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Interdisciplinary Earth– GEOL1040

(N1, QD, SU)

Spring Semester 2024

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Credits: 3, No pre-requisites.

Welcome!

Welcome to introduction to interdisciplinary Earth! We live in an era characterized by complex global challenges, that threaten the sustainability of the interconnected Earth system, thus the need for interdisciplinary approaches to scientific inquiry has never been more critical. To transcend disciplinary boundaries and address current environmental challenges, we require an understanding of the many facets in which sciences operate. This includes an understanding of natural science principles, but also requires a critical interrogation of origins and issues related to the prevailing, often exclusive, culture in natural sciences. It requires curiosity for disciplinary approaches and knowledge, but also humility and a true interest in understanding team functioning and effective communication to bridge disciplinary boundaries.

Over the course of this semester, we will delve into the theory, practice, and real-world examples of advantages and challenges of interdisciplinary approaches. We will draw from examples in the geosciences and critical zone science, investigating the complex interactions between the Earth's surface and subsurface environments related to sustainability. You will learn about examples from medicine and engineering to evaluate where interdisciplinary approaches have led to transformative solutions, but also investigate situations where lack of humility, understanding and collaboration caused catastrophic outcomes.

By spanning so many disciplines and approaches across scales, everybody will likely be outside of their comfort zone for some of the time. It is actually very important for scientists to develop healthy strategies to work within this discomfort and take responsibility for developing individual and team skills. In other words, this course is not meant for you to just hear about science, teamwork and communication, but to also define a group topic, experience team dynamics and practice communication using a variety of techniques.

Completing this course fulfills the following general education requirements:

N1: Natural Science (without lab):

1. Demonstrate familiarity with scientific thought, observation, analysis, experimentation, and formal hypothesis testing in relation to the general field or topic of the course.
2. As appropriate to the level and field of the course, make informed judgments about scientific information and arguments related to the natural world.
3. As appropriate to the level and field of the course, use appropriate theories and models to predict change in natural systems over time.

QD: Quantitative and Data Literacy requirement:

1. Present data in a variety of ways, including analytical, graphical, and tabular.
2. Interpret data, solve problems, and draw conclusions from data presented in a variety of ways, including analytical, graphical, and tabular, and communicate the thought processes involved.
3. Evaluate data-rich information and determine whether the resulting conclusions make logical sense or support a given argument within the context provided.

SU: Sustainability requirement:

1. Have an informed conversation about the multiple dimensions and complexity of sustainability.
2. Evaluate sustainability using an evidence-based disciplinary approach and integrate economic, ecological, and social perspectives.
3. Think critically about sustainability across a diversity of cultural values and across multiple scales of relevance from local to global.
4. Recognize and assess how sustainability impacts their lives and how their actions impact sustainability.

We will work with these main course goals across main themes:

1. Nature and origin of natural sciences (N1): Demonstrate an understanding of origin and the nature of science, including challenges with hegemonic ways of knowing. Develop foundational skills in scientific inquiry, including deductive and inductive reasoning.

2. Quantitative approaches in natural sciences (N1, QD): Demonstrate the ability to evaluate a variety representation of data for deductive and inductive reasoning and problem solving. Demonstrate the ability to draw conclusions from your own data plots generated in excel.

3. Interdisciplinarity (N1, QD): Define and explain the concept of interdisciplinary sciences. Recognize the historical context and significance of science and interdisciplinary research. Demonstrate an understanding of real-world examples of interdisciplinary research in addressing current challenges using examples from geosciences, critical zone science and engineering.

4. Sustainability (SU): Demonstrate the ability to have an informed conversation about the multiple dimensions of sustainability and evaluate sustainability related to interdisciplinary sciences in the context of economic, ecological, and social aspects. Think critically about sustainability across values and scales including your own impact.

5. Communication and team dynamics: Critically reflect on the necessity of, and challenges with, effective collaboration with individuals from diverse academic backgrounds. Understand the importance of clear roles and communication within teams and demonstrate ability to communicate interdisciplinary scientific concepts to non-specialist audiences.

