Erin Spring

EDUC 460.17: Specialization I, Secondary Science
Winter, 2026

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 within Alberta (including Nose Hill Métis District 5 and Elbow Métis District 6).

Start date: January 12, 2026
Last Day of Classes: March 13, 2026
Term Break: February 15-21, 2026

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.

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

COURSE DESCRIPTION:

The intent of the Specialization I Seminar is to introduce students to the concepts, theory, and design planning related to teaching within the specialization of Science. Theory as connected to an understanding of practical classroom experiences will particularly inform the course curriculum and will be explored through course readings, analysis of teaching/learning artifacts, and through the design of discipline-based learning and assessment plans. Topics in teaching and learning will include teaching inclusively and addressing the needs of diverse learners, effective integration of technology, and discipline-based inquiry. Assignments will present the opportunity for students to develop an understanding of short-term instructional designs and to begin to examine curriculum shifts in the province.

LEARNER OUTCOMES: Students will be knowledgeable about:

1) Developing a foundational understanding of the nature of discourse in the discipline, as related to teaching and learning, including specialized language, concepts, and terminology.
2) Understanding teacher as designer of learning and assessment plans and use of the resources available for designing learning and assessment.
3) Exploring and applying introductory theory related to the teaching of the discipline with an emphasis on designing discipline-based tasks and assessment processes and creating an adaptive classroom learning environment to better meet the needs of today's diverse learners.

4) Successfully designing short-term learning and assessment plans to deepen understanding of key ideas/concepts within the discipline.

COURSE DESIGN AND DELIVERY:

This course will be delivered face-to-face on campus with a D2L site wich contains required readings and other relevant class resources and materials (see d2l.ucalgary.ca). 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. If you do not own a personal device, there are computers available for student use in the Doucette library and the Taylor Family Digital Library

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 TASK	DESCRIPTION OF LEARNING TASK	PERCENTAGE OF FINAL GRADE	GROUPING FOR TASK	DUE DATE
LT1	**Inquiry into the Teaching of Science: Presentation**	30%	Pairs	Friday, Jan. 30, 2:00 pm
LT2	**Creation of Short-term Learning and Assessment Plan**	45%	Individual	Mar. 9 (draft) Mar 13 (final copy)
LT3	**Evolving Understanding of the Teaching of Science**	25%	Individual	Friday, Mar. 13

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

The use of generative AI (GAI) is permitted in this course. Students may use GAI tools for idea generation, concept clarification, initial exploration on a project, narrowing scope, outlining, finding initial sources and gathering/formatting references, getting feedback on draft and details, and creating titles or headings.

Students are responsible for all material produced by GAI as if they are the author (e.g., responsible for all matters related to copyright, academic misconduct, etc.). For further insights, the Taylor Institute has created some guiding resources and principles: https://teaching-learning.ucalgary.ca/resources-educators/generative-ai-teaching-and-learning

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/26722597860004336?auth=SAML

Resources for lesson and unit planning

Best Evidence Science Teaching (BEST): This collection of free resources is designed for secondary school science and is based on the best research evidence available. It includes diagnostic questions, formative assessments, and constructivist approaches to building understanding. The resources cover key concepts in biology, chemistry, earth science, and physics. https://www.york.ac.uk/education/research/uyseg/research-projects/bestevidencescienceteaching/

National Science Teaching Association (NSTA): The NSTA provides a comprehensive list of vetted and recommended online teaching resources. These resources cover a wide range of science topics and are suitable for different grade levels. https://www.nsta.org/resources

Next Generation Science Standards (NGSS): NGS, though developed in the United States, offer a robust framework that aligns well with Canadian science education goals and science instruction. NGSS resources promote scientific reasoning, problem-solving, and real-world application. https://www.nextgenscience.org/

WEEKLY COURSE SCHEDULE:

Dates	Topics/Themes	Readings and Assignments
Week 1	Essential Question (EQ): What are the goals of EDUC 460? • EDUC 460 Course Outline review – LT1, LT2, and LT3 • LT1: Partner Selection & Topic selection (D2L) • LT2: Chapter selection (D2L) What does Alberta Education deem as curriculum? Intro to LT1, workshop format, & 5Es. Intro to LT3 Intro to LT2 & chapter selection *(whole/part/whole)* In class time to work on LT1: refine your question.	**Review *Front Matter*** of the Science Programs of Study (PoS) *that supports your grade of interest either* 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 **Assigned readings** for Weeks 2 to 7 **Reference for LT1:** Bybee, et al., (2006). The BSCS 5E Instructional Model: Origins, Effectiveness, and Applications. BSCS, 1–19. https://media.bscs.org/bscsmw/5es/bscs_5e_executive_summary.pdf *How can we use the BSCS 5E Instructional Model to plan our lessons and units?* **Assigned Chapter for LT2 see schedule in D2L:** Wiggins, G. J. & McTighe, J. (2005). Understanding by design (2nd Edition) https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/detail.action?docID=3002118
Week 2	EQ: • What are the goals of science teaching; "Learning science, learning about science, and doing science"? (Science as a process, not just a body of	**Readings for LT3** Feynman, R. P. (1969). What is science? The Physics Teacher, 7(6), 313-320. https://pubs-aip-org.ezproxy.lib.ucalgary.ca/aapt/pte/article/7/6/313/278346/What-Is-Science *Feynman argues that science is a way of trying not to fool yourself. How can this*

	facts.) • What does it mean to be a teacher of science? • What is your understanding of scientific reasoning and inquiry? LT2: Stage 1. Identify Desired Results (foundational knowledge, attitudes & skills). In class time to work on LT1	*idea be applied to classroom teaching, especially when addressing student misconceptions or pseudoscientific beliefs?* Rennie, L. (2005). Science awareness and scientific literacy. https://espace.curtin.edu.au/handle/20.500.11937/31481 https://research-ebsco-com.ezproxy.lib.ucalgary.ca/linkprocessor/plink?id=b3ba9854-a79c-3901-95e7-9c9a93cd2bcd *Rennie highlights the role of community and industry partnerships in fostering scientific literacy. How can science teachers effectively integrate community-based experiences into their curriculum to enhance students' understanding of science in everyday life?*
Week 3	**EQ:** • What does it mean to facilitate and support a "constructivist classroom"? (Curiosity and questioning as central to learning.) • Who are the learners? • Design thinking & Big Ideas • The "Instructional Core" • What does it mean to be a "designer" of learning? In class time to work on LT1 & LT2, Stage 1 LT#1: Workshops: schedule posted in D2L	**Readings for LT3:** Aikenhead, G.S., Orpwood, G., & Fensham, P. (2011). Scientific literacy for a knowledge society. In C. Linder, L. Ostman, D.A. Roberts, P-O. Wickman, G. Erickson, & A. MacKinnon (Eds.), Exploring the landscape of scientific literacy (28-44). New York: Routledge, Taylor and Francis Group. ****E-book UofC Library*** https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=592911&ppg=39 https://www-taylorfrancis-com.ezproxy.lib.ucalgary.ca/chapters/edit/10.4324/9780203843284-9/scientific-literacy-knowledge-society-glen-aikenhead-graham-orpwood *The authors argue that scientific literacy must be relevant to students' lives and the broader knowledge society. How can science educators balance teaching core scientific concepts with preparing students to critically engage with science-related societal issues?* Driver, et al., (1994). Constructing Scientific Knowledge in the Classroom. *Educational Researcher* p. 5-12. https://journals-sagepub-com.ezproxy.lib.ucalgary.ca/doi/abs/10.3102/0013189X023007005 https://www-jstor-org.ezproxy.lib.ucalgary.ca/stable/1176933 *Driver et al. argue that students construct scientific knowledge through social interaction and negotiation of meaning. How can teachers create classroom environments that support this kind of knowledge construction while maintaining scientific accuracy?* **Reading for LT2:** Harlen, W. (Ed.) (2010). *Principles and big ideas of science education.* p.21-23 https://www.ase.org.uk/bigideas *How can the "big ideas" of science education be used to guide curriculum design and help students develop a coherent understanding of scientific concepts across disciplines and grade levels?* **LT#1 Due: Friday, 2:00 pm** LT#1: Workshops 1. How do learning theories such as constructivism, conceptual change, and social learning inform the design of inquiry-based science instruction and support students in developing scientific understanding? 2. How can science teachers use the Claim-Evidence-Reasoning (CER)

