Integrating Climate Change for Elementary Pre-Service Teachers: Tales from the Field

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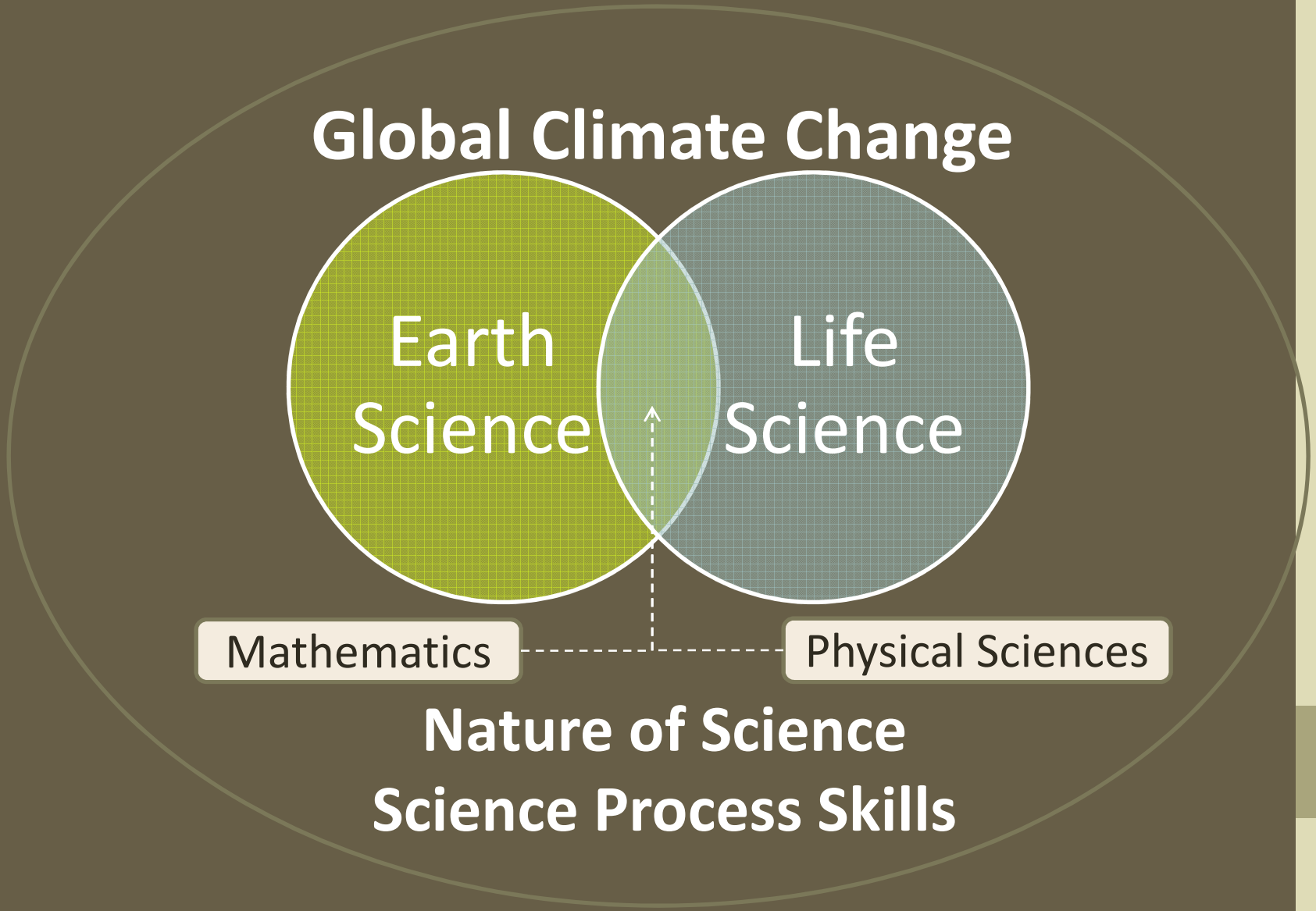
History of Integrated Earth/Life Science Course

- Prior 2009: required 1 lecture & 1 lab
- State mandated 2 sequence science course
- Decided on a physical science & an integrated Earth & Life science course
- Overarching theme: Global Climate Change

Course Development

- Internal grant to work on early preparation for the course
- Development of a Master Document
  - Guiding questions
  - Key objectives for each class
  - Concepts for Earth & Life science, including Nature of Science & science process skills
- Goals:
  - Develop understanding of Earth & Life science concepts
  - Teach/learn through inquiry
  - Model science teaching
  - Nature of science & science process skills in the science classroom

