



Climate Change and Sustainability Lab Projects



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Abstract:

Global climate change, exacerbated by anthropogenic effects, is well documented and has serious implications for the future of the planet. Educating university students in sustainability practices through cooperative learning labs can increase the wealth of their educational experience and potentially plant the seeds of sustainable practices in the next generation. We designed a cooperative learning lab that split a class into six small groups, each of which were assigned a project to be completed over a two-week period. The group projects are listed in the center table of this poster. Our primary objectives were for the group projects to result in an increased understanding of the facts of global climate change, public perceptions, local sustainability practices, and to facilitate cooperative working and presentation skills in our students.

Introduction:

Global climate change is a major factor in social, economic, and environmental policy worldwide. From 1970 to 2004, carbon dioxide emissions due to human activities have increased by 80% (IPCC 2007). The Intergovernmental Panel on Climate Change (IPCC) (2007) noted that global climate change was unequivocal based global air and ocean temperatures, widespread melting of snow and ice, and rising sea levels. Much of this change is due to the anthropogenic causes of urbanization and agricultural practices (Karl and Trenberth 2003). Given these trends, sustainability education is a key component to readying the next generation to deal with these global climate challenges. In the U.S., universities are responding to student-driven requests for more sustainable practices on campus with recycling programs, trayless cafeterias, and the use of native plants in gardens and planters. Some universities have employed full-time sustainability coordinators to organize and fund efforts on campus. Many degree programs in the biological sciences have even incorporated core courses in sustainability. These local efforts have been united through national organizations such as the Higher Education Associations Sustainability Consortium (HEASC) and the Association for the Advancement of Sustainability in Higher Education (AASHE). However, there is a lack of broad implementation across all major universities, including our institution, Saint Louis University, which was recently issued a D- grade by the Sustainable Endowments Institute (2008). Our goal is to improve implementation of these resources through a cooperative learning lab on sustainability practices.

Cooperative learning is a method of teaching in which students work together as partners within a small group to accomplish a single goal, often through a division of labor. This type of learning readily incorporated into lab-based exercises due to the temporal, equiptmental, and supply-limited nature of labwork (Lazarowitz et al. 2006). Working in a cooperative learning environment can mitigate classroom anxiety (Panitz 1999), decrease overall errors as students review correct one another (Lazarowitz et al. 2006), and develop the social skills necessary to work cooperatively with others (Johnson et al. 1984).

Objectives:

- To use cooperative learning as a tool for increasing student knowledge about a. the immediate and long-term need for drastic reductions in greenhouse gases, b. the global energy crisis, c. the need for more energy efficient technology, d. the current international, national and state governmental policies on greenhouse gases, e. community outreach programs in the Saint Louis area that promote sustainable practices, f. the awareness of the general public of climate change, g. Saint Louis University's current sustainable practices.
- To increase a student's ability to perform a research project in a group setting.
- To increase student's presentation skills.

Lab Outline:

- Week 1
- As a pre-lab assignment students read "Green Destiny: Universities Leading the Way to a Sustainable Future" (Uhl and Anderson 2001) and answer questions based on the paper.
 - Students view documentary *An Inconvenient Truth* followed by a class discussion about the film.
 - Student groups are randomly assigned to a project and are given a project description and presentation grading rubric.
 - As a post-lab assignment students worked in their group to plan an outline of their presentation.

- Week 2 (actually two weeks after group projects are assigned)
- Student groups deliver a PowerPoint presentation on their assigned project.

Group Project Descriptions:

Group 1: Climate Change Educator

This project had three components:

- Present background information on climate change
- Identify and address global warming myths
- Provide examples of current scientific research on climate change

Group 2: Current and Future Technology for Sustainable Practices

This group focused on current and future technology for sustainable practices.

This project had three main components:

- The current and future energy crisis and its impact on human populations around the globe
- The technology for sustainable practices to decrease our demand on fossil fuels, including:
 - alternative energy sources (clean coal, wind, solar and nuclear)
 - fuel cell technology
 - carbon dioxide capture technology
- The positive and negative aspects of each of the above practices

Group 3: Pollster

This group surveyed the Saint Louis community to determine their knowledge level on climate change and sustainability issues. The student-created survey included knowledge-based questions such as: "How many people are on Earth today?", opinion-based questions such as "How important is sustainability to your lifestyle?" and demographic questions such as "What age bracket do you belong to?".

