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A Multimedia Approach to Climate Change Education

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A MULTIMEDIA APPROACH TO CLIMATE CHANGE EDUCATION

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Abstract

This paper discusses the development of an upper-level college course on Climate Change created as part of an interdisciplinary Honors Seminar Series. The course makes use of multimedia instructional techniques to examine the physical, economic, and political dynamics of climate change. The curriculum includes an appraisal of assorted global warming websites, computer-based simulations and analysis of relevant climate data, as well as a review of the literature and other media including documentaries such as *An Inconvenient Truth*. The so-called global warming debate subsidized by the fossil fuel industry also is discussed.

Introduction

A decade ago global warming was considered conjecture. Today, the reality of climate change is unfolding at a rapid rate. The ten warmest years on record all occurred within the past 15 years. The annual mean surface temperature for 2005 was the warmest since temperature observations began in 1850, and the world has not been as warm as it is now for at least a millennium. Data from ice cores reveal concentrations of carbon dioxide are at their highest levels in 650,000 years and are expected to double pre-industrial levels during this century, which could raise global temperatures 2 to 5 Celsius degrees. The impacts of climate change are readily apparent around the planet. Retreating glaciers and extreme precipitation events cause flooding in some areas while elsewhere water bodies are evaporating. Tropical diseases are spreading as hurricanes become stronger and more destructive. Ice sheets and alpine glaciers are melting, which combined with thermal expansion of the oceans continue to raise world sea levels. In light of these findings, a college-level Honors Seminar course on climate change was developed using a multimedia approach that includes computer-based techniques to examine the physical, economic, and political dynamics of global

warming with the goal of increasing awareness of the evidence, impacts, and mitigation strategies associated with global warming.

Evidence and Impacts

The Intergovernmental Panel on Climate Change (IPCC), comprised of more than 2000 of the world's best atmospheric scientists, recently revealed that the warmest years of the past century have taken place since 1990 as the atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 parts per million (ppm) to current levels of nearly 380 ppm. The natural range of carbon dioxide concentration during the past 650,000 years is between 180 to 300 ppm according to ice core data (IPCC, 2007). In a conservative global warming scenario based on 1 to 3 Celsius degrees of warming by the year 2100, the IPCC concludes that such change will put the most stress on those systems already affected by pollution, thus increasing resource demands and unsustainable management practices.

If global warming continues as the IPCC and others have suggested, locations from the equator toward the poles will begin to experience higher temperatures which ultimately could lead to more severe droughts, rainstorms, heat waves, and floods (Stevens, 1998). Locations in the Arctic and temperate latitudes are likely to experience warmer and stormier winters. Summers might be hotter with less precipitation, and summer rains will be the result of thunderstorms rather than showers. Regional aspects such as variations in hills, lakes, coastlines, and soils will affect local climate, so that some areas could experience higher or lower temperatures than the mean global changes (Schwartz, 1992). Factors such as ground-level air temperatures, relative humidity, dew concentrations, exposure to winds, persistence of snow, length of frost-free growing season, and duration and intensity of sunlight vary considerably. However, an increase in temperature of 1 to 3 Celsius degrees over the next century would be equivalent to shifting isotherms toward the poles by 150 to 550 kilometers (Kates, 1997). Thus, higher latitude locations can expect to be exposed to greater increases in temperature.

Among the most publicized impacts of global warming are rising sea levels. It has been reported that during the past century, sea levels rose by 5 to 10 inches (Stipp, 1997). Although estimates are extremely variable, a recently published paper in the journal *Nature* states that by 2100 sea levels will be about 20 inches higher than today as a result of global warming, with thermal expansion of seawater accounting for over half of this rise (Gregory & Oerlemans, 1998). A more conservative account suggests global warming is most likely to contribute to a 6-inch increase in sea levels by 2050 and an increase of about 14 inches by 2100 (Edmonson, 1997). A rise in global temperatures would also increase the number and intensity of tropical storms along the coasts. With the majority of the world's population living near the sea, mitigation strategies should be in place to minimize the associated negative effects on the economy as well as coastal ecosystems.

Climate Change Education

The Climate Change Honors Seminar takes an interdisciplinary approach attempting to synthesize diverse ideas, observations, and forecasts concerning climate change. Through a review of the literature, presentations, and discussions as well as an analysis of websites and videos, participants can gain insight into how climate change is altering the planet, potential impacts on the future, and useful planning tools to address its effects. The following examples demonstrate how achievement of these goals and objectives are anticipated.

Simulations and Scenarios

Geographic Information Systems (GIS) modeling applications are a valuable technique to simulate the impact of climate change on coastal areas while addressing the need to better understand climate variability and disseminate this information. Storm surge is a rise in water level as gale force winds drag surface water toward the shore allowing the water to pile up into a mass. The low atmospheric pressure in a tropical cyclone also contributes to storm surge causing water levels to rise. The combination of wind blowing toward the coast forcing surface waters landward and low atmospheric pressure pulling water higher elevates sea level and storm surge heights. Storm surge along low-lying coastal plains can be extremely devastating when the rise in sea level allows

water to flow far inland. It is predicted that by the year 2100, approximately 600 million humans will live on coastal floodplains lower than the 1000-year flood stage (Nicholls & Mimura, 1998). Burns (2000) reports the majority of residents in the Caribbean, the accompanying infrastructure, and many socioeconomic activities are located within a few hundred meters of the coastline. The physical size of the smaller, low elevation islands, such as those of the Aegean Sea, limits their capacity to handle extreme weather events and the accompanying storm surge. Additionally, if the global mean sea level rises as predicted, the present high water mark will be reached more often resulting in a substantial increase in the amount of land area that is at risk of inundation (Hubbert & McInnes, 1999).