Curricular Model

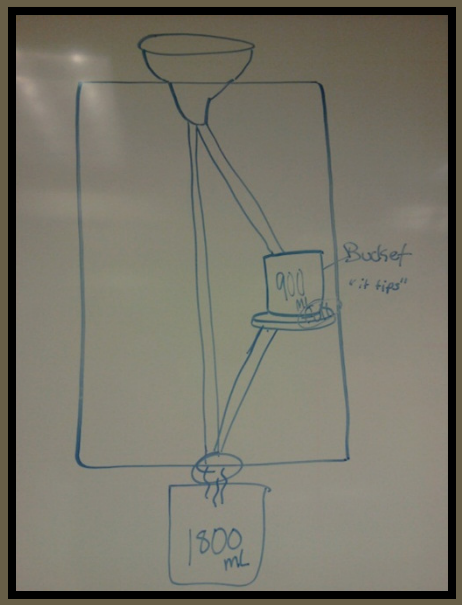


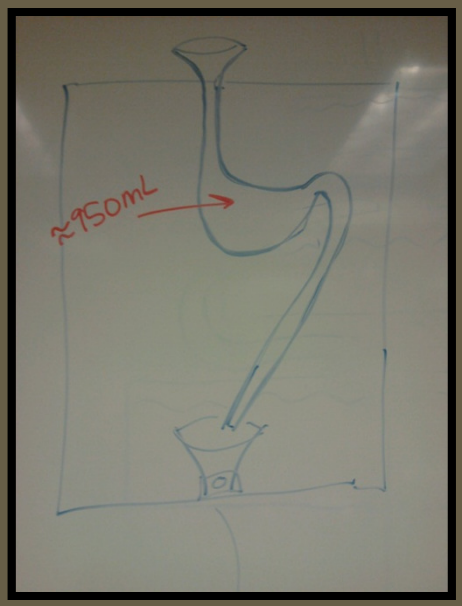
Teaching the Course

- Two professors (one for each discipline)
  - Students move between the classes
  - When possible, two professors in same classroom
- Consistency among the professors is key
  - Grading scale & approach
  - Types of assignments
  - Objectives – list at beginning/go over at end of lesson
  - Exam layout
  - Academic freedom not in danger!
- Weekly meeting among the group
- Reflection questions, GCC in the media, GCC in the classroom

A Student's Schedule

- An Earth Science student will for example:
  - Will stay with me for the first 3 classes, then switch to see my life science counterpart for 3 classes
  - Then for several classes will switch back & forth each class
  - Then we will teach a topic together – all students in one room, with either earth or life professor leading
  - This similar patter continues for the rest of the semester



