davis, B., Francis, K., & Friesen, S. (2019). *STEM Education by design: Opening horizons of possibility*. New York: Routledge. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=5763030

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

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

Section-Based Readings

Please follow your instructor's advice on which readings you should read for your section. Additional readings may be assigned by your instructor according to the emergent needs and particular course design for each section.

Defining STEM Education

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

Kantayya, S. (Producer). (2020). Coded Bias. 7th Empire Media. https://digitalcollections.ucalgary.ca/asset-management/2R3BF1SJT1WEM?WS=AssetManagement

Sabbagh, U. (2017). Science has already been inseparable from politics. https://blogs.scientificamerican.com/guest-blog/science-has-always-been-inseparable-from-politics/

Shanahan, M. C., Burke, L. E. C. A., & Francis, K. (2016). Using a boundary object perspective to reconsider the meaning of STEM in a Canadian context. Canadian Journal *of Science, Mathematics and Technology Education*, *16*(2), 129-139. https://doi-org.ezproxy.lib.ucalgary.ca/10.1080/14926156.2016.1166296

ViMAP

Sengupta, P., Brown, B., Rushton, K., & Shanahan, M-C. (2018). Reframing coding as "mathematization" in the K-12 classroom: Views from teacher professional learning. *Alberta Science Education Journal*, 45 (2), 28-36. Available from https://prism.ucalgary.ca/bitstream/handle/1880/107764/Reframing%20Coding%20as%20"Mathematization"%20in%20the%20K–12%20Classroom%20Views%20from%20Teacher%20Professional%20Learning.pdf?sequence=1

Scratch

Resnik, M. et al. (2009). Scratch: Programming for all. *Communications of the ACM, 52* (11), 60-67. https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/10.1145/1592761.1592779

EV3

Francis, K., Rothschuh, S., Hamilton, S., & Diehl, G. (2021). Steering a robot to engage in number and spatial sense. *The Variable*, 6(1), 15. http://www.smts.ca/wp-content/uploads/2021/02/The%20Variable%20-%202021%2C%206%281%29.pdf

Minecraft

Gee, J.P. (2012, March 19). *James Paul Gee on learning with video games*: Edutopia. https://www.edutopia.org/video/james-paul-gee-learning-video-games

Kim, B., Rasporich, S., & Gupta, D. (2019). Imagining the sustainable future through the construction of fantasy worlds. In P. Sengupta., M.-C. Shanahan., & B. Kim (Eds.). *Critical, transdisciplinary and embodied approaches in STEM education* (pp. 61–82). New York, NY: Springer. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=6000776&ppg=77

Stranger, D. (2021). *New Minecraft world to teach students about Anishinaabe culture*. Retrieved from https://www.aptnnews.ca/national-news/new-minecraft-world-to-teach-students-about-anishinaabe-culture/

Resources for LT2:

Banks, R. B. (2012). *Slicing pizzas, racing turtles, and further adventures in applied mathematics* (Reissue edition.). Princeton, NJ: Princeton University Press. [e-book in library] https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=894679

Banks, R. B. (2013). *Towing icebergs, Falling dominoes, and other adventures in applied mathematics* (Reissue edition.). Princeton, NJ: Princeton University Press.[e-book in library] http://ebookcentral.proquest.com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=1084830

Benson, S., Addington, S., Arshavsky, N., Cuoco, A., Goldenberg, E. P., & Karnowski, E. (2004). *Ways to think about mathematics: Activities and investigations for Grade 6-12 teach*. Thousand Oaks, Calif: Corwin Press Inc. [on reserve in Taylor Digital library]

Bolt, B. (1991). *Mathematics meets technology*. Cambridge ; New York: Cambridge University Press. [on reserve in Taylor Digital library]

Gardiner, T. (1996). *Mathematical challenge*. New York: Cambridge University Press. [on reserve in Taylor Digital library]

Gardiner, T. (2002). *Senior mathematical challenge: The UK national mathematics contest 1988-1996*. Cambridge; New York: Cambridge University Press. [on reserve in Taylor Digital library]

