MICHIGAN STATE
UNIVERSITY

environmental
science +
policy PROGRAM

2012
CLIMATE CHANGE
EDUCATION
SYMPOSIUM

<u>Outcomes from Breakout Sessions</u>

The core concepts to address in climate change education:

<u>College</u>:

1. **Scientific basis**
   a. biogeochemical cycling (e.g., carbon)
   b. solar radiation/ variation
   c. greenhouse effect vs. climate change
   d. examples of observations / evidence for change
   e. interactions between atmosphere, terrestiral and aquatic ecosystems, organisms and humans (e.g., + / – feedback loops on climate change)

   Suggested methods for implementing:
   1. Begin with teaching about the atmosphere and build up
   2. Start by introducing misconceptions and then work backwards
   3. Get students engaged in an activity about how climate change will impact them personally (i.e., movies, written exercises, drawing) to show how future topics are meaningful to their lives.
   4. Perhaps if the goal of the course pertains mostly with core concepts 3, 4, and 5, begin with "assuming we all understand and agree with the climate science…what can we do as citizens, policy makers, etc.

2. **Using models**
   a. The purpose and function of models in climate science
   b. The uncertainty in a model and the role of uncertainty in science (e.g., why is that something scientists are comfortable with but the public is not).
   c. Assumptions of models
   d. Scenarios that models help us predict

3. **Climate commitment** – climate change is happening, lets figure out how to deal with the changes that are already occurring and keep it from getting worse.
   a. Risk assessment
   b. Cost / benefit analysis
   c. Strategic planning (e.g., military moving bases from at risk locations such as Island bases where sea level is rising and Interior Alaska where permafrost thaw is threatening infrastructure).
   d. Individual and societal concerns

e. At risk populations (particularly underdeveloped nations)
4. **Stakeholder identity**
    a. Identify individuals and societies that will be affected by climate change
    b. Obligation to future generations

5. **What can we do to mitigate**
    a. Human response to climate change
    b. Next steps at individual, household, regional, and international levels.

<u>K-12</u>:

1. Core scientific concepts: burning fossil fuels is a major source of anthropogenic CO_2; there are both anthropogenic and natural causes of climate change; climate is different than weather; climate has inherent oscillations and variations (but how much to stress this was debated)

2. "nature of science"-type concepts: scientific knowledge still features uncertainty (as do other fields), but tries to reduce uncertainty for decision making; climate change will affect both ecological and human systems; human economies, and thus potential vocations (related to adaptation and mitigation strategies) will change going in to the future; all K-12 education should incorporate local connections, not just describe a global picture

<u>Informal education</u>:

1. A key to getting the interest of an audience is to relate to their existing core values.

2. One core value shared by the majority of Michigan residents is their relationship to (or interest in) the Great Lakes. Accordingly, show how people are "connected" to the Great Lakes and how it is impacted. Foster an awareness of how climate change impacts to the Great Lakes also impact the average citizen of Michigan.

3. Discuss how climate change will impact the waters of the Great Lakes
    a. What are the impacts to lakes and streams' water levels, water quality – and subsequently the use of these waters for recreation, fishing, etc.
    b. What are the impacts to agriculture
        ▪ Supply
        ▪ Drought
        ▪ Food prices

4. What are the impacts to our urban areas (heat island impacts, water bans, etc.)

5. Foster an awareness of climate change and energy demands

    a. Demonstrate the "embedded" costs of energy (what it takes to produce a particular product) in consumer goods.
    b. Show how the individual can do something "actionable" to reduce their energy consumption (i.e., better insulate their home to make it more comfortable and easier to keep warm or cool).

Gaps / struggles in current climate change education.

College:

1. Dealing with political views of climate change

2. Creating an environment where students can align science knowledge with interactions in society and personal responsibility.

K-12:

1. Content and understanding of science: fuller understanding requires conceptually connecting multiple data sets across multiple scales, and this is very difficult for students; many students don't have a working knowledge of the practices of science (i.e. how knowledge is built); science certification for elementary teachers is often weak or non-existent.

2. Connections to other fields of study: economic implications of climate change are not often discussed in economics classes or vocational training options; uncertain responses to the "politicization" of climate change debates; helping teachers to realize that climate change can be addressed and discussed in other venues than science class – its ramifications aren't purely scientific

3. Acknowledging moral and ethical implications of climate change – this is also related to addressing the motivation and relevance of the topic to students. Why should they care about this in their lives and local communities?