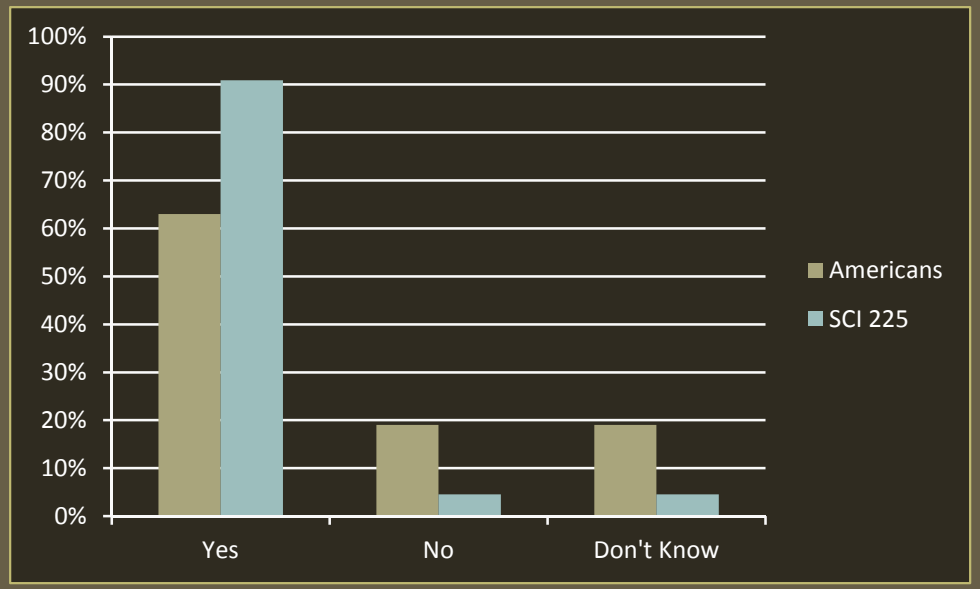


Classes	Guiding GCC Question	Life Science	Earth Science	TYPE
1 & 4	What is GCC?	Biogeography	Climate & Weather	BLOCK
2 & 5	How is climate influenced naturally?	Natural Selection	Geosphere, Hydrosphere & Atmosphere	
3 & 6	How is climate influenced naturally?	Biodiversity	Geosphere, Hydrosphere & Atmosphere	
7 & 8	Has GCC occurred in the past?	Evolution & Phylogeny	Geologic Materials	SWAP
9 &10	Has GCC occurred in the past?	Energy Flow & Trophic Structure	EXAM 1	SWAP
11 &12	What factors influenced GCC in the past?	Biogeochemical Cycling	Orbital Cycles & Carbon	SWAP
13 &14	What factors influenced GCC in the past?	Inheritance & DNA Structure/Function	Protein Structure/Function	TOGETHER
15 & 17	Is GCC happening now?	Phenology & Plant/Animal Life Cycles	Physical Changes in Historical Time	BLOCK
16 & 18	Is GCC happening now?	Phenology & Plant/Animal Life Cycles	Physical Changes in Historical Time	
19 & 20	Are humans involved in current GCC?	Are humans involved in current GCC?	Nature of Models & Energy Resources	TOGETHER
21& 22	What are the projections being made?	EXAM 2	Changes in the Physical Earth	SWAP
23 & 25	What are the consequences of GCC?	Community Structure & Loss of Biodiversity	Sea Level, Glaciers, & Shifting Climate Zones	BLOCK
24 & 26	What are the consequences of GCC?	Community Structure & Loss of Biodiversity	Sea Level, Glaciers, & Shifting Climate Zones	
27 & 28	What are the social implications? What do we do next?	Prioritizing Issues Related to GCC	Stabilization Wedges	TOGETHER

Is it working?

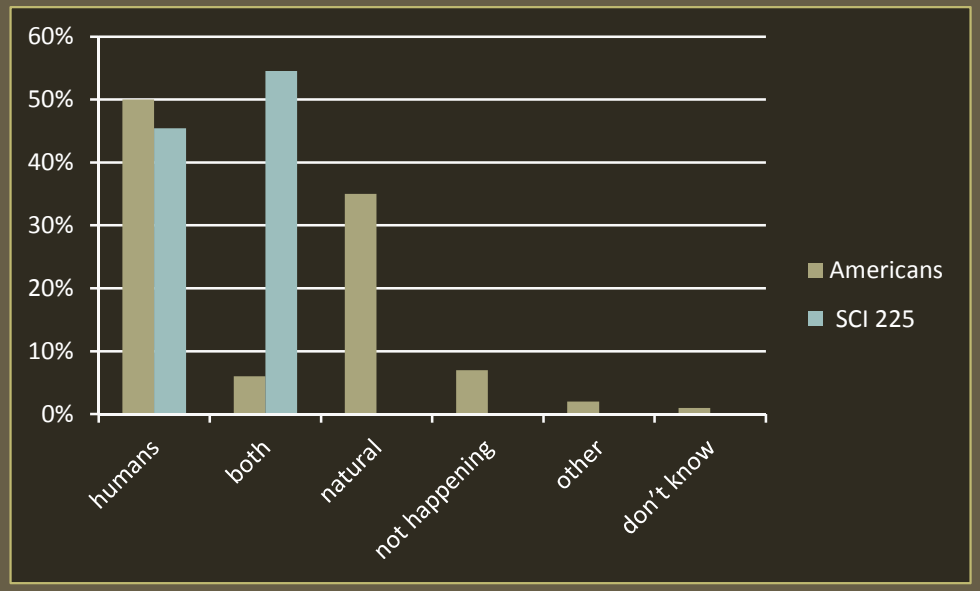
- Yale Project on Climate Change Communication: America's Knowledge on Climate Change (http://environment.yale.edu/climate/files/ClimateChangeKnowledge2010.pdf)
- end of course survey about global climate change

Is global warming happening?



