

Pilot Implementation of an Interdisciplinary Course on Climate Solutions

*Mudd Design Workshop VII
Claremont, CA
28-30 May 2009*

Jinny Rhee
Mechanical Engineering
Eugene C. Cordero
Meteorology
Lawrence R. Quill
Political Science

Motivation

“Technical and non-technical issues are inextricably and increasingly linked”

-S.D. Sheppard, J.W. Pellegrino, B.M. Olds, 2008

For environmental engineering, a survey indicated the importance of combining societal aspects along with engineering and science, as well as teamwork and communication skills.

-E. Morgenroth, G.T. Daigger, A. Ledin, and J. Keller, 2004

“Emerging evidence suggests that project-based learning encourages and supports collaborative work and that it improves retention and enhances design thinking.”

-C.L. Dym, A.M. Agogino, O. Eris, D.D. Frye, and L.J. Leifer, 2005

Innovative Pilot Course on Climate Solutions

General Education: Culture, Civilization, and Global Understanding

- 1 of 4 upper division GE requirements for all majors at SJSU
- 28 students in pilot from all 6 colleges

Broad Range of Lecture Topics (8 weeks)

- *P. Hadreas*, **Humanities and Arts**: Ethical issues and global concerns;
- *E. Cordero*, **Science**: Global warming science;
- *J. Rhee*, **Engineering**: Renewable energy and its use in the world;
- *L. Quill*, **Social Sciences**: Political dimensions of global climate change;
- *A. Osland*, **Business**: Green entrepreneurship and sustainable business;
- *R. Bandyopadhyay*, **Applied Science and Arts**: Eco-tourism;
- *A. Fountain*, **Humanities and Arts**: Environmental campaigns in American history.

Midterm

Multidisciplinary Group Projects with Competition (7 weeks)

- 4-5 multidisciplinary students per group led by faculty member
- Faculty were not assigned any students from their college

Data and Assessment

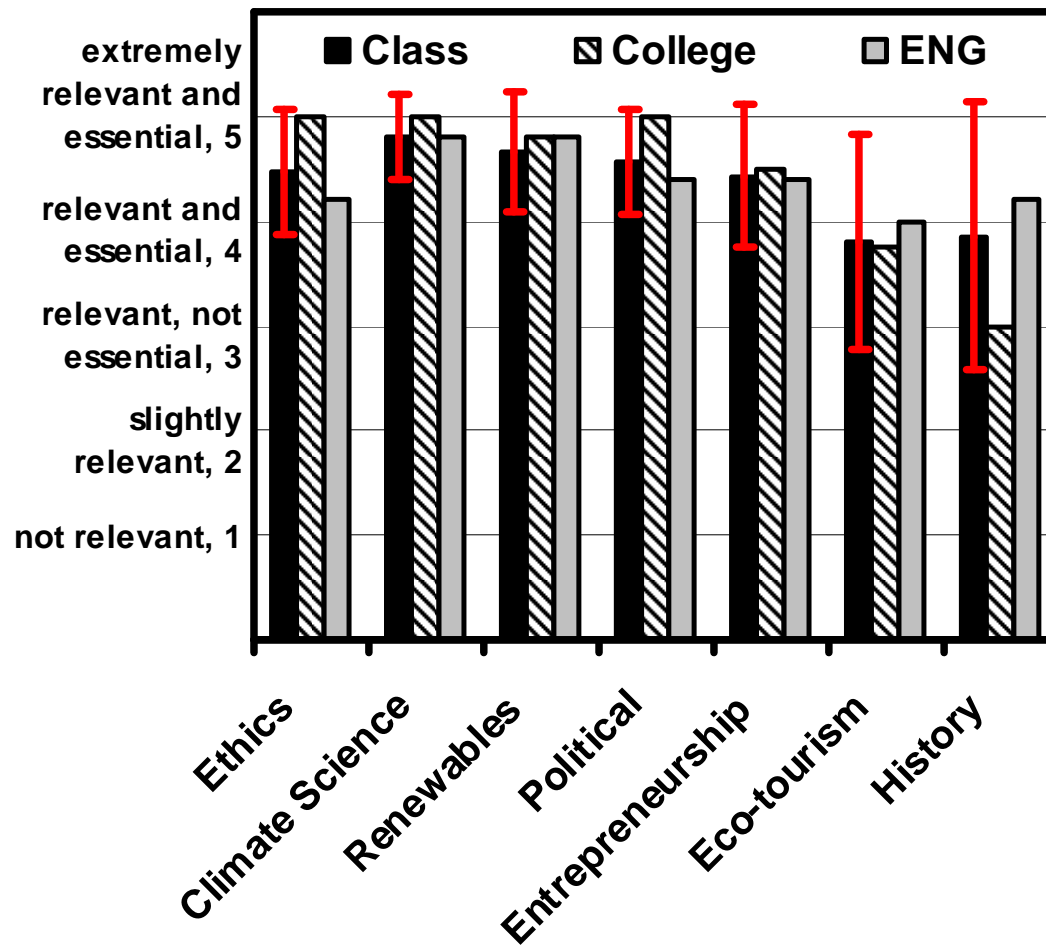
Data collected from three constituents:

- Students (21/27 responses to online survey received, implemented with “asset” by Seton Hall)
- Faculty instructors (7/7 interviewed by authors)
- Deans of participating colleges (5/6 interviewed by authors as of conference paper)

Questions for assessment:

- How successful was the integration of broad range of topics?
- What worked, what could be improved?
- What was the role of competition in the classroom?
- What were the challenges?
- What were the benefits?

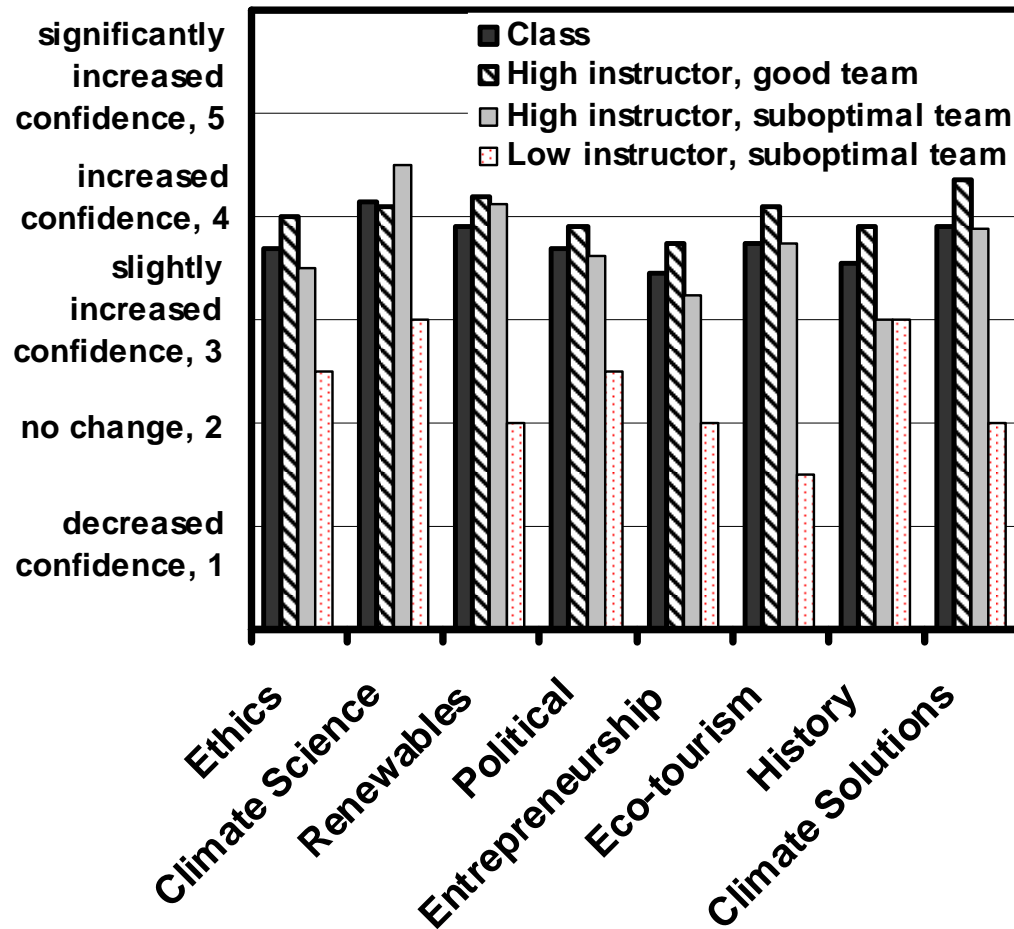
Relevance of Lecture Topics



Student evaluation of relevance of lecture topics to climate solutions. Average ratings are compared for (a) entire class, (b) students from college of lecturer, and (c) engineering students. Standard deviations for class averages are indicated by error bars.

