EDUC 535.17 S01 Specialization II: Secondary Science
Fall 2024

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

Class Dates: Sept. 4, 11, **18**, 25; Oct. 2, 9, **16**, **23** (Orange dates – Assignment due)

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 the Undergraduate Programs in Education office for questions related to pre-requisite courses.

Office Hours: Available after class or by appointment. Office hours will be held primarily on zoom unless otherwise necessary.

Email: Students are required to use a University of Calgary (@ucalgary.ca) email address for all correspondence. **Please, always add "[EDUC 535]" in the subject line of your e-mail so I can prioritize your communication (ex. "[EDUC535] Assignment 1 question").**

COURSE THEME: METAPHORS, MYTHS, AND MISCONCEPTIONS IN SECONDARY SCIENCE TEACHING

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 Studies;
3) Successfully apply theoretical knowledge to the design of a longer-term unit and assessment plan.

Extended Course Overview:
The intent of the Specialization Seminar II is to deepen students' understanding of the practical aspects of teaching within the specialization of science and to connect this practice with specific theoretical concepts and broader social contexts. In this course, students will be provided with opportunities to refine their knowledge of theories and pedagogies within the science classroom context.

Special emphasis will be placed in presenting concepts and models that can provide learners with an opportunity to learn how complex systems function and to understand that solutions to current global problems require a science that integrates an interdisciplinary approach accommodating multiple, and often divergent, perspectives.

Students will also become familiar with relevant Ministry documents associated with the Alberta Curriculum and draw on practical experiences of science education to participate in meaningful discussions and to connect these observations with a vision for their own teaching. The emphasis of the course is on designing for student learning in science (subject-specific; assessment to strengthen student learning and improve instruction; and designing for inclusion, differentiation, and inquiry).

Course Design and Delivery This course will be delivered face-to-face on campus with possible engagement in a D2L environment. The course will be delivered through a design-based and inquiry-focused approach where learning intent, expectations and assessment processes are made visible and transparent. Participation is crucial to the knowledge building in this course. Students will require access to a computing device that contains current software and hardware capable of running D2L, creating documents for learning tasks, and ability to run free programming platform software such as Scratch. If you do not own a personal device, there are computers available for student use in the Doucette library and the Taylor Family Digital Library.

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

Generative AI: Course participants are invited to use artificial intelligence tools, including generative AI, to gather information, review concepts, and/or to help produce assignments. However, (1) it is the student's responsibility to inform the instructor in writing of the intention to use such technology in advance of its use; (2) the student is ultimately accountable for the work they submit; (3) any content generated or supported by an artificial intelligence tool must be cited appropriately; and (4) the instructor reserves the right to deny any uses of generative AI determined to be harmful or against the goals of learning. Misuse of these tools will be considered academic misconduct and will be treated as such.

Required Resources: All required resources can be found in the weekly schedule. Additional class readings and other support resources will be posted on the course shell in D2L prior to class. It is your responsibility to keep up with materials and announcements posted on D2L.

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. https://www-tandfonline-com.ezproxy.lib.ucalgary.ca/doi/full/10.1080/09500690701749305

Alberta Education (2003/2009/2014). *Program of Study: Sciences Grades 10-12.* Edmonton: Government of Alberta. https://education.alberta.ca/media/3069389/pos_science_7_9.pdf

Amin, T. G. (2020). Coordinating metaphors in science, learning and instruction. *How metaphors guide, teach and popularize science*, *6*, 73. https://library.oapen.org/bitstream/handle/20.500.12657/63290/external_content.pdf?sequence=1

Bargerhuff, M. E. (2013). Meeting the needs of students with disabilities in a STEM school. American Secondary Education, 3-20. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=89935756&site=ehost-live

Beach, R. (2023). Addressing the Challenges of Preparing Teachers to Teach about the Climate Crisis. *The Teacher Educator*, 1-16. https://www-tandfonline-com.ezproxy.lib.ucalgary.ca/doi/full/10.1080/08878730.2023.2175401

Beger, A., & Olaf, J. Ã. (2015). The cognitive role of metaphor in teaching science: Examples from physics, chemistry, biology, psychology and philosophy. *Philosophical Inquiries*, *3*(1), 89-112. https://philinq.it/index.php/philinq/article/view/116

Beger, A. (2016). Different functions of (deliberate) metaphor in teaching scientific concepts. *Metaphorik. de*, *26*, 57-84. https://www.metaphorik.de/sites/www.metaphorik.de/files/journal-pdf/26_2016_beger.pdf

