AB

EDUC 535.09/.17/.23: Science Specialization II - Combined
Summer, 2024

Start date: Monday, July 8, 2024
Last Day of Classes: Friday, 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: Available after class or by appointment. Please add course number to the subject line of your email.

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

COURSE DESCRIPTION:
The intent of the Specialization Seminar II is to deepen your understanding of the practical aspects of teaching within the specialization and to connect this practice with specific theoretical concepts. While this second specialization course focuses more on practical knowledge, you will also refine your knowledge of discourse and theory within the discipline and develop a deeper understanding of ways to enact this theory in a classroom context. You will additionally become familiar with any relevant Ministry documents associated with the Alberta Curriculum and draw on practical classroom observation from the field experience to participate in meaningful discussion and to connect these observations with a vision for your own teaching. The emphasis of the course is on designing for student learning (subject-specific; assessment to strengthen student learning and improve instruction; and designing for inclusion, differentiation, and inquiry).

LEARNER OUTCOMES:
Over the course of the semester, students will:

1) Further develop a deeper conceptual understanding of the historical, socio-cultural, political contexts of the *discipline of Science Education*, and relate this to curriculum planning in the specialization area,
2) Identify and critique the *key learning perspectives* (as outlined in the front matter of the Programs of Study) and *intentions* (learning objectives) across the units in a grade from the Alberta Programs of Study,
3) Successfully apply theoretical knowledge to the design of a longer-term unit and assessment plan.

COURSE DESIGN AND DELIVERY:
This course will be delivered face-to-face on campus with some engagement in a D2L environment. This course is delivered through a problem-based and inquiry-focused approach. Student participation is crucial to the knowledge building in this course. While there are readings, they do not "contain" the knowledge of this course. Your learning will be primarily through applying concepts from the readings while you experience, design, and critique science learning activities. Students are expected to participate in whole-class and small-group discussions conversation and Desire2Learn (D2L) discussion forums that will include postings and responses in

small-groups. Assessment is based on rubrics for the three Learning Tasks. For most class activities, you will need a device with reliable internet connectivity to access D2L, the library website, YouTube, etc.

LEARNING TASKS OVERVIEW:

The full assignment descriptions and assessment details will be discussed in class and posted to D2L. The descriptions in this syllabus should be treated as summaries or overviews, not the full and complete assignment requirements.

LEARNING TASKS OVERVIEW

Learning Task	Description of Learning Task	Weight	Group/ Individual	Due Date
LT1	An Inquiry into Teaching Science: Knowledge Building in a Community of Inquiry	30%	Pair	Monday, July 15, 1:00 pm
LT2	Creation of a Unit and Assessment Plan	40%	Individual	Friday, July 19, 1:00 pm
LT3	Evolving Conceptual Understanding of Science Teaching	30%	Individual	Monday, July 22

Note: A and A+ are both worth 4.0. A+ is given at the instructor's professional discretion based on work of rare and exemplary quality.

AI-generated text

Students are expected to create their own content for all assignments and writing should be of their own work. AI-generated text is permitted as long as the text is appropriately cited with respect to which program generated the text and how the text was generated (e.g., keyword prompts) with a reference list using APA 7 format and appendix with full transcript.

"Quoted material" (OpenAI, 2023; see Appendix A for the full transcript).

Reference

OpenAI. (2023). *ChatGPT* (Sept 22 version) [Large language model]. https://chat.openai.com/chat

Readings

Reading protocols will be discussed during our first class.
The Leganto lists for these readings can be found in D2L under "My Tools".
Furthermore, here is the link:
https://ucalgary.alma.exlibrisgroup.com/leganto/public/01UCALG_INST/lists/22614231960004336?auth=SAML

DAILY COURSE SCHEDULE:

