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

Global Climate Change

Earth Science

Life Science

Mathematics

Physical Sciences

Nature of Science

Science Process Skills
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 pattern continues for the rest of the semester
<table>
<thead>
<tr>
<th>Classes</th>
<th>Guiding GCC Question</th>
<th>Life Science</th>
<th>Earth Science</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 4</td>
<td>What is GCC?</td>
<td>Biogeography</td>
<td>Climate &amp; Weather</td>
<td>BLOCK</td>
</tr>
<tr>
<td>2 &amp; 5</td>
<td>How is climate influenced naturally?</td>
<td>Natural Selection</td>
<td>Geosphere, Hydrosphere &amp; Atmosphere</td>
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</tr>
<tr>
<td>3 &amp; 6</td>
<td>How is climate influenced naturally?</td>
<td>Biodiversity</td>
<td>Geosphere, Hydrosphere &amp; Atmosphere</td>
<td></td>
</tr>
<tr>
<td>7 &amp; 8</td>
<td>Has GCC occurred in the past?</td>
<td>Evolution &amp; Phylogeny</td>
<td>Geologic Materials</td>
<td>SWAP</td>
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<tr>
<td>9 &amp; 10</td>
<td>Has GCC occurred in the past?</td>
<td>Energy Flow &amp; Trophic Structure</td>
<td>EXAM 1</td>
<td>SWAP</td>
</tr>
<tr>
<td>11 &amp; 12</td>
<td>What factors influenced GCC in the past?</td>
<td>Biogeochemical Cycling</td>
<td>Orbital Cycles &amp; Carbon</td>
<td>SWAP</td>
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<tr>
<td>13 &amp; 14</td>
<td>What factors influenced GCC in the past?</td>
<td>Inheritance &amp; DNA Structure/Function</td>
<td>Protein Structure/Function</td>
<td>TOGETHER</td>
</tr>
<tr>
<td>15 &amp; 17</td>
<td>Is GCC happening now?</td>
<td>Phenology &amp; Plant/Animal Life Cycles</td>
<td>Physical Changes in Historical Time</td>
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<tr>
<td>19 &amp; 20</td>
<td>Are humans involved in current GCC?</td>
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<td>Nature of Models &amp; Energy Resources</td>
<td>TOGETHER</td>
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<tr>
<td>21 &amp; 22</td>
<td>What are the projections being made?</td>
<td>EXAM 2</td>
<td>Changes in the Physical Earth</td>
<td>SWAP</td>
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<tr>
<td>23 &amp; 25</td>
<td>What are the consequences of GCC?</td>
<td>Community Structure &amp; Loss of Biodiversity</td>
<td>Sea Level, Glaciers, &amp; Shifting Climate Zones</td>
<td>BLOCK</td>
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</tr>
<tr>
<td>27 &amp; 28</td>
<td>What are the social implications? What do we do next?</td>
<td>Prioritizing Issues Related to GCC</td>
<td>Stabilization Wedges</td>
<td>TOGETHER</td>
</tr>
</tbody>
</table>
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 confident global climate is happening compared to 63% of Americans.
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.

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?