

## Impacts of climate change: Basis for a teaching enhancement approach for climate action

Espinosa, Ken Paul M.

Baliuag University, Philippines ([kenpaulespinosa@baliuagu.edu.ph](mailto:kenpaulespinosa@baliuagu.edu.ph))

Caisip, Andrian A. ✉

Pacific Training Group, Australia ([andriancaisip.au@gmail.com](mailto:andriancaisip.au@gmail.com))



ISSN: 2243-7703

Online ISSN: 2243-7711

OPEN ACCESS

**Received:** 9 July 2023

**Revised:** 17 July 2023

**Accepted:** 28 July 2023

**Available Online:** 28 July 2023

**DOI:** 10.5861/ijrse.2023.49

### **Abstract**

This study aimed to determine the level of awareness about the impacts of climate change among the participants, who were Filipino youth college students attending higher education institutions in Manila City. The researchers employed a descriptive-survey research design to identify knowledge gaps in the participants' present level of awareness regarding the impacts of climate change. The study participants were purposively chosen because they possessed certain characteristics and features that the study entails and requires. An expert-validated, self-made survey questionnaire was utilized in this study. The overall findings indicated a clear need to significantly boost Filipino college students' awareness of the implications of climate change, with a focus on the sectors of agriculture, coastal resources, forestry, and infrastructures, while the participants' awareness was limited with regard to the impacts on health and water resources. As a result, the vast majority of participating Filipino college students demonstrated that there are knowledge gaps regarding how adversely climate change has affected these sectors. In addition, the study discovered a significant difference between the assessments of the Filipino youth college participants in terms of age and year level in college. Therefore, the context of the findings must be taken into account when creating a teaching enhancement approach that can be incorporated into general education courses in higher education institutions and that would raise the level of awareness of Filipino youth college students in order to promote and advocate for climate action.

**Keywords:** awareness, education, climate change, climate action, teaching enhancement approach

## **Impacts of climate change: Basis for a teaching enhancement approach for climate action**

### **1. Introduction**

Climate change has been globally recognized as one of the most pressing crises of this century (Ali et al., 2021; Anthony et al., 2021; Tran et al., 2021). The temperature of the Earth's surface has risen by 0.850 degrees Celsius from 1980 to 2012. Elevating global temperature is an evident impact of climate change (Pachauri et al., 2014) that has a broad range of effects and presents intertwined threats to social and ecological systems as well as the economy, particularly the agricultural, water, and energy sectors (Graziano et al., 2018; Hundera et al., 2019; Reismann et al., 2021) and, generally, global sustainability (Qazlbash et al., 2021). Climate change presents a significant risk to the world. It is projected to increase the future hazard of droughts (Liu & Chen, 2021) and indicates an elevating frequency and intensities of disasters and extreme weather such as variability of temperature, rainfall, sea-level rise, and the alteration of extreme climatic indices (Asante et al., 2021; Chowdhury et al., 2020).

The negative consequences brought by climate change have been causing suffering in a lot of countries (Nyang'au et al., 2021), but they have had bigger impacts on the poor, young, elderly, sick, and marginalized communities (Paul et al., 2019). There are direct and indirect connections between climate change and COVID-19 that prove that climate change is intertwined with human health in general (Tsagkaris et al., 2021). With this and the adverse impacts on agricultural production, climate change leads not only to food insecurity but also triggers threats to human welfare, security, and global stability (Croft et al., 2018; Nyang'au et al., 2021), which then lead to rising numbers of civil conflicts.

Greta Thunberg, a Swedish environmental youth activist, inspired the young generation to take a stand and appeal to policymakers towards mitigating the impacts of climate change (Haugestad et al., 2021). Students have been growing in number as they call the attention of legislators and political leaders to alleviate the impacts of climate change and have started participating in and organizing green movements (Calculli et al., 2021; Oliver & Adkins, 2020). Compared to adults, young citizens possess deeper awareness and are more committed and concerned about the climate crisis since climate change affects future generations more than other generations (Calculli et al., 2021; Jürkenbeck et al., 2021). Additionally, politicized social identity, perceptions of environmental threat, and shared responsibility are the main factors that encourage the young generation to be involved in movements regarding environmental and climate change issues (Haugestad et al., 2021).