Assessment:

- **Pre-meeting quizzes (Course Goal 1-3, 25%):** Before each lecture time you will have pre-meeting materials to complete. This includes recordings, readings, and other multi-media content.
- **At-home quizzes (Course Goal 1-3, 25%):** I will assess your knowledge and understanding in open-book quizzes. I encourage peer-to-peer mentoring and it is fine to work in study groups, but you need to hand in your own work, and you need to have understood what you are submitting.
- **Sustainability reflection (Course Goal 4, 20%):** You will compile a reflection on sustainability in relation to interdisciplinary sciences. We will use peer feedback and discussions using discussion boards and yellowdig before the final reflection is due (rubric in the appendix).
- **Yellowdig prompts (Course Goal 3-5, 10%):** We will use yellowdig for reflections/discussions around sustainability, data use, identity in science, communication and teamwork.
- **Communication pitch (Course Goal 5, 20%):** Participation in communication exercises and presentation to a broad audience. Over the course of the semester, we will co-develop a rubric based on your observations of guest speakers and we will use this for assessment at the end of the semester.

Letter grades correspond to percent grades (in parentheses) as follows:

A+ (97–100), A (93–96), A- (90–92), B+ (87–89), B (83–86), B- (80–82), C+ (77–79), C (73–76), C- (70–72), D+ (67-69), D (64-66), D- (60-63), F (below 60).

Reading: We will use a variety of readings that I will supply, including peer reviewed publications, and multi-media content. Resources on interdisciplinary sciences and the nature of science will be drawn from text such

“Introduction to Interdisciplinary Studies” by Allen F. Repko, “Becoming Interdisciplinary: An Introduction to Interdisciplinary Studies” by Tanya Augsborg, “Who's Asking?: Native Science, Western Science, and Science Education” by Douglas Medin and Megan Bang and Introduction to environmental geochemistry by Pete Ryan.

Schedule (subject to changes):

Over the course of the semester, we will move through the various aspects related to interdisciplinary sciences, from an introduction to the importance of teams and communication, the nature of science and sustainability back to teams and communication. Note that this schedule is subject to changes based on the availability of guest speakers and inclusion of current events.

Week	Topics	Example activities
<i>Introduction</i>		
1	Course orientation and syllabus review Introduction to Interdisciplinary Sciences. What is Interdisciplinary Science? The importance of perspective	Case study: when things go wrong. An example of incomplete data and reasoning
<i>Interdisciplinary science teams and communication part 1</i>		
2	The importance of teams and communication, teamwork, and cross-Disciplinary Collaboration	Case study: engineering
3	Effective Communication in Science, connecting to your audience, the power of story	Guest speaker, improv exercises, in person practice for 1/3, remote content for 2/3.
4	Reflecting on communication in science. Connecting to your audience, the power of story	Guest speaker, improv exercises, in person practice for 1/3, remote content for 2/3. Optional field trip (likely VT comedy club)
<i>Nature of science, science of nature and sustainability</i>		
5	Science of Nature - Nature of science, Historical context. Deductive and inductive reasoning.	How do we use data? Who is speaking? What is their perspective? How do they communicate?
6	Different ways of knowing, roles of data, values, and identity in science.	Ways of knowing. How we think about data. Guest speaker: identity in science, stories vs. publications.
7	Significance of interdisciplinary research for sustainability.	Connecting economic, ecological, and social perspectives of sustainability.
8	Significance of science and interdisciplinary research environmental challenges	Case study from geosciences, Critical Zone Science, and ecology: using data
9	<i>Spring break</i>	
10	Significance of science and interdisciplinary research environmental challenges	Case study from geosciences, Critical Zone Science, and ecology: using data
<i>Interdisciplinary science teams and communication part 2</i>		
11, 12	Cognitive toolkits and the science of teams. Thinking Critically About Disciplinary Perspectives and interdisciplinary needs.	
13-15	Group presentations, communication, and feedback sessions. We will have short pitches from groups with discussions, followed by wrap up and final assessment.	

