

AC 2008-1475: ENVIRONMENTAL CONCEPTS OF CIVIL/CONSTRUCTION ENGINEERING STUDENTS

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Environmental Concepts of Engineering Students

Abstract

This paper deals with the Environmental Concepts held by Civil/Construction Engineering students and their concern towards the Environment. Based on a survey instrument adapted from The Environmental Resource Center (ERC), the mean and standard deviation of the responses were calculated. The average value was 224 which is considered in the "Earth Watchdog" category.

The survey instrument was completed by students enrolled in a Hazardous Waste Management course and may measure the level at which pollution has touched the respondents' lives. Specifically, many believe the environment in which they live is good and haven't been personally harmed by pollution. Others seemed convinced of the gravity of environmental problems, but also appear to realize the underlying cause may be human greed and selfishness. This paper discusses the findings of the investigation and suggests future actions which may be undertaken.

Introduction

In its fourth decade, the environmental movement has won enormous support among Americans, support that is likely to be put to the test as the nation addresses environmental problems global in scope. Most "green" issues are presented as choices between protecting the environment and growing the economy: You can have a logging industry *or* save the spotted owl. You can reduce greenhouse gases *or* have industrial growth. Most Americans, however, seem to be seeking a choice that includes *and* rather than just *or*. They tell pollsters they care about the environment and fear it will get worse, yet seem torn on how to respond and unready to accept the sacrifices that some environmentalists believe are necessary.

Twenty-five years ago, environmentalists could target "point sources" -- pollution that could be tied to a specific source, such as smokestack industries, toxic waste dumping, and ocean discharge pipes. It was a war against pollution that people could see and smell. That struggle, difficult as it was, at least had the advantage of clarity, both in the causes and the solutions. Now much environmental effort has shifted to more diffuse "non-point" pollution, caused by problems on a regional or even global scale. In the 1970s and 1980s, for example, the fight against ocean pollution concentrated on industrial outfall pipes, improved sewage treatment, and dumping garbage at sea. Now, environmental regulators in many areas are contending with problems like "runoff"; pollutants washed into the sea from farms, businesses and lawns. Global warming is perhaps the most prominent example of a potentially catastrophic problem that so far has few tangible manifestations. Despite mounting evidence that the climate is changing and global temperatures rising as a result of carbon emissions, deep differences exist about the urgency of climate change and who should bear the burden of addressing it.^{1, 2}

The Public View

Half of Americans say they consider themselves environmentalists, but that's down from three-quarters of the public in 1989. Yet most Americans, particularly younger people, also tell survey researchers they expect the environment to get worse in the 21st century. Although relatively few people regard the environment as one of the nation's most pressing issues, most regard it as an important one.^{1, 2}

The Survey Instrument

The month of April generally marks the anniversary of Earth Day, a day to focus on concerns for each other and all life on earth. In order to measure interest in the environment, an Earth or Consequences questionnaire was developed which offers a starting point for reassessing lifestyles. An individual can examine, then answer, to see what behaviors can be changed to become a better friend of the world.

The survey instrument consists of 19 questions which individually may be scored at 20 points as follows:

1. Avoid buying products with excessive packaging
2. Shop with cloth shopping bags
3. Carpool, walk, bike or take public transit whenever possible and consolidate errands
4. Keep car tuned and tires properly inflated
5. Purchase organic produce and request such products at local grocery stores
6. Compost yard and food waste
7. Have insisted on recycling programs in the workplace and school environment
8. Turnoff unnecessary lights when no one is in the room
9. Have replaced the majority of household incandescent lighting with compact fluorescent bulbs
10. Have taken at least three measures to conserve water use (i.e., installing water conserving showerheads, efficient toilets, and running only full loads in dishwashers and washing machines)
11. Support and vote for environmentally concerned political candidates
12. Recycle cans, newsprint, plastic bottles, and cardboard and recycle or reuse glass
13. Use non-toxic cleaning products (Such as vinegar, baking soda, and biodegradable soaps)
14. Use only phosphate free and chlorine free biodegradable detergents
15. Participate in a yearly tree planting program or restoration project
16. Have had names/addresses removed from junk mail lists
17. Choose to eat low on the food chain (grains and veggies) for at least 75 percent of the total diet to reduce the impact of food production on land and water resources.
18. Use less hazardous, non-toxic alternative products whenever possible
19. Stay informed on environmental issues