Hamilton, G. (2017) *Math pickle*. Available: http://mathpickle.com

Moscovich, I. (2006). *The big book of brain games: 1000 playthinks of art, mathematics & science*. New York, NY: Workman. [on reserve in Taylor Digital library]

Moskowitz. (2003). *Adventures in mathematics* (1 edition.). River Edge, N.J: World Scientific Publishing. [e-book in library] http://ebookcentral.proquest.com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=1681495

Shasha, D. (1992). *Codes, puzzles and conspiracy: A new mathematical thriller from Dr. Ecco*. New York, NY: W H Freeman. [in library]

Shasha, D. (1998). *The puzzling adventures of Dr. Ecco*. Mineola, NY: Dover Publications. [on reserve in Taylor Digital library]

Resources for LT3:

Your instructor will give an instruction of the specific resource to be used in your class (*Note:* you will not use all the listed resources for your LT3).

- *NetLogo* Open Software: https://ccl.northwestern.edu/netlogo/
- *ViMAP* Open Software: http://www.vimapk12.net/
- *Scratch* Open Software: https://scratch.mit.edu/
- *Minecraft* Open Software**:** https://education.minecraft.net/hour-of-code
  Note*: LT3** is a problem-based learning experience. This learning task requires you to have only an overview of the components of Minecraft. The accompanying document ***Getting Started with Minecraft provides resources to support you in the completion of LT3. A template from the World Library, https://education.minecraft.net/class-resources/worlds/
- *CS Unplugged* https://csunplugged.org/en/
- *Makerspaces* https://library.ucalgary.ca/education-makerspaces
- *Lego EV3 software* https://education.lego.com/en-us/downloads/mindstorms-ev3/software

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 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, and contributing to threaded discussions. 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 collaborative and supportive dialogue.

Note: Please refer to instruction from your course instructor on specific enactment of the learning tasks and activities for your section.

LEARNING TASK	DESCRIPTION OF LEARNING TASK	GROUP/ INDIVIDUAL	WEIGHT	DUE DATE
LT1	Inquiry into Teaching Through STEM Integration: Community Knowledge Building	Individual	30%	Biweekly
LT2	Mathematization and Designing of Rich Tasks	Group or Individual	25%	October 25
LT3	Pt. A: Designing a STEM Challenge (to be showcased at the STEM Showcase)	Group or Individual	25%	December 8
	Pt. B: Reflection on the Design of a STEM Challenge	Individual	20%	December 8

WEEKLY COURSE SCHEDULE:

Note: Please refer to instruction from your course instructor on specific weekly course schedule and readings for your section.

Class Dates: September 7-December 9, 2021

Field Experience I: October 12-22, 2021

Term Break: November 7-13, 2021

Date	Topic	Readings and Tasks
Week 1 Sep 7-10	Conceptualizing STEM education	Davis et al (2019). Chapter 1: STEM – disciplinarity vs transdisciplinating
Week 2 Sep 13-17	Conceptualizing STEM education	Sabbagh (2017) and/or Shanahan et al (2016) and/or Alonso Yanez et al (2019) Blog entry 1
Week 3 Sep 20-24	Mathematics in STEM education	Davis et al (2019). Chapter 3: Mathematics – calculation vs modeling and/or Sengupta, Brown, Rushton, & Shanahan (2018).
Week 4 Sep 27-Oct 1	Rich Mathematical Tasks in STEM education	Alberta Education Programs of Study (Science and Mathematics) Piggott, J. (2014) Blog entry 2
Week 5 Oct 4-8	Design in Learning	Davis et al (2019). Chapter 2: Learning – acquisition vs participating
Week 6 Oct 25-29	Technology in STEM education	**Submit LT2 by Oct 25** Kantayya, S. (Producer). (2020). *Coded Bias*.
Week 7 Nov 1-5	Computational Thinking in STEM education	Alberta Education Programs of Study (Science and Mathematics) Reading of your instructor's choice Explore the resource of your instructor's choice Blog entry 3
Week 8 Nov 15-19	Engineering Design Process	Davis et al (2019). Chapter 5: Engineering - Application vs Innovating NGSS (n.d.) Engineering design