Rules: WHAT’S OK AND WHAT’S NOT OK

ACADEMIC HONESTY AND PLAGIARISM – Academic honesty is expected of all students. The University of Vermont has a very strict policy concerning academic honesty and plagiarism. Please see the statement on academic honesty <http://www.uvm.edu/~uvmppg/ppg/student/acadintegrity.pdf>. Plagiarism constitutes a violation

of Academic Honesty and warrants failure on an assignment and/or failure in the course. The consequences of plagiarism or cheating range from a score of zero on the assignment or exam, to failing the class with an XF and filing a complaint with the University's Coordinator for Academic Honesty which can result in expulsion from UVM.

What's OK: it's ok and even expected that you work together and help each other with work in lecture and labs. For individual assignments it is OK to ask a friend, tutor, or group member to help you, however, you have to compile your own work based on this understanding.

What's not OK: Delivering any work without having understood it brings you into a potential danger zone: it is not ok to simply copy an answer, writing or quizzes. Plagiarism includes copying part or all of a fellow student's report, copying from original references, texts, or websites without proper citations etc.

RESPECT – It is of utmost importance to maintain a respectful environment in class, and this includes online environments. We expect this from all of you as you should expect this from us. You are here to learn, and we are here to help you learn with mutual respect.

What's OK: it's OK to arrive late if you have any unforeseeable events. It's OK to miss class for any reason that is out of your control (e.g. sickness) BUT I expect you to make up for it. This means completing all assigned reading, online content and contact your group for additional materials, spend some time with this BEFORE you contact me or the TA with questions.

It's OK to disagree with each other and ask for clarification. It's OK to feel frustrated when things don't go well.

What's not OK: It is not OK to disrupt class. It is not OK to expect a private tutoring session from the TA if you missed class for any reason. Before you contact us or come to office hours you should complete all assigned reading, watching, check in with your group as appropriate and spend some time thinking about the materials. We will be happy to address any remaining issues. It is not OK to blame, shame or insult anybody e.g., when you disagree. It is not OK to work out your frustration on others.

COPYRIGHT ON TEACHING AND CURRICULA MATERIALS – It is the University's policy that teaching and curricular materials (including but not limited to classroom lectures, class notes, exams, handouts, and presentations) are the property of the instructor.

What's OK: you can and will use all class materials for your own learning.

What's not OK: electronic recording and/or transmission of classes or class notes is prohibited without express written permission from me. Such permission is to be considered unique to the needs of an individual student (e.g., ADA compliance), and not a license for permanent retention or electronic dissemination to others. For more information, please see the UVM policy on Intellectual Property, sections 2.1.3 and 2.4.1. In short, do not share any class materials.

EMAIL – email is an important way of communicating; at the same time, it is not uncommon for faculty members to receive more than a 100 emails per day and emails can get lost.

What's OK: please contact me with any questions on the lecture or lab part that you cannot solve by yourself; I will answer you within a few business days. If you want an appropriate answer to your particular question, it is important to be precise in your wording. Also, please note that I will not answer emails during afterhours or weekends.

What's not OK: please do not contact me with questions you could have googled or ask content questions before you completed the assigned reading/watching. Please don't count on last minute help during afterhours when an assignment is due, you might not get an answer in time. Please use a respectful tone when writing me. It is not uncommon that faculty are addressed with "Yo", "Dude" etc, which is not acceptable.

SICK? – We still are dealing with COVID...

What's OK: If sick and potentially infectious (COVID, Flu, etc.), please do not come to class and let me know by email. After getting over a cold, consider wearing a mask for some time as a courtesy to others.

What's not OK: please do not come sick to class. It used to be considered "heroic" to push through and come to work/class feverish, coughing and sniffing. But all you do is prolong your recovery and get others sick. Take care of yourself and of others by staying home.

