



STUDENTS' AWARENESS OF CLIMATE CHANGE AND CARBON FOOTPRINT MITIGATION

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ABSTRACT

This study evaluates the Students' Awareness of Climate Change and Carbon Footprints Mitigation at Isabela State University, Jones Campus, with 200 students randomly selected to all levels and gender which employed a mixed method of research. This design is an approach to inquiry that combines both qualitative and quantitative approaches. Also, all inferential statistics assumed an alpha level of .05. Probability (p) values below this level are significant. Mean (M) and standard deviation (SD) were used to describe the level of awareness of climate change and carbon footprint mitigation. Furthermore, a factorial analysis of variance was conducted to determine whether significant differences exist in students' awareness of climate change and carbon footprint mitigation across programs or courses, place of origin, gender, and year level. Moreover, the overall results of the study on the students' awareness of climate change and carbon footprint mitigation show relatively high levels of use of the set indicators. There was a high level of awareness among students on switching off the lights and using gadgets responsibly as well as the importance of waste segregation and proper waste disposal. The second objective on the significant difference in students' awareness of climate change and carbon footprint mitigation according to their programs/courses, place of origin, gender, and year levels. There was no statistically significant difference in their level of awareness across Programs/Courses, place of origin, gender, and year levels. This implies that students' awareness of climate change and carbon footprint mitigation was the same regardless of their program, address, gender, and year level. This indicates that students at ISU-Jones Campus are highly aware of various aspects of climate change and carbon footprint mitigation, with most items reflecting extreme awareness. This suggests a strong foundation for promoting and implementing further environmental sustainability practices within the campus community. Further, in order to compile more comprehensive data and further assess how both knowledge and pro-environmental behavior can be achieved in Philippine classrooms, future researchers should also think about extending the variables involved in the study of climate change awareness and carbon footprint engagement.

Keywords: Students' Awareness of Climate Change, Carbon Footprints, Emissions, Mitigation



INTRODUCTION

The Philippines contributed 0.33 percent of the world's greenhouse gas emissions in 2012 with its total greenhouse gas emissions of 157.6 million metric tons of carbon dioxide equivalent. In 2022, the total increase in CO₂ emissions due to energy use was 0.9%, or 321 Mt, setting a new record of more than 36.8 Gt. Energy accounted for 54 percent of greenhouse gas emissions, with agriculture, industrial processes, waste, land-use change, and forestry contributing 33 percent, 8 percent, 7 percent, and -1 percent of emissions, respectively. The secretary of the Department of Environment and Natural Resources, Cimato (2019), reaffirmed in the PRE-SONA 2019 that the Philippines has one of the lowest carbon footprints among nations with comparable levels of development.

Climate change, however, happens when modifications to the Earth's climate system lead to new weather patterns that persist for at least a few decades and maybe millions of years. According to ADB (2010), the Philippines is particularly vulnerable to risks brought on by weather-related events. Climate change will make this situation worse by increasing the frequency of extreme weather events, altering temperature trends, changing rainfall patterns, and raising sea levels. Natural disaster losses currently exceed 0.5 percent of GDP yearly, and climate change is predicted to make them far worse. As a result, this issue transcends environmental issues to become one of development. However, climate change will also open up new funding opportunities for a more viable low-carbon economy and enable impacted nations to implement adaptation strategies (ADB, 2010).

The globalization and digitalization that have quickly connected the world have made the context of climate change even more problematic. The uncertainty and complexity of the world increase. Along with these megatrends, humans are threatening all life on Earth by drastically altering the climate, wildlife, and landscapes of the globe. The Anthropocene, a new geological epoch that has been formed by humanity, is now in existence.

Global climate change is a result of the current environmental footprint of humanity growing at an unsustainable rate (Kucukvar et al., 2015). One of the many factors steadily causing our planet's disruption is the carbon footprint. Others may not be aware that these so-called footprints have detrimental emissions from carbon dioxide gas. Moreover 30 billion metric tons of carbon dioxide were measured globally in 2020, with nearly 17 billion metric tons coming from the Asia Pacific region, which includes the Philippines, according to Statista (2021).

