



Reframing the Teaching of Climate Change Through Empathy and Social Innovation

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Abstract

Since the First Intergovernmental Panel on Climate Change (IPCC) report (1990), science educators have been developing numerous activities and learning modules for students at all levels, from primary through university. Yet, most of our instructional design has focused on scientific literacy using traditional scientific boundaries (e.g., classical physics), as if students were an empty vessel and lacking core climate science knowledge. Climate change educators have also embraced policy and economic theories as part of developing the students understanding through a more integrated approach and one that involves the Anthropocene as an ideological framing (Leichenko & O'Brien, 2020). We present here our experience with introducing social innovation through empathy mapping as a means for developing agency or the belief that one's actions can create change when solutions are often too abstract or the psychological distance for sufficient appraisal of issues is too distant. We present here preliminary results from a survey on climate change empathy, emotion, and psychological distance among undergraduate students in environmental science and education. Results show a strong relationship among a student's emotion, empathy, and social distance as it relates to support for mitigation policy.

Keywords: *Empathy, Psychological Distance, Climate Change*

Introduction

The purpose of this study is to examine new pedagogies that reframe the teaching of climate change from a position of teaching about the science to one where the students' relationship with climate change becomes the focus. Traditionally in the sciences, we approach the curriculum from a scholarly academic perspective where students are assumed to be novices within the discipline, and therefore, are taught what to know and how to engage with science from the perspective of a scientist [8]. Similarly, over the past five decades, science curriculum has adopted a more social constructivist approach, where learning the science is considered developmental and based on experiences with doing science [4]. Yet, we still witness students in university or college settings, who possess strong declarative knowledge about climate change, unable to engage in praxis; connect human community with climate change through action [5].

Since 2008, students at Colorado College have had the opportunity to take a course dedicated to the science of climate change, which also included climate change policy. The format of the course is a combination of lecture, in-class activity, and lab, with labs focusing on data analysis (e.g., Vostok ice core data) and modeling (carbon cycle, climate change). The course is immensely popular, with as many as 150 student per year (out of a population of about 2,000) taking the course. In addition, the course serves as a required introduction course in the Environmental Science and Environmental Studies major. The traditional assumption is that students in the course are very aware of climate change (from previous studies or informed media). The course focuses on the fundamentals of classical physics as a necessary foundation for understanding global climate as well as basic political theory in understanding global politics of climate change. Students complete the course with genuine concern about the changing climate and the impact on biodiversity and human population. Some students even engage in campus-wide sustainable development activities. Yet, there still is a need to "recalibrate" how we teach science [6]. Therefore, the goals of this preliminary student study is to 1) determine a new framing of how we educate about climate change using social reconstructionism pedagogy, focusing on the co-creation of knowledge [7] and 2) to engage students with course content by asking them, "what is your relationship with climate change?"



Review of the Literature

Curricular Ideologies

Schiro describes four curricular ideologies which serve as orientations or positions towards the development of curriculum with the purpose of educating content novices [8]. The traditional science curriculum approach is *scholarly academic*. In this approach, students are to learn the knowledge accumulated to date. Students are to engage with and within the content discourse community, learning the appropriate methods, lexicon, and language to essentially become members of the community (e.g., chemistry courses leading to the production of chemists). Professors must be scholars in the community, often required to conduct research and publish often as part of their tenure. Students, therefore, must operate within the science community framework and become “mini-scholars” to be successful. Climate change courses that originate from the sciences will more than likely adopt this ideology, as is in the case of Colorado College.

The second curricular orientation and approach is *social efficiency* [8]. The applied sciences (e.g., environmental science) general adopt this ideology, where meeting the needs of environmental concerns of society serves as a form of training, where competencies lie in the performance of activities. Here, students not only learn the methods and lexicon of the discourse community, but also learn performance-based skills (e.g., speaking with stakeholders, writing environmental impact statements). Climate change activities at universities, sometimes tied to academic programs, but often still lacking, may involve social efficiency curriculum as “extra” [5].