Although students have a positive environmental attitude, they seem to be less familiar with or educated on the impacts of climate change (Lagbas & DI. Habito, 2016) and could still improve their knowledge regarding this topic (Domantay et al., 2021). From both a health and climate change mitigation perspective, it is pertinent to improve the level of climate-specific health literacy since high levels of awareness about climate change and its impact on health, society, and the economy are correlated (Reismann et al., 2021; Tran et al., 2021). Moreover, awareness is one of the approaches to establishing effective implementations of climate change resilience programs and adaptive capabilities (Iturriza et al., 2020b; Mercado, 2016), since vulnerability and adaptive capacity have often been tied to discussing the societal attributes of climate change (Ahsan & Warner, 2014). Generally, it is imperative to raise the public's awareness of the effects of climate change (Jürkenbeck et al., 2021). An important factor in climate change awareness is education level.

Education is one of the most powerful tools for raising awareness about environmental concerns and climate change (Calculli et al., 2021). Education initiatives might consider inoculation techniques to help neutralize the negative effects of misinformation on the public's understanding of climate change. Educational attainment is a predictor of climate change awareness (Ballew et al., 2020; Iturriza et al., 2020a). Together with gender and

occupation, education influences adaptations to climate change (Qazlbash et al., 2021).

The Philippines is a tropical archipelagic nation. Due to its geographic location, it is one of the most disaster-prone countries on the planet, exposed to seismic activities, intense tropical cyclones, and coastal hazards susceptibility, which are then exacerbated by climate change (Bollettino et al., 2020; Combest-Friedman et al., 2012; Valenzuela et al., 2020). Although the Filipinos are aware of the increase in temperature, seasonal variability, and intensifying rainfall, the community members do not have a clear understanding of the risks. Hence, there is a clear indication of the need to increase awareness to correctly explain and transmit knowledge about potential hazards since the more aware we are, the more prepared we are to take action and prepare for disasters (Bollettino et al., 2020; Valenzuela et al., 2020).

The commitment of the young generation is crucial to the future of the world in addressing the threats and concerns caused by climate change. Currently, there are limited media and educational programs in this area. As new platforms for communications, education, and social change emerge, online and serious games are gaining currency in search of innovative approaches to raising climate change awareness (Ouariachi et al., 2017). Public outreach and educational activities are common components of climate change adaptation toolkits that aim to improve local adaptive capacity through knowledge and awareness (Graziano et al., 2018).

This paper aimed to determine the level of awareness about the impacts of climate change among the participants, who were Filipino youth college students attending higher education institutions in Manila City. In order to effectively teach about the impacts of climate change in general education courses at higher education institutions, this served as the foundation for the development of a teaching enhancement approach for climate action. The study also examined the difference in awareness levels among Filipino youth college student participants based on their profiles.

Specifically, the study sought to answer the following questions:

- What is the profile of Filipino youth college student participants in terms of age; sex; and year level in college?
- What is the level of awareness among the Filipino youth college students' participants in Manila City on the impacts of climate change in terms of the following sectors: agriculture; coastal resources; forestry, health; water resources; and infrastructures?
- Is there a significant difference in the assessments of Filipino youth college student participants' level of awareness on climate change impacts when grouped according to their profiles?
- How may the findings be utilized to serve as the basis for a teaching enhancement approach?

### *1.1 Theoretical Framework*

The study was anchored in the social cognitive theory postulated by Albert Bandura in 1986. This theory emphasized the dynamic interaction between and among people, their behavior, and their environment.

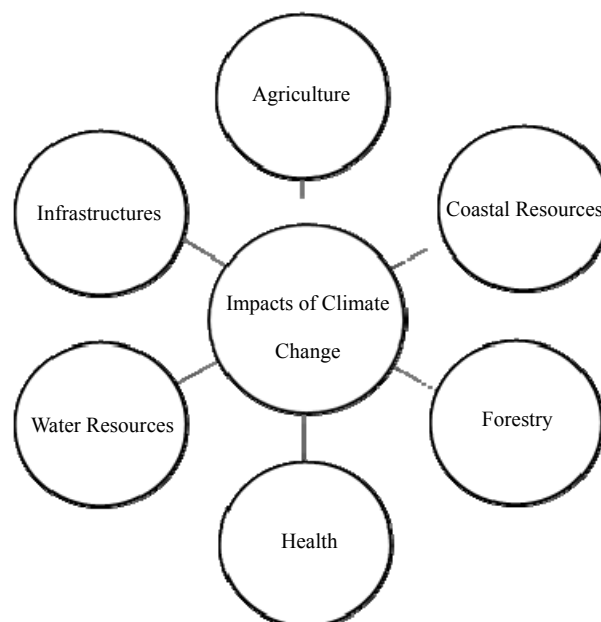
Knowledge about climate change is the foundation for having a solution to avoiding or reducing its impacts. Education, particularly in higher education, plays a central role in learning, innovation, and research and can equip Filipino youth college students with the knowledge and skills necessary to become agents of change within wider communities. This could result in a behavioral change that is necessary for them to become fully aware of the impacts of climate change. As awareness is the first step toward adaptation and mitigation actions, the inclusion of climate change in education, co-curricular activities, and research programs is vital (Filho et al., 2023; Sjöblom et al., 2022). Effective teaching of science can stimulate an interest in the subject and result in an enhancement of scientific knowledge and literacy. Furthermore, climate change education in higher education not only provides knowledge but also develops skills that lead to behavioral changes towards sustainable