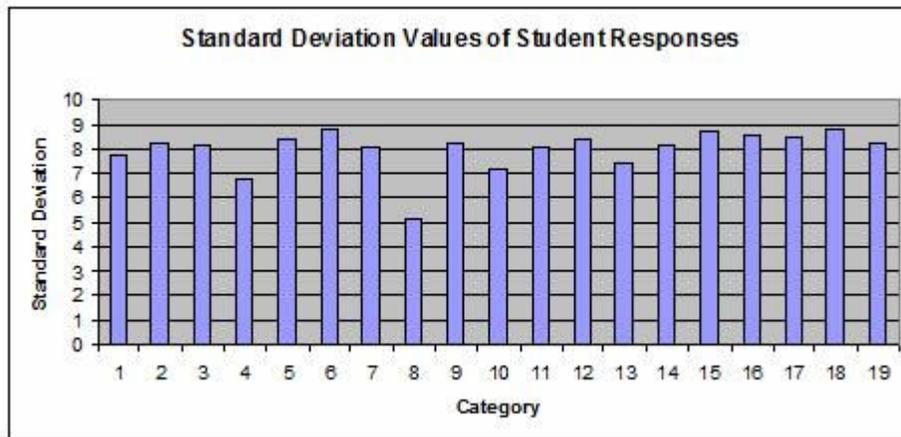
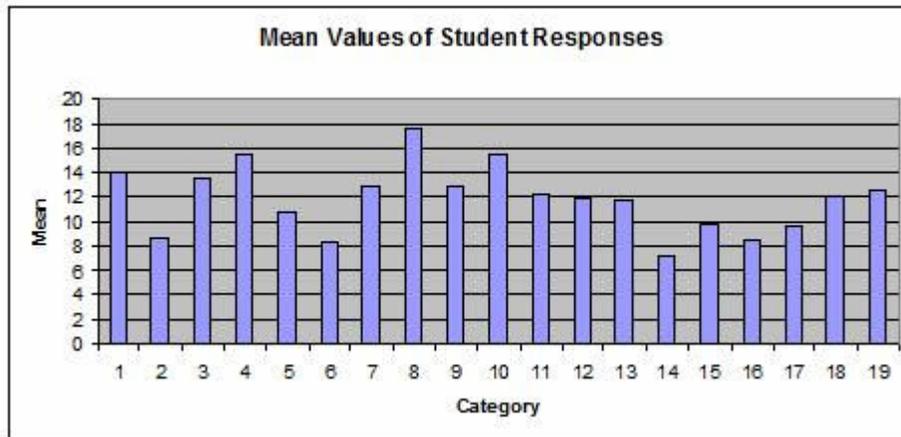
The total score will reveal the level at which an individual supports the environmental movement as shown below:³

Eco citizen	320 points or more
Earth steward	240-319

Earth watchdog	180-239
Eco-starter	100-179
Environmental Couch Potato	40-99
Professional polluter	40 or less

Results and Analysis

Following two charts show the mean and standard deviation values of the student responses.



1. Avoid buying products with excessive packaging

The average value of this question is 14 which indicate that students might tend to avoid buying products with excessive packaging. This supports the importance of waste reduction. Most of the products we buy, or at least their packaging will eventually require disposal. Packaging now accounts for 33% of all our garbage. The average Texan discards about 4.5 pounds of trash each day. If each person reduced waste by only 1 pound each week, the amount of reduction statewide would total 312,000 tons a year. The family who reduces waste in the home helps protect the environment. Waste reduction is as important as recycling in saving natural resources, energy,

and disposal space and costs, and in reducing pollution risks. Careful buying and disposal habits can also stretch the family budget.

2. Shop with cloth shopping bags

This question has a response of roughly 8. This is true, because students generally will not be prepared to shop with cloth shopping bags. They might feel it's abnormal to do so. Also, they get free plastic bags to carry from all the stores. In fact, each year across the world some 500 billion plastic bags are used, and only a tiny fraction of them are recycled. Plastic bags, and other plastic refuse that end up in the ocean, kill up to one million sea creatures every year, such as birds, whales, seals, sea turtles, and others. And the number of marine mammals that die each year because of eating or being entanglement in plastic is estimated at 100,000 in the North Pacific Ocean alone. A growing list of communities and countries are beginning to rethink their dependence on plastic bags. Already a complete or partial ban on the bags has been approved in Australia, South Africa, parts of India, China, Italy, Bangladesh and Taiwan.

