Raising the Level of Environmental Concern of Senior Students taking the Electronics Engineering Laws and Ethics Through Climate Change Awareness Study

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Highlights

- One of the most neglected areas of concern of engineers is the environment.
- By studying the level of awareness on climate change, Electronics Engineering Laws and Ethics course may be improved to raise environmental concern amongst students.

Abstract

Two general areas that future electronics engineers are honed are competence and character. Most of the courses he takes fall in the general area of competence. This includes subjects like Circuit Theory, Electronic Design and Analysis, Communication Systems, and the like. Subjects dealing with character, in contrast, are limited. In some universities, it may just be Electronics Engineering (ECE) Laws and Ethics and the focus is on "engineering made by man for man." In this traditional view of Engineering, the environment is often neglected since it's not about "man" (as opposed to the "society"). Over the last years, however, concerns about the environment have been heightened as evidenced by the inclusion of clauses on the environment on the code of ethics of certain institutions. For this reason, is also important that such concern and care are taken to the classrooms. In the Philippines, a major topic under this is climate change due to the Philippines' high vulnerability due to its limited resources to adapt socially, financially, and of course, technologically. This paper sought to determine the level of awareness on climate change of ECE Laws and Ethics students and use this as the basis of recommendation to improve course delivery In particular, this paper would like to find out: (1) the level of awareness on climate change of Senior Students of Electronics Engineering (ECE) Laws and Ethics; (2) the factors which would the ECE students perceive to significantly influence their level of awareness on climate change; and (3) the recommendations on the development of the course to further raise the level of awareness on climate change. Qualitative and quantitative methods were employed in this paper. Using the instrument modified from the one created by Barreda (2018), students enrolled in the ECE Laws and Ethics were surveyed and results were analyzed to answer the research question. The recommendations were collected and considered for the next syllabus review.

Key Words: environmental concern; engineering ethics; engineering education; climate change

1. Introduction

Smith (2021) defined Engineering as "the application of science to the optimum conversion of the resources of nature to the uses of humankind." This was based on several past definitions, including the one from the Engineering Council for Professional Development in the US. He also mentioned how Great Britain would simply define engineering as "the manufacture or assembly of engines, machine tools, and machine parts" and he traced back its history to the time of Imhotep of Egypt. In the entire narrative, it could be seen that the interest of Engineering is centered on benefiting man. After all, it was man who created engineering. Over the years, however, growing concern on the environment has been tacked in Engineering Societies. Leiffer et al. (2009) the environment has been neglected in the first half of the 20th Century, leading to

massive destruction of forests or even entire species and pollution of water, air and soil. Now, Engineering is not just about humans; the environment is now given more emphasis too because of these issues.

Speaking of the environment, one of the most current issues that are being discussed is the issue of climate change. As Barrada (2018) noted from the United Nations Framework Convention on Climate Change, this issue is significant in the Philippines because of its high vulnerability to its impact. One factor causing this is the climate-sensitive processes such as agriculture which have a direct impact on the attainment of sustainable development. Future engineers have a direct or indirect effect on these processes so it is important to determine their level of awareness on this issue right before they graduate and what are their thoughts about their training so far. These future engineers are those enrolled in the ECE Laws, Contracts and Ethics course last 3rd Term, AY2020-2021. Together, their class was able to share their insights by completing the survey questionnaire administered to them. Being the ones educated today, their increased level of awareness on climate change through education may even help mankind's survival in the future. (Agboola & Emmanuel 2016 and Al Yousuf 2016)

2. Methods

The study aimed to answer the following research questions:

(1) What is the level of awareness on climate change of Senior Students of Electronics Engineering (ECE) Laws and Ethics?
(2) What factors would the ECE students perceive to significantly influence their level of awareness of climate change?
(3) What are the recommendations on the development of the course to further raise the level of awareness on climate change?

This study follows both the quantitative and the qualitative methods. For the quantitative, the instrument of Barrada (2018) was used and results were reflected in Tables 1, 2, and 3. It was slightly modified to fit in the classroom context but its core remains unchanged. The modification lies in the several open-ended questions that were added in the last part of the survey to gain further insights from the views of the respondents. The instrument remains to have two parts. The first part collected the data on students profiles such as age and gender while the second part gathered data on the students level of awareness on climate change and their thoughts about how these were processed in the course. The five-point Likert scale was still used in closed questions.

