Assessing students knowledge about Global Climate Change using concept maps

Preparing Students to become Stewards of the Earth

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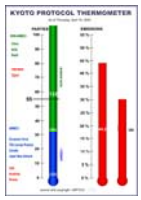
Course Overview

Course Objective

Development and negotiation of a Climate Agreement following the Kyoto Protocol



Instructional Goals

- **To help students develop**
  - **an understanding of the basic scientific underpinnings of ESS/global climate change**
  - **critical thinking, analysis, writing and presentation skills, and to enhance their abilities to work in teams in the construction of components of an environmental treaty**
  - **appreciation of the relationship between the multiple facets of the global climate change issue (political, societal, economic and scientific)**
- **To provide students with**
  - **background necessary to develop scientific reasoning in support of environmental policy decision making**
  - **scaffolding for students to take ownership of learning as there is a huge amount to learn**
- **To engage students in cogent public discourse of controversial global change issues (literate citizenship)**

Knowledge Intended Learning Outcomes

K1. Students will develop a knowledge about basic facts and terms, concepts and theories of global climate change.
K2. Students will improve their ability to synthesize and integrate the information learned in class and outside, and the research done on the internet to develop, present and write articles for the protocol.
K3. Students will improve their ability to apply (transfer) techniques (e.g., research, analysis) and methods (e.g., argument building) learned in class to gain new knowledge in global climate change.
K4. Students will be able to appreciate aspects of global climate change that are relevant to their daily and future lives (citizenry).
K5. Students will develop an understanding of the role of science and technology - on the development of environmental policies and of the different influences (e.g., economics, politics) on their implementation.

Identifying prior knowledge and evaluating learning

- **why identify prior knowledge?**
  - **serve as the foundation for learning**
  - **misconceptions can be an obstacle to learning**
- **what are the special challenges for evaluating this class?**
  - **Specific topics are chosen by students**
  - **Not all students are studying and learning the same thing**

Class Activities

- **Science, Policy and Economics Lectures**
- **Writing Assignments, Rubrics and Feedback**
- **Presentations and debates, rubrics and feedback**
- **Lab sessions (research and presentations preparation)**
- **Agreement negotiations (Summit) and writing**

Role Playing and Rules

- **Students play role of Government or NGO representatives**
- **Students are expected to learn about the specifics of their role**
- **Students are expected to be true to their role**

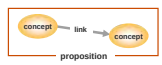
The Final Summit and Negotiated Agreement

- **Students develop elements of final agreement over length of course**
- **Content negotiated over the last few class periods**
- **Final written version, drafted by students, forms basis for final negotiations**
- **Students argue for their final position during summit on final day of class**

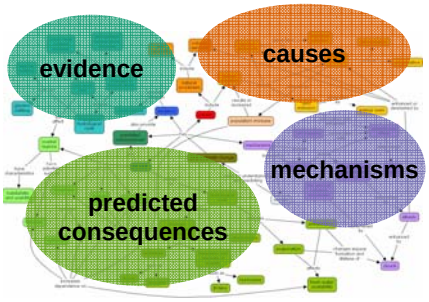
Concept Map Assessment of Learning

Concept Maps

Students create concept maps in response to a set of focus questions to demonstrate their knowledge about global climate change. Propositions (node+link+node) are evaluated and the students' concept maps are compared to the instructor's map as a basis for evaluation.



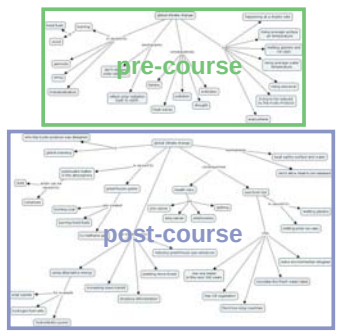
Expert Concept Map



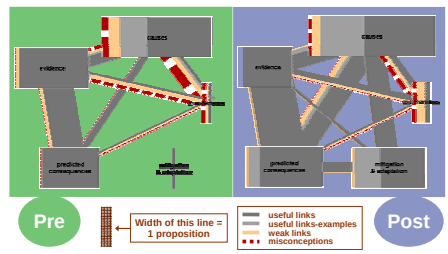
Questions:

What is GCC?
What is/are the:
- **evidence?**
- **mechanisms?**
- **causes?**
- **consequences?**

One Student's Pre- and Post-Course Concept Maps



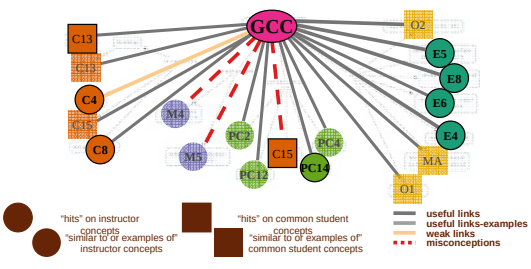
Pre- and post-course proposition quality and distribution (class average)



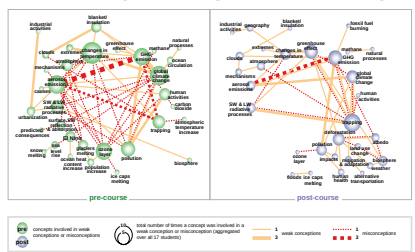
The figure above shows links between concepts within each category and between categories, with the post-course maps showing a greater degree of interconnection. The figure below shows concepts that appeared on the class's post-course maps but not on their pre-course maps.

Student's Concept Map categorized and propositions evaluated

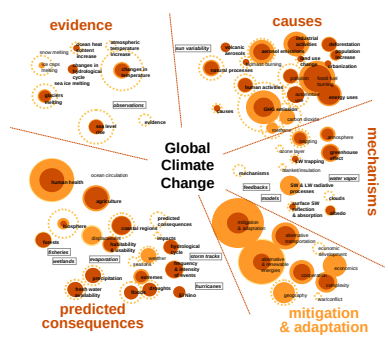
In order to evaluate student concept map structure and more easily identify gaps in knowledge and areas of misconception, student concepts are categorized on the basis of the concepts used in on the expert map. Concepts used by students that do not appear on the instructor's map are also classified.



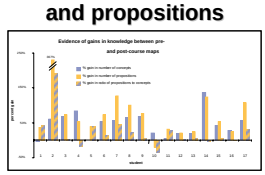
Incidence of weak concepts and misconceptions between pre- and post-course maps



Change in concepts between pre- and post-course maps



Gain (%) in # of concepts and propositions



Changes in quality of student propositions