University of Minnesota
Humphrey School of Public Affairs

PA 4790. Science to Action: How does Science & Technology Inform Policy?
Course Syllabus
Science, Technology & Environmental Policy
M/W 4:00-5:15, East Bank, Fall 2020

DRAFT:
2/18/20

This syllabus is under construction and will be updated until the Fall 2020 term starts. Check back occasionally.

Instructor
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Course Philosophy

The intent of this course is to introduce undergraduate students, primarily in STEM majors, to the larger world of public policy and how science and technology informs business and policy strategy and decision making. This interaction has a major impact on the economy, culture, and people’s lives, yet often happens without forethought and with many unintended consequences.

Undergrad STEM students are well versed in their major area of study, this is a course to introduce them to the various ways that science and engineering more broadly transitions to the world at large. Major topics in the class will include, but are not limited to, climate change mitigation and adaptation, energy transition, environmental justice, water and food security.

Who should take this course? This course should be of interest to any student in a STEM, health or design related major that is interested in how topics in their field move from theory into an actual broader impact in the world. Conversely, students in policy, global studies and business will be interested in how policy is developed from a broad range of inputs and stakeholders. Initially it may seem obvious if you think about a technology creating impact by being incorporated into a product or to a client or patient setting. But what about a broad challenge like climate change mitigation and adaptation? How does a single product or idea
have an impact on that? Broader impact involves the business, public and non-profit sectors. A topic like climate change is deeply intertwined with all those sectors. How does science permeate into all those sectors? Policy is probably thought of as a political activity or the realm of students interested in political science or a government career. However policy is dependent on no one single discipline. The development of science and technology-focused policy involves taking into account the well-being of all citizens, requires excellent problem solving skills, holistic thinking, a breadth of knowledge and the ability to work with a wide range of professionals. These are all skills that will make anyone more impactful in their career. This course will cover the frameworks and practices around science and technology policy and how they are shaped.

Learning Objectives

Policy is typically a graduate or professional school pursuit. As an undergraduate course, the objective here is to introduce the field to advanced undergraduates as either a further field of study or to further their understanding of policy in enhancement of knowledge of their own field.

Primary Learning Objectives

● Students will gain a basic understanding of a more holistic world view and how to anchor that view to their STEM expertise.
● Students will understand and apply basic public policy theory and frameworks to select case study topics. (see Public Policy Primer)
● Students will understand and apply policy implementation frameworks to select science or technology topics. (see Theory of change and eightfold path).
● Students will apply core concepts from readings and lectures to contemporary policy issues, even in cases where the scientific or technical dimensions may be unfamiliar.
● Students will understand major institutions that shape science, technology, and environmental policy. How do these institutions and systems affect how STEM innovations and developments move into the economy?

Secondary Learning Objectives

● Students will synthesize knowledge from multiple sources.
● Students will develop a basic understanding of the concept of system thinking and stakeholders.
● Students will understand different paths to implementation and apply the appropriate path to their proposed intervention or solution.
● Students will discuss and identify key leadership traits as they create arguments for panels and debates.
● Students will defend in oral and written communications the various stages of select papers and positions.
● Students will understand cultural and societal implications of their proposed intervention.
● Students will work effectively in a team and with mentors.
- Students will create and deliver effective oral presentations.

Contribution to undergraduate student learning outcomes.
- Can locate and critically evaluate information
- Have mastered a body of knowledge and a mode of inquiry
- Can communicate effectively
- Apply the role of creativity, innovation, discovery, and expression across disciplines

Grading

Student Deliverables
- 25% - Reading assignments, participation.
- 25% - Structured debates - perhaps with the invited guests. The guest could moderate and review the point/counterpoint. All students have 1 or 2 papers, the ones in the debate/panel have more to read/prepare. Every student has to do at least two of these.
- 25% - Analysis of case studies - short 3-5 page papers answering some questions on each case study.
- 25% - Final paper/presentation - Pick a topic (from your major), write your own analysis

Course Structure

The course will employ a combination of topical lectures (including guest lectures from in and out of the academy), case studies, structured discussions and simulations, and student panels and presentations.

This is a 3 credit course. It will meet twice a week with 75 minute sessions.

Module 1 - Introduction to Science, Technology and Environmental Policy
Objective: The objective of this first module is to introduce the breadth of the topic and the course, to practice a simulation to gain an understanding of this breadth, and to start to develop a broader world view.

Week 1 Session 1. Introduction. Lecture and discussion.
- Define Wicked Problems and Grand Challenges. This class will cover topics such as climate change mitigation and adaptation, environmental justice, energy transition, food and water security,
Introduce Public Policy - What is encompassed by this course and by policy in general. As in many STEM fields, defining the problem is important in policy.

Week 1, Session 2. Simulation of discussion on a Case Study. Simulation is TBD but will be a role playing session over the course of a class. There are off-the-shelf cases but may develop one for a MN case (such as nitrogen runoff, solar garden installation or PolyMet).

Assignment due to read the roles, prepare for the negotiation, read the case. This, along with the debrief will take the whole class. Learning objective is to identify stakeholders, complexity of problem, a framework for addressing it. Begin to develop the mindset of students to be more inclusive and holistic.

