Project Summary
Examining the Impacts of Climate Change Education: a proposed research agenda

A key vision of the United Nations Framework Convention on Climate Change (UNFCCC), signed over a quarter century ago, called on the public and professionals to be involved with developing "adequate responses" to climate change through education, training, access to information and international collaboration and cooperation. While some progress has been made, there remain substantial gaps in our understanding of whether and how climate education and related efforts to inform and engage professionals and the public to take climate action through changes of attitude, behavior and policies. The sheer breadth and scope of climate education, which covers a broad range of activities designed to enhance the understanding of and address climate change, presents a challenge for assessing the effectiveness of climate education. Overlapping with climate education and outreach efforts, pedagogically based strategies to prepare society and limit the impacts of climate change range from informal physical or online trainings, short school assemblies and museum exhibits to in-depth, graduate and professional-level applied studies designed to address specific, technical climate challenges. To build on and augment the existing body of research in this broad domain, we propose a three-pronged research agenda to further examine the climate education and training landscape and its impacts on attitudes, behavior and/or policies and practices. These three stages of research, which could be deployed in sequence or concurrently depending on resource availability, are:

1. **UN CC:Learn Partner Countries**. Focusing on selected developing countries that are current partners with UN CC:Learn, we propose in-depth interviews with ten policy-makers and other stakeholders to document their background understanding in climate change, determine whether and to what extent the UN CC:Learn trainings were beneficial, and whether and how they have had the individual or collective agency to apply what they have learned toward policies and practices. The methodology will be modeled on the approach used by Otto et al. (2019) and could potentially be expanded beyond the initial scope of developing countries that have partnered with UN CC:Learn. The focus will primarily be on the impact of education and training (formal and informal) on policies and practice at a national or subnational scale.
2. **Global Snapshot.** This approach will involve surveying university students at ten countries around the world with diverse backgrounds to gauge their background understanding of climate change, assess the source of their understanding (whether through formal classroom, informal learning with peers, self-taught, etc.), and evaluate whether and how they have been able to apply their understanding in their own behavior or in practice. The methodology of this approach will be based on the study by Bain et al. (2016) of students in universities around the world, who were given online surveys translated to local languages that examined how emphasizing co-benefits encouraged climate action. The primary focus of this approach will be to identify understanding, knowledge gaps and drivers of climate action among the next generation of community leaders, who currently attend universities but will soon enter the workforce.
3. **International Investigation**. Coordinating efforts with the Gallup Organization on a proposed follow-up to their 2007-2008 World Poll, which examined climate-related understanding and attitudes of adults in 119 countries, this approach will potentially be synergistic with the more granular, detailed studies of UN CC:Learn partners and Global Snapshot of university students. The Gallup Organization, which conducted an international poll on knowledge and attitudes about climate change in 2007-2008 and has collaborated with other UN organizations including FAO,

and the UNFCCC and others have been in discussions with Gallup about this potential international survey.

The questions for the surveys will be finalized by the research team once the project is underway, but the overall aim will be to:

i) determine the general level of understanding climate change by measuring basic climate literacy of the respondents (current and future decision-makers, and adults around the world) and the sources of (or gaps in) their learning;
ii) measure their sense of agency related to climate action in their own lives and at community and national scales; and
iii) inquire into whether they perceive or can identify specific linkages between their understanding of climate change and actions they may have taken personally (e.g. consumer or lifestyle choices) or professionally (e.g. actions contributing to policy or practices.)

The research team will draw upon research partners' access to informants (including United Nations focal points, government officials) for the interviews of the UN CC:Learn Partner Countries, and respondent pools (specifically university students) for the Global Snapshot stages. The proposed International Investigation will require the expertise and international reach of the Gallup Organization.

Background

> Social science research is...clear: acquiring knowledge about climate change does not necessarily move individuals to action. Affective and social forces often influence risk perception and actions around climate change. Thus, knowledge must be paired with affect, beliefs, intentions, and motivation to enact change. So how do we move from knowledge and understanding to action? Creating learning opportunities for students to practice and build action competencies is critical...If climate change education is to become a force for change, outcomes need to shift from "critical thinking" to a solutions-focused "action competence" model – the ability to evaluate an array of possible actions, then choose and effectively implement the one that best solves a given program. (Niepold 2018).

Teaching and communicating the basics about the causes, effects, risks and possible responses to human caused climate disruption is not new. Over 60 years ago the National Academy of Sciences developed educational materials and the Bell Science Hour produced a film directed by Frank Capra that described to a general audience how burning fossil fuels could in time heat the atmosphere, melt ice caps and alter ecosystems. Over a quarter century ago, recognizing the importance of informed public support for addressing climate change, the United Nations Framework Convention on Climate Change, signed by the nations of the world in 1992, called in Article 6 for the signatories to develop education, training and opportunities for the public to be informed and engaged in developing adequate responses.