The survey was opened to 32 students of Electronics Engineering (ECE) Laws, Contracts and Ethics. This course was chosen because this is among the courses in the terminal year of ECE students in the Institute that tackles the environment in the context of engineering practice. Moreover, this course is a demonstrative subject for Student Outcome (f) – i.e., understanding of professional and ethical responsibility. Of the 32 students, 28 decided to join the survey, accounting for 87.5% of the total student population. The results from the survey were used as a baseline study and maybe expanded in the future to include other batches of students taking up ECE Laws, Contracts and Ethics.

3. Results and Discussion

All the 28 respondents for the survey came from the age range 20 – 30 years old. There is 68% male in the group and there are 32% female in the group. Eighteen percent (18%) of the respondents were working students while the remaining 82% were full-time students. As far as income is concerned, 45% declared that their family falls in the 0-5,500 PHP range, 11% in the 5,501 – 10,000 PHP range, 7% in the 10,001 –

20,000 PHP range, 14% in the 20,001 – 40,000 range and finally, 25% in the 40,001 and above range. As far as the number of people living in the house is concerned, 89% said that there were 1-5 of them in the household, 7% said there were 9 – 10 of them in the household and 4% said there were 11 and up of them in the household. On staying in their residence, 39% said they have been there for 21-30 years, 25% said they have been there for 11-20 years and 36% said they have been there for 0 – 10 years.

Table 1 shows the level of awareness on climate among the students of ECE Laws, Contracts, and Ethics. Based on the table, it can be seen that students are generally very much aware of the various issues as attested by the general weighted average of 98.56%. Moreover, it should be noted that the class is also aware that can alleviate climate change and that they should be concerned with the impact of their work on climate change, both as a citizen and as an Engineer.

Table 1. Level of Awareness on Climate Change Among ECE Students of FEU Institute of Technology

Indicators	Level of Awareness
Climate change is happening	100%
Climate change manifests in diverse ways in the world	100%
We are already experiencing the impacts of climate change	100%
I see climate change to be of immediate and urgent concern	100%
Climate change is a threat to sustainable development	100%
Is more harmful than beneficial	100%
It's caused mostly by human activities, not natural changes in the environment	100%
Increases surface temperature	100%
It causes sea level rise	93%
Causes increase in intensity of extreme weather events like heat waves, tsunami, flash flood and heavy rainfalls	96%
Leads to longer and more drought	100%
Leads to coastal erosion	96%
Influences agricultural yield negatively	100%
Poses threats to food security	96%
Causes Economic depression	93%
I can help alleviate climate change	100%
As a citizen, I should be concerned with the impact of my work to climate change	100%
As an Engineer, I should be concerned with the impact of my work to climate change	100%
General Weighted Average	98.56% (Very Much Aware)

***Note**: Very Much Aware: 81% - 100%; Much Aware: 61% - 80%; Aware: 41% - 60%; Moderately Aware: 21% - 40%; Not Aware: 20% and below.*

Table 2 shows the respondent's perceived factors that influence the level of awareness of the ECE students. Based on the obtained scores, education, public sources/family, personal experience, government actions/programs/interventions, training and seminar workshops, and the internet and social media are all very much important in influencing their level of awareness on climate change.

Table 2. Perceived Factors Influencing Level of Awareness on Climate Change

Indicators	Weighted Mean

Education	95%
Public Sources / Family	94%
Personal Experience	91%
Government Actions / Programs / Interventions	99%
Training and Seminar Workshops	96%
The Internet and Social Media	95%
General Weighted Average	95% (Very Much Important)

***Note**: Very Much Important: 81% - 100%; Much Important: 61% - 80%; Important: 41% - 60%; Moderately Important: 21% - 40%; Not Important: 20% and below.*

On the question, "To what extent were you able to appreciate the class discussions on your role as engineers in the protection and preservation of the environment," the class got a mean rating of 98% which is interpreted as "Very Much Appreciated." When asked what class activities did help the students appreciate their role as engineers in the protection/preservation of the environment, classroom discussion appears to be the most effective method at a frequency of 25. Results are shown in Figure 1.