		framework and structured discourse to help students develop deeper scientific understanding and engage in authentic scientific practices?
Week 4	**EQ**: What does it mean to be a "designer" of learning? In class time to work on LT2, Stage 1	LT#1: Workshops 1. How does science "really" works? 2. How do we teach science through the "Nature of Science"?
Week 5	**EQ:** What will you accept as evidence that student understanding took place? Stage 2. Determine what constitutes acceptable evidence of competency in the outcomes and results (assessment). In class time to work on LT2, Stage 2	LT#1: Workshops 1. How would my teaching reflect a Constructivist philosophy in my science classroom? 2. How do discrepant events challenge misconceptions and encourage conceptual changes? 3. How do we incorporate Science, Technology, Society (STS), and the Environment (STSE) approaches in our classroom? 4. How can we use formative assessment strategies to evaluate students' reasoning and argumentation in inquiry-based learning, and support their development of scientific explanations and critical thinking? **Resources for LT2:** Alberta Education. (2017). Competencies: Descriptions and indicators. https://education.alberta.ca/competencies/descriptions-indicators/
Week 6	**EQ**: How do you shift the responsibility of learning from the teacher to the students? Stage 3: Plan the Learning Experience and Instruction In class time to work on LT2, Stage 3	LT#1: Workshops 1. What would the four levels of scientific inquiry look like in our classroom? 2. What ways can we modify a lab activity (recipe) into more of an inquiry-based investigation? 3. How can we use simulations (sims) as a teaching tool in the science classroom (integrating technology)? 4. How can we respectfully integrate Indigenous ways of knowing and place-based knowledge into inquiry-based science teaching, while fostering meaningful connections between Western science and Indigenous perspectives? Friesen, S. (2009). What did you do in school today? Teaching Effectiveness: A Framework and Rubric. Canadian Education Association. http://www.galileo.org/cea-2009-wdydist-teaching.pdf *How can the principles of effective teaching—such as designing meaningful learning, fostering relationships, and improving practice collaboratively—be applied to create intellectually engaging and relevant science learning experiences for students?*
Reading Week		
Week 7	**EQ**: What does it mean to be a teacher of diversity? Stage 4: Learner differentiation	LT#1: Workshops 1. How can we apply culturally responsive pedagogy and inclusive strategies to support English language learners and other diverse students, while addressing bias and removing barriers in inquiry-based science classrooms?

	In class time to work on LT2, Stage 4	2. How can we create inclusive and safe learning environments by applying Universal Design for Learning principles and implementing effective safety practices in inquiry-based science classrooms and labs?
Week 8	EQ: What does it means to be a reflective practitioner? Peer review of LT2 (Monday)	LT#1: Workshops **LT#2:** • **Draft due: Monday, March 9 (final peer review).** • **Final submission due: Friday, March 13** **LT#3: Due Friday, March 13**

CHANGES TO SCHEDULE:
Please note that changes to the schedule and readings may occur to meet the emerging needs and dynamics of the participants in the course.

LEARNING TASKS AND ASSESSMENT

LT1: Designing Inclusive and Inquiry-Driven Science Learning (Group – pairs)

Due Date: Friday, January 30 @ 2:00 pm
Percentage of the Final Grade: 30%
Length: 45 minutes (30 min interactive workshop, 15 min. Q & A)

EQ: *How can science educators apply research-based strategies and theoretical frameworks to design inclusive, inquiry-driven, and conceptually rich science learning experiences that reflect the complexity and diversity of science education today?*

This task is designed to help you:
- Deepen your understanding of the **Nature of Science (NOS)**.
- Explore how science teachers interpret and implement curriculum documents (like the Alberta Programs of Study) into meaningful classroom instruction.
- Engage in professional conversations about **pedagogical content knowledge** in science education.

You will:
1. **Choose an inquiry topic** based on a key question related to science teaching (topics will be presented during 1st class).
2. **Connect your topic** to class discussions, readings, and your upcoming lesson plan (LT2).
3. **Design and deliver a 45-minute Professional Development (PD) workshop** for new teachers, using the **5E Instructional Model**:
    - Engage – Spark interest and curiosity.
    - Explore – Provide hands-on or minds-on experiences.
    - Explain – Clarify concepts and ideas.
    - Elaborate – Extend understanding through application.
    - Evaluate – Assess learning and reflect.

