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## **A Pedagogical Approach to Teaching Climate Change and Ethics**

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### **Abstract**

Climate change is not only a political, economic, and social crisis, it presents one of the great moral problems of our time. This paper describes an introductory course that describes the science, policy, and ethics of climate change. The course uses the pedagogical approach of integrative studies to provide students the tools to understand the basic science of climate change and its ethical implications. Students come away with a better sense of the moral dimensions of this phenomenon and the implications for human civilization and for the biosphere.

### **Introduction**

This paper describes a pedagogical approach to teaching climate change and ethics to students in an integrative studies course. Students are provided with the tools to explore the implications of climate change for the earth and human civilization as well as to explore the moral dimensions of climate change. Students complete two major projects during the course: a mid-Semester Living Room Conversation, and a final mock climate negotiation. The paper is structured with a beginning Review-of-Literature which describes the complexity of climate change research and how others have addressed teaching this difficult topic through a moral and ethical lens. The portion following this section outlines the methods and course structure in Methods and the projects in the course are described in Projects. The paper closes with a brief Conclusion.

### **Review-of-Literature**

Climate change research aims to establish a detailed understanding of the effects of increasing carbon concentrations in the atmosphere, and translating those into impacts on environmental, ecological, and social systems. Hence, climate change research studies complex systems, initially atmospheric, but also impacts of those changes on other biophysical and socio-ecological systems (and in turn socioeconomic systems) (Rind, 1999, Simon and Schiemer, 2015).

All of these systems are characterized by complexity – there are feedback loops (creating potential tipping points) making simple, linear cause and effect relationships hard to identify, especially for students. (McGuffie and Henderson-Sellers, 2001, Rind, 1999, Shackley et al., 1998). While climate modelling has developed rapidly, there is still development needed to improve these models for both research and decision-making processes (McGuffie and Henderson-Sellers, 2001, Moss et al., 2010).

This complexity means that many aspects of climate change are beyond predictive modelling. Hence, research has to rely on alternative ways of understanding these systems and testing findings that does not rely on traditional prediction and replication (Holm et al., 2013, Mooney et al., 2013, Yeh, 2015). At the same time, human systems involve values, emotions and ethical questions, especially over equity (Mearns and Norton, 2010). The increasing focus on climate change adaptation research, which focuses on the social response to biophysical climate change, highlights the complexity of climate change research (Füssel, 2007, Tol, 2005) and the difficulty of engagement on the student level with both science and ethics.

One result of this complexity is the uncertainty that surrounds climate change research (Barnett, 2001). Climate change fits the criteria of post-normal science, in that it is both highly uncertain but with very high stakes (Funtowicz and Ravetz, 1993, Ravetz, 1999). This challenges many of the established processes for doing research by requiring the inclusion of range of other knowledges (e.g. Indigenous/traditional knowledge, local knowledge, policy knowledge) into the traditional scientific process (Yeh, 2015).

This uncertainty creates challenges for communication as well: communicating that uncertainty without undermining trust in the research is a challenge for educators (Dessai et al., 2007, Heazle, 2010, Moss, 2007). Developing climate change research that provides straightforward 'solutions' to problems is often impractical; researchers must balance the need for cutting-edge, theoretical research with demands for applied, 'policy-relevant' science.

The complex nature of climate change means that any study of it requires a highly interdisciplinary approach (Olsen et al., 2013, Yeh, 2015). Climate change research has to consider the social, economic and political relationships around climate change, as recognized in the IPCC reports. The challenge of interdisciplinary research is well-known (Olsen et al., 2013, Reisinger, 2011, Yeh, 2015). Existing research silos and increased specialization have created barriers to collaboration across disciplines. The different approaches of natural and social sciences, in particular, provide difficulties in establishing an integrated approach as they often work to different ontologies, epistemologies, and methodologies (Holm et al., 2013, Mooney et al., 2013, Yeh, 2015). Further, the post-normal nature of climate change means that interdisciplinarity also needs to include and engage with a wide range of stakeholders (e.g. policy-makers, managers, decision-makers, industry, communities etc.) as part of the research process, thereby becoming transdisciplinary (Bäckstrand, 2003, O'Brien et al., 2013). However, as we discuss below, overcoming this barrier is key to realizing further potentials for climate change research and education at universities.

Researchers looking to address these barriers have highlighted how pedagogical approaches can encourage learning and critical thinking about climate change. Bardsley and Bardsley (2007) described a constructivist approach to teaching and applied learning to stimulate the analysis of the potential impacts of climate change on systems familiar to high school students, resulting in students discussing possible behavioral and broader personal responses to reduce the impacts of future climate change. Aaron et al. (2013) highlighted that the challenge of climate change offers educators in science, technology, engineering and mathematics (STEM) fruitful opportunities to foster interdisciplinarity, fostering youth talent in STEM fields and enhancing multiple literacy for all students.