Dixon, S. (2005). Inclusion—Not segregation or integration is where a student with special needs belongs. The Journal of Educational Thought (JET)/Revue de La Pensée Éducative, 33-53. https://ezproxy.lib.ucalgary.ca/login?qurl=https%3A%2F%2Fwww.proquest.com%2Fscholarly-journals%2Finclusion-not-segregation-integration-is-where%2Fdocview%2F213807077%2Fse-2%3Faccountid%3D9838

Enger, S. K., & Yager, R. E. (2009). Assessing student understanding in science: A standards-based K-12 handbook. Corwin Press (Chapter One, pages 1-11). https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=1104962&ppg=16

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/

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/publication/working-big-ideas-science-education

Hernandez, J., Scherr, R., German, M., & Horowitz, R. (2022). Place-based education in high school science: Situating energy and climate change in students' communities. *Sustainability and Climate Change*, *15*(1), 58-67. https://par.nsf.gov/servlets/purl/10330270

Iwuanyanwu, P. N. (2019). What We Teach in Science, and What Learners Learn: A Gap That Needs Bridging. *Pedagogical Research*, *4*(2). https://www.pedagogicalresearch.com/download/what-we-teach-in-science-and-what-learners-learn-a-gap-that-needs-bridging-5780.pdf

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/reader.action?docID=1212658&ppg=229

New York Science Teacher Common Science Misconceptions https://newyorkscienceteacher.com/sci/pages/miscon/subject-index.php

Ok, M. W., Hughes, J. E., & Boklage, A. (2018). Teaching and learning biology with iPads for high school students with disabilities. Journal of Educational Computing Research, 56(6), 911-939. https://journals-sagepub-com.ezproxy.lib.ucalgary.ca/doi/full/10.1177/0735633117713113

Oleynik, D. P., Scanlon, E. M., & Chini, J. J. (2022). The Epic and the Tragedy: Narratives of a Disabled Physics Student. Physics Education Research Conference. https://par.nsf.gov/servlets/purl/10421648

Rudolph, J. L. (2014). Dewey's "science as method" a century later: Reviving science education for civic ends. American Educational Research Journal, 51(6), 1056-1083. https://journals-sagepub-com.ezproxy.lib.ucalgary.ca/doi/full/10.3102/0002831214554277

Rudolph, J. L. (2024). Scientific literacy: Its real origin story and functional role in American education. *Journal of Research in Science Teaching*, *61*(3), 519-532. https://onlinelibrary-wiley-com.ezproxy.lib.ucalgary.ca/doi/full/10.1002/tea.21890

Shaha, A. (2011). Are science teachers using experiments as props in lessons? The Guardian. http://www.theguardian.com/science/blog/2011/jun/21/science-teaching-experiments-in-lessons

Sobel, D. (2004). Place-based education: Connecting classroom and community. *Nature and listening*, *4*(1), 1-7. Reprinted in *Green Living: A Practical Journal of Mindful Living* (Winter 2012-2013) https://www.greenlivingpdx.com/place-based-education/

Supalo, C.A. (2012). My Experiences as a Blind Chemistry Student. Braille Monitor. https://nfb.org/sites/default/files/images/nfb/publications/bm/bm12/bm1207/bm120703.htm

Supalo, C. A., Isaacson, M. D., & Lombardi, M. V. (2014). Making hands-on science learning accessible for students who are blind or have low vision. Journal of Chemical Education, 91(2), 195-199. https://pubs-acs-org.ezproxy.lib.ucalgary.ca/doi/full/10.1021/ed3000765

Sutherland, D., & Swayze, N. (2012). The importance of place in indigenous science education. Cultural Studies of Science Education, 7, 83-92. https://link-springer-com.ezproxy.lib.ucalgary.ca/article/10.1007/s11422-011-9371-1

Taber, K. (ND). Science metaphors. Science Education Research. https://science-education-research.com/teaching-science/constructivist-pedagogy/making-the-unfamiliar-familiar/science-metaphors/

Trauth-Nare, A., & Buck, G. (2011). Assessment for learning. The Science Teacher, 78(1), 34-39. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=61794775&site=ehost-live

Wiggins, G. (2005). Understanding by design: Overview of UbD & the design template. https://wpvip.edutopia.org/wp-content/uploads/2022/10/stw-normal-park-normal-understanding-by-design.pdf