Date	Topic	Readings and Tasks
Day 1	**Essential Question (EQ): What are the goals of EDUC 535?** • EDUC 535 Course Outline review – LT1, LT2, and LT3 **What is science all about? What is your philosophy of science?** **What is an inquiry practice as an organizing principal?** **What does Alberta Education deem as curriculum?** Intro to LT1	**Review *Front Matter*** of the Science Programs of Study (PoS) *that supports your grade of interest either* gd. 1-6: What is science and organization , gd. 7 – 8: p.1 – 10 or any of the gd. 10 – 12 courses: p. 1 – 12. • Alberta Education, (nd). Programs of Study. https://www.alberta.ca/programs-of-study.aspx **Resources for LT1**: Alberta Assessment Consortium: https://aac.ab.ca/ Username: Uof C email Galileo Educational Network. (nd). *Guide to Assessing Critical Thinking.* http://www.galileo.org/tips/rubrics/ct_rubric.pdf Galileo Educational Network. (nd). Designing rubrics. *Focus on Inquiry* https://inquiry.galileo.org/ch3/designing-rubrics/ Black, P. (2003). The importance of everyday assessment. In J. M. Atkin & J. E. Coffey (2003). *Everyday Assessment in the Science Classroom*. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=355237 Trauth-Nare, A., & Buck, G. (2011). Assessment for learning. *The Science Teacher,* 78(1), 34-39. https://bit.ly/2ZukloI UMass Boston. (2017, February 17). *Formative assessment practices of science teachers* [video]. https://www.youtube.com/watch?v=O3Uca60nGK0

Day 2	**EQ: How do teachers manage both the physical and instructional format of an inquiry-based classroom?** Intro to LT3 In class time to work on LT1: refine your question.	**Readings for LT3** (assigned on day1): Dorfman, B-S., Issachar, H., & Zion, M. (2020). Yesterday's students in today's world – open and guided inquiry through the eyes of graduated high school biology students. *Research in Science Education, 50*, 123-149. https://link-springer-com.ezproxy.lib.ucalgary.ca/article/10.1007/s11165-017-9683-6 Grueber, D., & Whitin, P. (2012). Valuing little steps toward inquiry. Science and Children, 50(3), 41-45. http://ezproxy.lib.ucalgary.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=82669917&site=ehost-live Zangori, L., Forbes, C., & Biggers, M. (2012). This Is Inquiry... Right?. Science and Children, 50(1), 48-53. http://ezproxy.lib.ucalgary.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=79310878&site=ehost-live
Day 3	**EQ: How to manage both the physical and instructional format of an inquiry-based classroom?** Intro to LT2: whole/part/whole approach In class time to work on LT1	**Readings for LT3** (assigned on day 1): Abrahams, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. International Journal of Science Education, 30(14), 1945-1969. http://dx.doi.org.ezproxy.lib.ucalgary.ca/10.1080/09500690701749305 Millar, R. (2009). Analysing practical activities to assess and improve effectiveness: The Practical Activity Analysis Inventory (PAAI). York: Centre for Innovation and Research in Science Education, University of York. https://www.rsc.org/cpd/teachers/content/filerepository/frg/pdf/ResearchbyMillar.pdf National Academies of Sciences, Engineering, and Medicine. (2021). *Call to Action for Science Education: Building Opportunity for the Future*. https://nap.nationalacademies.org/catalog/26152/call-to-action-for-science-education-building-opportunity-for-the

Day 4	**EQ: What does it mean to be a "designer" of learning?**
	
	LT2
	• Stage 1. Identify Desired Results:
	  • Sci. Inquiry & Prob. Solving through Technology or
	  • STS/NoS, Knowledge, Skills, and Attitudes (KSAs).
	• Design thinking & Big Ideas
	
	In class time to work on LT1
		Resources for LT2:
		Wiggins, G. & McTighe, J. (2005). *Understanding by design* (2nd Edition). Alexandria, VA: Association for Supervision & Curriculum Development. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=3002118 *** see Ch. 3, 4, 5, & 6**
		
		Harlen, W. (2015). *Working with Big Ideas of Science Education.* Hatfield, UK: Association for Science Education. Chapter 3-4 (pp 11-33) https://www.interacademies.org/sites/default/files/publication/working_with_big_ideas_of_science_education_-_online_july_final.pdf