The manufacturing of cement and the burning of fossil fuels account for the majority of the Philippines' carbon emissions, which have been increasing at a pace of 3.90 percent annually in recent years (Knoema, 2020). According to the Climate Transparency Report (2021), 1.18 tons per person were achieved in the Philippines as a whole. The study should focus on achieving the 13th sustainable goal, climate action, before discussing the nation's carbon footprint reduction.

The ultimate objective of this study is to interact with the national liabilities of its citizens. While the whole output falls short of its major goal for a developing nation, Serio (2017), people in the academic community are only moderately knowledgeable about reducing carbon footprints (Adanza, 2016). As a result, the researchers looked to gauge the level of awareness of reducing carbon footprints on the Isabela State University-Jones Campus while also suggesting potential solutions to address new environmental issues.

The public will greatly benefit from this study because they will better understand how their homes and places of education contribute to global warming. The purpose of this study was to benefit the following individuals and groups: It will raise student awareness of their carbon footprint and potential mitigation strategies at Isabela State University. Through this study, the researcher hopes to raise awareness about the environment and lessen the excessive emission of greenhouse gases. This study can also offer the Climate Change Commission important insights and suggestions for potential strategies to cut carbon emissions. Moreover, future scholars could use this as the starting point for their investigation into the negative effects of carbon footprints. This



might also serve as a guide for individuals looking for solutions to the problem of climate change.

OBJECTIVES OF THE STUDY

The researchers sought to evaluate Students' Awareness of Climate Change and Carbon Footprints Mitigation and provide information on reducing the said emissions. Furthermore, this specifically answered the following questions:

1. Determine the level of Students' Awareness of Climate Change and Carbon Footprints Mitigation at ISU-Jones Campus.
2. Determine the significant difference in Students' Awareness of Climate Change and Carbon Footprints Mitigation according to their Programs/Courses, place of origin, gender and year levels.

Based on the stated objectives, an alternative hypothesis below is derived:

There is a significant difference in Students' Awareness of Climate Change and Carbon Footprints Mitigation according to their Programs/Courses, place of origin, gender and year levels.

METHODOLOGY

The researcher employed a mixed method of research. This design is an approach to inquiry that combines both qualitative and quantitative forms so that the overall strength of the study is greater than either of the two forms.

In the qualitative approach, the descriptive type of research utilizing the survey method was used to Students' Awareness of Climate Change and Carbon Footprints Mitigation in a closed-ended questionnaire.

In the quantitative approach, the descriptive-evaluative, and descriptive-correlational types of research were employed to illustrate the socioeconomic status of the respondents.

Descriptive evaluation was utilized to explain the profile variables of the learners. Furthermore, descriptive-correlational was employed to identify the significant relationship between the variables.

The study was conducted at Isabela State University, Jones Campus, Jones, Isabela. The sample of this study was collected from all students enrolled in this semester 2023-2024 of ISU, Jones Campus. This research was employed on the basis of a simple random sampling technique.

The necessary information or data was gathered through a survey questionnaire. A total enumeration sampling was used to gather data to identify students' level of awareness of carbon footprint and provide information on reducing the said emission of ISU Jones Campus. The researchers used a closed-ended questionnaire, which consists of demographic and Likert-scale questions with the awareness response set and with its equivalent range at: Not at All-Aware by 1-1.74, Slightly Aware at 1.75-2.49, Very Aware at 2.50-3.24 and Extremely Aware at 3.25-4 weighted mean. The researchers adapted and modified the questionnaire from the research study of Adanza (2016) regarding the "Barriers to Mitigating Carbon Footprint in a Selected Academic Institution in Bacoor, Cavite." The questions focused on determining students' awareness of carbon footprint mitigation within their everyday use of electricity, appliances, food consumption, and waste disposal. Refer to Appendix A for the instrument used. Through this, the instrument was then validated by professionals who are experts in test construction to assess the face and content validity of the instrument before its implementation.

