Teaching Climate Change in the "Anthropocene": An Integrative Approach

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Abstract: Why are we still educating college and university students through a Holocene lens? How can we expect young people to engage with the transformative challenges required to meet the targets of the Paris Agreement when climate change education is organized in a narrow and linear fashion? Climate change courses and teaching modules largely emphasize scientific literacy through a focus on physical processes, documentation of rising emissions, and empirical evidence of a changing climate. Classroom explorations of responses to climate change are often limited to "business-as-usual" policy options, new technologies, and behavioral interventions to reduce emissions or promote adaptation. Such approaches make it difficult for students to recognize the social dimensions of climate change and to identify openings and entry points for sustainability transformations. This Viewpoint contribution argues that it is time to rethink climate change curricula within higher education and adapt it to the "Anthropocene." We present an integrative approach to climate change education that focuses on humans as active and reflexive agents of large-scale systems change, incorporates economic, political, cultural, psychological, and emotional dimensions of the issue, and fosters active engagement with transformations to sustainability.

1. Climate Change Education for the "Anthropocene"

Public awareness of humanity's impact on the global environment has increased dramatically over the past several years. Growing recognition of the gravity and urgency of the threat has led to a surge of concern and environmental activism among young people, as evident in the Fridays for Future climate strikes, climate marches, and expanding participation in organizations such as the Extinction Rebellion and the Sunrise Movement (Stuart and Gunderson 2019). More and more young people recognize that they will experience the greatest impacts *and* bear the costs of adapting and implementing effective climate solutions. They are describing climate change as a "climate crisis" or "climate emergency" that requires immediate action.

Are colleges and universities adequately responding to this urgent challenge and preparing students to engage with the scope, scale, speed, and depth of the transformations that are called for? In particular, are they preparing students to meet the targets of the Paris Agreement and to reach the United Nations Sustainable Development Goals? Despite increasing recognition of the complexity of the problem and the need for transformative solutions, climate change education at the college and university level is largely organized in a narrow and linear fashion (Hindley and Wall, 2018). That is, climate change courses and curricular interventions primarily emphasize scientific literacy through a focus on physical processes, documentation of rising emissions, and empirical evidence of a changing climate. Classroom explorations of responses to climate change are often limited to "business-as-usual" policy options, new technologies, and behavioral interventions to reduce emissions or promote adaptation. As a result, students have difficulty recognizing social, psychological, and emotional dimensions of

the issue, and often fail to see openings, possibilities, and entry points for active engagement with sustainability transformations.

In this Viewpoint contribution, we argue that it is time to recalibrate how we are teaching climate change within higher education and adapt it to the new proposed epoch, the Anthropocene. The Anthropocene denotes a period of pervasive human influences on global environmental systems (Steffen et al. 2015). Recognizing the Anthropocene means fundamentally rethinking our understanding of connections between humans and nature. It means seeing humans as active and reflexive agents of large-scale systems change, capable of responding with wisdom and foresight to reduce risk and vulnerability (Bai et al., 2016). It also means recognizing the political, economic, and cultural dimensions of climate change and drawing attention to the powerful actors, interests, and practices that shape uneven development policies and practices (Leichenko and O'Brien, 2019). By adapting climate change education to the Anthropocene, we can engage students with positive and empowering frameworks that motivate critical reflection and action on the types of transformative responses needed to adapt and thrive.

2. Teaching Climate Change: An Integrative Approach

The Holocene epoch, which began 11,700 years ago, is often described as the time when environmental conditions enabled human civilization to develop and flourish (Steffen et al. 2004). During this epoch, humans began to transform the land, exploit minerals and other resources, and harness the energy of fossil fuels, releasing stores of carbon and other greenhouse gases into the atmosphere. The impacts of these environmental changes over the past centuries have been profound, leading many scientists to suggest that we are living in a new epoch, the Anthropocene (Chin et al., 2017). In this new proposed geological epoch, and particularly over the post-1945 period that Steffen et al. (2011) suggested as the Great Acceleration, humans have been undermining the very conditions that have allowed them to thrive. The enabling conditions for human and non-human life are being transformed at a rate and scale unprecedented since the dawn of civilization, creating a multitude of challenges with respect to sustainability (Chin et al. 2017).

