Challenges To Climate Change Education

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INTRODUCTION

Global climate change is a complex and multifaceted issue that encompasses many disciplines. It's effects occur on different scales across the global landscape. While there is overwhelming consensus among the science community that humans are altering the environment, and an expansive collection of data exists to support this belief, skepticism regarding the validity of human-induced global climate change continues to grow among members of the general public. According to the latest national survey by the PEW Research Center for the People and the Press, the number of Americans who believe that global warming is a serious problem was 35% in 2009. This is down from 44% in 2008. Similar decline was seen when Americans were asked if there was solid evidence that the Earth was even warming - 71% of people answered 'yes' in 2008, while only 57% answered 'yes' in 2009 (PEW Research Center 2009). This downward decline in public acceptance of global climate change and the disparity in the information base represents a substantial burden on the science community. Numerous scientific groups have been established with the purpose of distributing information to the public and to policy makers with the intention of making the evidence about climate change accessible. It is through informed stakeholders that policies can be developed, and a proactive response to the challenges presented by global climate change can be initiated (Blake *et. al.,* 1997; Nevitte and Kanji, 1995). Closing the information gap between policy makers, the general public, and scientists, however, presents a series of challenges. Not only is the idea of global climate change difficult to conceptualize due to spatial and temporal gaps in cause and effect, but the issue faces further distortions in the media, and political, economic, and other institutions,

further blurring the public's understanding. The following will highlight three major barriers to climate change education: (1) conceptual barriers to understanding abstract science; (2) third-party interests; and (3) the media. The report concludes with suggestions for tailoring educational efforts to combat these obstacles.

THE MAJOR BARRIERS FACING CLIMATE CHANGE EDUCATORS

Concept formation is an integral part of learning. An important preliminary step in this work was to investigate the ways in which learning and concept formation have been described by a range of educational theorists, and then to apply those ideas to the development of a conceptual approach to learning about climate change. Climate change is, in itself, a difficult curriculum to both teach and understand, as many of its components can only be demonstrated at the abstract level. Because much of our understanding of the physical world lies in what we see, the ability to grasp abstract concepts varies from person to person. "Fifty percent of the cortex of the brain is thought to be devoted to processing visual information, indicating a profound, evolutionary commitment to a vision as a means of joining inner and outer conditions" (Sewall, 1995, p203). Ideas such as invisible greenhouse gases, an increase in 'average' global temperature, or limitations on the size of the atmosphere can, therefore, be perplexing as they counteract visual understanding. The general public does not interact with these notions in a concrete way, making it difficult to conceptualize their impact, especially on such a large scale.

The human population experiences variations in temperature on a daily, seasonal and yearly basis. In some areas this variation can be up to 40 degrees Fahrenheit in one day (Gilmore, 2000). Colder or milder winters than what is usual in a given area are common from year to year. When compared to the 2 to 6 degree Fahrenheit increase in average temperature

over a longer period of time as projected by climate scientists, the change doesn't seem like a big threat, and the issue loses all sense of urgency. In fact, some people even associate the warming trend as a positive thing, making everyone a little more comfortable (Robinson *et al.* 2007*)*.

It has also been noted that people tend to think on a time scale equal in length to their own life span. Because the projected changes won't be significant within the average person's lifetime, it is, therefore, difficult to truly grasp the implications of present actions on future generations. Nicholson-Cole (2005, p. 265) asserts that: "Where climate change [is] apparently not a personally salient issue to participants, they [are] more likely to describe abstract, wild and catastrophic imagery, based on timescales beyond the life of the current generation." It is apparent that there is a gap in understanding in regards to time scales. While it is easy to grasp immediate cause-effect relationships, long term scales seem to present an inherent challenge.