Zangori, L., Forbes, C., & Biggers, M. (2012). This Is Inquiry... Right?. Science and Children, 50(1), 48-53. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=79310878&site=ehost-live

Learning Task Overview:

LT	DESCRIPTION OF LEARNING TASK	GROUPING	WEIGHT	DUE DATE
#1	Inquiry into Metaphor/Myth of Science Project	Individual	30%	Sept. 18
#2	Unit and Assessment Plan	Group & Individual	40%	Oct. 16
#3	Evolving Conceptual Understanding of Science	Individual	30%	Oct. 23

Tentative Schedule of weekly activities/readings (topics, activities, and readings subject to change)

Date	Topics/Themes	Readings and Assignments
Week 1 - September 4 **<u>Why do we teach science</u>**	Welcome & Introductions Course overview Students understanding in Science Goals of teaching science	**<u>Be generally familiar with:</u>** 1. Alberta Science Programs of Study. https://www.learnalberta.ca/ProgramsOfStudy.aspx?lang=en&posLang=en&Core=Science and https://education.alberta.ca/science-10-12/programs-of-study/ **<u>Required Reading</u> (skimming)** 2. Rudolph, J. L. (2014). Dewey's "science as method" a century later: Reviving science education for civic ends. American Educational Research Journal, 51(6), 1056-1083. https://journals-sagepub-com.ezproxy.lib.ucalgary.ca/doi/full/10.3102/0002831214554277 3. Iwuanyanwu, P. N. (2019). What We Teach in Science, and What Learners Learn: A Gap That Needs Bridging. *Pedagogical Research*, *4*(2). https://www.pedagogicalresearch.com/download/what-we-teach-in-science-and-what-learners-learn-a-gap-that-needs-bridging-5780.pdf **<u>Suggested Reading</u>** 4. Beach, R. (2023). Addressing the Challenges of Preparing Teachers to Teach about the Climate Crisis. *The Teacher Educator*, 1-16. https://www-tandfonline-com.ezproxy.lib.ucalgary.ca/doi/full/10.1080/08878730.2023.2175401 5. Rudolph, J. L. (2024). Scientific literacy: Its real origin story and functional role in American education. *Journal of Research in Science Teaching*, *61*(3), 519-532. https://onlinelibrary-wiley-com.ezproxy.lib.ucalgary.ca/doi/full/10.1002/tea.21890

Week 2 - September 11 **Science is grounded in context and history**	Place-Based Learning and Experiential Learning Field activities in teaching science	**Required Reading** 1. Sobel, D. (2004). Place-based education: Connecting classroom and community. *Nature and listening*, *4*(1), 1-7. Reprinted in *Green Living: A Practical Journal of Mindful Living* (Winter 2012-2013) https://www.greenlivingpdx.com/place-based-education/ 2. Hernandez, J., Scherr, R., German, M., & Horowitz, R. (2022). Place-based education in high school science: Situating energy and climate change in students' communities. *Sustainability and Climate Change*, *15*(1), 58-67. https://par.nsf.gov/servlets/purl/10330270 3. 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/reader.action?docID=1212658&ppg=229 **Suggested Reading** 4. Sutherland, D., & Swayze, N. (2012). The importance of place in indigenous science education. Cultural Studies of Science Education, 7, 83-92. https://link-springer-com.ezproxy.lib.ucalgary.ca/article/10.1007/s11422-011-9371-1 5. Zangori, L., Forbes, C., & Biggers, M. (2012). This Is Inquiry... Right?. Science and Children, 50(1), 48-53. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=79310878&site=ehost-live
Week 3 - September 18 **Metaphors of Science**	Social nature of science teaching Intentional language in teaching science	**Required Reading (skimming)** 1. Beger, A., & Olaf, J. Ã. (2015). The cognitive role of metaphor in teaching science: Examples from physics, chemistry, biology, psychology and philosophy. *Philosophical Inquiries*, *3*(1), 89-112. https://philing.it/index.php/philing/article/view/116 2. Beger, A. (2016). Different functions of (deliberate) metaphor in teaching scientific concepts. *Metaphorik. de*, *26*, 57-84. https://www.metaphorik.de/sites/www.metaphorik.de/files/journal-pdf/26_2016_beger.pdf

