Navigating Climate Change in the Classroom: Teacher preparation, practices and perceptions

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Introduction

Teacher Preparation
- Knowledge
- Strategies
- Practices

Influences
- Controversy
- Standards
- Resources

Professional development
- In Community
- Sustained
- Relevant

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<table>
<thead>
<tr>
<th>Year</th>
<th>Project</th>
<th>Secondary respondents (N)</th>
<th>Degree of engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>ICEE Needs Assessment</td>
<td>284</td>
<td>61%</td>
</tr>
<tr>
<td>2010</td>
<td>CLEAN Invitational Survey</td>
<td>300</td>
<td>56-93%</td>
</tr>
</tbody>
</table>
| 2011  | CLEAN Informant Network        | 145 (97% response rate)   | 80% middle school  
88% high school |
What do you hear from teachers about their preparation? Their perceptions about climate science?
Preparation: learning experiences (%)

- Self-directed
- Short/Variable
- Sustained

ICEE, 2009

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Perceived relevance of degree

Field of highest degree and perceived relevance

Percentage responding

Geoscience
Environmental sci.
Biology
Physical sci.
Liberal arts
Education
Other

Relevant  Not relevant

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Preparation: Coherent knowledge

• More comfort with Earth Systems
• Less comfort
  • Climate concepts (greenhouse effect)
  • Emerging topics (what will happen here?)
  • Evidence—how scientists know

“I was confused by the Izzit ‘Unstoppable Solar Cycles’” ICEE 2010, CLEAN 2011
Preparation: Alignment with science

- the Earth’s temperature has been rising over the past 100 years
- GW is already a serious problem
- recent GW is caused mostly by things people do
- the Earth is too big for human activities to influence its temperature
- not much can be done to reduce GW
- science that goes against GW theory is suppressed
- there is substantial disagreement among scientists about the cause of recent GW
- the hole in the ozone layer is contributing to GW

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"Scientists agree about the causes of recent climate change"

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CLEAN, 2011
PD shifts knowledge

GW happening
Concern GW
Cause is people
Scientists agree

Drop one
Stay same
Gain one
Gain two

ICEE workshop evaluation 2010

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2009–2011

• “...global climate change is both premature and over-hyped, too much media, too little long term science investigation other than recent trends…”

• “I was taught…in late 1960 that we were in fact entering into another “ice age” and today… I am to teach the other end of that continuum?”

• “Right now I am very concerned over the global warming emails and the implication that data has been changed…How can I teach about global change if scientists are not being honest about their results?”
Reasoning unclear

2009–2011

• “Teaching both perspectives of the issue within time constraints.”

• “More support materials—from both sides of the argument—are needed—in order to give this topic the time and depth needed to really inform and educate students.”

• Denialist? Needs PD? Unclear…..
2009–2011

• “I am much more confident in my knowledge and the ability to answer student questions, as well as be able to direct students to valid data sites for them to learn to read and interpret the scientific data for their own evidence.”

• “I am learning to rely on the science (evidence) and let the facts speak for themselves.” This makes it easier to present to students…and to other teachers.”

• “I want to objectively present the scientific data that presents climate change is real and an issue of immediate concern.”
What do you hear from teachers about their barriers and concerns?
Top Instructional Barriers

• Lack of alignment with standards
• Lack of content knowledge
• Parent, student beliefs

Wise, 2010
ICEE, 2009
CLEAN, 2011

Vocal school board members have approached administration, claiming that it is not occurring.

Students have been told that “global warming” is not real and that hurdle is hard to cross sometimes.

It conflicts with my students’ religion/faith.

We have some parents that do not believe in climate change/warming.