Week 9 Nov 22-26	STEM Challenge Design	Reading of your instructor's choice Explore the resource of your instructor's choice Blog entry 4
Week 10 Nov 29-Dec 3	STEM Challenge Design	Reading of your instructor's choice Explore the resource of your instructor's choice
Week 11 Dec 6-9	STEM Showcase	Please follow your instructor's instruction on the STEM Showcase **Submit LT3 by December 8**

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

LT 1: INQUIRY INTO TEACHING THROUGH STEM INTEGRATION: COMMUNITY KNOWLEDGE BUILDING (INDIVIDUAL, 30%)

Due Date
Blog weeks (as specified in the above weekly schedule)

- Blogs: Wednesdays (midnight)
- Responses: Fridays (midnight)

Format: Blog Format, APA 7 formatting

The purpose of the learning task is to provide ongoing reflections on to the following question: *How has your conceptualization of teaching STEM through a design-based and inquiry-focused approach changed, been modified, or reinforced?* Your response will be in the form of a blog; that is, you will write from a personal perspective that allows you to connect directly with your readers and support knowledge building.

Note: While this is an overarching question, as a community of learners, we will pose prompts or sub-questions the week preceding the blog entry. Further details and explanations will be presented to you in class.

i For each of the specified blog weeks, you will post an approximately 500-word blog in D2L Discussions by Wednesday midnight.
ii You will then respond to two other peers by Friday midnight. Approximately 200 words each.

This connection allows you to interact and share ideas with your colleagues. Thoughtfully plan how you will engage the members of your class on your insights and learning. Your blogs and responses must be persuasive, that is, you should take a personal stance on the question and explain your response, using relevant and varied evidence. Your blog must include significant insights from:

- Professional discussions (In-Class Discussion and Activities)

- Course readings and resources (including In-Class Discussion on the readings)
- Current research
- Classroom observations/experiences

Note: Blog Entry 2
This week, we start working on Learning Task 2. This task engages conversations about rich and authentic problem-solving approaches to mathematics teaching and learning.

For this week's blog entry, please select one mathematical concept (e.g. area, perimeter, multiplication, addition, ratio, etc.). Once you choose a mathematical concept, look for its definition/s and identify one article (via Google Scholar) that reports common misconceptions of students' understanding of that concept. Outline the common misconception/s found in the article.

Post your blog entry in the following format:

1) Mathematical Concept:

2) Definition:

3) Article reporting common misconception/s:

4) Common Misconception/s:

CRITERIA FOR ASSESSMENT OF LEARNING TASK 1

Criteria	A to A+ Meets all and exceeds some requirements	B+ to A- Meets all requirements	B- to B Meets most requirements	Does not meet requirements
Articulates a clear, insightful and growing understanding of STEM concepts	Blog and responses are clearly communicated and reflects learners' understanding of key STEM concepts.	Blog and responses are clear and somewhat reflects learners' understanding of key STEM concepts.	Blog and responses are generally clear, but understanding of STEM concepts is not evident.	Blog and responses are unclear.
Relevant evidence from the readings and other sources to support responses	Build upon content from the readings, conversations, and experiences to open new possibilities in understanding. Demonstrates skillful use of high quality, credible, relevant sources to develop ideas that are appropriate for the discipline. Cites all content obtained from other sources. APA 7 citation style is accurate.	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline. Cites most content obtained from other sources. APA 7 citation style is accurate.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline. Cites some content obtained from other sources. Citation style is either inconsistent or incorrect.	Does not use credible and/or relevant sources to support ideas that are appropriate for the discipline. Does not cite sources.

Democratizing knowledge	Blogs mention/refer to at least two other posts from peers in a meaningful way.	Blogs mention/refer to other posts from peers in somewhat meaningful ways.	Blogs mention/refer to one other posts from peers but not in a meaningful way.	Blogs do not mention/make reference to one other posts from peers.