		3. Amin, T. G. (2020). Coordinating metaphors in science, learning and instruction. *How metaphors guide, teach and popularize science*, *6*, 73. https://library.oapen.org/bitstream/handle/20.500.12657/63290/external_content.pdf?sequence=1 **Suggested Reading** 4. Taber, K. (ND). Science metaphors. Science Education Research. https://science-education-research.com/teaching-science/constructivist-pedagogy/making-the-unfamiliar-familiar/science-metaphors/ 5. New York Science Teacher Common Science Misconceptions https://newyorksciencteacher.com/sci/pages/miscon/subject-index.php
Week 4 - September 25 **Mid-Course Check-In and Work Period**	Mid-Course Check-In Discussion In class work time & feedback group work	**Assignment 1 Due Friday, September 27th - 30%**
Week 5 - October 2 **Unit Planning in High School Science**	Designing a Unit and Assessment Plan Identify and critique key learning perspectives in the Alberta Program of Studies	**Required Reading** 1. Enger, S. K., & Yager, R. E. (2009). Assessing student understanding in science: A standards-based K-12 handbook. Corwin Press (Chapter One, pages 1-11). https://ebookcentral-proquest-com.ezproxy.lib.ucalgary.ca/lib/ucalgary-ebooks/reader.action?docID=1104962&ppg=16 2. Wiggins, G. (2005). Understanding by design: Overview of UbD & the design template. https://wpvip.edutopia.org/wp-content/uploads/2022/10/stw-normal-park-normal-understanding-by-design.pdf **Suggested Reading** 3. 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/publication/working-big-ideas-science-education

Week 6 - October 9 **Science Activities and Experiments**	Science Activity Planning and assessment Teaching science using experiments	**Required Reading** 1. Shaha, A. (2011). Are science teachers using experiments as props in lessons? The Guardian. http://www.theguardian.com/science/blog/2011/jun/21/science-teaching-experiments-in-lessons 2. 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. https://www-tandfonline-com.ezproxy.lib.ucalgary.ca/doi/full/10.1080/09500690701749305 3. ***Find a concept inventory in your discipline and bring it with you ready to discuss*** **Suggested Reading** 4. Galileo Educational Network. (nd). Guide to Assessing Critical Thinking. http://www.galileo.org/tips/rubrics/ct_rubric.pdf 5. Galileo Educational Network. (nd). Designing rubrics. Focus on Inquiry. https://inquiry.galileo.org/ch3/designing-rubrics/ 6. Trauth-Nare, A., & Buck, G. (2011). Assessment for learning. The Science Teacher, 78(1), 34-39. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sch&AN=61794775&site=ehost-live
Week 7 - October 16 **Science is grounded in context and history**	Inclusion and equity in the science classroom	**Required Reading** 1. Supalo, C.A. (2012). My Experiences as a Blind Chemistry Student. Braille Monitor. https://nfb.org/sites/default/files/images/nfb/publications/bm/bm12/bm1207/bm120703.htm 2. Supalo, C. A., Isaacson, M. D., & Lombardi, M. V. (2014). Making hands-on science learning accessible for students who are blind or have low vision. Journal of Chemical Education, 91(2), 195-199. https://pubs-acs-org.ezproxy.lib.ucalgary.ca/doi/full/10.1021/ed3000765 3. Dixon, S. (2005). Inclusion—Not segregation or integration is where a student with special

		needs belongs. The Journal of Educational Thought (JET)/Revue de La Pensée Éducative, 33-53. https://ezproxy.lib.ucalgary.ca/login?qurl=https%3A%2F%2Fwww.proquest.com%2Fscholarly-journals%2Finclusion-not-segregation-integration-is-where%2Fdocview%2F213807077%2Fse-2%3Faccountid%3D9838 **Pick one and read before class:** 4. Ok, M. W., Hughes, J. E., & Boklage, A. (2018). Teaching and learning biology with iPads for high school students with disabilities. Journal of Educational Computing Research, 56(6), 911-939. https://journals-sagepub-com.ezproxy.lib.ucalgary.ca/doi/full/10.1177/0735633117713113 5. Bargerhuff, M. E. (2013). Meeting the needs of students with disabilities in a STEM school. American Secondary Education, 3-20. https://ezproxy.lib.ucalgary.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=89935756&site=ehost-live 6. Oleynik, D. P., Scanlon, E. M., & Chini, J. J. (2022). The Epic and the Tragedy: Narratives of a Disabled Physics Student. Physics Education Research Conference. https://par.nsf.gov/servlets/purl/10421648 **Assignment 2 Due Friday, October 18th - 40%**
Week 8 - October 25 **Course Debrief and Work Period**	Course Debrief Field Experience Prep Conversation Conceptualization of science teaching work period	**Assignment 3 Due Friday October 27th, - 30%**

Assignments

The course is structured around the completion of three assignments. The assignment descriptions and assessment details will be discussed in class. The instructor will facilitate the ongoing work and will support students as they engage in the assignments by providing ongoing, timely and constructive feedback to further learning.