Furthermore, to the average observer, the atmosphere appears to be massive when compared to any impact humans might have on it on a global scale. The idea of a limitless atmosphere is rarely combated. To imagine the human population changing the content of the Earth's entire atmosphere defies this perception of the seemingly limitless Earth and atmosphere. In order to begin to change this perception, scientists are forced to rely on models and technology to obtain images of the thinness of the atmosphere relative to the size of the Earth, which may or may not be effective in convincing others. The use of models in science and scientific teaching is often a point of contention. Models can paint a superficial picture of the system, accurately emphasizing some element of the idea being analyzed but inaccurately portraying another aspect of the system (Matthews, 2007).

Even scientists, themselves, still struggle to figure it all out (Parmesan & Yohe, 2003). Despite the availability of models and simulations of Earth's climate that consider extensive data

from millions of years of climate proxies, there are still fundamental uncertainties in our understanding of natural and human-imposed climate changes, and in the factors controlling climate dynamics over the past several million years (IPCC, 1996). Much of this is due to a lack of information regarding past climatic conditions, and the limited resources available for obtaining it. Scientists have demonstrated that changes in climate can be induced naturally and by anthropogenic means, and that the changes seen as of yet have occurred faster than previously found (IPCC, 1996). Most events in people's lives are perceived on a linear scale. Time passes in one direction, in a predictable and constant manner, with most cause and effect relationships happening in an easily perceivable time scale. Nature, however, does not work this way. Cause and effect relationships are often separated by factors of time and space, making it more challenging for people to notice these interactions. Natural events can be chaotic and unpredictable.

The public looks to the scientific community to provide accurate information and definitive answers in regard to predictions of the future, but science is inherently uncertain (Bradshaw & Borchers, 2000). When scientists analyze a theory, their tests can only be used to disprove the theory not confirm its "correctness." A theory can never be proven, only further supported. Climate change is one such theory. There is always the possibility that future research will qualify or even disprove previous work. Putting this information is a neat package that can be explained to and accepted by a visual-based nonscientific community is not easy. Earth's climate system is a delicate weave of many different processes operating on a series of thresholds. Scientists do not know when a climatic threshold may be reached, but they do know they exist (Stocker, 1999; Alley *et al.* 2003; Keller *et al.* 2007). This had created a general skepticism toward scientific claims of increasing temperatures (Farke *et al.,* 2009). Because the

human-induced climate changes are ongoing, and these changes both directly and indirectly affect some geographic areas differently than others. It is extremely difficult to precisely predict the extent of change in any one area (IPCC, 1996). Mistrust only continues to grow as scientists succumb to monetary incentives from independent parties (Huddy & Gunnthorsdottir, 2000), and the promise of recognition overcomes attention to fair and accurate science. Since it was brought to light that mistakes had been published in the latest IPCC report on climate change[1], skepticism regarding the phenomenon has only multiplied.

In addition, however effective the communication of scientific uncertainty may be, eventually students return to their everyday world where they are bombarded by other political, economic, and social institutions, each with their own agendas when it comes to the issue of global climate change. At the forefront of this interaction are print and electronic media, acting as the key players in the transfer of information to the general public (Antilla, 2010; Nelkin, 1995). For many, public media is the only source of information, thus ensuring the accuracy of published information is critical. Unfortunately, this is not the case.

It has been noted that media does not follow closely with scientific progress, and instead relies on its ability to get a good story or make a profit (Nelkin, 1995). For instance, consider positive feedback loops, arguably the driving force behind much of the concern surrounding climate change. As noted by Antilla (2010), in the year 2006, 248 scientific journal articles on the major role of positive feedback mechanisms in climate change and the concept of climate tipping points were published. In the same year, only 23 appeared in U.S. news sources. In early reporting on climate change, scientists were the primary sources of information, but now politicians and interest groups have entered the scene (Trumbo, 1996). This has created the sense

[1] see http://www.openletterfromscientists.com

that there is a heated debate among experts regarding when global climate change will happen and whether or not it will occur at all, and that both sides are relatively equal in their evidence basis and numbers. This debate about the actual gravity of the "environmental situation" and whether or not "warning" signs are accurate or merely manipulative propaganda, further contributes to public confusion (Forsyth, 2003).