Currently, the essential climate literacy needed for informed decision-making and action is uneven at best. For example, a synthesis review of the Doha Work Programme (UNFCCC 2016), designed to revitalize the original intentions of Article 6 of the Convention found that barriers remain on implementing the goals set forth in Article 6 of the Convention, including "the lack of public awareness and knowledge, absence of institutional arrangements, inadequate funding, lack of human resources and insufficient coordination and cooperation among a country's authorities."

The reasons for this historic lack of climate education are many: the topic is complex, crossing many disciplines, it is considered to be controversial even though the science is robust and well established, it is poorly covered in existing curriculum, and many educators lack background in the domain (National Research Council 2010, 2011).

That said, concern about climate change around the world is high, especially among the educated. A recent Pew survey of 26 nations (2019) found that in most of the surveyed countries, majorities say global climate change is a major threat to their nation, with people with more education tending to be more concerned about climate change, and younger people and women having higher levels of concern in some countries.

One of the challenges climate educators and trainers have experienced is the inherent tension between the goal of general universal education to build critical thinking and social skills promoted by many education advocates versus a more content-specific knowledge and skills focused approach in order to understand and be better able address specialized content areas (Bengtsson 2018). While universal education, especially at the secondary level and above, has been demonstrated to reduce natural disaster risks associated with climate change (Lutz 2014, Muttarak 2014), there is also an acknowledged down-side to increased levels of education: increased affluence and energy consumption. As O'Neill and co-authors (2018) highlight, while most social goals related to directly meeting physical needs--nutrition, income, access to energy and sanitation--are inherently connected to resource use, they can in theory be modified and streamlined without going beyond planetary boundaries. However, "[a]n important exception to the overall pattern is secondary education, which is both strongly coupled to resource use and associated with high resource use."

Therefore, to avoid universal secondary education from being a substantial contributing factor to increased resource consumption, educational practices will need to encourage climate smart, low-impact, sustainable lifestyle pathways. Inherent in the climate literacy theory of change is the assumption that well delivered, pedagogically sound climate education that results in cognitive, attitudinal and behavioral change will foster appropriate action to reduce climate risks and thereby protect current and future generations.

Over the past two decades, research on climate education has examined different populations, including university students (Bain 2016), secondary (Plutzer 2016) and undergraduate educators (Lombardi 2012) and the general public (Lee 2015, Leiserowitz 2018). Specialized techniques, such as school assemblies (Flora 2015) and role-playing simulations (Rooney-Varga 2018), have been evaluated, and this has all contributed to a growing body of literature and understanding of effective practices. Emerging from this research is a growing consensus that knowledge about climate change is insufficient to motivate individuals into action (Dewaters 2013, Schultz 2005), and that affective and social dynamics have a strong influence on risk perception and in motivating climate action (Doherty 2016, Kahan 2012, Weber 2006). Climate education, which overlaps with and ideally is integrated synergistically with related communication and outreach (McCaffrey 2015), should inform and inspire action (Vaughter 2016, Niepold 2018), and the evidence is clear that knowledge, as important as it is in making informed decisions, must be coupled with beliefs, emotions (Smith 2014), and motivation to result in behavior change and action (Lombardi 2012, Bain 2016).

Molthan-Hill and colleagues (2019) in their global survey of university staff from 45 countries found that climate change education approaches are highly variable, and they identified four typical strategies for how climate change science and solutions are currently being taught: 1) *piggybacking* (adding on climate change topics into existing curricula, often in as ad hoc way), 2) *mainstreaming* (encouraging course leaders to integrate and embed climate-related topics throughout the curriculum), 3) *specializing* (offering special courses for students interested in the topic), and 4) *connecting* (such as a required course for all incoming students that provides an overview of climate and related sustainability science and solutions).

Related to the above background and context, the topic of agency, efficacy, or ability to act, whether on an individual, collective or proxy scale, is particularly relevant to examining the impacts of climate education, training and public information, awareness and participation. Much has been written about the issue of agency and empowerment, with O'Brien suggesting that individuals through political agency are the key to tackling climate change (2015). But individuals, especially youth who have limited agency in their lives as minors, but adults as well, often feel overwhelmed by the global scale and societal challenges to taking meaningful climate action. Even government officials in a position to shape and implement policy who understand the causes and effects of climate change and appreciate present or future dangers may feel highly constrained by political and financial pressures that limit their ability to take actions to shape policies and practices.