ICEE, 2009

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Before instruction:

• Align with standards and curriculum
• Frame for learners’ perspective
• Find high quality resources—evidence/inquiry
• (Maybe) talk with administrators
Strategies to forestall controversy

• During instruction:
  • Employ inquiry, evidence-based pedagogy
  • Controversy as a teachable moment
  • Integrate climate throughout
  • Outside speakers
  • Integrate solutions

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Practice: where climate topics are taught

Percentage teaching climate topics

- Biology
- Chemistry
- Computers/technology
- Earth/space science
- Environmental science
- General science
- Physical science
- Physics
- Social studies
- Other

CLEAN 2011

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Practice: Time by topic

- relationships between ocean circulation, weather, and climate
- Earth's climate varies over time and place
- predicting and mitigating natural events
- effects of global warming
- GHG emissions cause global warming
- human decisions affect global warming
- multiple ways to reduce GHG emissions
- individuals' emissions of GHGs vary

Wise, 2010
Practice: Instructional time for climate

Percent teachers

Middle school  High school

- Over 90%
- 76–90%
- 51–75%
- 26–50%
- 11–25%
- Less than 10%

CLEAN 2011

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Teaching practice vs. student interest

- Lectures: MS Student interest: 10, MS use: 50, HS student interest: 40, HS use: 90
- Discussions: MS Student interest: 90, MS use: 70, HS student interest: 80, HS use: 60
- Hands-on lab activities: MS Student interest: 70, MS use: 80, HS student interest: 50, HS use: 70
- Student research: MS Student interest: 40, MS use: 60, HS student interest: 50, HS use: 80
- Field work: MS Student interest: 30, MS use: 40, HS student interest: 40, HS use: 50
- Visualizations/simulations: MS Student interest: 20, MS use: 30, HS student interest: 20, HS use: 30
- Study local issue or problem: MS Student interest: 30, MS use: 40, HS student interest: 30, HS use: 40
- Creative works: MS Student interest: 20, MS use: 30, HS student interest: 20, HS use: 30
- Scientific technology: MS Student interest: 10, MS use: 20, HS student interest: 10, HS use: 20
- Scientific data: MS Student interest: 10, MS use: 20, HS student interest: 10, HS use: 20

Percentage respondents

CLEAN 2011

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“By connecting this within the physical science curriculum I have been able to bring it in without really labeling it “climate science” which has helped me to keep some of the pre-conceived notions out of the equation.”
Extent to which solutions are considered

- Not at all
- To small extent
- To some extent
- To a large extent

CLEAN 2011

Percentage Respondents

Middle School | High School | Lower Division | Upper Division

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Reviewed climate and energy resources

http://cleanet.org/

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Need better materials

- Honors/AP
- Low reading level
- Remedial math/quant
- English language learners

Percentage respondents

- Middle school
- High school
- Lower division
- Upper division

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Sources of encouragement

Wise, 2010 JGE
Importance of community

% of Earth science teachers

experience enhanced teaching
experience hindered teaching

community experiences around teaching GW

Wise, 2010
• Most perceive institutional support
• Most perceived as resource by colleagues
• Climate scientist connections
• National science/education communities
• Local/regional communities
Professional development opportunities

• Online course ICEE Spring 2012
  • 3 credit grad ENVS or Continuing Ed or nominal admin fee
  • Teaching strategies, Essential Principles Climate Lit, capstone local teaching activity
  • Email susan.buhr@colorado.edu

• CLEAN webinars
  http://www.cleanet.org/clean/community/webinars/index.html

• CLEAN online faculty workshops
  • April 2–14, 2012 – Communicating Climate Science in the Classroom
  • May 7–16, 2012 – Teaching Climate Complexity
Conclusion

Opportunities:
• Reach to all society
• High interest
• Encouragement is effective
• Potential standards alignment

Challenges:
• Persistent controversy
• Lack of alignment with standards
• New topic for most
Question: If you have tried or considered teaching climate change in your classroom, what kinds of challenges have you come up against?

- Content (Personal knowledge, Curriculum Integration)
- Lack of Resources
- Controversy of Topic
- Influence of Parents
- Lack of Teaching Time
- Fatalistic feeling by students

Learnmoreaboutclimate survey among Colorado teachers 2011, N=53
Challenges: Earth Science in H. S.

AGI, Geosci Workforce Report, 2011
See also NAGT Position Paper

Biology (1 yr) Chemistry (1 yr) Physics (1 yr) Geol/E.S. (0.5 yr)

Male
Female

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