Observing ethical considerations in gathering data, the researchers sought permission from the School Administrator of Isabela State University for the conduct of the study. Data was collected through surveys and questionnaires. The questionnaires were distributed to the respondents via Google form after thoroughly explaining the tabulations. There were 200 participants involved in this study. This study was



conducted during the Second Semester of the School Year 2023-2024 in the new normal setup. Also, the scope of the study includes the following: 1. Level of students' awareness of carbon footprint mitigation in ISU-Jones Campus 2. Significant difference in students' levels of awareness of carbon footprint mitigation according to their programs/courses, place of origin, gender and year levels?

Furthermore, a request for cooperation and assurance that all information gathered was treated strictly and confidentially.

This section described the tests and procedures executed on the data. All data were imported and analyzed in SPSS® Statistics version 26. This software was used entirely in the analysis, except for effect size calculations, which were not implemented, for which G*Power was used (Faul, Erdfelder, Buchner, & Lang, 2009). All inferential statistics assumed an alpha level of .05. Probability (p) values below this level are significant.

For the first question, mean (M) and standard deviation (SD) will be used to describe the level of students' awareness of carbon footprint mitigation in the ISU-Jones Campus. For the 2nd and final question, a two-way independent analysis of variance (ANOVA) was used to determine if there were significant differences in students' levels of awareness of carbon footprint mitigation according to their programs/courses, place of origin, gender, and year levels. The F -statistic and its associated p -value will be used as an omnibus test to assess the global significance of the difference, while the t -statistic was used for comparisons. Pearson's r was used as an effect size in this procedure and was interpreted using the same guidelines from Cohen (1988). i.e., F for the omnibus test of difference, t for comparisons, and r for effect size. However, a Bonferroni adjustment was made to compensate for the number of profile variables involved. So instead of using a .05 alpha value, this procedure will use $.05/2 = .025$. Again, the procedure was bootstrapped in anticipation of non-normal and heterogeneous distribution; and thus, said assumptions were not explored.

Through these statistical tools, the researchers determined the level of awareness of the ISU students on carbon footprint.

RESULTS AND DISCUSSION

This section will describe the tests and procedures executed on the data. All data are imported into a licensed version of IBM® SPSS™ Statistics 27. This software is used entirely in the analysis, except for some simple calculations that are not implemented in the software.

All inferential statistics assumed an alpha level of .05. Probability (p) values below this level are significant.¹

For the first objective, mean (M) and standard deviation (SD) were used to describe the level of awareness of climate change and carbon footprint mitigation. The range of values in

Table 1 was used to describe each mean.

Range	Level of awareness
1.00–1.79	Not at all aware
1.80–2.59	Slightly aware
2.60–3.39	Neutral
3.40–4.19	Very aware
4.20–5.00	Extremely aware

Table 1
Range of Values of Descriptive Interpretations

Range	Level of awareness
1.00–1.79	Not at all aware
1.80–2.59	Slightly aware
2.60–3.39	Neutral
3.40–4.19	Very aware
4.20–5.00	Extremely aware

For the second objective, a factorial analysis of variance was conducted to determine whether significant differences exist in students' awareness of climate change and carbon footprint mitigation across programs or courses, place of origin, gender, and year level. The F -statistic and its associated p -value were used to determine the significance of each profile variable, while partial eta squared (η_p^2) was used to determine the magnitude of the difference across each category.



This effect size statistic was interpreted using the guidelines from Cohen (1992): .01 means *small difference*, .06 means *moderate difference*, and .14 means *large difference*. Initial analyses showed no major violations of normality and homoscedasticity, which are essential assumptions for this procedure.

1. Level of awareness of climate change and carbon footprint mitigation

The analysis aimed to determine the level of students' awareness of climate change and carbon footprint mitigation at ISU-Jones Campus, using the mean (M) and standard deviation (SD) for descriptive statistics. Based on the results in the overall level of awareness is rated at 4.21 ($SD = 0.56$), indicating that students are extremely aware of climate change and carbon footprint mitigation practices.