Learn more about the 5E Model: https://lesley.edu/article/empowering-students-the-5e-model-explained

What You'll Submit:

- A **presentation** designed for new teachers (format is flexible—choose what works best).
- A **list of references** in **APA 7 format**.
- A **digital folder** with supporting materials:
  - Workshop slides, handouts, links, or other resources.
  - Upload this folder to both **Discussions** and **Assignments** in D2L.

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.
Quality & Meaningfulness of Research Question			
Rationale: What and Why do you want to know "this" with respect to informing pedagogical practice?	Clearly articulates the importance of the topic in informing pedagogical practice. Provides thorough reasoning for why understanding "this" is crucial for teaching the discipline effectively. Demonstrates deep understanding of the connections between the topic and pedagogy.	Provides adequate explanation of the importance of the topic in informing pedagogical practice. Offers some reasoning for why understanding "this" is relevant to teaching the discipline. Shows some understanding of the connections between theory and practice.	Explanation of the importance of the topic in informing pedagogical practice is unclear or lacking. Limited reasoning provided for why understanding "this" is relevant to teaching the discipline. Weak connections between theory and practice are evident.
How will this presentation make a difference to our teaching of science?	The workshop content is highly relevant to participants' professional needs and provides in-depth coverage of the topic. Direct links are made to how new knowledge in this area will support teaching in the service of learning.	The workshop content aligns well with participants' needs and offers a solid level of depth. Links are made to how new knowledge in this area will support teaching in the service of learning.	The workshop content is somewhat relevant to participants' needs and lacks depth in certain areas. Few or no links are made to how this question will support teaching in the service of learning.
Critique & Critical Analysis			
What are the connections between theory and practical situation?	Effectively applies theoretical concepts to real-world teaching scenarios. Demonstrates how theories guide decision-making and instructional practices Cites all academic content obtained from other sources. APA 7 citation style is accurate.	Applies theoretical concepts to practical settings with some effectiveness. Demonstrates an understanding of how theories can inform teaching practices. Cites most content obtained from other sources. APA 7 citation style is accurate.	Application of theoretical concepts in practical settings is limited or ineffective. Fails to demonstrate a clear understanding of how theories translate into actionable strategies for teaching. Citations do not employ APA 7 citation style.
Overall Presentation of Findings			
How effective is the creation and development of conceptual ideas in contributing to our pedagogical content knowledge?	Facilitates the careful and critical development of conceptual ideas, ensuring participants grasp fundamental concepts and their implications for pedagogical practice. Offers clear explanations, examples, and opportunities for discussion to support participants' comprehension and application of pedagogical information, concepts and skills. All 5Es are clearly and effectively implemented with strong pedagogical alignment.	Supports the development of conceptual understanding to some extent. Provides explanations and examples but may lack clarity or coherence in facilitating participants' comprehension and application of pedagogical information. Most of the 5Es are implemented with moderate effectiveness.	Development of conceptual understanding is limited or ineffective. Explanations and examples are unclear or insufficient, hindering participants' comprehension and application of pedagogical information. Few or unclear use of the 5Es; lacks coherence or depth.

LT2: Designing an Annotated Discipline-based Learning and Assessment Plan
(Individual submission)

Peer Editing Draft: Monday, March 9 @ 2:00 PM
Final Submission: Friday, March 13
Weight: 45% of final grade
Submission Type: Individual (but collaborative planning is encouraged in developing sequential lessons)

Purpose of the Assignment:
This task helps you:

- Design a **short-term learning and assessment plan** that reflects thoughtful instructional design.
- Apply the **Understanding by Design (UbD)** framework by McTighe & Wiggins.
- Make your **pedagogical thinking visible** through annotations and reflections.

Lesson Plan Requirements:

1. Choose **one** of the following based on your grade level focus:
    - **K–6:** 30–40 minute lesson
    - **Grades 7–9:** 60-minute lesson
    - **Grades 10–12:** 80-minute lesson
2. Your plan must:
    - Be based on a **specific outcome or competency** from the Albert Programs of Study.
    - Follow a **clear and comprehensive learning design template**.
    - Include the **10 aspects of the UbD framework** (as outlined in the rubric).
3. Annotation Expectations: You will annotate your lesson plan **to explain your thinking.**
    - Why you made specific design choices.
    - How your plan reflects the **UbD approach**.
    - How this lesson fits into a **larger unit**.
    - What **pedagogical content knowledge** you're applying.

