Drawing Scientific Conclusions Based on Typical Global Climate Change Data: An ICCARS Math, Science and Technology Instructional Unit

Dearborn Center For Math, Science and Technology

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INTRODUCTION

During the 2011-2012 school year, 10th and 11th grade students at the Dearborn Center for Math, Science & Technology (DCMST) will participate in a year-long series of investigations and activities in their math and science classes. Participating teachers will be John Bayerl (Biology), Jennifer Gorsline (AP Statistics) and Deena Parks (Biology).

This unit was designed with the specific goal of integrating Global Climate Change investigation into existing curriculum. Furthermore, the unit is also an essential part of DCMSTs ongoing School Improvement Plan (SIP) goal of improving students ability to draw scientific conclusions based on empirical evidence.

ALIGNMENT TO SPECIFIC CLIMATE LITERACY PRINCIPLES

While most of the Climate Literacy Principles will be covered during this unit, a specific effort has been made to align to the one specific principle in each course.

In Biology, the emphasis will be on Essential Principle 2 (Climate is regulated by complex interactions among components of the earth system) with a focus on sub-topics D (the abundance of greenhouse gasses is controlled by biogeochemical cycles) and F (the inter-connectedness of earth's systems means that a significant change in any one component can influence earth's equilibrium)

In AP Statistics, the emphasis will be on Essential principle 5 (Our understanding of the climate system is improved through observations, theoretical studies, modeling) with a focus on sub-topic C (Construct computer models and make predictions about future climate behavior).

TIMELINE

The lessons within this unit will be covered at various times during the year as part of the regular curriculum in each class. This is not a “stand-alone” unit, but rather a series of investigations interspersed within normal classroom activities building to a final evaluative assignment at the end of the year. Specific timeline benchmarks are discussed in the unit outline that follows.

UNIT OUTLINE

Following the Constructionist Paradigm, DCMST students will complete various lessons, explorations, and activities throughout the year to to construct their own understanding of and then defend their own conclusions about Global Climate Change based on the empirical evidence they have collected.

In their Biology class students will conduct six (6) labs based on the carbon cycle. These are available through Wayne County (MI) RESA at: https://sites.google.com/site/iccarsproject/carbon-cycle .

The approximate timeline for these activities is:

- animal respiration (October)
- plant respiration/photosynthesis (November)
- burning fossil fuel (January)
- auto exhaust study (February)
- pH changes in water (March)
- investigating carbon sinks (April)

Additionally throughout the year, biology students will participate in a year-long GLOBE atmosphere observation project using the school weather data station. Students will be responsible for recording daily observations using this protocol, and will combine their results to create a year-long database of observations. Students will also conduct a land use exploration of their campus using both the land use protocol (ground truth) and NASA satellite/AeroKat imagery (Remote Sensing). Information on the GLOBE Student Research Campaign (SCRC) can be found at:
https://sites.google.com/site/iccarsproject/resources/globe .

The approximate timeline for these activities is:

- Site selection and station installation (September)
- Daily student observations (teams of 2 students) (November-April)
- Campus land use remote sensing activity (March)
- Campus land use investigation protocol (April/May)

In the context of their biology curriculum, students often practice their "reading for information" skills by reading a piece of scientific literature and crafting a review of the assignment, basing their conclusions on evidence from the reading. In addition to the regular readings (on a wide variety of scientific topics) students will complete at least two projects from the NASA data lessons website:
http://mynasadata.larc.nasa.gov/ClimChg_lessons.html

The approximate timeline for these activities is:

- "Coral Bleaching" (Fall Semester—December?)
- "March of the Polar Bears" (Spring Semester—April?)

At the end of the year (May), biology students will complete a final capstone project as part of their final exam. This project is also aligned with the school SIP writing goal (drawing conclusions from evidence). Student will write a persuasive essay on the topic of Global Climate Change. They will be evaluated using a school-wide conclusion rubric on their use of evidence to support their conclusions. This evidence should include examples from each of the activities above.

Students in the AP Statistics course will use the GLOBE SCRC weather/climate change data collected by biology students as an example data set for various stats units during the year. They will also investigate trends in weather/climate by completing the CLEAN activity "US Historical Climate" found at: http://serc.carleton.edu/introgeo/mathstatmodels/examples/XLstats.html .

USE OF ICCARS RESOURCES IN UNIT

In completing the unit, students will use many of the resources provided by ICCARS. They will implement the GLOBE SCRC observations in the spring (land cover) and throughout the year (collection of atmospheric observations on a daily basis). They will be introduced to the NASA data sites as part of the capstone overview and encouraged to include data from these sites in their final evaluation. They will also explore NASA data as part of the campus land use project in the Spring. Remote sensed data (Landat, AeroKat and Google Earth) data will be used as part of the campus-wide land use project as well.

Additional Student Projects

Because DCMST is a STEM school, students in the 10th and 11th grade complete student research projects and compete in various school, city, county and state science fairs. It is hoped that this project will provide students with a large (longitudinal?) weather data set to use in weather/climate research projects, introduce them to remote sensing data for use in a variety of climate and environmental studies, and inspire some students to pursue further research into global climate change using empirical evidence.