Mentoring Atmospheric Science Graduate Students at Colorado College:

Expanding the Pipeline by Educating Future Educators

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Introduction:

Objective seven of the CMMAP strategic plan is to teach the next generation of climate scientists to become better educators. One of the strategies to accomplish this objective is to provide an opportunity for Colorado State University (CSU) to literally be thrown "into the fire" and

co-teach an upper division Atmospheric Physics class at Colorado College (CC).

Knowledgeable and exciting teachers will increase the pipeline to the atmospheric science field. We believe educators can maximize the pipe flow by:

- Improving pedagogy
- More hands-on learning
- Getting involved with all levels of students.

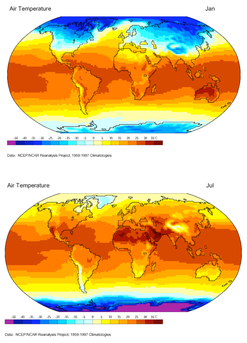
Pedagogy:

Many, if not all students have spent time in a class where the professor filled "the pool of knowledge" and the students were expected to be sponges and soak up as much as possible. This traditional view of teaching can work for some, but not for all. Cognitive research provides five key ideas about how students best learn. This research found that students learn best by:

- constructing their own understanding based on their prior knowledge, experiences, and skills.
- following a learning cycle of exploration, concept formation, and application
- connecting and visualizing concepts and multiple representations
- discussing and interacting with others.
- reflecting on their progress and assessing their own performance.

For this block, we wanted the students to be more responsible and engaged in the learning process. To accomplish this, the POGIL (Process Oriented Guided Inquiry Learning) approach (funded in part by NSF/DUE) was used. A normal day would look like the picture to the right (can you spot our "special guest"?). We designed worksheets to introduce concepts often using real data. Lecturing for a full three hours is not an effective use of time on the block plan.

A POGIL Example - The Polar Vortex:



Here's a section from a POGIL worksheet we designed and used this block (more examples are in the binder below).

To the left is the average global surface temperature for January and July

1. Compare the equator to North Pole temperature gradient in January to the equator to South Pole temperature gradient in July. Which is stronger? Why

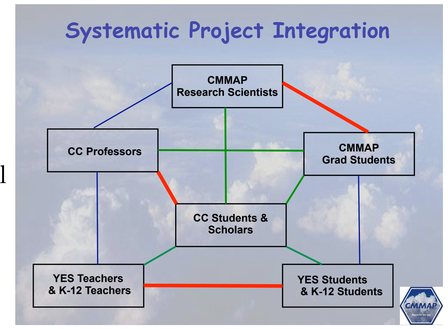
2. Using the thermal wind equations and your response to Q1, would you expect the winds aloft to be stronger in North during January or in the South during July?

3. Based on your response to Q1 and Q2 would you expect the Arctic or Antarctic stratosphere to become more isolated in their respective winters?

Hands-on and Inquiry Learning:

The CMMAP grant allowed the purchase of eight radiosondes for the course, allowing the CC and K-12 students to get a great hands-on learning experience (the students did the launches). During the course, the students were asked to become science-minded by designing and executing a study evaluating the health effects of air pollution at two proposed sites for a new children's center.

The students used a number of lab instruments and historical data to assess the air quality at two local sites to determine where the children's center should be located.



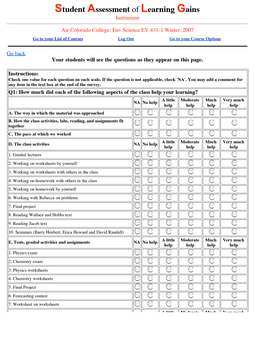
In this project, the students took the lead, forming all the important questions of the study and the methodology.

Get them while they're young!:

Crucial to CMMAP is increasing the "web of connections" from research scientists to elementary students. The radiosondes offered an excellent opportunity to reach out to the youngest of future scientists.

The Catamount Institute's Young Environmental Stewards (YES) 4th - 5th students came out to launches twice. CC students and I let the students launch the balloons and take atmospheric measurements. Interactions like these are essential to expanding the pipeline into the field.

Performance Assessment:



Student Assessment of Learning Gains

Instrument

Air Colorado College: Fav Science EV 431-1 Winter, 2007

Go to your List of Courses | Log Out | Go to your Course Options

Go back

Your students will see the questions as they appear on this page.

Instructions:
Check one value for each question on each scale. If the question is not applicable, check 'NA'. You may add a comment for the instructor in the box at the end of the survey.

Q1: How much did each of the following aspects of the class help your learning?

	NA	No help	A little help	Moderate help	Much help	Very much help
A. The way in which the material was approached	○	○	○	○	○	○
B. How the class activities, labs, reading, and assignments fit together	○	○	○	○	○	○
C. The pace at which we worked	○	○	○	○	○	○
D. The class activities	NA	No help	A little help	Moderate help	Much help	Very much help
1. Guided lectures	○	○	○	○	○	○
2. Working on worksheets by yourself	○	○	○	○	○	○
3. Working on worksheets with others in the class	○	○	○	○	○	○
4. Working on homework with others in the class	○	○	○	○	○	○
5. Working on homework by yourself	○	○	○	○	○	○
6. Working with Rebecca on problems	○	○	○	○	○	○
7. Final project	○	○	○	○	○	○
8. Reading Wallace and Hobbs text	○	○	○	○	○	○
9. Reading Jacob text	○	○	○	○	○	○
10. Seminars (Barry Hanbert, Erica Howard and David Randall)	○	○	○	○	○	○
E. Tests, graded activities and assignments	NA	No help	A little help	Moderate help	Much help	Very much help
1. Physics exam	○	○	○	○	○	○
2. Chemistry exam	○	○	○	○	○	○
3. Physics worksheets	○	○	○	○	○	○
4. Chemistry worksheets	○	○	○	○	○	○
5. Final Project	○	○	○	○	○	○
6. Forecasting contest	○	○	○	○	○	○
7. Worksheet on worksheets	○	○	○	○	○	○

To determine how well the students learned, rather than what they liked, we used the Student Assessment of Learning Goals (SALG) approach (also funded in part by NSF/DUE). This online template allows the professors to assess how well the students believe they achieved the various learning goals for the class.

Statistical analysis within the various categories allows professors (and CMMAP students) to improve future versions of this class.

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