This classroom computer simulation begins with a base map of Florida and the establishment of mean sea level for various coastal counties based on topographic quadrangle contour lines, which are the most valuable data for determining which locations might be inundated. Digital images available from local county governments are incorporated into the GIS to enhance visualization. Students then adjust sea level according to estimated rates of increase associated with each hurricane category. For example, a category I hurricane could have a storm surge of four to five feet while storm surge for a category II is estimated at six to eight feet. A category III hurricane might be accompanied by nine to twelve feet of storm surge while the rare category IV and V hurricanes could bring a wall of water from 13-18 feet high. Once the potential inundated regions have been delineated, students can determine at-risk areas along coasts based on population distribution within residential, commercial, and recreational areas. Similarly, the infrastructure that supports these centers such as power generation and fresh water sources that might be threatened by high water can be assessed. The exercise also is useful for establishing the location of storm shelters and evacuation routes.

Climate Change Cinema

Several exceptional videos are available that speak to the need of students to become personally involved in an effort to mitigate climate change. *Global Warming: The Signs and the Science* is a film narrated by international recording artist Alanis Morissette. The program features numerous science experts who review a growing body of evidence

concerning the consequences of a changing climate, and explores how individuals, communities, and organizations are creating new approaches to safeguard future generations. Another film designed to spark discussion among climate change students is *Who Killed the Electric Car?* The documentary is narrated by actor Martin Sheen and tells the story of the electric cars that first began to appear in California back in 1996. The vehicles were quiet, quick, produced no exhaust, and ran without gasoline. Ten years later these futuristic cars were recalled, confiscated, and crushed by General Motors. The film offers insight into the economic and political power of automakers and the oil industry that should give us all cause for concern.

The forerunner among the climate change cinema is the Oscar winning documentary *An Inconvenient Truth*, which makes the convincing case that climate change is real, caused by humans, and its effects will be cataclysmic if we do not act immediately. Former vice-president and winner of the popular vote in the 2000 U.S. presidential election, Al Gore presents a wide array of climate change science and data in a contemplative and compelling way. The movie essentially is a film of the slide show and lecture that Gore has presented to audiences all over the world. As we understand the personal events that shaped his character, Gore transcends politics with a heartfelt plea to reverse the harmful effects of global warming through personal responsibility based on the notion that climate change mitigation is a moral issue.

After receiving hundreds of e-mails from teachers interested in using *An Inconvenient Truth* to educate students about global warming, the producers have donated 50,000 copies of the DVD to teachers across the USA interested in using the film as a teaching tool in classrooms. A free curriculum guide to accompany *An Inconvenient Truth* also is available. The curriculum is aligned with national curriculum standards and is designed for use in Earth Science, Environmental Science, Physics, and Chemistry classes. Similarly, the British government sent copies of *An Inconvenient Truth* to every secondary school in the United Kingdom, and the film is required viewing for all students in Norway and Sweden.

Global Warming Websites

The number of websites addressing the topic of climate change is almost endless and beyond the scope of this paper. However, it should be noted that great care is required to avoid non-scientific sites proposing that global warming is unsubstantiated and no cause for concern. Several of these fossil fuel funded organizations created to spread misinformation concerning climate change are described in the following section and on the website of the Union of Concerned Scientists (<http://www.ucsusa.org>).

The Greening Earth Society was founded on Earth Day in 1998 by a cooperative of coal-dependent utilities in the western USA to discredit climate change science and prevent regulations that might damage coal-related industries. Their approach is to promote the view that increasing levels of atmospheric carbon dioxide are good for humanity because higher levels of greenhouse gas emission will help plants grow larger.

The Oregon Institute of Science and Medicine instigated the Petition Project in 1988. The purpose of the project was to discredit the IPCC by sending a mass mailing to thousands of scientists urging them to sign a petition rejecting the Kyoto Protocol. A forged National Academy of Sciences (NAS) article that downplayed global warming accompanied the petition. The phony NAS article was never peer-reviewed nor was it accepted for publication, and the Academy released a strong statement disclaiming any connection to this effort while reaffirming the reality of climate change. However, by that time the petition had been widely distributed across the Internet and damage from this misinformation continues today.

Founded in 1989 by 46 corporations and trade associations, the Global Climate Coalition funded several flawed studies on the economics of mitigating climate change along with a multi-million dollar advertising campaign against the Kyoto Protocol. Fearing a backlash from consumers, British Petroleum withdrew its membership in 1997 followed by other large corporations including DaimlerChrysler, Texaco and General Motors. However, the coalition remains a powerful and well-funded force focused on obstructing efforts to clarify climate change.

Conclusion

Global warming and climate change are among the most serious environmental problems the world community faces today. Each individual is involved and needs to be properly informed. This information should include the evidence, the impacts, and actions that can be taken to minimize the negative effects of altering Earth's climate system. The topic is extremely complex and the challenge for educators is to enlighten students through ways and means that are truthful, understandable, and comprehensive (Houghton, 2004). As Al Gore (2006, p. 296) explains, "We can unleash the creativity, innovation, and inspiration that are just as much a part of our human birthright as our vulnerability to greed and pettiness. The choice is ours. The responsibility is ours. The future is ours."

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