Day 5	**EQ: What does it mean to be a "designer" of learning?** LT2: Stage 1. Identify Desired Results LT#1: Workshops: schedule posted in D2L In class time to work on LT2, Stage 1	**LT#1 Due: Monday, 1:00 pm** **Resources LT2**: Grady, J. (2010). The inquiry matrix; A tool for assessing and planning inquiry in biology and beyond. *Science Teacher*, (November), 32–37. https://bit.ly/2zwdDiK Parmar, B. (2017, April 24). The one crucial skill our education system is missing. Retrieved from https://www.weforum.org/agenda/2017/04/one-crucial-skill/
Day 6	**EQ: What will you accept as evidence that student understanding took place?** LT2: Stage 2. Determine what constitutes acceptable evidence of competency in the outcomes and results (assessment). LT#1: Workshops In class time to work on LT2, Stage 2	**Resources for LT2:** *Understanding by design:* ***see Ch. 7 & 8**

Day 7	**EQ: How do you shift the responsibility of learning from the teacher to the students?** Stage 3: Planning the appropriate learning activities. LT#1: Workshops In class time to work on LT2, Stage 3	**Resources for LT2:** *Understanding by design*: ***see Ch. 9 & 10** Alberta Education. (2019). *Health and safety in the science classroom: Kindergarten to grade 12*. https://education.alberta.ca/media/3795623/health-and-safety-in-the-science-classroom.pdf Bybee, et al., (2006). The BSCS 5E Instructional Model: Origins, Effectiveness, and Applications. BSCS, 1–21. https://media.bscs.org/bscsmw/5es/bscs_5e_full_report.pdf
Day 8	**EQ: What does it mean to be a teacher of diversity?** Stage 4: Learner differentiation LT#1: Workshops In class time to work on LT2, Stage 4	**Resources for LT2:** Alberta Education. (2010). *Making a difference: Meeting diverse learning needs with differentiated instruction*: Chapter 13 (Science) http://education.alberta.ca/media/1234045/makingadifference_2010.pdf Alberta Education. (nd). Benchmarks, strategies, and resources for teachers of English language learners. http://www.learnalberta.ca/content/eslapb/

Day 9	**EQ:** What does it mean to be a teacher of diversity? Stage 4: Learner differentiation LT#1: Workshops In class time to work on LT2, Stage 4	**Reading** (assigned on day 1): Alberta Teachers' Association. (2020). *Foundational knowledge for indigenous education*. https://teachers-ab.libguides.com/c.php?g=710500&p=5068847 Kimmerer, R. (2013). Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teaching of plants. (pp. 216- 240) Milkweed Editions. https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=1212658#
Day 10	EQ: What does it means to be a reflective practitioner? Peer review of LT2	**LT#2: Due: Friday, July 19, 1:00 pm (for peer review). Final draft Monday, July 22** **LT#3: Due Monday, July 22**

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
There are 3 required Learning Tasks for this course. Completion of all tasks is required to pass this course.

LT1: ***Design a science-based performance task and associated rubric.***
(Individual or Group submission)

Due Date: Monday, July 15 @ 1:00 pm
Percentage of the Final Grade: 30%

Intent of LT#1: Your objective is to craft a unique educational assessment that accurately and effectively evaluate your students' science learning and skills. This summative performance task and rubric should serve as an alternative to traditional testing, tailored for a designated *grade*, *science course* (e.g., Sci. 10-4, Bio 20, etc.), and *unit*. This task should allow your students to demonstrate and employ their science understandings and skills aligned directly with the Program of Study's unit outcomes, both general and specific.

Note: *This learning task can be integrated into Learning Task 2: Creation of a Unit and Assessment Plan.*

Requirements:

1. Design a summative performance task and associated rubric that:
    - applies learned knowledge and skills, not just recall or recognition (Bloom's Taxonomy),
    - is open-ended and typically does not yield to a single, correct answer,
    - establishes a novel and authentic context,
    - provides reliable evidence of understanding and
    - can evaluate a product or performance based on established criteria from the Program of Study unit outcomes.
2. During the course, you will conduct a 20 to 30-minute Professional Development workshop designed for teachers, focusing on introducing your performance task. This session will emphasize how the task encourages students to demonstrate their understanding and application of scientific concepts, principles, and skills in practical or simulated settings. Furthermore, you will discuss how the task assesses students' ability to authentically apply their scientific knowledge and skills, moving beyond mere memorization or recall.
3. Resources for the actual task, including the task descriptor, rubric and student handouts must be submitted to both D2L-Discussion (to share with peers) and D2L-Dropbox (for assessment).