I. Assignment 1: Inquiry into Metaphor/Myth of Science Project, 30%, Due: Wednesday, September 18th

For this assignment, students will explore a Science Metaphor/Myth encountered at the secondary level in the student's teachable area as well as the conceptions/misconceptions that may arise from its usage in teaching. The Metaphors/Myths chosen for this assignment should emerge from class activities, engagement with peers & class readings, and should be connected to the development of the longer-term unit plans (Assignment 2). Students will investigate the topic through research into resources within the discipline and through peer discussion of personal experiences and observations. The choice of metaphors/myths for this assignment are up to each individual student based on their own interests, although https://science-education-research.com/teaching-science/constructivist-pedagogy/making-the-unfamiliar-familiar/science-metaphors/ is a good starting place for ideating if they get stuck.

Artifacts of Assignment 1 will be shared electronically via D2L Discussion Board on the date due. This post can include text, visuals, media, links, or any other medium allowed by D2L. Students should be creative in the development of this post. Submission components for the **Inquiry into Metaphor/Myth of Science Project** will include:

1. A starting explanation of your chosen Metaphor/Myth including a clear statement of the curricular concepts connected to it, an explanation of what makes it a Metaphor/Myth, and some conceptions/misconceptions that arise from using it in teaching.
2. A brief summary of your thoughts as a developing teacher on your chosen Metaphor/Myth as well as new or further questions raised as a result of your learning. Include a digital collection illustrating your developing thoughts through the process of exploring your Metaphor/Myth. You can create these and/or share existing links or examples (where copyright permits). The connection to your Metaphor/Myth should be made clear.
3. A list of resources used in the project completion (APA 7th edition).
4. Two responses to posts by classmates on D2L of your own thoughts on their Metaphor/Myth as a developing teacher.

Grading Criteria for Assignment 1

For Assignment 1, you will be assessed based on the following criteria (which will be expanded on in a rubric posted to D2L)

1. Quality and meaningfulness of Metaphor/Myth and resources used in investigation
    - Metaphor/Myth is articulated clearly, insightfully, and completely.
    - Metaphor/Myth is clearly connected to the Alberta Science Curriculum.
    - Metaphor/Myth is meaningful to teaching high school science.
    - Argument demonstrates an emerging understanding of concepts and theories related to the teaching of the discipline.
    - Submission includes at least 3 peer reviewed references.
2. Overall Presentation of Metaphor/Myth
    - Metaphor/Myth is presented in an organized, clear, and succinct way.
    - Thoughts as a developing teacher are presented with “I statements” and demonstrate a growing understanding of science teaching.
    - Resources are cited correctly and embedded when relevant.
3. Quality of responses to classmates
    - Responses to peers are thoughtful and representative of a growing teacher identity.

II. Assignment 2: Design of a Unit and Assessment Plan, 40%, Due: Wednesday, October 16th

For this assignment, students will work in small groups to design a set of individual unit learning plans that are illustrative of key aspects of curriculum and educational research introduced in the course. Students will then present on their chosen Metaphor/Myth & set of Unit Plan designs as a group in order to build the collective teacher toolbox of the class. Students will select the unit they will explore from one of their Metaphors/Myths submitted for Assignment 1 and design a larger unit plan around that topic. These unit plans may take any form chosen by the groups/individuals (such as around a specific project, a unit as distinguished in the Alberta Programs of Study, or other design choice). The learning design and the theoretical framework supporting it will be posted online for analysis and "feedforward" suggestions from members of the class.