LT2: MATHEMATIZATION AND DESIGNING OF RICH TASKS (INDIVIDUAL OR GROUP, 25%)

Due Date: October 25

LT2 introduces you to how a rich and authentic problem-solving approach to teaching and learning helps to build students' conceptual understanding of concepts from a wide range of disciplines through mathematization.

By the end of this learning task you will be able to:

- Identify and develop student understanding of concepts within rich, inquiry focused and authentic problems that involve mathematization
- Connects these concepts explicitly to Alberta Education's *Programs of Study* strands and general outcomes
- Make connections between disciplinary concepts and mathematization

With instructor guidance, individually or in teams (max. of 4 members), you will research, develop and present a rich, real-to-the-world-of-the-child problem that authentically incorporates mathematization. The problem (or task) should help students develop their understanding of a concept in any grade or discipline, and they should engage in some form of mathematization to solve the problem or accomplish the task. You should be able to explain and justify why the task is a rich task using references to Piggott (2014) and why it is an example of mathematization using references to Sengupta et al. (2018) and Davis et al. (2019, Ch. 3). You may include additional references if you choose.

What you will design:

Create a presentation for an audience of preservice teachers (i.e., your classmates) that shares and explains your rich task and provides three example solutions to the task. The presentation can take any form that you choose (e.g., a narrated PowerPoint, an animated video, a booklet with photos). In terms of length, there really isn't a limit because it will vary a lot by format but something around 5-8 min. video, 8-10 narrated or annotated slides, 4-6 pages of text and illustrations would be appropriate.

Your presentation should include the following elements:

- An explanation (for a teacher audience) of what the rich task is and how you would introduce it to students (e.g., would they have read a particular book first, is this at the beginning or end of the unit, is there a set-up for the task—a story or case study?)
- A statement of the rich task for your students, including the question/problem, any guidance about materials or research, description of groups (if any). (This is the only component that is written with a student audience in mind.)
- An explanation of the disciplinary concept(s) with reference to the Alberta Programs of Study (any course/grade) and a description of the mathematization involved.

- An explanation and justification (using the references noted above) of why this is a rich task and why it is an example of mathematization.
- Three example solutions to the problem/task. These could be in the form of photos, sketches, models, writing, whatever is appropriate to your task.

CRITERIA FOR ASSESSMENT OF LEARNING TASK 2

Criteria	A to A+ Meets all and exceeds some requirements	B+ to A- Meets all requirements	B- to B Meets most requirements	Does not meet requirements
Presentation of the Mathematical Problem	Presents the mathematical problem through an Essential Question referenced to Design Thinking	Presents the mathematical problem through an Essential Question	Presents the mathematical problem	No presentation of the mathematical problem
Rationale	Clearly explains the intent of the task and why the problem is rich, inquiry focused and authentic to the world of the student.	Explains the intent of the task and why the problem is rich, inquiry focused and authentic to the world of the student.	Rationale is ambiguous and the problem is procedural and rote in nature.	No rationale provided. Problem is procedural and rote.
Relevant Evidence to Support Rationale	Demonstrates skillful use of high quality, credible, relevant sources to develop the rationale. Cites all content obtained from other sources. APA 7 citation style is accurate.	Demonstrates consistent use of credible sources to develop the rationale. Cites most content obtained from other sources. APA 7 citation style is accurate.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that develop the rationale. Cites some content obtained from other sources. Citation style is either inconsistent or incorrect.	Does not use credible and/or relevant sources to support the rationale. Does not cite sources.
Concept Identification: *Two mathematical concepts*	Identifies concepts contained in the problem with explicit connections to STEM components and the Mathematics PoS strands and general outcomes.	Identifies concepts contained in the problem with minimal connections to STEM components and/or the Mathematics PoS strands and general outcomes.	Concepts insufficiently identified, missing, or underdeveloped in the problem with missing connections to STEM components and/or the Mathematics PoS strands and general outcomes.	No concepts identify within the problem and no connections to STEM components and/or the Mathematics PoS strands and general outcomes.