CRITERIA FOR ASSESSMENT OF LEARNING TASK 1

Criteria	A to A+ Meets all and exceeds some requirements	A- to B+ Meets all requirements	B to B- Meets most requirements.	C to C+ Limited in meeting requirements
Performance Task and Rubric Design				
Application of scientific knowledge and skills	• clearly requires the application of learned scientific knowledge and skills and goes beyond simple recall or recognition, necessitating deep understanding and active use of student learning and • will allow students' product or performance to demonstrate a high level of insight and evidence of their understanding and mastery of the subject matter.	• generally, requires the application of learned scientific knowledge and skills and mostly goes beyond mere recall or recognition, encouraging students to actively utilize their learning and • will allow students' product or performance to competently and effectively showcases their understanding and provide reasonable evidence of proficiency of the subject matter.	• somewhat calls for the application of learned scientific knowledge and skills and partially moves beyond mere recall or recognition, somewhat relying on surface-level understanding and • will allow students' product or performance to adequately showcases their understanding but lack depth or sophistication, providing moderate evidence of proficiency of the subject matter.	• minimally requires the application of learned scientific knowledge and skills and predominantly focuses on recall or recognition, with little opportunity for active application of learning and • the resulting product or performance will be incomplete, failing to effectively showcase the student's understanding and mastery of the subject matter.

Open-ended nature	• highly open-ended, allowing for diverse interpretations, approaches, perspectives and solutions that align with success criteria and • process for completing the task is flexible, accommodating diverse learners.	• moderately open-ended, permitting some degree of interpretation, variation in approach, and few possible responses that align with success criteria and • process for completing the task allows for some flexibility with some constraints on methods or strategies.	• somewhat open-ended, offering limited room for interpretation, variation in approach, and few possible responses that may meet success criteria and • process for completing the task are somewhat constrained with limited degree of flexibility.	• not significantly open-ended, offering little or no room for interpretation and variation in approach with a single, clearly defined response t aligns with success criteria and • process for completing the task is highly structured with rigid guidelines.
Establishment of novel and authentic context	• establishes a highly novel and authentic context that immerses students in realistic conditions and constraints with compelling goals, authentic audiences, and realistic obstacles to overcome in achieving a successful product or performance and • conveys a clear sense of purpose and relevance to students, fostering intrinsic motivation in the preparation process and demonstrates a strong understanding of how their learning applies to real-world situations.	• establishes a moderately novel and authentic context that provides students with realistic conditions and constraints with relevant goals, audiences, and obstacles to overcome in achieving a successful product or performance and • conveys a sense of purpose and relevance to students, encouraging them to invest effort in preparing and demonstrating an understanding of how their learning connects to practical situations.	• establishes a somewhat novel and authentic context that provides students with some realistic conditions and constraints with basic goals, audiences, and obstacles in achieving a successful product or performance and • conveys a limited sense of purpose and relevance to students, requiring some effort to connect their learning to the task and practical application.	• lacks a novel or authentic context, failing to provide with realistic conditions and constraints with simplistic goals, audiences, and obstacles that do not reflect real-world scenarios and • lacks a clear sense of purpose and relevance to students, resulting in minimal effort in preparation and no connection between their learning, the task and practical application.
Evaluated with established criteria and rubric	• criteria for assessing product or performance are precisely aligned with the science Program of Study's unit outcomes, ensuring clarity and specificity in evaluation and • facilitate fair and accurate assessment by enabling defensible, judgment-based evaluation and providing comprehensive performance level descriptors for varying levels of understanding and proficiency.	• criteria for assessing product or performance are generally aligned with the science Program of Study's unit outcomes, though minor ambiguity may exist and • enables defensible evaluation, although with some room for interpretation, while performance level descriptors provide reasonable guidance for assessing student work.	• criteria for assessing product or performance are somewhat aligned with the science Program of Study's unit outcomes, lacking clarity and direct links, leading to evaluation ambiguity and • need refinement for stronger assessment defensibility as performance level descriptors offer basic understanding and proficiency profiles with gaps or inconsistencies in assessment guidance.	• criteria for assessing product or performance are misaligned with the science Program of Study's unit outcomes, lacking clarity and direct linkage, resulting in significant evaluation ambiguity and • weak foundation for defensible evaluation with insufficient or absent of performance level descriptors for assessing understanding and proficiency.
Professional Development Workshop				
Engagement and Interaction	• actively engages participants through various interactive activities and discussions.	• encourages participation and interaction among attendees through a mix of activities and discussion.	• occasionally engages participants but lacks consistent interaction or opportunities for engagement.	• fails to engage participants, relying solely on lecture-style presentations without any interactive elements.
Clarity of Materials and Presentation Delivery	• materials and presentations are clear, well-organized, and effectively delivered, enhancing participants' understanding of the task and associated rubric.	• materials and presentations are mostly clear and well-organized, with occasional lapses in clarity or delivery.	• materials and presentations are somewhat disorganized or difficult to follow, hindering participants' comprehension.	• materials and presentations are unclear, disorganized, or poorly delivered, making it challenging for participants to grasp the content.