Most individual items reflected a high level of awareness among students. For example, the highest mean score was for the awareness of the necessity to switch off lights when not in use ($M = 4.69$, $SD = 0.50$), which is categorized as extremely aware. Similarly, students showed strong awareness of the benefits of switching off electronics and other equipment when not in use ($M = 4.42$, $SD = 0.71$), and the importance of waste segregation and proper disposal ($M = 4.46$, $SD = 0.69$).

The awareness of choosing energy-efficient devices and appliances also scored high ($M = 4.25$, $SD = 0.72$), as did the knowledge of the advantages of adopting energy-saving appliances to reduce carbon emissions ($M = 4.26$, $SD = 0.73$). Students were also extremely aware of practices like decomposing biodegradable waste ($M = 4.32$, $SD = 0.77$) and organizing the fridge to reduce food waste ($M = 4.20$, $SD = 0.78$).

However, some areas indicated a slightly lower level of awareness, although still within the very aware range. For instance, awareness of the energy efficiency rating for windows, doors, and streetlights scored a mean of 4.16 ($SD = 0.77$), and the awareness of using eco-friendly packaging for food scored a mean of 4.25 ($SD = 0.75$). The awareness of the environmental impact

of a plant-based diet ($M = 4.18$, $SD = 0.76$) and the benefits of using bicycles or walking for short journeys ($M = 4.16$, $SD = 0.80$) also fell into the very aware category. As a result, the investigation showed that organizations that provide community services, education, and research have a significant impact on both sustainable development and the battle against climate change (Cordero et al. 2020). According to Robinson et al. (2018), Carbon Footprint is a highly helpful tool for exerting more control over environmental impact activities. It also offers a baseline against which to assess the results of subsequent mitigation initiatives on campus (Letete et al. 2011). Furthermore, the study's findings supported Urie Bronfenbrenner's Ecological Systems Theory (1898), which holds that a person's upbringing has an impact on all facets of their life. The theory also clarified how a person picks up knowledge from the various environments in which they live. Furthermore, these findings supported the research of Akten & Akyol (2018), which noted that even the most basic decisions made by humans—such as where to live, eat, travel - leave an ecological imprint on the planet. It is necessary to recognize the consumption category from which our individual footprint originates to comprehend the connection between our everyday actions and the utilization of natural resources. By putting certain steps into place, these footprints can be decreased (especially consumption reduction, resource conservation).

Overall, the data indicate that students at ISU-Jones Campus are highly aware of various aspects of climate change and carbon footprint mitigation, with most items reflecting extreme awareness. This suggests a strong foundation for promoting and implementing further environmental sustainability practices within the campus community.

2. Difference in the level of awareness across profile variables

A factorial analysis of variance was used to assess the difference in students' level of awareness across the identified profile variables,



shown in Table . Overall, there was no statistically significant difference in students' level of awareness across the profile variables, $F(11, 179) = 0.84, p = .602$, also evidenced by the small magnitude of difference ($\eta_p^2 = .049$).

Table 2
Descriptive and Inferential Statistics on the Difference in Students' Level of Awareness

Profile	Descriptives		Comparison		
	M	SE	F ^a	p	η_p^2
Program					
BSA	4.02	0.19	1.48 ^b	.223	.024 ^c
SCT	4.12	0.19			
CCJE	3.86	0.21			
CEs	4.14	0.20			
Address					
Carrio	4.08	0.20	0.33 ^d	.717	.004
Base	4.06	0.17			
Others	3.96	0.20			
Gender					
Male	4.02	0.15	0.04 ^e	.964	< .001
Female	4.01	0.15			
Others	4.09	0.36			
Year					
First	4.16	0.15	1.06 ^f	.380	.023 ^g
Second	4.27	0.16			
Third	4.11	0.31			
Fourth	4.35	0.18			
Others	3.28	0.59			

Note. Overall statistics: $F(11, 179) = 0.84, p = .602, \eta_p^2 = .049$.