3. Carpool, walk, bike or take public transit whenever possible and consolidate errands

Here, the mean value of the student response is 13.5. By consolidating errands and shopping close to home, you can shrink the driving miles that go into your shopping trips. Start by doing any errands you can within walking distance of your home. When you've exhausted the shop-by-foot possibilities, then you can turn to businesses that are within a short drive from home. For these and all other shopping trips, it makes sense to consolidate errands and take care of several at once. This will save time and gas, and reduce your emissions.

4. Keep car tuned and tires properly inflated

The average value of this question is one of the highest with 15.4 point. Car care is definitely a win-win situation. Besides helping the environment, a properly maintained and operated vehicle will run more efficiently, will be safer, and will last longer - up to 50% longer, according to a survey of ASE-certified Master Auto Technicians. Every day, motorists who drive with under-inflated tires and poorly maintained engines waste 7 million gallons of gasoline.

5. Purchase organic produce and request such products at local grocery stores

Here the mean value of the student response is 10.7. When we buy organic foods, it helps keep the Earth's air and water free from pesticides and chemical fertilizers. Also, it helps support small entrepreneurial farmers who are committed to building the living soils of their farmland and the living souls of their employees. Buying organic foods makes a conscious choice to eat well and to treat the earth well.

6. Compost yard and food waste

The mean value of the student response is 8.23. The most preferable option for reducing the generation of yard waste is to switch from manicured turf grass to a landscape containing native plants those plants which have evolved over thousands of years in a particular region. As native

plants require minimal or no mowing, the generation of yard wastes are significantly reduced or completely eliminated. Here, the answer is below average since most students live in apartments and do not have the opportunity to compost waste.⁴

7. Have insisted on recycling programs in the workplace and school environment

The mean value of the student response is 12.85. With all the beverage containers, paper and other recyclable materials that are produced, schools have the potential for generating substantial revenues through recycling. Setting up bins in convenient places for people to deposit recyclables at your school can involve all students, encourage daily recycling and maximize revenues. Establishing a Community Collection Point at School will make students, parents and other local residents drop off recyclables at school on a permanent basis. This will require investing in recycling bins and designating a convenient location.

8. Turnoff unnecessary lights when no one is in the room

The student response of this question averages 17.62. This gets the highest response of all the questions. Reason for this is understandable. It doesn't require much effort to switch off the lights while leaving a room when nobody is in the room. A very easy way to save energy is to turn off all unnecessary lights and utilize smaller bulbs, such as a desktop lamp as it will use much less wattage than the giant bulbs on an overhead light fixture.

9. Have replaced the majority of household incandescent lighting with compact fluorescent bulbs

The mean value of the student response is 12.85. This category doesn't get the best response because many students might not have the knowledge of fluorescent bulbs and their advantages. If every American home replaced just one light bulb with an Energy Star qualified bulb, it would save enough energy to light more than 3 million homes for a year, more than \$600 million in annual energy costs, and prevent greenhouse gases equivalent to the emissions of more than 800,000 cars.⁵

10. Have taken at least three measures to conserve water use (i.e., installing water conserving showerheads, efficient toilets, and running only full loads in dishwashers and washing machines)

This question averages 15.57 which is good. Installing water conserving showerheads is very economical and easy. Many water conservation agencies offer such products at a very affordable price. Many students should have the awareness of such products. Running full loads in dishwashers and washing machines conserves water and is attainable for students who use these machines on a regular basis.

11. Support and vote for environmentally concerned political candidates

The student response value is 12.14 points. The reason for such a low value for this category is that many of the students undertaking this quiz don't have the eligibility to vote in the USA.

Immigration policies don't allow international students to vote. But they are eligible to show support for environmentally concerned candidates.