LT2: Designing a Unit and Assessment Plan *(Individual or Group submission)*

Due Date: Friday, July 19, 1:00 pm (for peer editing), Final submission, Monday, July 22
Percentage of the Final Grade: 40%

Intent of LT2: The intent of LT2 is to design a unit and assessment plan. We will be using a Whole-Part-Whole learning model over the 2 weeks of the course to develop the unit plan. The framework for evaluating your unit plan is based on the principles of Understanding by Design (UbD), focusing on the clarity of learning goals, alignment with enduring understandings, validity of assessment methods, clarity of rubrics/criteria, engagement and differentiation in learning experiences, and alignment with UbD principles.

Expectations of LT2:

- The unit plan will be comprised of one unit covering:
  - 4 weeks with 80-minute classes for a Senior High class, or
  - 7 weeks with 45 - 60 minutes classes for a Middle/Junior High class.
  - 7 weeks with 30 – 45 minutes classes for an Elementary class.
- The unit plan must follow a clear and comprehensive **design for learning focused template (in D2l Content)** that promotes deep understandings of a key concepts and competency of the discipline.
- **Use the following rubric to guide your unit design and assessment.**

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
Stage 1 - Lesson Rationale: To what extent does the design focus on building understanding of targeted content based on an Alberta Education Program of Studies?			
Alignment with Big Ideas and Enduring Understandings	The unit plan demonstrates a clear alignment with overarching Big Ideas in science and the enduring understandings are well-developed and deeply integrated throughout the plan.	The unit plan shows alignment with Big Ideas in science and the enduring understandings are evident, although some connections may require further development or clarification.	The unit plan exhibits limited alignment with Big Ideas and the enduring understandings are inconsistently integrated, indicating a need for stronger connections and more explicit integration.
Targeted Understanding: Clarity of Learning Goals and Outcomes	Learning goals/outcomes are clearly stated, aligned with a Program of Study (PoS) standards, and reflects important knowledge, skills and attitudes.	Learning goals/outcomes are generally clear and aligned with standards but may lack specificity in some areas.	Learning goals/outcomes are somewhat unclear or not fully aligned with standards, making it difficult to determine what students should know, understand, and be able to do.
Framing of targeted understandings by essential questions	The essential questions foster genuine inquiry and critical thinking, deeply aligning with the targeted understanding. These questions effectively frame key concepts, encouraging students to explore complex relationships within the content and apply their understanding to new challenges.	Essential questions demonstrate alignment with the targeted understanding yet lack depth or clarity. They generally frame key concepts and encourage exploration; they do not consistently promote deep exploration or effectively prompt application to new challenges.	Essential questions are somewhat aligned with the targeted understanding but potentially has limited effectiveness in fostering inquiry and critical thinking, providing limited framing of key concepts and fail to effectively encourage exploration or application to new challenges,
Misconceptions	Misconceptions are relevant and targeted within the lessons.	Some misconceptions are identified and somewhat targeted.	Some misconceptions are identified, but not targeted
Alignment of Ab Ed's PoS Outcomes with lesson sequence	Lessons align with the science PoS outcomes and unit emphasis (NoS, ST, STS, STSE), demonstrating a comprehensive understanding of the knowledge and skills students are expected to acquire.	Lessons generally align with the science PoS outcomes, but some standards may be overlooked or only partially addressed, requiring attention to ensure comprehensive coverage.	The lessons lack alignment with the science PoS outcomes, with significant gaps in coverage or misunderstanding of the knowledge and skills students should acquire.