    Uses **mark-ups, comments, or notes** directly on your lesson plan to show your reasoning.

Resources to Use:

- The **rubric** to guide your planning and annotation.
- Course readings and discussions.
- Alberta Programs of Study and other curriculum documents.

CRITERIA FOR ASSESSMENT OF LEARNING TASK 2

Criteria	A+ to A Meets all and exceeds some requirements	A- to B+ Meets all requirements	B to B- Meets most requirements
For each of the criteria below, your annotation will be part of the assessment. Annotations must explain design choices and rationale, alignment with UbD principles, integration into a larger unit and/or application of pedagogical content knowledge.			
Making your thinking visible: Explain how . . .	Annotations display a sophisticated and elegant understanding and analysis of the role of planning in lesson design.	Annotations display a competent understanding, if not analysis, of the role of planning in lesson design.	Annotations display some understanding of the role of planning in lesson design but lacks analysis.
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: explain how the lesson builds toward these understandings and fits into the unit's overall narrative.	The lesson plan demonstrates a clear alignment with the overarching unit's general outcome and the enduring understanding is well-developed and deeply integrated throughout the plan.	The lesson plan shows alignment with the overarching unit's general outcome and the enduring understanding is evident, although some connections may require further development or clarification.	The lesson plan exhibits limited alignment with the overarching unit's general outcome and the enduring understanding is inconsistently integrated, indicating a need for stronger connections and more explicit integration.
Targeted Understanding: Clarity of Learning Goals and Specific Outcomes: explain how the outcome guides the lesson and connects to knowledge, skills, and attitudes.	Specific learning outcome is clearly stated, aligned with a Program of Study (PoS) and reflects important knowledge, skills and attitudes along with the unit emphasis (NoS, ST, STS, STSE).	Specific learning outcomes is generally clear and aligned with standards but may lack specificity in some areas.	Specific learning outcomes is 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: explain how these questions guide exploration and connect to real-world applications, helping students see relevance and complexity.	The essential questions(s) foster genuine inquiry and critical thinking, deeply aligning with the targeted understanding. The question(s) effectively frame key concepts, encouraging students to explore complex relationships within the content and apply their understanding to new challenges.	Essential question(s) demonstrate alignment with the targeted understanding, yet lack depth or clarity, and while they generally frame key concepts and encourage exploration, they do not consistently promote deep exploration or effectively prompt application to new challenges.	Essential question(s) is 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.
Addressing Misconceptions: explain how they help you design activities that clarify concepts and deepen understanding.	Misconceptions are relevant and targeted within the lesson.	Some misconceptions are identified and somewhat targeted.	Some misconceptions are identified, but not targeted.
Stage 2 - Assessment Evidence: To what extent do the assessments provide fair, valid, reliable, and sufficient measures of the desired results?			
Balanced Assessment: explain how formative and summative assessments are used to support learning.	Balanced assessment is integral to the learning and woven into the 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 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 Outcome with Assessment Criteria: explain how criteria are directly tied to the lesson's goals, ensuring students know what success looks like.	Criteria align closely with stated learning outcome for the lesson. They reflect the specific knowledge or skills that students are expected to demonstrate as a result of the lesson.	Criteria generally align with learning outcome but may lack some specificity or alignment in certain areas.	Criteria shows limited alignment with learning outcome and hinders their effectiveness in guiding student learning.
Transparency and Student Involvement: explain how you communicate expectations and involve students in co-creating criteria or reflecting on their learning.	Criteria are transparently communicated to students, ensuring they understand how their performance will be assessed and what factors will be considered in evaluation.	Criteria are communicated to students, but transparency or student involvement may vary.	Criteria are poorly communicated to students, leading to confusion or misunderstanding about assessment expectations.
Self and Peer Assessment: explain how students use criteria to assess themselves and others, promoting ownership and deeper understanding (metacognition).	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: explain how each phase is intentionally designed to build understanding and support inquiry.	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: explain how you chose activities, examples, and approaches that make the subject accessible and engaging.	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: explain how students connect ideas and use them in new contexts.	Lesson consistently facilitates deep understanding of the content by encouraging students to make connections, analyze information critically, and apply concepts in diverse contexts.	Lesson generally prioritizes deep understanding over surface-level knowledge acquisition.	Lesson predominantly focuses on surface-level knowledge acquisition, with activities that emphasize acquiring information, facts, and formulas.

