Making a Climate Connection for Kids

Bruce L. Larson, May 2008

Abstract: The complexities of climate change ask a great deal of teachers, but the need to prepare our students grows daily. This article strives to cover the basics of climate and provide teachers with a balanced selection of resources for presenting the topic to students. Learning about climate requires observation, data collection, math analysis, graphical interpretation, and geography to name a few related topics. These are not static skills, but tools which can be used in teaching and learning science throughout the K-12 experience. **[note: photos are available, but are pending model releases – I wanted to get this into review quickly].**

Courtesy of European Union – for educational use

'Climate Change' vs. 'Global Warming'

Right off the bat I'm advocating a change in terminology! Because so many variables are at work in climate change, 'global warming' is a poor choice for describing what is going on with climate since it doesn't incorporate potential changes from natural cycles or human activity such as pollution. El Nino and La Nina events are longer term cycles which can significantly shift climate warmer or cooler on a short term basis. A recent German computer model suggests that deep Atlantic Ocean currents may slow warming for a decade or so (*Nature*, May 2008). It's important to have an appropriate context to help explain such seeming contradictions. 'Global warming' is a catchy cliché which doesn't do justice to the complexity of climate change, and begs media attention rather than reflection on the problem. I encourage teachers to adopt 'climate

change' and be in step with the IPCC and European Union terminology for introducing and teaching the topic.

Weather vs. Climate

Those of us who reside in New England only have to 'wait a few minutes' to get some 'weather we like' to paraphrase Samuel Clemens. But, like everywhere else on the planet Earth, we do have to wait decades or longer to see if the climate is changing. In trying to teach climate, there is a developmental flow from *sensing* relative temperature, to *observing* cloud shapes, studying weather patterns and extreme weather, to ultimately *understanding* climate. For middle schoolers, you could add an even greater level of complexity by adding space 'weather' to the mix (Web ref. 1a)! Pre-teaching the *sensations* of weather begins as early as the primary grades (K-2). Grade 3+ students can master thermometers, observe clouds and wind speed, and master simple graphs, which means they can collect meaningful *observational data* on the weather. Making the jump to understanding climate requires the ability to read graphs, do averages, deal with a geologic time scale and pair that with an understanding of the geography of regions and biomes and is within the scope of the elementary grades (4+ - middle school).

Creating a 'Climate' of Interest in Weather

I love studying the weather, from tracking hurricanes to using the 'old sayings' to make a local short term forecast. Modern tools for documenting weather have enabled the integration of satellite data with networks of observations to create vast databases for modeling weather patterns. The technological revolution in meteorology has added a layer of complexity and mystery in the way the public consumes weather and climate information. Pulling aside this veil of obscurity involves connecting an awareness of weather to a greater interest in studying it in the primary years. In my school, this begins with the morning 'Weather Team' bulletin on daily

conditions, presented by third-fifth graders during the morning announcements. Kindergarten classes record the hours of daylight to track the seasonality of sunlight. In the fall, our fourth and fifth grade classes use the excellent tracking charts available from the National Weather Service (Web ref. 1) to combine some geography and math during the height of the hurricane season. Hurricanes are a natural way to bring up physical science concepts like convection, water cycle, and energy transfer. A good way to get students involved in 'looking up' is the NASA S'Cool project which uses upper elementary and middle school students to 'ground truth' CERES satellite data of cloud cover (Web ref. 2). Having a weather station at school can be an asset to teaching weather. There are two ways to go: your own system, not connected to a larger network (like the Davis products) or a complete program tied in with other schools and offering a package of teacher support (Web ref. 3). I mention the two longest running products, not as endorsements, but as examples of what to expect for cost and quality. In the end, hooking your students on weather is fundamental in leading them to the goal of understanding climate and climate change. For more information of weather stations, you can go to the www.lmnts.org website which covers school weather stations under the weather module of the site.

Understanding Climate

Climate reflects an average set of conditions for a given terrain and time of year. These include temperature, barometric pressure, precipitation and humidity. If your school employs its own weather station, you can begin to derive climate data for your school by averaging these readings. You can also factor in variables such as cloud cover, 'bud break', ice out in local ponds or lakes, and events like first and last snow. Some of these milestones (and archives) will be available from your state climatologist or cooperative extension agent. If your school belongs to a weather sharing network, you can share climate parameters with schools from other parts of the

US or world. You'll get some geography along with the weather! By having a tradition of weather interest in your school supported by data collection and archiving, the stage will be set for the more complicated task of examining changes in climate. A good way to start is to examine variations in small local areas called 'micro-climates'. By looking at a variety of microclimates, students can begin to appreciate the many variables which contribute to the local and global climate. Micro-climates can change over the course of a day based on sun, shade, and terrain. Fortunately, there are some intermediate activities which will illustrate the concept of 'micro-climate'. A simple one gets students using thermometers to map classroom microclimates (an example, Web ref. 4). You can adapt this exercise for use around your building or playground. Once students are used to the idea of climate variability and the ways that climate factors can be measured, you can ease into the topic of long term climate change.