12. Recycle cans, newsprint, plastic bottles, and cardboard and recycle or reuse glass

Roughly 11.9 points is the average response value for this category. Many engineering students show interest on recycling techniques taught while listening to a lecture and submitting homework to get credit. But if it comes to implementing it practically, they tend to ignore the process. The reason for this might be due to their busy schedule, lack of knowledge, and little support from recycling agencies. A few facts and figures⁴ about recycling appear below:

- In 1999, recycling and composting activities prevented about 64 million tons of material from ending up in landfills and incinerators. Today, U.S recycles 32 percent of its waste, a rate that has almost doubled during the past 15 years.
- While recycling has grown in general, recycling of specific materials has grown even more drastically: 50 percent of all paper, 34 percent of all plastic soft drink bottles, 45 percent of all aluminum beer and soft drink cans, 63 percent of all steel packaging, and 67 percent of all major appliances are now recycled.
- Twenty years ago, only one curbside recycling program existed in the United States, which collected several materials at the curb. By 2005, almost 9,000 curbside programs had sprouted up across the nation. As of 2005, about 500 materials recovery facilities had been established to process the collected materials.

13. Use non-toxic cleaning products (Such as vinegar, baking soda, and biodegradable soaps)

The mean value of the student response is 11.8. Understandingly students gave medium response for this as there may not be many concerned with cleaning products. While buying cleaning products from a supermarket, students tend to ignore the toxicity of the product. Most of them look for price and the brand. Hopefully, many should use non-toxic cleaning products after participating in this endeavor.

14. Use only phosphate free and chlorine free biodegradable detergents

The mean value of the student response is 7.1. This is the question with the smallest response which indicates that students don't care about the chemistry of detergents. They use a good brand name and do not perceive the importance of using phosphate and chlorine free biodegradable detergents.

15. Participate in a yearly tree planting program or restoration project

The mean value of the student response is 9.86 which indicates students tend not to participate in planting or restoration programs. Seriously, it's almost impossible for many engineering students

to participate in such endeavors. Course work, exams, sports etc., these are the things which most of the students will be interested of during graduate study.

16. Have had names/addresses removed from junk mail lists

Surprisingly 8.42 points is the average response for this question. Lack of awareness and interest might have resulted in this low response. Personally most students have never removed name/addresses from junk mail lists because they get very little junk mail.

17. Choose to eat low on food chain (grains and veggies) for at least 75 percent of my total diet to reduce the impact of food production on land and water resources.

The mean value of the student response is 9.57 points. Americans are very health conscious. By reading the nutritional information they have the opportunity to avoid eating poor food. Similar interest is shown by many of the engineering students.

18. Use less hazardous, non-toxic alternative products whenever possible

The mean value of the student response is 12.0 points. Non-toxic products were discussed earlier in question 13, which also was awarded similar response, (11.8).

19. Stay informed on environmental issues

The mean value of the student response is 12.57 points. There are a large numbers of environmental issues related to the following

- Climate Change
- Conservation
- Energy
- Soil
- Nanotechnology
- Nuclear issues
- Overpopulation
- Ozone depletion
- Pollution and Waste

It is difficult to stay informed on all these environmental issues. In fact, students are mainly concerned with their specific studies. That may be one of the reasons for the response rate to this question.

Importance of Corporate Social Responsibility

Familiarity with areas of environment concern will be of importance to future employees of business. Corporations, headquartered in most major countries, regularly produce reports on corporate social responsibly. The companies are increasingly pressured by non government organizations to document their policy regarding issues ranging from corruption to global

warming. In addition, companies increase report their environmental impact and seek ways to counteract the environmental damage caused by their activities. For example, the German company Volkswagen is funding the planting of 250,000 trees in the United States to offsets the carbon emissions of its cars. Corporations will need to produce reports which reflect understanding trends in social responsibility.⁶

Conclusion

The findings indicate that engineering students are generally concerned with environmental issues. For example, the response rate to the questionnaire was 224 which is considered in the “Earth Watchdog” category. This is two levels below the Eco-citizen category suggesting the need for possible improvement in the level of environmental concern in engineering students. If the increase is considered important, it may possibly be accomplished by discussing the environment in more engineering classes.

In general, young people are thought to be more concerned with the environment than older individuals. Here, the findings indicate that senior and graduate level university students are not in the highest (eco-citizen) category. This outcome may indicate the perceptions of these students have changed from earlier (high school?) years based upon their life experience.

Nevertheless, as has been mentioned, many students believe the environment in which they live is good and haven’t been personally harmed by pollution. Others seemed convinced of the gravity of environmental problems, but also appear to realize the underlying cause may be human greed and selfishness.

Acknowledgement

Special thanks to Arden Ellen Nixon for her assistance in preparing this paper.

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