Stage 2 - Assessment Evidence: To what extent do the assessments provide fair, valid, reliable, and sufficient measures of the desired results			
Balanced Assessment	To accurately gauge student learning, balanced assessment, using a variety of methods, is integral to the learning and woven into the day-to-day fabric of teaching and learning. Appropriate criterion-based scoring tools are used to evaluate student products and performances.	Balanced assessment is used on a regular basis and is part of the teaching and learning. Some various criterion-based scoring tools are used to evaluate student products and performances.	Assessment is primarily summative with limited or irregular use of formative assessment to improve teaching and learning.
Alignment of Learning Outcomes with Assessment Criteria	Criteria align closely with the learning outcomes from the PoS. (*Ab Ed Achievement Indicators*)	Criteria generally align with the learning outcomes from the PoS.	Criteria shows limited alignment with the learning outcomes from the PoS.
Integration of Authentic Performance Tasks From LT#1	The performance task seamlessly integrates essential understandings from each lesson in a sequential manner, requiring students to apply core concepts in a logical progression to complete the task effectively.	The performance task integrates essential understandings from each lesson, although the sequential application of core concepts may require minor adjustments or clarifications to ensure a smooth progression.	The performance task shows limited integration of essential understandings from each lesson, with disjointed or unclear connections between core concepts, indicating a need for revision to strengthen sequential integration.
Self and Peer Assessment	Students have numerous and appropriate opportunities to actively engage in both self-assessment and peer-assessment with clear understanding of assessment criteria and opportunity to provide thoughtful feedback.	Students have some opportunities to participate in self-assessment and peer-assessment.	Students' participation in self-assessment and peer-assessment is limited.

Stage 3: To what extent is the learning plan effective and engaging			
Alignment with 5Es Cognitive Learning Model	The design exhibits a comprehensive alignment with the 5Es model, seamlessly integrating all five phases in a sequential and coherent fashion, ensuring each phase is clearly defined and purposefully integrated to furnish students with a structured and meaningful learning experience conducive to fostering deep understanding.	The design employs the 5Es cognitive learning model, integrating the majority of its five phases cohesively, though with minor inconsistencies or gaps, overall providing students with opportunities for engaging in exploratory activities, cultivating conceptual understanding, and applying their learning meaningfully.	The design partially incorporates the 5Es cognitive learning model, integrating some aspects while lacking coherence or consistency in implementation, potentially leading to notable omissions or deficiencies in certain phases, thus resulting in a fragmented learning experience for students.
Design Is Informed by Pedagogical Content Knowledge	The design demonstrates a sophisticated integration of science content knowledge (including scientific concepts, principles, theories, and models) and pedagogical expertise (such as inquiry-based learning strategies, hands-on activities, and real-world applications), creating meaningful learning experiences.	While there is room for deeper integration of subject matter knowledge and pedagogical practices to enhance the design, lessons demonstrate a good understanding of effective Science teaching, showing potential to facilitate student learning and engagement in the subject.	The design demonstrates minimal content and pedagogical expertise in science, lacking an in-depth understanding of the intricacies of teaching the subject.
Work Fosters Deep Understanding	Lessons consistently facilitate deep understanding of the content by encouraging students to make connections, analyze information critically, and apply concepts in diverse contexts.	Lessons generally prioritize deep understanding over surface-level knowledge acquisition.	Lessons predominantly focus on surface-level knowledge acquisition, with activities that emphasize acquiring information, facts, and formulas.
Authenticity of Tasks	The learning tasks closely resemble real-world scientific practices, requiring students to apply scientific knowledge and skills in a meaningful context, aligning with authentic scientific inquiry, problem-solving, critical thinking, and scientific reasoning.	The learning tasks reflect elements of real-world scientific practices, providing students with opportunities to apply scientific knowledge and skills in a relevant context, with limited opportunity to engage in inquiry, problem-solving , critical thinking and scientific reasoning.	The learning tasks lack authenticity, failing to resemble real-world scientific practices or provide meaningful context for students' learning, relying too heavily on rote memorization or procedural tasks, limiting students' opportunities for meaningful engagement with scientific inquiry.
Differentiated Instruction	The design incorporates a diverse range of tasks and activities that cater to multiple learning styles, interests, and readiness levels. Tasks are appropriately scaffolded to support learners at different skill levels, ensuring that all students are appropriately challenged and supported.	The design includes differentiated tasks and activities that address different learning styles, interests, and readiness levels to a satisfactory extent.	Differentiation of tasks and activities is limited or lacking in the design. There is little evidence of intentional efforts to address diverse learner needs, and instruction may primarily follow a one-size-fits-all approach.
Stage 4: Alignment			
Alignment with UbD Principles	Learning experiences are aligned with UbD principles, emphasizing essential questions, inquiry-based learning, and authentic tasks that promote deep understanding.	Learning experiences mostly align with UbD principles but may lack coherence or consistency in their implementation.	Learning experiences have some alignment with UbD principles, but fail to consistently incorporate essential questions, inquiry, or authentic tasks.