Thinking Globally, Teaching Locally About Climate

Many European school systems have already begun to integrate teaching about climate into their curricula. A terrific site is the UK 'Climate Choices' site (Web ref. 5) which is geared to 9-11 year olds. The strategy of presenting climate impact scenarios from around the world will appeal to the passions and blossoming global awareness of upper elementary students. Researching and writing your own warming scenarios using the UK stories as a scaffold would be a great starting point. Here in the US, there are shocking changes in Alaskan native villages and many of our students have personally experienced regional drought and flood extremes. Putting these events into context with research is the challenge, and I refer to the IPCC graphs as a starting point. As a math exercise, trying to make the correlation connection between two graphs will be a challenge, but I believe that grade 4 and above will be able to make the connection successfully. There is even a stirring of work by authors on the topic, most notably

Lynne Cherry and Gary Braasch's new book **How We Know What We Know About Our Changing Climate: Scientists and Kids Explore Global Warming (About Our Changing Climate)** (Dawn, 2008). This book inspires interest rather than fear, and provides accurate information for students and adults.

Educate Yourself

Teaching about climate and climate change is a great demand to place on teachers. It is a complex topic which has endured divisive and politically sensitive debates for decades. For our students, the goal is to present a curriculum which affords an understanding about how things work and gives them the framework of the problem without the hype and hyperbole of news outlets. With the awarding of the 2007 Nobel Prize to *The Intergovernmental Panel on Climate Change (IPCC),* I think teachers can move beyond the history of the debate and onto the particulars of the issue. The IPCC executive summary is a good place to start (Web ref. 6). Another resource is the European Union climate change website which includes sections for teachers and students (Web ref. 8). For upper elementary and middle school teachers who really want to have an understanding about weather and brush up on their physical science skills, I recommend the Datastreme program of the American Meteorological Association (Web ref. 7). The program is administered regionally and usually comes with college credit. Pop quiz: Why is 'greenhouse' a poor adjective to describe gases like CO2 which absorb heat form the sun? Answer at the end of the article!

Conclusion

This is a story which has no conclusion, only what I would hope was a beginning. The goal of climate education is not to strike fear in the hearts of our students, but to give them knowledge and tools for understanding the tasks which lie ahead for them as citizens of the world.

Pop quiz answer: A real greenhouse gets warmer because the air inside is being warmed by the surfaces being heated by the sun. This heated air has no place to go (convect) so the greenhouse is warmer relative to the air outside. CO2 absorbs infrared radiation being re-radiated from the Earth's surface, trapping energy which would ordinarily escape into space. Despite this error, the gases which trap infrared radiation in the atmosphere are still commonly referred to as 'greenhouse' gases.

" If you don't like the weather in New England, just wait a few minutes." *attributed to Samuel Clemons*

Cherry, Lynne; Braasch, Gary. How We Know What We Know About Our Changing Climate: Scientists and Kids Explore Global Warming (About Our Changing Climate). Dawn, 2008. ISBN: 978-1584691037.

Keenlyside, N.S., et al *Letter. Nature* **453**, 84-88 (1 May 2008) | doi:10.1038/nature06921

All of the web references are available as direct links at
http://www.lmnts.org/ClimateChangeLinks.htm

Web reference 1a: http://www.spaceweather.com/

Web reference 1: http://www.nhc.noaa.gov/HAW2/pdf/AT_Track_chart.pdf

Web reference 2: http://asd-www.larc.nasa.gov/SCOOL/

Web reference 3: http://weather.weatherbug.com/weather-education/default.asp

Web reference 4: http://www.lmnts.org/pdfs/ProbingTemperature.pdf

Web reference 5: http://www.climatechoices.org.uk/index.htm

Web reference 6: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

Web reference 7: http://www.ametsoc.org/amsedu/DataStremeFrames.html

Web reference 8: http://ec.europa.eu/environment/climat/campaign/schools/teachers_en.htm

This article and pdf's of the handouts are available at www.lmnts.org by going to the modules page and clicking on the 'Weather' link.