Informal education:

1. Determine how to develop concise climate change information that is useful to (i.e., actionable by) the general public.

2. How do we better communicate concepts like "carbon footprint" without alienating a large portion of the target audience (right wing conservatives)? Another option it to consider a slightly different concept like "energy footprint" or "personal budgetary footprint."

3. Climate change and its impacts needs to be integrated into many disciplines and not considered a separate educational program.

4. There needs to be better access to climate change tools, for both the private individual's personal applications and for planning purposes by local professionals, possibly via the web.
   a. One option to consider is an emphasis on participatory planning exercises (for adaptation planning) via the web, especially to address the largely untrained, volunteer planning officials at the local level.

5. Credible climate change and related data sources need to be provided for use at the local level (especially for local planning) and for K-12 educators.
   a. Any climate change data sets need to be accompanied by a frank discussion of associated data uncertainties.

How interdisciplinary approaches can benefit climate change education -- what different disciplines bring to the table for climate change education.

College:

1. Natural science students need to have a background understanding of the social sciences influencing views of climate change and social science students need a background in the natural science behind climate change.

K-12:

1. There are multiple ways of understanding the natural world, of which science is just one. It does have particular value in explaining and predicting natural phenomena, but should not operate in isolation.

2. Climate education must be consistently applied to local scales (since rich understanding of global scales is a later-developing ability). This provides links to place-based education and other efforts to provide students with a sense of their local community's history and change over time. For most kids, they will care far more about science that they can see in their neighborhoods and that will apply to the jobs they or their parents could have.

3. Working on projects that come out of climate education can add to students' sense of empowerment.

Informal education:

1. Remove climate science as a separate discipline from formal education. This prevents it from becoming a target either for budget cuts or due to (personal) political reasons. Alternatively, integrate climate science into all other disciplines/fields of interest including math, history, geography, science, etc.

2. Climate science integration into other disciplines/fields will help to improve communication of the subject matter due to its context with that associated field (i.e., math, geography, etc.).

3. Know your audience and frame the climate change topic accordingly! Try to leave out "red flag" language to get your point across, etc.
   a. Farmers: climate change => water availability, water quality => irrigation and plant growth

   b. Hunters/fishermen: deer and deer pests, cold water streams becoming warm water fisheries, etc.

   c. Health care workers: heat island impacts in the inner city, droughts, etc.

How instructors can use personal experiences/[climate change] research in the classroom

<u>College</u>: did not have time to answer.

<u>K-12</u>:

1. You must consistently model good choices (practice what you preach).

2. OK for teachers to express personal convictions and rationale for those convictions, as long as it is not done in a way that squelches or belittles students' convictions

3. Class activities and projects can be used to build personal conviction and attachment of students to their place, not just didactic lessons.

<u>Informal education</u>:

1. Use personal experiences about climate change that people can relate to
   a. Impacts to gardening (changing planting and harvesting times, increased hardiness of formally southern species, northern migration of plant pests)

   b. Impacts to fishing/hunting (see earlier examples)

   c. Be able to show the impact of insulating your home - or improving your home's energy efficiency

   d. All personal experiences can be used to segue into more formal "scientific" research to augment or reinforce those personal observations

   e. Provide case studies: Show how others have been able to reduce the impact of climate change on their lives.

2. Lay out the process(es) available to change existing local/state/federal policies favorable to energy inefficiency. Make this part of an existing civics, political science or policy class!

Role of technology/media in instruction?

College: did not have time to answer.

K-12:

We didn't discuss this at any length due to time limitations, but did generally agree that although it is extremely helpful to climate change education for many reasons, initiatives should prepare for a wide range of technologies to be available when rolled out into classrooms.

Informal education:

1. Social media (Facebook, Twitter, etc.) is a great connecting/networking tool if used properly!

2. The web can play a pivotal role in providing access to high quality data for policy and decision-making

3. The web can and should provide access to:
    a. tools needed for data use, such as modeling, projections, etc.,
    b. interactive simulations,
    c. case study examples to help users understand how to apply the data,

4. Technology should be used to help target outreach to specific audiences at their points of decision making,

5. We should consider how to make the technology (web, etc.) entertaining to attract target audiences to climate change information, tools, etc.
    a. We may want to discuss this issue with IT application developers

    b. We may wish to consider how to incorporate gaming technology into climate change-related websites