Week 2, Session 1. What are the elements and areas in Science, Technology and Environmental Policy (STEP)? A case study, an examination of the case simulation done in week 1, will be done to show the aspects of developing a policy. This will include quantitative and qualitative methods, stakeholder analysis, multidisciplinary teams, societal implications, and policy frameworks.

Week 2, Session 2. Assign a reading plus have students find another source on topic. Class discussion will introduce and utilize the MIT FLOWER (The Framework for Long-term, Whole-system, Equity-based Reflection) system. This system introduces and helps students practice the idea of measuring and ensuring multiple and equitable benefits for a given policy.

The EN-ROAD MIT games are too complex for this early, something students know, maybe around water or energy (maybe something like a solar garden installation)

Module 2 - Frameworks to Create and Implement Science, Technology and Environmental Policy
Objective: The objective of this module is to introduce common tools, approaches and frameworks. Students will have a chance to practice these as well as see them applied in various cases.

Week 3 Session 1. Problem solving. Good policy starts with defining the problem. This sounds simple but rarely is. This class introduces the Eightfold Path to effective problem solving, which is one framework. This class session, including workshop time, will work on good and bad problem definitions.

Week 3 Session 2. Theory of Change. This is another framework and common approach. This class introduces Theory of Change and Logic Model, and includes workshop time to apply it.

Week 4 Session 1. Quantitative Assessment. This is not a class on quantitative methods, that would be multiple semesters. But it is important to understand how important data is to good policy development. This will be done using the EN-ROADS Climate solutions simulator.
allows both more understanding about Climate solutions and quantitative methods. This class session introduces the topic and prepares students for a class exercise.

Week 4 Session 2. EN-ROADS simulation workshop and debrief (assignment as well).

Week 5. Session 1 Qualitative methods, Equity and Environmental Justice.
Week 5 Session 2 Assignment, work.

Week 6 Session 1. Implementation Pathways. Examples of how public policy, business, NGO and activist sectors interact. Illustrate with a case study, ideally related to the one the previous week to highlight the qualitative aspect of this.
Week 6 Session 2. Assignment: Write a 1-2 pag recommendation. Class workshop on topic (structure this as a team follow on to the quantitative work the previous week.

**Module 3 - Mid term Assess and Reflect**
Objective: This is about to mid term. Much of the basic knowledge has been given. This is an open week for now in the class, to catch up and reflect

Week 7 Session 1. Assignment - mid term reflection.
Week 7 Session 2.

**Module 4 - Case Studies**
Objective: This module will cover several case studies on topics of interest. The knowledge of the tools, approaches and frameworks learned to date will be applied to discussion and work related to these case studies.

Weeks 8-11 Case study presentations. Guest lectures and assignment on topics. Students have assignments from the 3 areas below:

- Verbal - point counter point session in class.
- Written - sample policy briefs (1 -2 pages)
- Quantitative analysis using tools like Climate Interactive and MN Climate data.

**Module 5 - Final Application and Reviews**
Objective: The final assignment will allow the student to develop a final recommendation using the tools and approaches developed during the class.
Week 12-15. Work on final plans and presentations. As an example, the final project can use the EN-ROADS simulator, where teams have to decide on a scenario, run the sim, make a presentation and write a policy brief on it.

- Pick case studies around the sub areas (Energy, transportation, housing, food/ag, water)
  - Students pick both a topic, and then discuss the ways to impact (policy, NGO, etc.)
- You are advising the state on how to do this. Bring in some commissioners to actually listen (Steve K, Tim Sexton, MPCA, Met Council, Great Plain, Fresh Energy.)

Possible Case Studies being examined

From Praxis Book
Simulation (Bison in Yellowstone)

From STEP Intro course
- Synthetic biology (innovation and IP)
- Deploying "big science" models for climate change (government-led R&D)
- The DOE loan guarantee program and ARPA-E (entrepreneurship and public policy)
- Global innovation in cookstoves (innovation for sustainable development)
- CAFE standards cost-benefit analysis (environmental policy principles)
- Acid Rain in the 1990 Clean Air Act Amendments (environmental policy spheres)
- Pipelines: Dakota Access and Keystone (environmental justice)
- The Montreal Protocol (global environmental change)
- Cape Wind (expertise, public engagement, and society)

To Be Developed
- Polymet
- Renewable energy targets
- Nitrogen runoffs

Topics (these are topics that may layer across as examples):

- Water
- Renewable energy
- Food and Ag
- Climate Adaptation
- Environmental Justice \{this should be embedded in all the topics\}
- Genetics, personalized medicine
- Automation and AI
- Air Quality
- Transportation
- Internet (deep fakes, cyber security, etc.) - \textit{Maybe not worth a separate one.}
- SDGs (Sustainable Development Goals)
- Impact Investing/ESG

**University and School policies**

For links to University of Minnesota and Humphrey School policies, please click the “U of M Policies” link on our course Canvas site, or see [https://z.umn.edu/PolicyStatements](https://z.umn.edu/PolicyStatements). Policies include information on student conduct, scholastic dishonesty, sexual harassment, equal opportunity, disability accommodations, and more.