production and consumption that can impact society at large (Oliver & Adkins, 2020) and promotes an environment conducive to learning.

Given the limited time for successful mitigation, the urgency of taking action on climate change has increased. Standardized ways of measuring and regularly reporting progress are necessary to maintain an up-to-date evidence base and assess the effectiveness of curricular interventions (Brennan & Madden, 2023).

Thus, this theory emphasized the critical role of education towards Filipino youth college students, particularly in higher education, as a means to have behavioral change to increase awareness and knowledge of climate change, develop skills and behaviors toward sustainable production and consumption, and foster agents of change to influence wider communities conducive to an environment that takes action to combat climate change. Effective teaching methods and standardized measurement of progress are also important components in promoting successful mitigation of climate change.

Figure 1. The Conceptual Diagram of the Study



The conceptual diagram of the study, which focused on the sectors of agriculture, coastal resources, forestry, health, water resources, and infrastructures, is shown in Figure 1 below. The intention of this research was to determine the level of awareness of the impacts of climate change among Filipino youth college student participants attending in higher education institutions in Manila City, Philippines. Similarly, this study also aimed to develop a teaching enhancement approach for climate action that could be integrated into the instruction of general education courses in higher education institutions. This can be used to raise climate change awareness among the youth in the Philippines and encourage climate action in support of UN Sustainable Development Goal No. 13. The development of the teaching enhancement approach can be modified and improved through stakeholder response, recommendations, and analysis in various sectors.

## 2. Methods

### 2.1 Research Design

The researchers utilized a descriptive research design, with the study focusing on determining the current

level of awareness of Filipino youth college student participants studying in Manila City. The level of awareness of the participating Filipino youth college students was assessed in order to identify knowledge gaps. This served as the foundation for a teaching enhancement approach for climate action that could be used to integrate research findings for effective instruction of the impacts of climate change in general education courses in higher education institutions. The researchers used a survey as a type of descriptive research to collect, outline, interpret, analyze, and present the data collected.

### *2.2 Participants and Sampling Procedure*

The study participants were purposively chosen because they possessed certain characteristics and features that the study entails and requires. Filipino youth college student participants, ages 30 and below, studying in higher education institutions in Manila City, Philippines, were invited to participate in the study on their own accord. A total of 100 Filipino youth college student participants from Manila City voluntarily participated in the study.

### *2.3 Data Gathering Procedure*

An expert-validated, self-made survey questionnaire anchored to the impacts of climate change and supported by pertinent studies and related literature served as the research instrument used to gather data. This was done to gauge how well-informed Filipino youth college students were about the impacts caused by climate change. The instrument includes quantitative items about the profile of participating Filipino youth college students as well as the impacts of climate change on agriculture, coastal resources, forestry, health, water resources, and infrastructure. The research instrument of the study had both its face and content validated by experts. This was tested for reliability using Cronbach's alpha, and the result was acceptable (0.78). A letter of consent from the participant was included with the questionnaire to request their cooperation in providing truthful and complete answers. The participants were also told that if they had any questions or concerns about anything on the questionnaire, they could get in touch with the researchers. After the respondents had finished completing the e-survey form, the questionnaires were automatically retrieved from the application used in the data collection process.

### *2.4 Ethical Considerations*

The researchers adhered to the principle of informed consent. It is the responsibility of the researchers to fully explain the purpose, objectives, and methodology of the research study to the Filipino youth college participants. Prior to the start of the actual data collection, they were asked for their permission. Data collection was initiated as a result of the participants' voluntarily taking part in the study. All data were collected from Filipino youth college students who agreed to engage with the research; their identities were never disclosed to those outside the study. The study's findings were used solely for the purposes of the investigation and related studies. Moreover, the self-determination principle was consistently used in the research process. The Filipino youth college student participants were informed that they could withdraw or continue at any time while data collection was underway. They were informed that participating in the study could be advantageous for them and the study's main intent. They were shielded from all forms of manipulation.