Bandura (2000) has long focused on building collective agency through shared beliefs in order to produce the needed collective action, and Heald (2017) build's on Bandura's theory, concluding that "unreasonable" people with high self- and collective efficacy may, though moral engagement and imagination, manage to cut through the "climate silence" that often prevents deep discussion about the risks that can lead to effective, adequate responses. While education generally encourages young people to be "reasonable," the recent student-led climate strike movement offers an example of how young people who have "done their homework" and understand the risks of climate change have become "unreasonable" in order to disrupt what the view as the lack of sufficient action to address the climate crisis. Thus, effective climate education has the potential to serve as a social tipping point toward rapid and substantial reduction of greenhouse gases and carbon sequestration (Otto in review).

To counter feelings of hopelessness (Ballew 2018, Bushell 2017) suggests that a clear, unifying narrative that engages people in a way that is understandable to them and resonates with their world view and anchors the reality of climate change in their everyday life is needed to inspire agency and action at all levels, but with a way of connecting their actions with the global level solution. Such a narrative cannot be easily conveyed through typical media communications or social media messaging, though it could be reinforced and amplified by such communication and outreach. Unifying narratives that encourage individual agency toward collective action, customized for the context of local communities and cultures, and linked to other sustainable practices (Barth 2016) and co-benefits, specifically economic and scientific advancement and more moral and caring communities (Bain 2016) can be optimized through effective, targeted, pedagogically robust climate education and training.

This research agenda will attempt to determine whether, through training of professionals, the educational background or self-taught learning of university students, and through the understanding of adults around the world such narratives and actionable information is being conveyed, and if not, where the gaps and opportunities to address them may lie.

Project Details & Methodology

This plan proposes at micro, meso and macro scale stages to survey policy, decision-makers and potentially other relevant audiences (university students, the broader public) in order to: i) seek evidence of the general level of climate literacy of the respondents and the sources of (or gaps in) their learning, ii) measure their sense of agency related to climate action in their own lives and at community and national scales, and iii) inquire into whether they perceive or can identify specific linkages between climate literacy and action.

In addition, as a tangential and emerging "action research" opportunity, this study may be able to also examine whether and to what extend recent student-led protests are related to their understanding of the causes, effects, risks and responses to climate change.

Following are related research questions, which can be modified with other collaborative partners before questionnaires are finalized:

i) What is the relative level of understanding of the causes, effects, risks and responses to climate change and how has that been reached (or not)?
ii) What scale (individual, household, community, national, continental, global) is climate action most appropriate in your opinion, and to what extent do you feel you or others (collectively or through proxy) have agency to take such action?
iii) Has what you have learned led you to take action to reduce climate risks in your personal life, and if so, what changes have you made?
iv) In your professional life, has your understanding of climate change in any way influenced your perspective or decision-making, and if so, what do you attribute this changed perspective to?

Phase 1- UN CC:Learn Partners

We propose surveying government policy or decision-makers in the developing world as the primary audience for the first phase of this study. The phase builds on the initial research plan developed by staff of UN CC:Learn responding to recommendations from a mid-term evaluation that called for an enhanced logical framework and theory of change identifying the project's pathways, assumptions, and external influences. Through a series of in-depth interviews modeled on the approach used by Otto (2019) and following a series of survey questions similar or identical to those used in the other phases of this larger research agenda, we will seek to determine whether the past activities and outputs of UN CC:Learn and other trainings contributed to the participants' understanding, attitudes, and personal or professional actions related to climate change, and, if appropriate, whether the training influenced in any meaningful way related policies. The interviews will be conducted in person when possible (at the Sec. General Climate Summit in September 2019 or COP25 in Santiago, Chile, December 2019), and via Skype, Zoom or similar telecommunications technology when face to face interviews are not possible. The interviews will be conducted by an independent researcher, potentially a graduate student or professional intern, and results will be analyzed and summarized for potential publication in a peer review journal. This research phase will complement the internal evaluation conducted by UN CC:Learn to assess the general satisfaction with the provision of education and training so far. Budget requirements are modest for this option, but it will require a substantial time commitment over at least six months to organize and another six months to analyze and summarize. Estimated budget: 25,000 Euros of direct or in-kind salary and overhead support.

Phase 2- Global Snapshot

Organizing an effort involving approximately ten universities in diverse countries around the world, this approach will be similar to the study by Bain et al. (2016) that examined the role of co-benefits in encouraging climate action among university students, a web-based survey translated into local languages and national context will be deployed through collaborative partners, specifically faculty at the universities. While no financial incentives will be offered for participation in the study, the faculty participation will be encouraged through the incentivization of being a published in a high impact peer review general. Dr. Bain has offered to be involved in an advisory role in such a project. Although not directly related to UN CC:Learn, which specializes in trainings and consulting on the development of national climate change learning strategies in developing countries, the results of this study are relevant to better understanding i) the level of penetration of climate knowledge into higher education around the world, ii) the relative sense of agency and empowerment among the educated youth of today, who will be the leaders of tomorrow, and iii) gauging whether and to what extent understanding of climate change is influencing changes in behavior and actions. This effort will require a researcher dedicating a substantial portion of one year to organizing the survey and analyzing results. Budget requirements are small for this option but will require substantial time commitment over at least six months to organize the survey instrument and collaboration partnerships and another six months to analyze and summarize the results of the survey.

