

AN OPEN-SOURCE CLIMATE CHANGE CURRICULUM FOR UNIVERSITY EDUCATION BASED ON IPCC SYNTHESIS SCIENCE

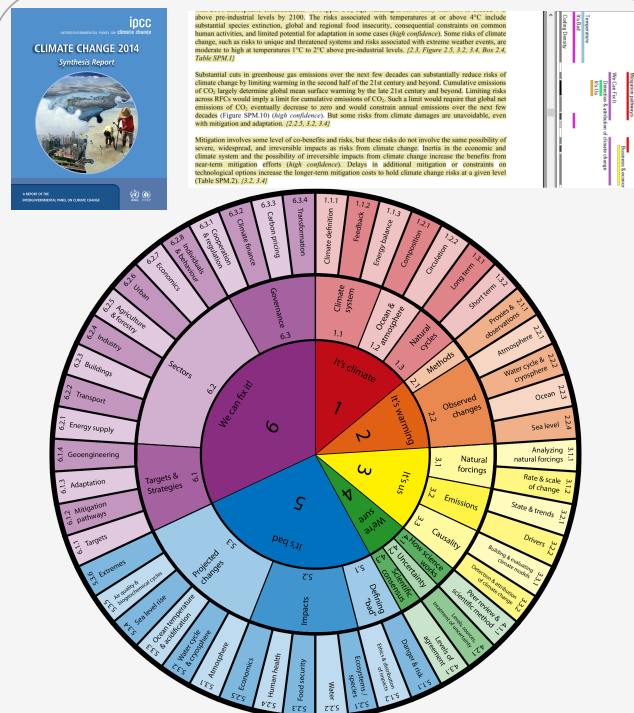
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Translating the latest climate science into university education

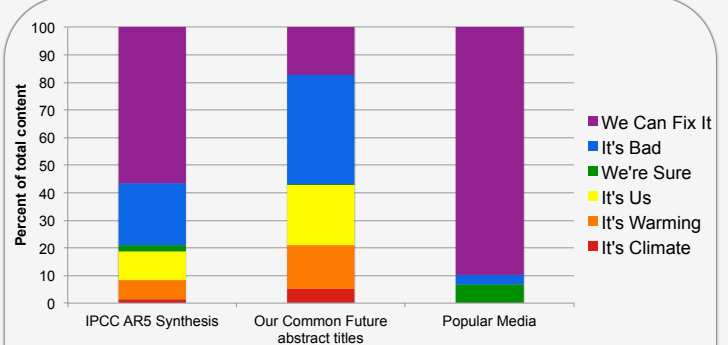
- A climate-literate citizen should be able to read and understand the summaries produced by the IPCC, which represent the current state of the art in the scientific understanding of climate change. Such understanding is critical to meaningfully participate in a civic society increasingly shaped by climate change.
- However, although outreach and dissemination efforts have been increasing, to date we are not aware of any efforts to link the IPCC reports with curriculum design in higher education. Developing such links is essential to ensure that students are equipped with the skills and knowledge they will need. It can also improve teaching experiences through increased efficiency in course preparation, linking teaching and research, and in sharing best teaching practices with participating colleagues.
- Here we analyze the content of the IPCC synthesis report and use this analysis to develop a framework for teaching a comprehensive university course on climate change.
- We assess how many of the core elements of our framework are addressed by courses offered at top international universities, and the distribution of these elements in the content of the IPCC synthesis report, submissions to the Our Common Future Under Climate Change, and popular media reports.
- Next steps will be to compile suggested teaching resources in line with this framework to fully equip students to understand and act on climate change.

Developing a teaching framework from content analysis of the IPCC Fifth Assessment Synthesis Report



- We used qualitative content analysis (NVivo software) to code the content of the IPCC AR5 Synthesis Report. Two independent researchers coded the entire report, with 92.8% agreement between categories.
- The coding frame was developed in an iterative process. Initial categories were identified from the major headings from the Summary for Policymakers from the three working groups of the IPCC, and five elements from Krosnick et al. (2006, *Climatic Change*) and Ding et al. (2011, *Nature Climate Change*).
- These were used to identify six core topics (center of wheel) and their constituent elements, refined through ongoing coding, resulting in the above framework for a comprehensive climate change curriculum.

Science is increasingly focusing on climate impacts and solutions

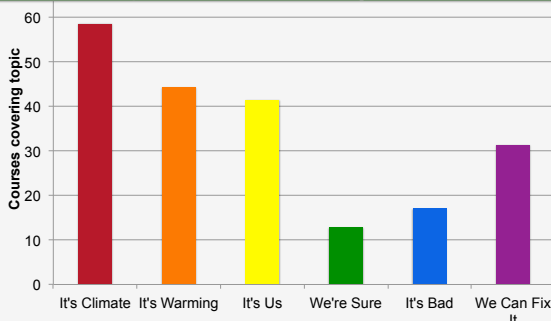


Analysis of three sources relative to our framework, showing strong focus on impacts and solutions as the majority in scientific and media content. Sources: left, content of the IPCC AR5 Synthesis report (2014); middle: 671 randomly selected abstract titles submitted to the Our Common Future Under Climate Change conference (30.5% of total abstracts); right, 36 popular press articles from 10 countries (primarily from May-June 2015) about the international climate negotiations in Paris at the end of 2015 (COP21).



Word clouds comparing the content of the First (left, 1990) and Fifth (right, 2014) IPCC Synthesis Reports shows increasing focus on confidence and mitigation.

Higher education emphasizes physical science fundamentals, less attention to impacts and solutions



- We analyzed the curricula of 70 courses on climate change currently being taught at top universities worldwide relative to our framework.
- Based on analysis of syllabi available online or provided by course instructors, we found that the majority (56%) covered only one of the six core topics; only one course (at Harvard University) covered all six topics (data not shown).
- Within the core topics, the most commonly taught (by nearly 60% of courses) was "It's climate," focusing on the functioning of the natural climate system. Less than 20% included climate change impacts ("It's bad"), and less than a third focused on climate change policy and solutions ("We can fix it.")

Conclusions and next steps

- We have shown that there is a need for a comprehensive, research-based climate change course in higher education, which at present is largely unmet.
- Such courses are essential to promote deep student learning using thoughtfully designed teaching and assessment activities to promote intended learning outcomes, as well as the real-world illustration of the method of scientific inquiry applied to socially relevant problems.
- We have contacted the instructors for courses that covered four, five, or six of the core topics, and are currently developing teaching materials based on these exemplary courses to be available online as education resources.
- Ultimately, using scientific syntheses as the basis for university curricula would help close the gap between research and classroom learning, promote increased scientific understanding, and help ensure that the resources devoted to scientific synthesis efforts are translated to broader benefits for society.