### *2.5 Data Analysis*

A weighted mean was used to determine the level of awareness of Filipino youth college student participants about the impacts of climate change on agriculture, coastal resources, forestry, health, water resources, and infrastructures. The z-test and analysis of variance (ANOVA) were used based on the normality test results to determine whether there were significant differences in the assessments of the Filipino youth college student participants when they were grouped based on their profiles.

### 3. Results and Discussions

This section presents the results and discussion of the three main variables that made up the research study: the profile of the participants, their level of awareness on the impacts of climate change, and the difference in participant assessments when grouped according to their profiles.

#### 3.1 Filipino Youth College Student Participants

The data gathered showed that 54% of the Filipino youth college participants in the study, who were enrolled in higher education in Manila City and were between the ages of 30 and below, were female and 46% were male. According to the data gathered, 44% of the participating Filipino youth college students were between the ages of 18-20, 45% were between the ages of 21–25, and 11% were between the ages of 26–30. Moreover, the data collected showed that 42% of the Filipino youth college student participants were first-year students, 24% were second-year students, 21% were third-year students, and 13% were fourth-year participants.

#### 3.2 The Impacts of Climate Change

**Table 1**

*The Level of Awareness of Filipino College Student Participants on the Impacts of Climate Change*

Climate Change Impacts	Weighted Mean	Qualitative Interpretation
Agriculture	3.9	NA
Coastal Resources	3.9	NA
Forestry	3.8	NA
Health	4.0	A
Water Resources	4.0	A
Infrastructure	3.9	NA
Overall Mean	3.9	NA

Note. Legend: 5 as Fully Aware (FA); 4.0–4.9 as Aware (A); 3.9 and below as Needs Attention (NA).

The knowledge gaps among Filipino youth college students regarding the impacts of climate change on agriculture, coastal resources, forestry, health, water resources, and infrastructures is shown in Table 1. The information gathered showed that, among the areas where climate change can have a negative impact on various societal sectors, the majority of the participating Filipino college students were unaware of the consequences of climate change and that there was a need for attention. Among the impacts of climate change on the sectors listed above, the table shows that agriculture, coastal resources, forestry, and infrastructure were not given much attention by Filipino youth college students, with weighted means of 3.9, 3.9, 3.8, and 3.9, respectively, while health (WM = 4.0) and water resources (WM = 4.0) received considerable attention. This could be related to a study conducted in the Philippines about the public view of climate change, wherein 59.9% of the participants are unaware of the climate change impacts and could still be further improved (Bollettino et al., 2020). Another thing would probably be the misconceptions that persist across all levels of education (Milovanovic et al., 2022) caused by reliance on mass and social media for information (Ha et al., 2023).

According to the study's findings, there is a clear need for strengthening the awareness of Filipino youth and college students on the impacts of climate change. One of the most fundamental problems facing humanity now is climate change. If individuals throughout the globe do nothing to cut back on increasing greenhouse gas emissions, it may result in adverse consequences that are already being felt and could get worse over time. The researchers considered that in order to further educate the youth's awareness of these detrimental effects and misconceptions, formal education about them should come first. To make sure that college students are fully aware of its impacts, educators have to thoughtfully consider how to best approach the college students to address this concern about awareness. Additionally, it is critical to teach the class in such a way that college students are expected to translate what they learn to practical scenarios in order to fully develop their potential as environmental advocates.

3.3 The Difference in the Assessments on the Impacts of Climate Change

**Table 2**

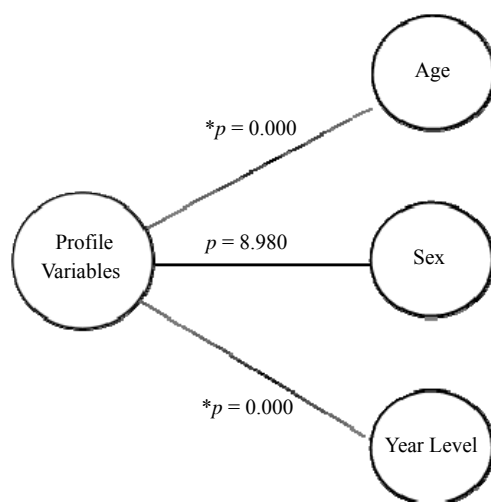
*Assessment of Filipino youth college student participants on the impacts of climate change according to profiles*

Profile Variables	Computed values	p-value	Decision	Interpretation
Age	$F = 9.60$	0.000	Reject Ho	Significant
Sex	$Z = 5.35$	8.980	Accept Ho	Not Significant
Year Level in College	$F = 8.26$	0.000	Reject Ho	Significant

Note. The p-value is significant below alpha 0.05

The computed values for age ( $p = 0.000$ ) and year level ( $p = 0.000$ ) in the assessment are shown in Table 2. The differences in these values indicated implications, while the null hypothesis was accepted in the area of sex ( $p = 8.980$ ). Since the null hypothesis was tested at a level of significance of 0.05 in the areas of age and year level, the study's results demonstrated that there was a significant difference to reject it.