A shift from a Holocene to an Anthropocene perspective places society at the center of analyses of climate change, revealing how particular human-environment relationships and forms of societal organization are dramatically transforming the global environment (Lövbrand et al., 2015). Yet, most courses on climate change in higher education still approach the problem through a Holocene lens. This approach focuses on the ways that human activities are affecting different components of the Earth system (e.g., the biosphere, atmosphere, hydrosphere, and cryosphere). It recognizes that humans are experiencing and adapting to the impacts of climate and environmental change, but human activities are nonetheless framed as "external" stressors that are undermining "natural" systems. In other words, many climate change courses have not fully integrated the human and social dimensions of environmental change.

Below, we describe three axioms of an integrative approach to teaching climate change that can help prepare students for the challenges of the Anthropocene. We draw upon our own

experiences teaching aspects of climate change for more than two decades within universities in the United States and Europe, as well as our recently published textbook, *Climate and Society: Transforming the Future* (Leichenko and O'Brien, 2019). Each axiom emphasizes a need for new ways of seeing and engaging with climate change in order to motivate transformative thinking and action.

Axiom 1: Worldviews, values, and emotions shape how we relate to climate change

An Anthropocene lens highlights interconnections between environmental and social facets of climate change and calls for an integrative approach to climate change education. Such an approach links climate change to underlying worldviews and beliefs about how humans relate to each other, to non-human species, to the natural world, and to the future. Recognition of these linkages is already occurring in some fields, for example in the acknowledgement of hybrid "socio-natures" in critical physical geography (Lave et al. 2018). Drawing attention to the ways that norms and values both reflect and influence social systems and human–environment relationships, an integrative approach requires awareness of assumptions and biases within different climate change discourses. Making norms and values explicit within classroom discussions can help students recognize those that are taken for granted, whether related to energy use, transport, food, or fashion. Why are meals with meat the norm in most cultures, rather than meals that are plant-based? Why are single-occupancy automobiles the dominant mode of transport in many places, rather than bicycles or public transportation? How are growing preferences for "fast-fashion" contributing to rising energy usage and climate change? Recognizing the influence of worldviews and values not only allows questioning of the perceived norms and "necessities" that contribute to high-energy lifestyles, but also opens opportunities for discussion of alternative ways of living and being.

Approaching climate change education from the perspective of the Anthropocene also means recognizing that emotions shape understandings of and engagement with the issue (Head 2016; Ryan 2016). Climate change has become an emotional issue for many students, and learning about observed environmental changes, scenarios for the future, and the implications for biodiversity, livelihoods, coastal communities, urban settlements, and health and well-being can lead to feelings of powerlessness, anger, fear, sadness, and grief. Students who have been directly affected by extreme events such as hurricanes or wildfires may experience both short and longer-term psychological and emotional impacts. Teaching about the emotional dimensions of climate change can help students relate to a wide range of feelings, and to explore how possibility, a sense of purpose, and constructive hope can motivate action (Ojala, 2012).

Recognizing the subjective dimensions of climate change is also vital for effective communication about the issue (Moser and Dilling, 2011). While presentation of evidence-based observations and datasets are useful for identifying causal relationships, patterns, and trends, research from the social sciences and humanities increasingly highlights the importance of narratives for engaging diverse audiences (Veland et al., 2018). Acknowledging the limits of traditional science communication can also open space in the classroom for exploring the role

of art, film, literature, and music as effective means of connecting both intellectually and emotionally with the issue (Bostic and Howey, 2017). These forms of communication, which may entail use of art, video, or design, move climate change education beyond the realm of equations, graphs, and data, requiring a capacity to integrate different ways of knowing and relating to different viewpoints. By incorporating climate change in the context of the Anthropocene into the broader curriculum, educators can present fresh perspectives that help students see a wider range of solutions and entry points for critical engagement (Galafassi et al., 2018; Wodak, 2018).

Axiom 2: How we frame the issue of climate change influences the types of solution identified

Climate change is often perceived as an environmental issue best addressed through technical, managerial, and behavioral solutions implemented through climate policies and international agreements. Yet, other discourses and framings of the issue are also important to introduce into the classroom, as they draw attention to the many dimensions of climate change, as well as the diversity of solutions that are currently discussed and debated. A critical social framing, for example, highlights the role of power, politics, vested interests, and unequal economic and trade policies in driving greenhouse gas emissions. It also recognizes the legacy of colonialism, development policies, and inequalities based on factors such as gender, race, class, and indigeneity, which have marginalized groups of people and influenced their vulnerability and capacity to adapt to climate change. Such an approach questions assumptions about ever-increasing rates of economic growth, ever-expanding consumption, and rising levels of social inequality. It also considers how globalization and urbanization processes drive climate change and influence responses. By situating climate change within its dynamic social context, the critical social discourse draws attention to a wider range of responses that extend beyond environmental policies (Leichenko and O'Brien, 2019).