LT3: DESIGNING AND REFLECTING ON A STEM CHALLENGE (PART A – GROUP 25%)

Due Date: December 8

Working as an individual or in a small group (max. of 4 members), you will design a rich and STEM design challenge that students could complete using a robotics or an online programming environment. The main context of the challenge can be any disciplinary area (or multiple disciplinary areas) but should intersect with mathematics and/or science in some way. Or it should intersect with some other discipline in some way, if the main context is mathematics or science. It should also address the broad topic of: *Building a Better World* (which can be interpreted in many different ways).

The product of the Learning Task will be a digital presentation of some type (e.g., narrated slideshow, website, video, etc.) to be showcased at the STEM Showcase (via D2L).

The presentation should include:

- A Statement of the challenge, as you would explain it to students. This should also include any relevant contextual information that you will use to introduce or frame the task for students. For example, if the task would come after reading a novel, briefly describe the novel and the activities students would have experienced that contribute to them understanding and completing the task. This contextual information could be things that happened over a few weeks (e.g., the novel) or it could include things just from one or two days that lead up to the task, whichever is appropriate for your task.
- An example "solution" to the task. This could be communicated by providing a link, screenshots, a supplementary video or any other means that illustrate a potential solution that you came up with to address the challenge posed to students.
- Describes and illustrates engineering design processes specific to the challenge. This should include describing how you engaged in engineering design processes to create your example solution and how you would scaffold engineering design processes while your students work on their solutions.
- Identifies and explains TWO disciplinary concepts intrinsic to the challenge; Explain the understanding of these concepts that students should have (or develop) to complete the task. "Students would understand that..." These can be from any discipline(s) in any grade.
- Identifies and explains at least ONE concept from math or science that is intrinsic to the challenge. (Or if the two disciplinary concepts above are from math or science, then one concept from another discipline.) This concept can be from the same grade or a previous grade but again explain the understanding that students would need to have or develop to complete the text. "Students would understand that..." In your presentation, be sure to use terminology that appears in our course readings.

Please refer to terminologies that appear in the following criteria for assessment:

Chapter 5 in Davis, B., Francis, K., & Friesen, S. (2019). *STEM Education by design: Opening horizons of possibility*. New York: Routledge. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=5763030

CRITERIA FOR ASSESSMENT OF LEARNING TASK 3, PT. A

Criteria	A to A+ Meets all and exceeds some requirements	B+ to A- Meets all requirements	B- to B Meets most requirements	Does not meet requirements
STEM Challenge				
Challenge	Created a rich, authentic, and inquiry-based STEM challenge, that centralizes the theme of *Build a Better World*.	Created a STEM challenge that is rich and authentic, that touches upon the theme of *Build a Better World*.	Created a STEM challenge but does not accurately reflect the expectation for this challenge. May not have all needed information.	Did not create STEM challenge.
Digital Presentation				

Criteria	A to A+ Meets all and exceeds some requirements	B+ to A- Meets all requirements	B- to B Meets most requirements	Does not meet requirements
STEM Challenge				
Engineer Design Process				
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.
Mathematics (x2) and Science (x1) Concepts				
Concept Identification	All concepts are clearly, accurately, and sufficiently identified and developed within the challenge. Direct connections are made to the Programs of Study general outcomes.	Most concepts are accurately identified and developed within the challenge. Connections are made to the Programs of Study. 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 Explanation	The ways that the concepts connect to the challenge are clearly, sufficiently, and accurately explained.	The ways that the concepts are addressed by the challenge is explained. More detail is needed.	The ways that the concepts are addressed by the challenge are ambiguous and/or generic.	The ways that the concepts are addressed by the challenge are not stated or are in accurate.
Digital Presentation				
Visual Presentation	Design and layout of presentation is creative, visually appealing, and effectively supports readable; using word count, font style, color, headlines, bullets, and numbers. Graphics (e.g., diagrams, picture, tables, figures, etc.) effectively enhance the text. Content is clearly arranged so that the viewer can easily understands the purpose of the challenge without narration. Cites all content obtained from other sources. APA 7 citation style is accurate.	Overall design and layout of presentation is visually appealing that supports readability. Adequate use of word count, font style, color, headlines, bullets, and numbers. Graphics enhance the text. Content is arranged so that the viewer can understand the purpose of the challenge without narration. Cites most content obtained from other sources. APA 7 citation style is accurate.	Design and layout of presentation is adequate but somewhat cluttered. Choice of word count, font style, color, headlines, bullets, and numbers detract from the readability. Graphics are limited in enhancing the text. Content arrangement is somewhat confusing and does not adequately assist the viewer in understanding order without narration. Cites some content obtained from other sources. Citation style is either inconsistent or incorrect.	Design and layout of presentation not very visually appealing; cluttered; choice of word count, font style, color, headlines, bullets, and numbers hinder readability. Graphics do not enhance the text. Organization, presentation, and readability is inconsistent and or distracting and does not adequately assist the viewer in understanding order without narration. Does not cite sources.