The third curricular orientation and approach is the *learner centered* [8]. This particular approach is built of constructivism and the learning cycle [4]. This particular approach is found in most often in elementary and secondary school science classrooms across the United States, but not necessarily in university or college settings where lecture and lab remain the primary content delivery methods. Climate change activities geared toward the learning of climate change has adopted a more learner-centered approach. Yet, these activities are still designed to learn the science using constructivist approaches and may not be centered on the students’ own experiences.

The four curricular orientation and approach is *social reconstructionism* [8]. Here the approach to teaching and learning begins with a detailed awareness of a societal problem and associate justice-equity issues. The assumption is that education should focus on a solutions that result in a more just society for all members. This particularly ideology is common in disciplines that intersect humanism and socialism.

The social reconstructionist orientation provides promise for recalibrating climate education from teaching about the climate to educating about the climate from the orientation of the students’ relationship with climate change. This new paradigm provides an opportunity to reframe climate change education from one that is science centered to one that is more global centered. The framing has two primary domains: new pedagogies and framing climate change justice as a fundamental human right [1].

Developing climate literacy with new pedagogies

New climate change pedagogies need to be orientated towards student biographies, where students knowledge and experience become assets [7]. In addition, learning becomes framed by four domains of knowledge: declarative (what I know); procedural (how I know); conditional (when I need to know); and, conceptual (why I need to know). These new knowledges can be developed from the foundation of a student’s relationship with climate change. Asking students about their relationship reveals their lived experiences (e.g., drought and fire in Colorado) and their declarative knowledge. From there we can build new pedagogies centered around self-reflection, dialog, critical analysis, and the plurality of multiple narratives [1]. These new pedagogies generate the co-construction of knowledge, where discourse becomes the tool for engaging interest in developing more content, new methods, and creative solutions [7]. The capacity for achievement increases when the students and professor are entangled in research collectively with the outcome of social reconstruction as the goal. For example, students in the climate change course at Colorado College collectively researched the environmental impact of a local coal-fired powerplant and engaged with stakeholders on finding suitable solutions. The result is a shift towards wind and solar energy and a decommissioning of the power plant ahead of schedule.



The climate change course at Colorado College has both environmental science/studies majors and general education students, who studies span the humanities and social sciences, as well as more traditional science disciplines. As we rethink the course, particularly shifting aware from scholarly academic towards social reconstructionism and more towards and asset based pedagogy, we wanted to determine the students’ empathy towards climate change.

Climate change as a societal threat has gained traction in the United States, mostly due to severe weather events in the southern states and extreme drought and wildfire in the west. According to Argonne National Laboratory, electric and hybrid vehicle sales have risen 58.7% from January 2021 to January 2022. Consumer indicators, particularly passenger vehicles, are an indication of climate change awareness, providing purchases are motivated by the desire to engage in new behaviors that mitigate climate change (Chu and Yang). Negative emotions toward climate change (e.g., anger, fear, sadness) has been shown to lead to an increase a person’s ability to adapt a new perspective with regards to climate change [3]. Additionally, a person’s anxiety and sadness mediate a person’s perception in supporting policy, and when combined with a person’s proximity of climate change threat (e.g., severe drought), then a person’s support for mitigation policy is further increased.

For this particularly study, we wanted to test the constructs of empathy, emotion, and psychological distance with 18 to 22 year old students attending an institution of higher education, many of whom share social change, social justice, and sustainability values. The main objective was to determine the baseline of students’ empathy, emotion, and psychological distance in order to plan a new pedagogical strategy founded in social reconstruction and innovation.

Methods

This non-experimental mixed-method design was conducted at Colorado College, a highly selective liberal arts college consisting of about 2,000 student in their undergraduate studies. Two sets of students, one in environmental studies (N = 120) and the other in education (N=42) were surveyed using an instrument designed after Chu and Yang [3]. The purpose of the small study was to determine whether measures would capture sufficient information for reliability of scale test and three cycle coding.