The students were then expected to present the results of their survey to their peers.

Group 4: Saint Louis University Sustainable Practices

This group evaluated Saint Louis University's current sustainability practices by focusing on:

- Transportation
- Residence Halls
- Landscaping
- Research and Teaching Buildings

Students were expected to be quantitative and avoid broad generalized suggestions. After evaluating current University practices, the groups proposed recommendations to make Saint Louis University a more sustainable campus by making suggestions for both the average student and the University administration. The suggestions included a cost-benefit analysis.

Group 5: Local Outreach and Awareness Efforts

This group began by investigating what local communities are doing in an effort to become more sustainable. Suggested research topics included:

- community gardens
- groups that collect leftover food for local shelters
- local harvest grocery stores
- community education groups on climate change and/ or sustainability
- car sharing programs

This group also proposed an outreach plan for making the Saint Louis University community more aware of the global climate crisis and the need for more sustainable practices. This plan focused not only on education but also community organization.

Group 6: Policy Educator

This group researched the laws that have been passed or proposed to decrease the greenhouse gas emissions that contribute to global warming. They were expected to present the information in a format that was easy to understand for the average person. The research included information on three levels:

- International: Kyoto Protocol, European Union Emission Trading Scheme, etc.
- National: Acid Rain Program and the Clean Air Act, current proposed legislation, etc.
- State: California Global Warming Solutions Act (California), Regional Greenhouse Gas Initiative (nine Northeast states), Emissions Reduction Market System (Illinois), etc.

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Assessment:

As part of the end of the semester lab course assessment, the students answered three questions on the effectiveness of the Climate Change and Sustainability Projects (Table 1). This assessment was an anonymous survey given through the course Blackboard site. The students were asked to gauge their improvement in understanding of the topics presented in the group projects using the five response categories shown in Table 2.

Table 1. Assessment questions for the Climate Change and Sustainability Lab.

1	How did the Climate Change and Sustainability Lab improve your understanding of global warming, the greenhouse effect and climate change?
2	How did the Climate Change and Sustainability Lab improve your understanding of the need for sustainable practices and the technology for these practices?
3	How did the Climate Change and Sustainability Lab improve your understanding of the current and proposed laws on greenhouse gas emissions (Kyoto Protocol, Cap 'n Trade systems, etc)?
4	How much did the lab improve your written and verbal scientific communication skills?

Table 2. Response categories for assessment questions.

1	Not at all
2	A small amount
3	Somewhat
4	A moderate amount
5	A great deal

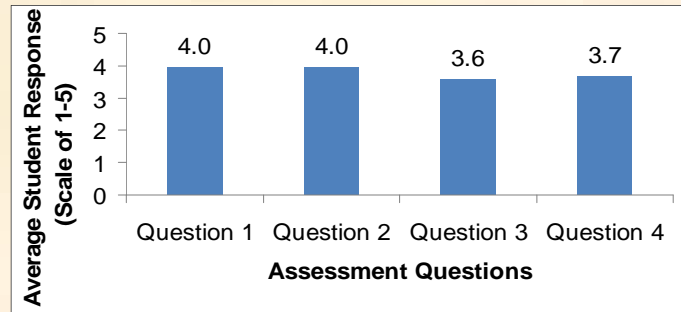


Figure 1. Student responses to assessment questions indicate an increased level of knowledge about climate change and sustainability due to the group projects.

Results and Conclusions:

The results of the 292 completed surveys demonstrate that the students believe they gained a greater understanding of the topics presented in the group projects. The mean student response for assessment questions one and two was 3.96 while question three was 3.59 and question four was 3.67 (Figure 1).

This lab provides an effective means of increasing student and community understanding of global climate change and sustainability practices through an interactive, cooperative learning framework. Future labs could incorporate additional group projects that focus on more local concerns and initiatives, and/or a greater emphasis on outreach within the community.

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