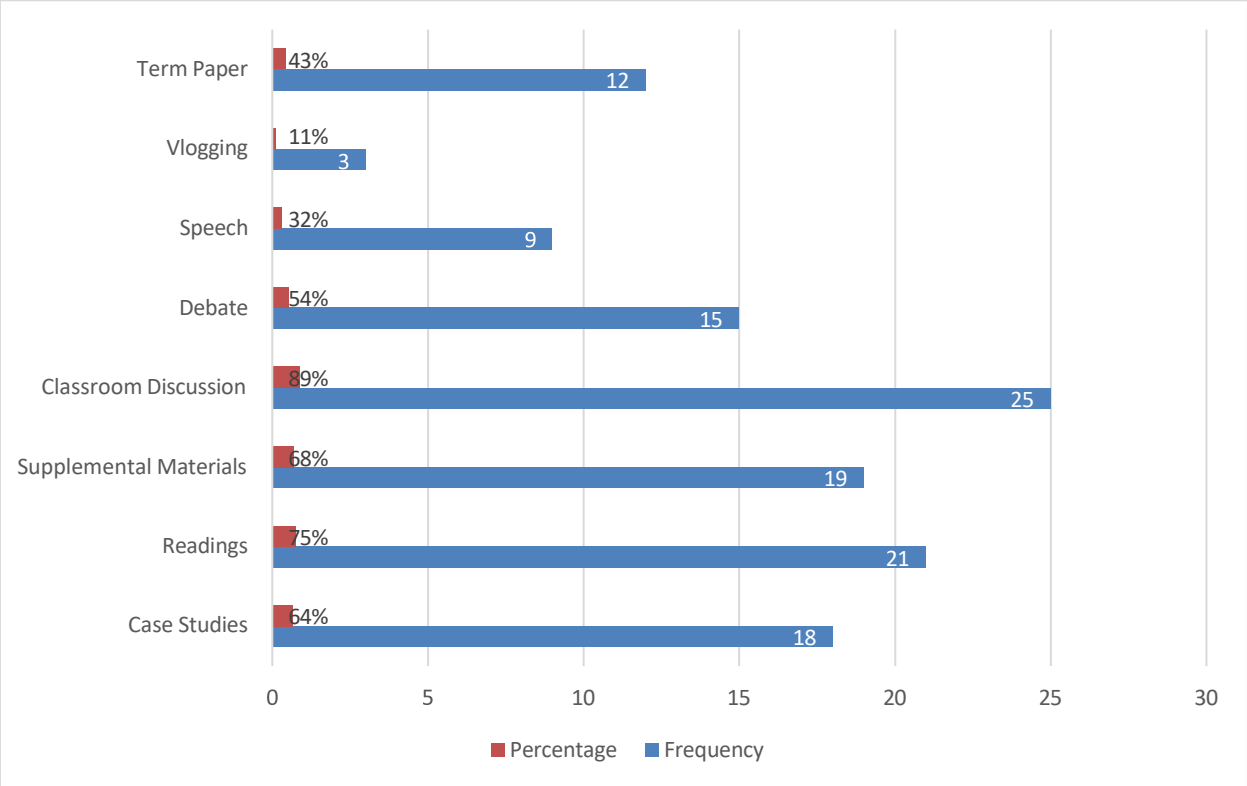

Figure 1. Teaching and Learning Activities That Helped Students Appreciate Their Role as Engineers in the Protection/Preservation of the Environment

As UNESCO (n.d.) claims, "Education is crucial to promote climate action." Hence, recommendations of students on how to make their class better in terms of raising the level of environmental concern carry weight also in this study. They include the following: First, students recommend more class discussions on the issue of climate change. They would want to have more cases, and actual scenarios to learn from. They would also like more opportunities to share their personal experiences on the topic. It is recommended to consider the Four Learning Theories (iEduNote 2021) in conducting the discussion for maximum effect. Second, students

recommend more engaging activities as watching films that center on climate change or having more debate on the topic. Third, students also recommend a dedicated topic on climate change. Currently, the topic is under the module entitled "The Engineer's Duty to the Society and the Environment." Fourth, students are also interested to know the output of researches nowadays which are connected to climate change. They may even be surprised to find out how Banwell et al. (2016) thought of developing the Philippines as a global hub for disaster risk reduction. Fifth, students also recommend creating applications that would tackle climate change such as vlogging and proposing innovations. As professors, it would not hurt to incorporate these suggestions in the next revision of the syllabus to strengthen more the delivery of the course while at the same time, reinforcing awareness and action to combat climate change..

4. Conclusions

This study has the following conclusions:

(1) Students of ECE Laws, Contracts and Ethics are very much aware of the issue of climate change.
(2) Education, Public Sources / Family, Personal Experience, Government Actions / Programs / Interventions, Training and Seminar Workshops, and the Internet and Social Media are the factors that ECE students perceive to significantly influence their level of awareness on climate change.
(3) To further raise the level of awareness on climate change, it is recommended to have more class discussions, make activities more engaging, provide a dedicated topic on climate change, present research outputs on climate change, and have students create vlogs and innovations that would tackle climate change.

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