Authenticity of Tasks: explain how tasks mirror real-world practices and encourage scientific thinking or problem-solving.	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: explain how you support diverse learners through varied tasks, scaffolding, and flexible grouping.	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: explain how your plan follows the three stages of UbD and supports deep, purposeful learning.	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 Understanding of the Teaching of Science (Individual)

Due Date: **Friday, March 14**
Percentage of the Final Grade: 25%

Assignment Overview

This individual assignment invites you to reflect thoughtfully on the contexts and challenges within science education today.

Guiding Question: How is your conceptualization of teaching Science changing, being modified, or reinforced throughout this course?

Format Options

You may choose one of the following formats for your response:

- Conventional academic essay
- Imagined Socratic dialogue between a teacher and student
- Illustrated story
- Animation
- Short video
- Podcast

Length:
• Written formats: ~700 words
• Multimedia formats: ~5 minutes

Assignment Guidelines

1. Connection to Course Material: Use specific concepts, strategies, or theories from the course. Explain how these ideas align with or challenge your previous beliefs or experiences. Consider comparing multiple ideas and synthesizing them into a new understanding.
   Tip: Use a checklist of key course concepts to guide your reflection.
2. Link to Personal Experience: Reflect on your own experiences as a learner of science. Describe how these experiences shaped your views on teaching science. Discuss any changes or reinforcements in your perspectives due to the course.
   Tip: Include specific moments that were impactful or transformative.
3. Use of Specific Examples: Use concrete examples from course readings, activities, or interactions. Include moments from your own learning journey that have influenced your evolving view of teaching science.
   Tip: Cite readings or discussions directly to support your points.
4. Clarity and Organization: Ensure your response is well-organized, clear, and easy to follow. Ideas should flow logically. Use headings or transitions to guide your audience.
   Tip: Use a structure appropriate to your chosen format (e.g., intro-body-conclusion for essays).
5. Critical Thinking and Insight: Demonstrate deep thinking about your learning. Make thoughtful connections and raise meaningful questions. Show that you're thinking beyond surface-level ideas.
   Tip: Use a reflection framework: What did I believe before? What changed? Why? What questions remain?

Self-Assessment Checklist
Use this checklist to review your work before submitting:
- Did I connect multiple course concepts to my reflections?
- Did I include personal experiences and explain their impact?
- Did I use specific examples from the course and my life?
- Is my response clear and well-organized?
- Did I show critical thinking and raise meaningful questions?

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
Connection to Course Material	Thoroughly connects multiple course concepts, strategies, or theories to personal reflections. Demonstrates deep understanding and critical analysis.	Connects several course concepts, strategies, or theories to personal reflections. Shows good understanding and analysis.	Connects some course concepts, strategies, or theories to personal reflections. Shows basic understanding and analysis
Link to Personal Experience	Insightfully reflects on personal experiences and clearly links them to course material. Provides rich, detailed examples.	Reflects on personal experiences and links them to course material. Provides clear examples.	Reflects on personal experiences with some links to course material. Provides basic examples.

Use of Specific Examples	Provides numerous, well-chosen examples that effectively support reflections.	Provides several examples that support reflections.	Provides some examples that support reflections.
Clarity and Organization	Response is well-organized, clear, and easy to follow. Ideas flow logically.	Response is organized and clear. Ideas generally flow well.	Response is somewhat organized and clear. Ideas are understandable.
Critical Thinking and Insight	Demonstrates excellent critical thinking and insight. Makes thoughtful connections and raises meaningful questions.	Shows good critical thinking and insight. Makes relevant connections and raises some thoughtful questions.	Shows basic critical thinking. Makes simple connections and raises few or surface-level questions.

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

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. Instructors can add penalties for late assignments here. 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 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

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.

Access and Privacy Office (Formerly) 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

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.