LT3, PT. B: BUILDING UNDERSTANDING OF TEACHING STEM COMPONENTS THROUGH A DESIGN-BASED AND INQUIRY-FOCUSED APPROACH (INDIVIDUAL 20%)

Due Date: December 8

Based on your conceptualization of STEM education, write a narrative (500 - 750 words) that reflects your own "*process of learning*" during this learning task and how these reflections will inform your own teaching. In particular, what would you need to consider in the design process in developing an inquiry-focused STEM challenge that reflects the theme of *Build a Better World*? The style of this submission should be a personal narrative, written in the first person. It can be submitted in any medium (e.g., written text, audio, or video recording).

CRITERIA FOR ASSESSMENT OF LEARNING TASK 3, PT. B

	Expert: A to A+ Meets all and exceeds some requirements	Practitioner: B+ to A- Meets all requirements	Apprentice: B- to B Meets most requirements	Unsatisfactory
Depth of Reflection	Demonstrates an in-depth reflection of own learning with insightful connections to the learning task. Interpretations are insightful and well supported with clear and detailed examples.	Demonstrates a general reflection of own learning with connections to the learning task. Interpretations are supported with examples.	A minimal reflection on own learning with minimal connections to the learning task. Interpretations are unsupported or supported with irrelevant examples.	Reflection demonstrates a lack of connection of own learning to the learning task. Interpretations are missing, inappropriate, and/or unsupported.
Evidence of Informed Teaching Practice	Reflection shows strong evidence of synthesis of ideas presented and insights gained throughout the learning task. The implications of these insights for teaching practice are thoroughly detailed. Clear links to the design process are provided.	Reflection shows evidence of synthesis of ideas presented and insights gained throughout the learning task. The implications of these insights for teaching practice are presented. Links to the design process are made.	Reflection shows little evidence of synthesis of ideas presented and insights gained throughout the learning task. Few implications of these insights for teaching practice are presented. Links to the design process are minimal.	Reflection shows no evidence of synthesis of ideas presented and insights gained throughout the learning task. No implications for teaching practice are presented. Links to the design process are minimal or not provided.
Composition of the Narrative	Writing is clear, concise, and well organized with excellent sentence and paragraph construction. Thoughts are expressed in a coherent and logical manner. There are minimal spelling, grammar, or syntax errors.	Writing is mostly clear, concise, and organized with good sentence and paragraph construction. Thoughts are expressed in a coherent and logical manner. There are a few spelling, grammar, or syntax errors.	Writing is unclear and or disorganized. Thoughts are not expressed in a logical manner. There a number of spelling, grammar, or syntax errors.	Writing is unclear and disorganized. Thoughts ramble and make little sense. There are numerous spelling, grammar, or syntax errors.

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.

Please note that A+ is an exceptional and a rare grade to be given only to works of excellence and of the highest quality.

Academic Accommodation

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/. Students who require an accommodation in relation to their coursework based on a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf.

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 Kyle Corry, esa@ucalgary.ca.

Werklund SU Representative is Dwani Joshi, educrep@su.ucalgary.ca.