Climate change is seen by some as a moral problem in part since its causes are connected to large CO<sub>2</sub> emissions from industrialized countries, whereas developing nations suffer the effects of these emissions. While a deeper discussion on this issue is outside of the scope of this paper, the moral dimensions of the problem should be acknowledged. Understanding and characterizing climate change as a moral problem is gaining wider currency in recent years: from the most recent IPCC Assessment Report (Kolstad et al., 2014) to Pope Francis' (2015) Encyclical, *Laudato Si*.

In its most recent Assessment Report, the IPCC Working Group 3 on Mitigation of Climate Change included for the first time a climate ethicist, John Broome, as a lead author of Chapter 3: "Social, Economic, and Ethical Concepts and Methods" (Kolstad et al., 2014). The chapter includes moral concepts such as moral responsibility, fairness, intergenerational and distributive justice, well-being, and non-human values. The chapter acknowledges that "ethical judgements of value underlie almost every decision that is connected with climate change, including decisions made by individuals, public and private organizations, governments, and groupings of governments" (Kolstad et al., 2014, 215). The moral concepts addressed by this work are for the first time receiving the same degree of publicity as the STEM fields have had over the past several decades. Broome's material is understandably introductory and nowhere reaches the level of sophistication of similar discussions found in non-STEM forums. Nevertheless, his chapter paves the way for more substantial discussions to come.

Notably, Pope Francis has highlighted the significance of thinking beyond the technological and economic aspects of climate change. He appeals for "a new dialogue about how we are shaping the future of our planet" (Pope Francis, 2015, 14). He cautions against endorsing the "extreme" positions of "those who doggedly uphold the myth of progress and tell us that ecological problems will solve themselves simply with the application of new technology and without any need for ethical considerations or deep change" (Pope Francis, 2015, 60). In other words, Pope Francis' widely read encyclical highlights the distinctly moral dimension of climate change that cannot be addressed by the STEM fields alone.

Moreover, a moral framing of climate change means that researchers need to consider their responsibilities in ensuring that their research and its impact have positive effects.

This is reflected in the growing interest in Responsible Research and Innovation (RRI) (Burget et al., 2017, Owen et al., 2012). This agenda highlights the need to ensure governance of research and innovation that is inclusive of other stakeholders and ensures that research addresses social and environmental issues (Stilgoe et al., 2013). It strongly reflects the recognition that many areas of research, including climate change, have become 'post normal' science.

There has been debate over whether considerations of the moral or axiological aspects around environmental issues make any substantial difference in the outcome of policies – fundamental to research having impact (Norton, 1991, Stenmark, 2002). However, Stenmark (2002) shows how policy outcomes often vary widely depending on whether one adopts an anthropocentric, biocentric, or ecocentric axiological position. Similarly, Kassiola (2003) shows that if underlying social values and their by-products – e.g., the “ceaseless material consumption and the resulting overconsumption producing depletion of natural resources and environmental pollution” (Kassiola, 2003, 10) – are left unexamined, then it is possible new policies will unintentionally reproduce those values, treating the symptoms rather than the roots sources of our environmental problems.

For this reason, philosophy, and more specifically, moral inquiry, is an important tool for analyzing climate change mitigation and adaptation strategies. Universities already house different departments and disciplines that conduct research into these areas in their own ways, but there is untapped potential for these disciplines to come together to fully address the multidimensional challenges of climate change. Hence, a pedagogical approach that allows students to explore climate change through the lens of both science and ethics is a valuable and useful exercise.

## **Method**

Students who enter the course come from a variety of backgrounds and majors, as well as a variety of college standing (1st-8th colligate semesters). Some students are first semester freshmen, while others are seniors completing their final course requirements. This course gives students a basic understanding of energy and energy usage as well as engaging with current questions about climate, weather and climate change through the lens of ethics. As students come from a variety of backgrounds, both in college coursework/preparation and in science literacy, it is a challenge to engage the entire class in discussion and dissection at a sufficiently challenging yet not unreachable level. In order to meet this challenge, I approach the course from the perspective of scientific inquiry. By initially introducing the class to the scientific inquiry process, I provide students a framework with which to fit existing knowledge and to place new knowledge.

Similarly, the coursework is structured such that it follows the wheel of scientific inquiry through the progression of course topics. The course begins by exploring the observations we have made with respect to weather and climate, for example, by asking students to research an extreme weather event and present their findings in the form of a discussion post or course presentation. Through this lens, students are invited to consider the relationship between these events and changing climate. Once they begin

to see the linkages between current events and the larger picture of climate change, they are asked to think about what we know and what might be responsible for this, leading to the second focus of the course on ethics. Students then “investigate the known” by learning about energy and energy usage from a global perspective, then narrowing to the national picture, then narrowing further to the local energy portfolio. By starting students with the global perspective, it helps them to place their learning in context.

