## Teaching Notes

### By *Melissa Hage*

[*Melissa.hage@emory.edu*](mailto:Melissa.hage@emory.edu)

*770-784-8345*

**Course Information**

Institution: Oxford College of Emory University (2-year liberal arts branch of Emory University)

Department: Environmental Sciences

Course Name: Introduction to Environmental Studies

Level: **Lower/Upper Undergraduate** (select one) Lower Undergraduate

Course type: **Lab/Lecture/Both** (other, please describe) (select one) Both lab and lecture

Students: **Majors/Non-majors** (select one) Mixture, but primarily non-majors

Number of Students: 22

**Module Information**

Original Module Name: Climate Change

Link to Original: <https://serc.carleton.edu/eddie/enviro_data/activities/climate_change.html>

Modified Module Name: Investigating Evidence for Climate Change

Files associated with modification: (ie. Class Worksheet, Summative Quiz, Lecture Powerpoint, etc) Class worksheet, Lecture PowerPoint, Final Exam questions)

**Teaching Notes**

*(Think about what you would like to read about this activity if you came back to it in 2 years)*

* How did this module fit into your overall course curriculum (e.g., relationship to other content, relationship to course learning objectives)?

This module was an excellent fit with my overall course curriculum. We had just finished sections on Nonrenewable and Renewable Energy Sources This module was completed over 2 course periods and took place after a guest lecture from someone from the Solar industry and the module was followed by 2 additional classes on evidence for climate change and climate change solutions. I found students utilizing knowledge from this module in their discussion points. The module also fit in with Part 2 of the larger division of the class, where Part 1 was focused on understanding the natural world (topics include population dynamics, community interactions and change, evolution, ecosystems, and biodiversity) and Part 2 was understanding human impact on the natural world (human population growth, agriculture and ecology of food, air pollution, water quality, nonrenewable energy source, renewable energy sources, and climate change). The module also fit in nicely with my course learning objectives:

The two **overarching goals** of this course are:

1) to peak your curiosity about the Earth they inhabit, gain knowledge about the natural world, and to share that curiosity and knowledge with others. You should be able to observe the world around you, marvel at what you see, and understand the processes at work.

2) to impart to you a relevance of scientific knowledge and processes so that you can become more critical thinkers and better decision-makers – economically, politically, socially, and personally.

At the completion of this course, you will be able to:

* ***Discuss*** the major themes in environmental science
* ***Understand*** the natural world and the human impact on its processes, and how those impacts can be mitigated
* ***Observe*** the natural world, generate questions, and evaluate evidence
* ***Develop*** field techniques and ***analyze*** real-world data
* ***Evaluate*** ongoing environmental issues through the lens of sustainability
* ***Communicate*** scientific information both verbally and in writing
* Did you use the entire EDDIE modules as presented? If not, which components did you use?

I did use the entire EDDIE module as presented. The only addition I made was including some Excel shortcut tips into the student instruction handout.

* What did you change about the module and why?
* What was the prep like?
  + What did you do to prep ahead of module implementation?
  + How much time went into prep?

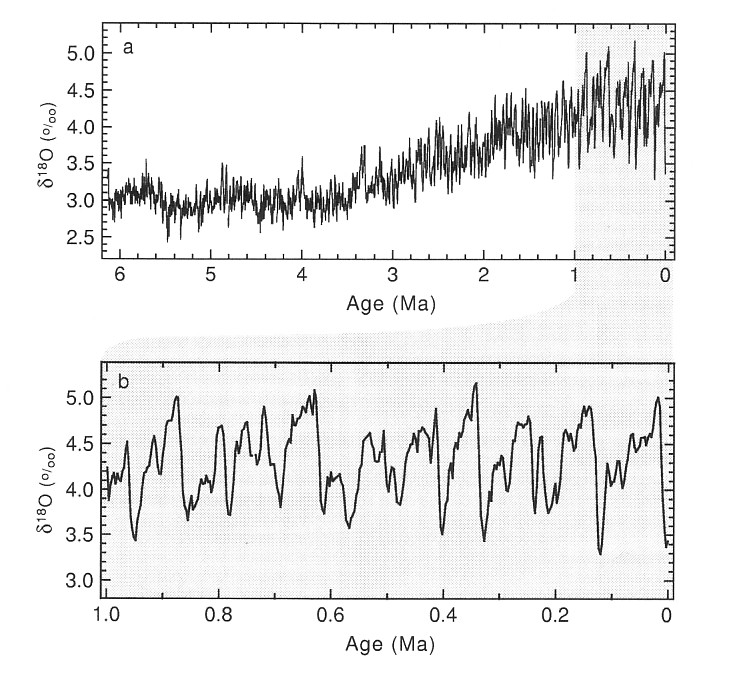
I learned from the implementation of a previous EDDIE module and worked through the entire module on my own as if I were a student. This took me about 1.5 hours.

* How did the activity go?
  + What went well and why?
  + What went wrong and why?
* What do you think students took away from the activity?
* Where did students struggle the most?
* Would you do this activity again?
  + If yes, what would you change in the future?
  + What suggestions would you give to a colleague before they used it in their teaching?
* Is there anything else you’d like to make note of?

Students seemed to like this module better than the Water Quality one, but I think that was in part to how much smoother the implementation of this one went relative to the other module. The timing was much better and finding the required data was much more straightforward. Still, a lot of time was spent making graphs, resulting in not a lot of time discussing what they were finding. Students had to finish assignment as homework, despite having 2 full 75-mins class to work on things. Maybe too much time on PowerPoint intro/lecture? Might consider having students make graphs prior to coming to class, so that they still get the practice using Excel and finding/downloading large datasets, but then most of the class can be focused on data interpretation and discussion - of what the data means, how it was collected, how it can be interpreted, etc. Might be a good place to insert discussion of data interrogation so that students learn how easily it is to manipulate data to say what someone wants. How can we examine data and who is collecting it so that we can trust any reported results?

Exam Questions:

1. How can ice cores be used as sources of paleoclimate information?
   1. Examination of the change in the type of pollen found in the ice
   2. Analysis of the thickness of ice rings in the cores
   3. Analysis of gas bubbles trapped in the ice
   4. Analysis of carbon isotope ratios
2. Oxygen isotope analysis measures the
   1. amount of radioactivity due to oxygen isotope decay
   2. proportions of 2 different types of oxygen atoms
   3. total oxygen present
   4. rate of oxygen depletion
3. Which of the following statements best describes the pattern of Earth’s CO2 concentrations over the past 600,000 years relative to now?
   1. The Earth’s CO2 has usually been higher than it is now
   2. The Earth’s CO2 has usually been lower than it is now
   3. The Earth’s CO2 has fluctuated a lot, and has been both higher and lower in the past 600,000 years
   4. There is no way to tell what the Earth’s CO2 concentrations were in the past



1. In the graph of ocean sediment data above, what do the circled time periods represent?
   1. Warm periods
   2. Periods of high CO2 levels
   3. Dry periods
   4. Cold periods

Discuss how we know climate change is happening, that human activities have contributed to current climate change, and some of the consequences of this climate change. How do we know the changing climate is not part of a natural cycle? Make sure you include specific/details and not just broad statements. Think about specific lines of evidence. (Hint: Think about what you learned from the ice core climate change module to help answer this question).