Artifacts of Assignment 2 will be submitted individually, shared electronically via a digital folder to be uploaded on D2L on the date due. This post can include text, visuals, media, links, or any other medium allowed by D2L. Submission components for the **Design of a Unit and Assessment Plan** will include:

1. An individual component: You will individually design a Unit Plan for learning and assessment to foster deep understanding of science at the secondary level. Submission of this plan will be in the form of a .doc AND a .pdf file submission based on a provided (or approved) template. Components of this submission will include a rationale for the learning plan, as supported by theory and discipline discussed in and beyond the course, discussion of practicalities of enacting this Unit Plan (i.e. how it fits it into a larger context/concept), and consideration for integration of effective formative assessment strategies for scaffolding/learning progression and adapting to the needs of diverse learners.
2. A group component: You will present on your chosen Metaphor/Myth and set of individually created Unit Plans to the full class in order to build up a collective teacher toolbox. Presentations will be a 15- 20 minutes long (depending on group size) and will be shared electronically via D2L Discussion Board in-class right before each presentation

Grading Criteria for Assignment 2

For Assignment 2, you will be assessed based on the following criteria (which will be expanded on in a rubric posted to D2L)

1. Quality of unit structure
    - Unit plans cover the entirety of a single unit of junior high or high school instruction (4-6 weeks of 90-minute daily classes) with direct connections to the Alberta Science Curricula.
    - Considerations are embedded of required prior content knowledge, skills, or other considerations for each lesson, activity, and the unit itself.
    - Assessment opportunities (formative and summative) are embedded throughout the unit design with clear expectations for students
2. Recognition of diversity
    - Unit plan includes considerations of accessibility and understanding inclusion within school systems.
    - Unit plan includes opportunities for discussion of multiple ways of knowing.
3. Overall Presentation of Unit Plan
    - Unit Plan is presented in an organized, clear, and succinct way.
    - Resources are cited correctly and embedded when relevant.
4. Group Presentation of Unit Plan and Metaphor/Myth
    - Presentation is organized, clear, and succinct.
    - All members of the small discussion group contribute equally (as agreed upon by the group).
    - Unit plans are presented in ways that other classmates might be able to adapt them into their own teaching.
    - Metaphors/Myths are presented in ways that are accessible to classmates with other disciplinary backgrounds than those of the presenters.
    - Resources are cited correctly and embedded when relevant.

III. Assignment 3: Evolving Conceptual Understanding of Science, 30% Due Wednesday, October 23rd

For this assignment, students will respond to the prompt of "**Your changing conceptualization of science**" as way of reflecting thoughtfully on the pedagogical content knowledge in their subject area. Responses may take a number of forms, such as: an academic essay, an imagined Socratic dialogue between a teacher and student, an illustrated story, an animation, a short video or podcast, or other approved model. However, all responses must be persuasive – that is, students must fashion a personal stance on the prompt and then set out to persuade the reader of their interpretation using ***relevant and varied evidence.*** At a minimum, all responses must refer to the Alberta Education Programs of Study and at least 3 articles or chapters read during the course. In addition to these sources, you may also want to draw upon discussions in your class inquiry groups, additional readings from this and other courses, and observations made during your field experiences.

Artifacts of Assignment 3 will be submitted individually, shared electronically via a digital folder to be uploaded on D2L on the date due. This post can include text, visuals, media, links, or any other medium allowed by D2L. Submission components for the **Evolving Conceptual Understanding of Science Task** will include:

1. You will submit a single file, link to a webpage, or folder submission of whatever you chose to create as your response to the prompt.

Grading Criteria for Assignment 3

For Assignment 3, you will be assessed based on the following criteria (which will be expanded on in a rubric posted to D2L)

1. Quality of Argument
   - Argument is articulated clearly, insightfully, and persuasively.
   - Argument demonstrates an emerging understanding of concepts and theories related to the teaching of the discipline.
   - Submission includes at least 3 peer reviewed references.
2. Overall Presentation of Submission
   - Submission is presented in an organized, clear, and succinct way.
   - Submission uses an appropriate mode of expression for the argument being made.
   - Resources are cited correctly and embedded when relevant.

The Expectation of Excellence in Professional Work

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

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

As this is a professional program, experiences are designed with the expectation that all members will be fully involved in all classes and in all coursework experiences. As you are a member of a learning community your contribution is vital and highly valued, just as it will be when you take on the professional responsibilities of being a teacher.

- *Engagement in Class Discussion and Inquiry*

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

Expectations for Writing

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

- *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 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

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/627ed88eb4b041b7a2e8155effac350

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

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

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

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

the policy available at https://www.ucalgary.ca/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy

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

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

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

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

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

Werklund SU Representative is Tracy Dinh, educrep@su.ucalgary.ca.