Phase 3- International Investigation

In 2007-2008 the Gallup Organization internally funded a World Poll to survey attitudes and understanding of adults about climate change in 119 countries (Pugliese 2009). The data from the survey was further analyzed in the 2015 study by Lee et al., which highlighted that worldwide the highest predictor of awareness of climate change was educational attainment, but at the same time 40% of adults around the world have never heard of climate change, with even higher rates in some of the most vulnerable countries, such as Bangladesh. While other smaller surveys, such as recent Pew Surveys (2019) of 26 countries have confirmed that education level often correlates with concern about climate change, and follow-up to the original Gallup World Poll is overdue. The Gallup Organization is unable to internally fund an update of the World Poll, but discussions are now underway with representatives at Gallup, potential funders, and the UNFCCC Secretariat, to update this important international poll. Ideally, if this project is funded there will be an opportunity to collaborate with the Gallup consultants to revisit some of the same questions asked in the original survey, and add a few new questions that relate to the goals of this proposed research agenda: assessing the sources and level of climate understanding, the sense of agency, and whether behaviors, actions and/or policies and practices have been changed due to this understanding.

Summary and Conclusion

The research foundation that this study will incorporate includes the desk study findings of UN CC:Learn staff, related United Nations reports, including UNESCO summary of National Reports related to Article 6 of the Convention (now commonly known as ACE, or Action for Climate Empowerment), and the growing body of literature derived from the dozens of diverse climate education projects conducted over the past several decades.

We propose a three-fold approach looking first at professionals, specifically government officials or other relevant stakeholders, in UN CC:Learn partner countries, to determine whether and to what extent what they have learned has benefited their practices and decision-making, second at a diverse set of university students from ten or more different universities to better understand what they know about climate change and whether that understanding has influenced their actions or behavior, and third an international survey that ideally will reproduce and expand the 2007-2008 Gallup World Poll on climate change.

The aim of each phase will be to analyze the results and report the findings in a high-impact journal, such as Science or Nature Climate Change, and to share the insights and recommendations widely within and beyond the climate community. Following is a tentative timeline for each phase and how they might overlap if implemented concurrently:

<table>
<tr><th></th><th>First three months</th><th>Second three months</th><th>Third three months</th><th>Fourth three months</th></tr>
<tr><td>UN CC:Learn Partner Countries</td><td rowspan="2">Develop survey instrument and invite collaborators</td><td rowspan="3">Deploy instrument and collect results</td><td rowspan="3">Analyze data and write paper</td><td rowspan="3">Finalize paper and submit to journal</td></tr>
<tr><td>Global Snapshot</td></tr>
<tr><td>International Investigation</td><td>Work with international polling research company to develop coordinated plan</td></tr>
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Potential Research Collaborators (to be confirmed when research plan is formalized)

Name	**Institution**
Dan Bedford	Weber State University- USA
Frank Niepold	NOAA
Raya Muttarak	Wittgenstein Centre/IIASA
Erich Striessnig	Wittgenstein Centre/IIASA
Paul Bain*	University of Bath
Deb Morrison	University of Washington
Ming Lee	Sun Yat-sen (Zhongshan) University
Etsuko Kinefuchi	University of North Carolina at Greensboro
Jill Wertheim	Stanford University
Mona Behl	University of Georgia
Ludwig O. Federigan	The Climate Reality Project Philippines
Eileen Doohan	Renewable Nations Institute
Evans Tembo	ENVIROS- Zambia
Joseph Henderson	Paul Smith's College
Ann Armstrong	Cornell University
Avit Bhowmik	Karlstad University
Danaé Espinoza	Latin American and Caribbean Youth Climate Movement (CLIC!).
Philip Vaughter	UN University
Andrew Rzepa	The Gallup Organization

*Has offered to play an advisory role.

Potential Funding Sources

Many climate funders exist (see: https://bit.ly/2MoaRFk), and while many are involved with climate communication campaigns, few have historically supported climate education research. This is likely to change now that there is substantial evidence that, properly designed and delivered, climate education can blend the cognitive understanding, the emotional motivation, and the cultural and contextual values needed for climate action. In addition to the potential of being funded through a sovereign wealth fund, several of which have supported climate-related efforts in the past, following are a few private foundations that could be queried once a proposal has been finalized:

European Climate Foundation
KR Foundation
UN Foundation
Sea Change Foundation
Climate Foundation
MacArthur Foundation
Hewlett Foundation
Future Earth (supported by various national foundations and government programs)
Wallace Global Foundation
V. Kann Rasmussen Fund
Mayer and Morris Kaplan Family Foundation

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