Faculty also rated topics highly, and commented on benefit of multiple perspectives.

Importance of Faculty Team Members



Student evaluation of increased confidence in discussing course topics as a result of course. Average ratings are compared for (a) entire class, (b) student subgroup rating instructor highly and team dynamics good, (c) student subgroup rating instructor highly and team dynamics suboptimal, and (d) student subgroup rating instructor low and team dynamics suboptimal.

Impact of Competition

52% of the students rated the competition “Excellent” or “Good”

“[The competition] brought the project into real life instead of leaving it in the artificial atmosphere of the classroom”

“The competition was a huge motivator and I believe created a greater bond with my teammates.”

48% of the students rated it “Fair” or “Poor”

“The competition aspect made other groups secretive about their work and made the project more isolated than motivated.”

“I think the guidelines for the competition were not clear and therefore the project selection for the competition was skewed.”

Faculty offered differing views on competition

Some thought it did motivate students; others felt it kept them from communicating.

Final presentation probably enough motivation.

Challenges Encountered

Students: Non-uniform grading

“Each instructor had his/her own method for grading and that makes it hard for students to get a good grade.”

“Some of the questions on the exams were really easy and some were too in depth”

“I liked the idea of showing off our hard work for people interested in climate change, but I thought it was unfair to have people, unfamiliar with the requirements of the project and course, judge our work based on their personal opinion and interests.”

Faculty

- Coordination and organization
- Misalignment with university reward systems

Administration

- Resources (SJSU is a large public university)
- Time-intensiveness (addition of units to crowded curricula)
- Assembling faculty teams
- Burdens to departments

Education Benefits to Students

Please indicate your level of agreement with the following statements as a result of taking this course:

	1 <i>completely disagree</i>	2 <i>somewhat disagree</i>	3 <i>neutral</i>	4 <i>somewhat agree</i>	5 <i>completely agree</i>	Avg	Std Dev
<i>I understand the role of my discipline in society better.</i>	4.80% 1	4.80% 1	14.30% 3	38.10% 8	38.10% 8	4	1.0954
<i>I understand the role of other disciplines in society better.</i>	4.80% 1	0.00% 0	4.80% 1	52.40% 11	38.10% 8	4.1905	0.9284
<i>I am more enthusiastic about my discipline.</i>	4.80% 1	0.00% 0	33.30% 7	28.60% 6	33.30% 7	3.8571	1.0623
<i>I am more interested in learning about other disciplines.</i>	9.50% 2	4.80% 1	9.50% 2	33.30% 7	42.90% 9	3.9524	1.2836
<i>My communication skills have increased.</i>	4.80% 1	9.50% 2	14.30% 3	42.90% 9	28.60% 6	3.8095	1.1233
<i>My teamwork skills have increased.</i>	4.80% 1	9.50% 2	4.80% 1	38.10% 8	42.90% 9	4.0476	1.1609
<i>I am interested in working in fields related to sustainability upon graduation as a result of this experience.</i>	4.80% 1	0.00% 0	9.50% 2	33.30% 7	52.40% 11	4.2857	1.0071

We hypothesize that significant credibility is added by an interdisciplinary faculty team's ability to address a wider range of issues.

Student Comments

“It made me understand what skills or assets I can contribute to the group.”

“I did get a better understanding of other disciplines, and I am very happy that I am an engineer.”

“I have changed from a skeptic to a believer; I even fancy that being a sustainability manager might be a good second career for me.”

“Green energy is critical to the overall health of the world. My future may very well be in this field.”

“I plan to pursue a higher degree with the focus of my research on an environmental topic, such as energy storage.”

Benefits – Faculty/University

Faculty

- High level discussion among peers
- Scholarship potential; funding opportunities from NIH, NSF, e.g.
- 2 papers/3 proposals (to date) from related collaborative efforts from class

University

- Alumni donations
- Marketability of innovative and effective teaching
- Ability to tackle real-world problems that transcend disciplinary boundaries
- Fosters collaboration within university

Summary

- Broad range of topics is an essential and positive feature of course
- Faculty team members are of paramount importance to success of course
- Project is an essential part of synthesizing broad range of topics
- Reviews of competition were mixed
- Challenges included: coordination and administrative realities of academia
- Benefits included: inspiration to students, effective teaching of soft skills, faculty scholarship, innovative teaching



SAN JOSÉ STATE
UNIVERSITY