An examination of different discourses and framings of climate change can also help students make sense of climate change skepticism. Many students have family members, friends, or neighbors who hold different views on climate change. An awareness of the dismissive discourse helps students understand why actors who are heavily invested in fossil fuel industries or industrial agriculture may not take climate change seriously, and in some cases work against climate and energy policies. The dismissive discourse is not only about the denial of the science of climate change. It also includes those who accept the science but dismiss or minimize the importance of climate change relative to other pressing social and economic issues. The dismissive discourse likewise relates to those who express concern about climate change but fail to take action, underestimating their own capacity to influence change (Norgaard, 2011).

Recognizing multiple discourses and perspectives on climate change also brings out the many significant dimensions that need attention within climate change curricula. These dimensions include the political, economic, cultural, emotional, and ethical, which draw upon research and knowledge from the social sciences and the environmental humanities (Bostic and Howey, 2017). Incorporating history, language, literature, philosophy, economics, politics, and

geography into climate change education can provide students with broader and deeper understandings that enable them to integrate and contextualize the problem, while at the same time highlighting the many ways of engaging with climate change activism (O'Brien et al., 2018).

Axiom 3: Transformations to sustainability are possible and already underway

Recent reports of the Intergovernmental Panel on Climate Change (2018; 2019) identified multiple pathways to achieve sustained emissions reductions. These reports also documented a variety of strategies for adaptation intended to decrease vulnerability to climate change impacts and build resilience. Yet, neither mitigation nor adaptation will be sufficient for thriving in the Anthropocene. The notion that successful responses to climate change will require transformative action is increasingly recognized (IPCC, 2018; TWI2050, 2018). Many questions remain, however, about what transformation processes entail and which factors may activate or accelerate transformative change. Recognition is also growing that not all transformations will have equitable or desirable effects, and there is concern that the potential for resistance and conflict are often overlooked (Blythe et al., 2018).

Teaching about transformations is vital to climate change education, as more and more students are eager to engage with transformative solutions. Education for transformation requires critical thinking, the capacity to take perspectives, and actionable frameworks that help students make connections between the practical, political, and personal spheres of transformation (O'Brien, 2018). Within the practical sphere, a wide range of technical and behavioral changes are being proposed to achieve measurable results. Yet, the success or failure of these efforts is closely link to systems and structures associated with the political sphere. Strategies and interventions that challenge social and cultural norms, rules, regulations, and institutions can lead to resistance from vested interests, which often gives rise to social movements, political activism, and support for political candidates who advocate climate action. The personal sphere of transformation is where students can explore how beliefs, values and worldviews – including their own – influence how they relate to climate change and how they engage with solutions and actions in political and practical spheres.

Activating a sense of individual and collective agency within the classroom is also critical for initiating larger-scale changes (Petersen and Barnes, 2020). Through experiential learning, such as 30-day experiments with personal change, students gain a stronger sense of agency and a better understanding of how they can contribute to societal shifts, not just at the individual level but also at the cultural and systemic levels. By experimenting and engaging with change, students become aware of the relationships between individual change, collective change, and systems change, as well as the "ripple" effects created by their actions (O'Brien et al. 2019).

3. Transforming climate change education

Courses and modules on climate change are increasingly becoming part of the regular curriculum in colleges and universities (Molthan-Hill et al. 2019). As these courses and

programs are developed, providing integrative, "Anthropocene"-ready learning tools and conceptual frameworks will be critical for our students. Addressing climate change through an integrative approach involves questioning accepted norms, rules, institutions, policies, and practices that perpetuate unsustainable resource use. Such approaches also allow students to see climate change as both an environmental and social problem that is rooted in particular understandings of human-environment relationships and humanity's place in the world. By drawing attention to worldviews and values, the power of framings and discourses, and possibilities for transformative action, integrative approaches can help students identify responses that appeal to diverse understandings of climate change and its solutions.

The proposed geologic epoch of the Anthropocene introduces a powerful meta-narrative about human-environment relationships and their implications for Earth system processes. Beyond changes to individual courses, incorporating an Anthropocene lens may also require broader changes to the structure and content of some science and social science programs, and may necessitate the formation of new interdisciplinary programs and courses of study. Through our roles as researchers, teachers, and higher education leaders, we can play a key part in promoting transformative changes at the scales necessary both to limit warming to 1.5°C (IPCC, 2018) and to promote an equitable and sustainable world. Rethinking how we teach climate change in the Anthropocene is a necessary step for reimagining how society can thrive in this new epoch.

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