LT3: Evolving Pedagogical Content Knowledge of Science Teaching *(Individual submission)*

Due Date: Monday, July 22
Percentage of the Final Grade: 30%

In this assignment, you will have an opportunity to demonstrate your scholarly and professional thinking about your own philosophical belief**s** about the **nature of science** and how your work as a **science** teacher is strengthened by these beliefs. The intent of this assignment is to articulate and display your insights into the teaching of science.

- for each of the following issues, write a "pedagogical" belief statement, framed within the ***nature of science***, and
- how it would be translated into action in your classroom, the ***pedagogical content knowledge*** of **science** (evidence).

Each statement should be self-explanatory.

1. Purpose of Science Education
2. Teaching of Science
3. Learning of Science
4. Planning for Science Teaching and Learning
5. Assessment of Science Learning

You may choose a format that best allows you to respond to each issue and provide evidence of your thinking and understanding. Format of presentation may be a succinct individual written composition, an imagined Socratic dialogue, an illustrated story, an animation, or a podcast. A critical understanding of teacher practice related to each statement must be demonstrated within the submissions. I encourage you to draw on anecdotal notes from evidence of learning during your program and field experience. Length: max: 1200 words or 7 minutes.

CRITERIA FOR ASSESSMENT OF LEARNING TASK 3

Criteria	A to A+ Meets all and exceeds some requirements	B+ to A- Meets all requirements	B- to B Meets most requirements
Clarity and Insightfulness	The response articulates a clear, insightful and coherent understanding of teaching science within each pedagogical issue, demonstrating a deep understanding of the topic. Insights are communicated with precision and clarity, offering a clear perspectives and thoughtful analysis. The response effectively addresses the complexities and challenges associated with teaching science.	The response demonstrates a solid understanding of teaching science within each pedagogical issue, with insights that are generally clear, insightful, and coherent. Occasional lapses in clarity or depth of analysis.	The response offers a limited understanding of teaching science within each pedagogical issue, with insights that lack clarity or coherence and inconsistencies in the explanation, resulting in a somewhat fragmented understanding of the topic.
Uses of specific, concrete examples to explain and illustrate insights (evidence)	The response effectively uses specific, concrete examples to explain and illustrate insights, providing relevant and compelling evidence to support key points.	The response incorporates some specific examples to support insights, offering evidence to strengthen key points.	The response includes limited examples to support insights, with evidence that may lack relevance or insufficiently developed.
Organization and Structure	The response is well-organized, with a clear and logical structure for communicating insights. Ideas are presented in a coherent and systematic manner, with each pedagogical issue addressed in a structured and cohesive fashion. The response flows smoothly from one point to the next, enhancing the readability/viewing.	The response demonstrates adequate organization and structure for communicating insights. While there may be some minor disruptions in flow or organization, overall, the response presents ideas in a reasonably clear and coherent manner, allowing readers/viewers to follow the argument effectively.	The response lacks organization or structure, making it difficult for readers/viewers to follow the flow of ideas. There may be inconsistencies or abrupt transitions between points, hindering the overall coherence and effectiveness of the response.

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.