A similar pathway is followed for all ethical discussion. Students are invited to read *Uncertainty in Policy Making. Values and Evidence in Complex Decisions*, by Heazle (2010). The conclusion of the paper outlines lessons learned following the devastating hurricane on Cape Verde, which include challenges in communication and preparedness given the diverse socioeconomic population of the island. Students are asked to discuss the ethics involved in effective communication, both before and after extreme weather events and to consider the implications of ethical behavior. In this way, students both “observe” and “reflect on the findings.”

## **Projects**

To bring together student learning about climate change and ethics, students engage in Living Room Conversations using the summary for policy makers from Kolstad et al., 2014. A Living Room Conversation bring together between four and six individuals (ideally six) to host a meaningful conversation about an issue, where the focus is learning from one another and being open and curious, rather than debating the issue. Two students serve as hosts and each invites two other individuals to be part of the conversations. Living Room Conversations can take place anywhere, including via virtual tools like Zoom. The hosts come up with 2 well-researched facts and 5 open-ended, inclusive questions that they want to know the answer to that can lead into the relationship between people's values and thoughts about climate change. Some of these questions can be detailed, but there should be at least 2 large-scale open questions. To begin the conversation, students start with start with open discussion about their values before concentrating on climate. For the facts, students are required to cite peer-reviewed publications, using the IPCC summary as a jumping off point.

### **Project 1: The Living Room Conversation**

The Living Room Conversation is an open-source, non-profit project that was founded in 2010 with the aim of create a structured, intimate conversation format that would empower everyday citizens to discuss important issues with friends of differing political affiliations and backgrounds. The theory was that if two friends with different points of view, each invited two friends to join a conversation, with full disclosure about the intent and structure of the conversation, they could create a safe space for a respectful and meaningful exchange of ideas, develop new relationships and perhaps find common ground. Students utilize the Living Room Conversations as a way to synthesize their learning of both climate and ethics while engaging others in discussion. Student feedback related to this portion of the course included the important reflection: “I also liked that she had us doing this type of hands on activity in class. I feel that because she did that it made it much more fun to learn.”

## **Project 2: Mock Climate Negotiation**

The final for the course is a mock climate negotiation. Based on the Paris climate negotiations, students organize themselves in groups of four or five to represent a country that is not the United States. This exercise takes place in over two class sessions. During the initial session, students are reconfigured into five groups, so that all the ministers of culture are sitting together, all the ministers of environment, the ministers of energy, foreign ministers, and industry reps. The goal for this session is to have an open discussion without the pressure of negotiation. Each country presents its particular situation regarding energy, culture, etc. and then they should talk about 1) what useful information is missing about their country, and 2) how their particular portfolio intersects with carbon reduction goals for their country. The purpose here is to mimic the actual international process by which countries prepare for international organizations. To prepare for these negotiations, students complete and submit a short research paper of approximately 900 words. The subject of the research paper will depend on a) the chosen country and b) the students' administrative "portfolio." The job of the student is to understand their country's commitments under the Paris accord and how they fit into that country's overall goals. In other words, students are trying to understand what each country thinks are economically viable, technically feasible, and ethically important. For example, if a student chooses to represent the energy minister for China, they will want to know China's energy needs, current mix of energy production, and specific plans for renewable energy in the future. The research paper should include authoritative data from a variety of sources (such as from the recent IPCC Assessment Report (Kolstad et al., 2014) to Pope Francis' (2015) Encyclical, *Laudato Si.*) as well as analysis of those data. Following this class session, the mock negotiation is held. Each delegation is allowed 1-5 minutes (as determined by the moderators) to present a poster with its outline for the negotiation. The faculty moderator invites responses to the stated goals from other delegations; only those recognized may speak. Following presentation, students expected to engage in bilateral and trilateral negotiations with representatives from the other countries. Together they must join with other countries to generate a PowerPoint slide or two, which details how they intend to reach their CO<sub>2</sub> reduction goals and justifications. Following creation of these slides, students sit in their multi-country blocs and present the results of multi-lateral negotiations. Delegations are allowed 1-5 minutes (as determined by the moderator) to present their PowerPoint slides. After the first presentation, non-represented countries vote either to discuss or to move on to the next presentation. Objections must include positive alternatives. At the close of negotiations, results are binding and a new "accord" is generated. This exercise is a great close of the course as students must utilize their learning of both climate and ethics along with civil discourse to follow a dialogue that mirrors real world processes. Student feedback included the important quote: "The final climate negotiation helped me to really understand the positions of each country and how climate change affects everyone."

## Conclusion

This paper presents a brief outline of a novel pedagogical approach to teaching climate change and ethics through an integrative studies course. Students use the wheel of scientific inquiry to fit existing knowledge with new knowledge to broaden their understanding of topics in both climate and ethics. As part of the course, students synthesize their learning through two major projects; a mid-semester Living Room Conversation and the mock climate negotiation. This approach is unique in pedagogy by providing students with the tools to explore the moral dimensions of climate change and the implications for human civilization and for the biosphere.

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