^a $df_R = 179$. ^b $df_M = 3$. ^c $df_M = 2$. ^d $df_M = 4$.

^g Small difference

Moreover, the same can be inferred when looking at each profile variable, i.e., there was no statistically significant difference in their level of awareness across program, $F(3, 179) = 1.48, p = .223, \eta_p^2 = .024$, address, $F(2, 179) = 0.33, p = .717, \eta_p^2 = .004$, gender, $F(2, 179) = 0.04, p = .964, \eta_p^2 < .001$, and year level, $F(4, 179) = 1.06, p = .380, \eta_p^2 = .023$. This implies that students' awareness of climate change and carbon footprint mitigation was the same regardless of their program, address, gender, and year level. Therefore, literature evidence has revealed education as a predictor of climate change (Salman et al., 2018; Linden, S., 2015). This is consistent with the findings of this study because there is a positive relationship between educational level and climate change consciousness. Indeed, Salman et al. (2018), opined that taking courses in climate change education leads to increased awareness, change in attitudes, and behaviors that lead to climate change action. Furthermore, the study examined the relationship between geographic factors, demographic of age, gender, education, occupation, sub-region, and sources of information on climate change consciousness.

Some of the results corroborated findings of previous studies conducted outside and within the African continent (United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects (2022)).

CONCLUSION

The following are the major findings in the analysis: The overall results of the study on the student's awareness of climate change and carbon footprint mitigation show relatively high using the set indicators. The first objectives determine the level of Students' Awareness of Climate Change and Carbon Footprints Mitigation at ISU-Jones Campus. There was a high level of awareness among students on switching off the lights and using gadgets responsibly as well as the importance of waste segregation and proper waste disposal. Moreover, the second objective, determine the significant difference in Students' Awareness of Climate Change and Carbon Footprints Mitigation according to their Programs/Courses, place of origin, gender and year levels. There was no statistically significant difference in their level of awareness across Programs/Courses, place of origin, gender and year levels. This implies that students' awareness of climate change and carbon footprint mitigation was the same regardless of their program, address, gender, and year level. Overall, the data indicates that students at ISU-Jones Campus are highly aware of various aspects of climate change and carbon footprint mitigation, with most items reflecting extreme awareness. This suggests a strong foundation for promoting and implementing further environmental sustainability practices within the campus community.

RECOMMENDATION

It's critical that parents receive education about how taking good environmental care of their homes can help mitigate climate change and lower carbon emissions. In order to compile more comprehensive data and further assess how both knowledge and pro-environmental behavior can be achieved in Philippine classrooms, future researchers should also think about extending the



variables involved in the study of climate change awareness and carbon footprint engagement. These variables could include looking at the K–12 curriculum and its sections that emphasize ecological and carbon footprint as well as environmental and climatological issues, as well as determining the students' sources of information about climate change.

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AUTHOR'S PROFILE

Dr. Kristine Mae C. Sadang is an assistant professor at the College of Education, Isabela State University-Jones Campus, and has dedicated 13 years to teaching biology, biochemistry, and biotechnology. She earned degrees in biology, general science, and a Ph.D. in biology education. As a researcher, Dr. Sadang has published articles and presented at various local, national, and international conferences. She is also the recipient of the CHED Scholar, which falls under the Scholarships for Staff category, Instructor's Knowledge Advancement Program (SIKAP). She is also one of the authors in a refereed journal entitled "Performance of Broiler Chickens Fed Diet with Different Levels of Anabiong (*Trema orientalis* Linn.) Leaf Meal" in the Philippine Journal of Veterinary and Animal



Sciences. Beyond teaching, Dr. Sadang has authored educational modules in biology, climate change, and disaster risk management. Further, she continues to inspire and impact the academic community through her commitment to education, research, and public service.

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