RELIGIOUS HOLIDAYS – We endorse observation of religious holidays!

What's OK: by the end of the second full week of classes submit in writing your documented religious holiday schedule for the semester to us. Plan ahead and make you're your group knows if you will miss group work. Students who miss work for the purpose of religious observance will be allowed to make up this work. Please avoid informing us post-hoc (after the fact).

OTHER INFORMATION and POLICIES:

In keeping with university policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly recommended to discuss with their faculty the accommodations they plan to use in each course. Faculty who receives Letters of Accommodation with Disability Related Flexible accommodation will need to fill out the Disability Related Flexibility Agreement. Any questions from faculty or students on the agreement should be directed to the SAS specialist who is indicated on the letter.

Contact SAS:

A170 Living/Learning Center;
802-656-7753
access@uvm.edu
www.uvm.edu/access

A credit hour is now formally defined, for Title IV aid purposes, as an amount of work that reasonably approximates not less than: (a) one hour of classroom or direct faculty instruction and a minimum of two hours of out of class student work each week for approximately fifteen weeks for a semester or (b) at least an equivalent amount of work as required in (a) for other academic activities such as laboratory work, internships, practica, studio work, or other academic work leading to the award of credit hours.

Alcohol and Cannabis Statement:

The Division of Student Affairs has offered the following statement on alcohol and cannabis use that faculty may choose to include, or modify for inclusion, in their syllabus or Blackboard site:

Statement on Alcohol and Cannabis in the Academic Environment

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.

Teaching and Learning Style: Students learning style and instructors teaching style do not always match but there are ways to help each other. A good start is to assess *your* own learning style and to find out what you can do to support your own learning. Please take the "Index of Learning Styles Questionnaire" following this link: <http://www.engr.ncsu.edu/learningstyles/ilsweb.html>. The results are for yourself only, but this very simple test will help you to better understand your learning.

APPENDIX

Sustainability reflection

- 1) Sustainability learning outcome (SLO) 1:** ability to have an informed conversation about the multiple dimensions of sustainability.

- What did you think sustainability was before taking a SU course?
- What sustainability definition from the “sustainability buffet exercise” stuck out to you and why?
- What do you think are the biggest misunderstandings when talking about sustainability?

2) Sustainability learning outcome (SLO) 2: ability to evaluate sustainability related to interdisciplinary sciences to integrate economic, ecological, and social aspects.

- What are the most important sustainability aspects specifically with respect to interdisciplinary sciences?
- What is an example that exemplifies how economic, ecological and social aspect of sustainability might be easy to integrate? What is an example where this integration is difficult?

3) Sustainability learning outcome (SLO) 3: ability to think critically about sustainability across cultural values and scales from local to global.

- Concerning interdisciplinary sciences, what are examples where sustainability considerations may depend on cultural values?
- In which way are scales (local to regional to global) significant in this context?

4) Sustainability learning outcome (SLO) 4: ability to think critically about how you impact (and are impacted by) the sustainable practices.

- How can integrating what you learned in this course help addressing sustainability issues?
- What is the one unsustainable practice you wish people would stop?

Rubric for sustainability reflection	Excellent (full points)
Depth of Reflection	Response demonstrates an in-depth reflection on, and personalization of, concepts of sustainability in general and related to interdisciplinary sciences specifically. Viewpoints and interpretations are insightful and well supported. Clear, detailed examples are provided, as applicable.
Required Components	Response includes thoughtful reflection on all prompts. Each question or part of the assignment is addressed thoroughly.
Structure and writing	Writing is clear, concise, and well organized with excellent sentence/paragraph construction. Thoughts are expressed in a coherent and logical manner.
Evidence and Practice	Response shows strong evidence of synthesis of ideas presented and discussed during the course. The implications of these insights for the respondent's thinking about sustainability are thoroughly detailed, as applicable.