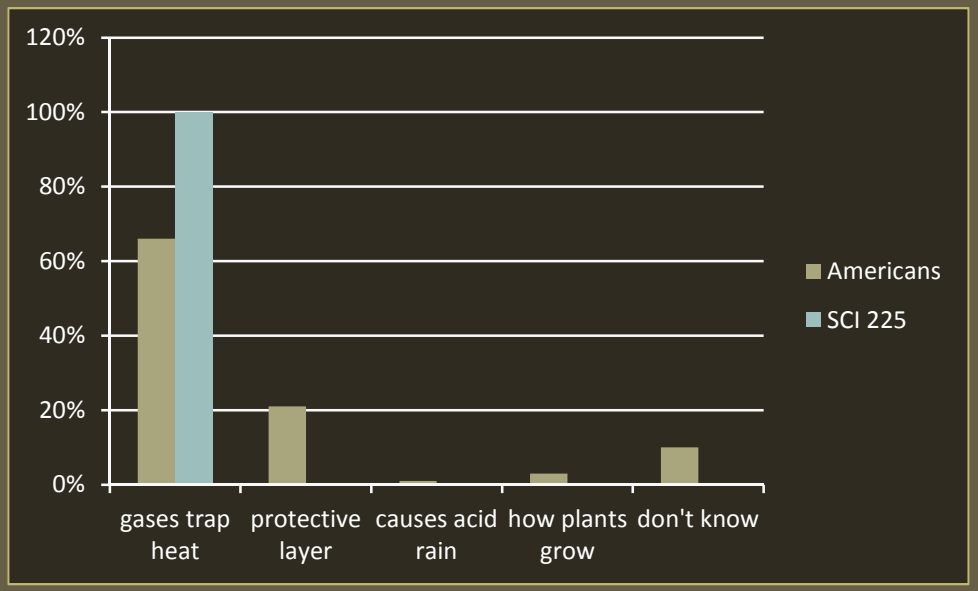
91% of students are confidant global climate is happening compared to 63% of Americans

What is the cause of global warming?



100% think humans contribute with 55% thinking that there are also natural influences as well, compared to 56% of Americans thinking humans contribute & 6% thinking there is also natural influences

The "greenhouse effect" refers to:



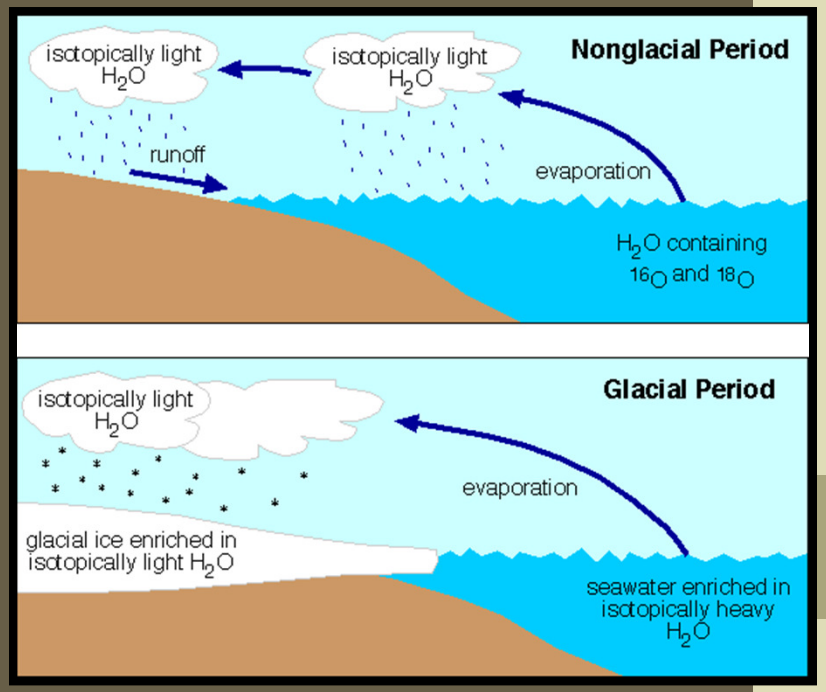
100% could define a greenhouse gas compared to 66% of Americans

Is it working?

- Student perception
  - Students don't like switching between two professors with a "substitute" teacher-like effect
  - Inquiry approach - "hands-on activities were a BLAST and really got you thinking"
  - SPS - Students feel more confident with graphs & interpretation at end of course
- Difficulties/challenges
  - Students come into class thinking it is a "how to teach science" course & not a science content course
  - Lack of math skills, a barrier to learning
  - Complaints about how much they dislike science – predisposes students to failure
  - Teaching this course limits our exposure to majors

Lessons Learned

- Misconceptions have given us ideas for new approaches
  - Ozone layer
  - Islands
  - evolution
- Backed off the amount of content, focusing more on integration & deeper understanding
  - Realizing it is not an Earth or Life science course but an integrated course for pre-service teachers



Where do we go from here?

- One professor
  - More integration between Earth & Life sciences
  - Students see one teaching front
  - In process of moving to a one-instructor model
    - Still working together on class content & activities
- Working on developing a series of ‘naturally’ integrated units
  - major integrated themes during semester
    - Biomes-climate-weather
    - Climate-Natural influences-Plate tectonics-biogeography-biodiversity

Thank you from all of us

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GCC/Course concepts Guiding questions

- What is Global Climate Change?
- How is climate influenced naturally?
- Has GCC occurred in the past?
- What factors influenced GCC in the past?
- Is GCC happening now?
- Are humans involved in current GCC?
- What are the projections being made?
- What are the consequences of GCC?
- What are the social implications?
- What do we do next?