Reporters are encouraged to get both sides of a story, but the relative sides have not been correctly represented in terms of quality or quantity (Antilla, 2010). Those with financial and other vested interests in the issue - such coal, oil, and gas companies - have spent millions of dollars supporting the continued use of fossil fuels and thwarting scientific claims of strange weather events by blaming it on normal occurrences like El Nino or El Nina (Nelkin, 1995). The political and socioeconomic implications of global climate change remain in the minds of many groups who advocate against policies fighting global climate change. Many of these special interest groups cite the monetary costs and lifestyle changes that will result from the recommended actions toward mitigating climate change as arguments against their implementation, but they fail to consider the results of not implementing them. The projected rise in global temperatures is generally believed to raise sea levels, and change precipitation and other local climate conditions. This will translate into alterations in forest structure, crop yields, and water supplies, which will impact not only the health of animals and plants, but also of that of humans (IPCC, 2007).

The problem may be further exacerbated by self-censorship by the news professionals themselves. According to the PEW Research Center (2000), a significant percentage of stories are ignored because they conflict with the interests of the news company or its advertisers.

Professional media are not the only source of inaccurate information. Everyday the amount of information on the internet grows. The lack of internet laws regarding the accuracy of published information allows anyone to publish anything on the internet for everyone to see. Anyone from organizations, educational institutions, and government agencies all the way down to community groups and individuals can serve as information providers for the internet community. Most of this information never goes through any sort of review or filtering process. Subsequently, it is very easy to find sites filled with inaccurate information and baseless claims about the validity of climate change - sites which anyone with access to a computer can be drawn to.

TAILORING EDUCATION TO OVERCOME THE OBSTACLES

Though it is important to engage all stakeholders, key modifications to curriculum will better inform our future educators and policy-makers. Many challenges face educators of climate change, but tailoring educational efforts to recognize and combat these challenges will minimize their impact on the learning process. From the aforementioned research, it is worth noting that educational efforts need to focus on making the invisible visible, making the abstract tangible, and easily switching between time scales (Winn, 1997; Furness *et al.* 1998). While these efforts may conflict with what school children perceive or hear from other third-party sources, by being alerted to such inconsistencies ahead of time, they are empowered to recognize factual representations from those based upon fictional biases.

More specifically, educators should focus on applying an inter-, multi-, cross-, and trans-disciplinary approach to learning (Naess, 2010). Doing so gives credit to the all-encompassing and global nature of the issue. Furthermore, teachers should recognize the predominant role of

the media and other information sources in student's everyday lives, realizing that each student enters the classroom with numerous preconceptions and misconceptions about the way the world works. Emphasizing a direct and unambiguous message, based on scientific fact and hands-on learning will better allow them to conceptualize abstract notions. It would seem then that hands on demonstrations and investigations would be the best approach for teaching kids. Kids should be exposed to some of the true research and the research process.

While they may present some challenges, computer and the internet represent key tools in combating climate change illiteracy. The same technology that allows for discussion also provides the tools for speedier access to that knowledge. In that sense, there is a continuing momentum in the realm of information sharing. The internet has opened up an easy portal for the scientific community to reach the modern day classroom, ensuring accuracy and promoting transparency (Farke *et al.,* 2009). As Trumbo (1999, p. 421) states, ''Contemporary science communication relies on visual representation to clarify data, illustrate concepts, and engage a public informed through an ever-increasing arsenal of computer graphics and new media tools." By designing educational resources that utilize this highly accessible tool, the move toward public understanding of climate change becomes that much more attainable.

With this in mind, in accordance with 2MBA project members, an educational website utilizing the possibilities of the internet as an open forum has been created to improve climate change educational resources available to the pubic. The website features real data, allowing students to compare changes in their own local area to others. Lessons included provide opportunities for place-based instruction related to climate change, others provide a more global perspective. The activities are geared toward secondary education students, where there are young people who will be affected most and for the longest period of time by climate change. It

is the author's hope that the resource continues to grow and is maintained in a way that is consistent with scientific findings, so that a trust in accuracy and transparency is created and maintained between scientists and the general public.

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