Developing a Climate Science Education Professional Development Program

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Developing a Climate Science Education Professional Development Program

Dan Shepardson
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Outline

- Developing a climate education network (team) and program
- Climate education challenges
Developing a Climate Science Professional Development Program

Project Goals

- **Goal 1.** Develop a professional development program and tool kit for climate science

- **Goal 2.** Implement professional development, using the tool kit (filed test and revise)

- **Goal 3.** Conduct a summer institute to prepare staff developers to use the professional development tool kit

- **Goal 4.** Establish the *Climate Science Education* network
Team Members

- Adam Baker, Meteorologist, National Weather Service, Indianapolis
- Mary Cutler, Naturalist, Tippecanoe County Parks and Recreation Dept.
- Mark Koschmann, Science Teacher, St. John’s Lutheran School, MI
- Ted Leuenberger, Science Teacher, Benton Jr./Sr. High School, retired
- Han Schmitz, Extension Educator, Purdue University
- Jan Sneddon, Director, Indiana Earth Force and President, Environmental Education Association of Indiana
- Olivia Kellner, Graduate Student

- Dev Niyogi (CoPI)
Developing the Team (Program)

- Community Building
  a. Getting to know ourselves (Who are we?)
  b. Developing a common knowledge base (What do we need to know?)
  c. Developing a shared framework (What do we want people to know?)

- Strategic and Action Planning
  a. Developing a shared program (What do we want our program to look like?)
  b. Identifying resources and tools (What activities and resources do we need?)

- Practice and Revise
  a. What worked? What didn’t work?

- Local Implementation

- Dissemination

- Assessment and Evaluation
Program Themes

- Climate System, Weather and Climate
- Earth Energy Budget, GHE and Greenhouse Gases, Carbon Cycle
- Global Warming, Climate Change, and Climate Variability
- Changes to the Climate System
- Tools, Monitoring, Models, and Data Sets
- Personal and Community Action
Challenge: Time and Complexity
Solution:

- Focus on Big Ideas/Key Concepts/Guiding Questions
- Link Abstract to Concrete
- Contextualize
Solution: Abstract ↔ Concrete
Challenge: Student Conceptions

Diagram: Network of environmental issues and impacts
- Ozone
  - Air Pollution
  - Burning Fossil Fuels
  - Deforestation
- Greenhouse Effect
  - Impacts
  - Causes
- Global Warming
  - Impacts
  - Causes
  - Melting Polar Ice
    - Cause
    - Ocean Rise
  - Climate Change
    - Cause
    - Increasing Temperatures
    - Plants, Animals, Humans Die
Solution: Climate System
Teachers’ (Adults’) Conceptions of a Climate System
### Challenge: Student Conceptions

<table>
<thead>
<tr>
<th>Mental Model of the Greenhouse Effect</th>
<th>Totals (n=225)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 5.</strong> Sun’s rays are “bounced” or reflected back and forth between the Earth’s surface and greenhouse gases, heating the Earth (may or may not identify specific greenhouse gases)</td>
<td>30 (13%)</td>
</tr>
<tr>
<td><strong>Model 4.</strong> Greenhouse gases “trap” the sun’s rays, heating the Earth (may or may not identify specific greenhouse gases)</td>
<td>78 (35%)</td>
</tr>
<tr>
<td><strong>Model 3.</strong> Greenhouse gases, but no heating mechanism, simply gases in the atmosphere</td>
<td>38 (17%)</td>
</tr>
<tr>
<td><strong>Model 2.</strong> Greenhouse gases cause ozone depletion or formation causing the Earth to warm</td>
<td>14 (6%)</td>
</tr>
<tr>
<td><strong>Model 1.</strong> “Greenhouse” for growing plants</td>
<td>65 (29%)</td>
</tr>
</tbody>
</table>
Challenge: Textbook Diagrams
Solution: Physical Model?
Challenge: Student Conceptions

Conception 1: The Hydrologic Cycle as Water Storage, Transformation, and Transportation with multiple Pathways (27%)

Conception 2: The Hydrologic Cycle as Water Storage and Transformation (36%)

Conception 3: The Hydrologic Cycle as a Weather Event (27%)

Conception 4: The Hydrologic Cycle as an Entity (10%)
Challenge: Textbook Diagram
Challenge: Experiencing Climate and Analyzing Data

- Ability to observe climate change
  Collect local weather data, but cannot monitor climate change due to time and scale issues
  We experience weather and often link it to climate change

- Data handling difficulties
  Distinguishing between description and interpretation
  Calculating and comparing means
  Making and Interpreting graphs
Solution: Weather and Data
Indiana November Temperature

http://www.ncdc.noaa.gov/o...climat...research/cag3/in.html
National Climatic Data Center  http://www.ncdc.noaa.gov/o...ncdc.html
http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp
Solution: Weather and Data
Indiana November Precipitation

![Graph showing actual precipitation, average precipitation, and trend over the years from 1900 to 2010. The graph has a y-axis labeled "Inches" ranging from -1 to 10 and an x-axis labeled "Year" ranging from 1900 to 2010. The actual precipitation is represented by green dots, the average precipitation by a black line, and the trend by a red line.]

- Actual Precipitation
- Average Precipitation
- Trend
Implications: Drought Education

- Build a Community/Network
- Develop Strategic/Action Plan
- What are the Educational Needs
- Review Drought Curriculum
- Identify Misconceptions