Assessing students knowledge about Global Climate Change using concept maps

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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 understandings of ES&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 issues (literacy 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 (citizenship).
K5. Students will develop an understanding of the role of science and technology - relevant to their daily and future lives (citizenship).
K6. 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.
K7. 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.
K8. Students will be able to appreciate aspects of global climate change that are relevant to their daily and future lives (citizenship).
K9. Students will develop an understanding of the role of science and technology - relevant to their daily and future lives (citizenship).
K10. 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.
K11. 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.
K12. Students will be able to appreciate aspects of global climate change that are relevant to their daily and future lives (citizenship).
K13. Students will develop an understanding of the role of science and technology - relevant to their daily and future lives (citizenship).
K14. 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.
K15. 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.
K16. Students will be able to appreciate aspects of global climate change that are relevant to their daily and future lives (citizenship).
K17. Students will develop an understanding of the role of science and technology - relevant to their daily and future lives (citizenship).
K18. 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.
K19. 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.
K20. Students will be able to appreciate aspects of global climate change that are relevant to their daily and future lives (citizenship).

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

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 (nodes+link+nodes) are evaluated and the students’ concept maps are compared to the instructor’s map as a basis for evaluation.

Expert Concept Map

- evidence
- causes
- predicted consequences

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 on the expert map. Concepts used by students that do not appear on the instructor’s map are also classified.

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.

Change in concepts between pre- and post-course maps

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

Gain (%) in # of concepts and propositions

Changes in quality of student propositions