The data collection instrument consisted of both qualitative and quantitative data collected with a single survey. The qualitative data consisted of four open ended questions: 1) When it comes to climate change, what do you think? 2) When it comes to climate change, how do you feel? 3) When it comes to climate change, what do you say?; and, 4) When it comes to climate change, what do you do?

Quantitative measures consisted of four scaled elements: 1) perceived social distance scale (3 items); 2) spatial distance scale (3 items); 3) emotion towards climate change (12 items); 4) support for mitigation policy (3 items); and, 5) behaviors toward minimizing climate change (3 items).

A Cronbach’s alpha was run on all scales (Table 1). All were deemed reliable except for *behaviors* toward climate change.

Table 1. Cronbach’s alpha test of reliability for scaled measures.

Scaled Variables (# of items)	Cronbach’s Alpha
Perceived social distance (3)	0.887
Spatial distance (3)	0.821
Emotion toward climate change (12)	0.881
Mitigation policies	0.868
Behaviors toward minimizing climate change (3)	0.672



Results and Discussion

Empathy

When students were asked “*when it comes to climate change, how do you feel?*” the overwhelming response was “fear”, “anger”, “nervous”, and “scared.” These concrete emotions are found to be central in mediating a person’s distance from concern and engage with climate change [3]. When students were asked, “*when it comes to climate change, what are you thinking?*” three main themes emerged: *cause* as in anthropogenic activities; *impact*, as in change in precipitation patterns, and *action*, as in policy reform. These terms align with a person’s emotion toward and social distance from climate change, indicating that the students have a strong empathy towards the climate change problem.

When students were asked, “*when it comes to climate change, what do you say?*” two main themes emerged: *need for action* and *accountability*, as in holding those in power accountable for causing climate change. These two themes are aligned with perceptions of mitigation and actions that should be taken by governments and corporations.

The final question, “*when it comes to climate change, what do you do?*” is directly related to personal behaviors. Two major themes emerged: *educate*, as in educating oneself on the issues of climate change and *support policy*, as in supporting politicians with “green” policy. If a person’s social and spatial distance towards climate change were narrow, we would expect participants to articulate more “do” behaviors, such as reducing one’s carbon footprint.

The latter qualitative finding indicates that while students are very aware of climate change, particularly the impacts on the environment, they are less focused on climate change as a form of human rights violation. Instead, their empathy is a clear indication of pedagogy that is orientated towards the “shock negative” rather than the “pedagogy of hope [1].

Correlations

We were interested in determining if any scaled variables, based on total of each measure, were correlated. The relationship between *spatial distance* and *social distance* was investigated using a Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality and linearity. There was a strong positive correlation between the two variables, $r = .659$, $n = 42$, $p < .05$, with high levels of social distance associated with high levels of spatial distance. This indicates that a person’s social distance from climate change is directly influenced their spatial distance.

The relationship between *emotion* and *mitigation* was investigated using a Pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality and linearity. There was a strong positive correlation between the two variables, $r = .652$, $n = 42$, $p < .05$, with high levels of emotion associated with high levels of support for mitigation policies. This results supports the qualitative findings from empathy mapping, indicating that students with strong emotional responses to climate change are likely to support climate mitigation policies, as green energy and carbon sequestration.

Conclusion: A New Pedagogical Approach

Assuming students in this small sample are representative of students with deep understanding of climate science and the impacts of climate change, then we must utilize this asset and re-orientate our courses towards a pedagogy of hope and global justice [1] The students appear to have a strong depth of knowledge about climate change. However, their orientation is still towards “shock negative.” The refocus can be reframed around the domains of knowledge: what, how, when, and why. We can begin our co-construction of knowledge by asking students, *what is my relationship with climate change*, using emotion and empathy as the starting point, rather than classical physics. This new pedagogy should involve pluralistic narratives to continue bridging the psychological distance towards climate action, particularly for those students whose spatial distance is triggered by anxiety, and subsequently less inclined to take action when feeling hopeless.



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