Figure 2. Diagram of the Difference in the Assessments of Filipino Youth College Student Participants



Note. \*significant

It was found that Filipino youth college students become more conscious as they get older and reach higher levels of their education. Thus, it was demonstrated that, when they were grouped by their age and year level in college, there was a significant difference in the assessment of Filipino youth college students' level of awareness of climate change impacts. This is supported by the studies of Filho et al. (2023) and Zeeshan et al. (2021), who found that the older Filipino youth college students are and the higher their education level, the more aware they are of the ramifications caused by the global climate crisis. This could also be related to the findings of Sjöblom et al. (2022) that related the level of awareness to actual experience. It has been shown that students who had more experience dealing with the effects of the climate crisis had a deeper understanding of the implications of climate change. It can be inferred that students link environmental issues with their own experiences in their immediate environments.

Although in this paper, the sex of the Filipino youth college students was rendered to have similar perceptions, it is worth mentioning that from a similar study by Filho et al. (2023); Ha et al. (2023); and Zeeshan et al. (2021), females are relatively aware of and have a better understanding of climate change than males, which is in contrast to the findings of the present study.

#### 4. Conclusion

The overall findings indicated a clear need to significantly boost Filipino college students' awareness of the implications of climate change, with a focus on the sectors of agriculture, coastal resources, forestry, and infrastructures, while the participants' awareness was limited with regard to the impacts on health and water resources. As a result, the vast majority of participating Filipino college students demonstrated that there are knowledge gaps regarding how adversely climate change has affected these sectors. The implications of the investigation indicated that educators should put the discovered gaps in perspectives in a way that is far less complicated to understand, ensuring that college students are provided with the foundation for an in-depth understanding of the impacts of climate change in the modern world. By contextualizing how these sectors have been impacted and how these have resulted in negative consequences for agriculture, coastal resources, forestry, and infrastructure, especially for human beings and other living things as well, educators may utilize these findings to strategically align their teaching approach to the most essential competencies that college students should acquire. In this way, college students could have comprehensive knowledge and awareness of the impacts of climate change and be advocates for climate action.

In addition, the study discovered a significant difference between the assessments of the Filipino youth college participants in terms of age and year level in college. The implications of the study could serve as the basis on which educators could utilize the findings to classify groups of college students according to their age level and present teaching approaches for each group in accordance with their developmental stage. Similar to this, educators could enhance their pedagogical approaches based on year level as college students progress through each phase of their academic years of study. Therefore, the context of the findings must be taken into account when creating a teaching enhancement approach that can be incorporated into general education courses in higher education institutions and that would raise the level of awareness of Filipino youth college students in order to promote and support climate action.

##### 4.1 Recommendations

This study indicated the necessity for climate change to be emphasized in education in preparation for students around the globe to take action against it. It is crucial to note that educators may be accountable for explaining any misconceptions surrounding climate change, but they cannot be entirely viewed as such. This complicated topic demands collaboration between numerous institutions, organizations, researchers, and other non-school parties interested in revisiting and altering instruction relevant to climate change. As a global urgent and value-related concern, climate change topics in education must be developed as part of teaching education. It should be extensively negotiated in policy, in which educational leaders play an essential role.

It is of the utmost importance for the environmental curriculum planner and educational leaders to revisit the environmental education curriculum to promote hands-on learning and participation in environmental advocacy. This can be accomplished by integrating environmental concepts into contemporary issues and providing hands-on experiences. It is critical to make this education available to students regardless of their educational background, area of specialization, or geographic location.

The difference in awareness could be associated with exposure to climate risks. To overcome this study's limitations, it is recommended that further studies include different regions of the Philippines. Another limitation of this study is that, since it was conducted during COVID-19, there was no social contact, and only those who do have access to the internet were able to participate.

#### 5. References

- Ahsan, M. N., & Warner, J. (2014). The socioeconomic vulnerability index: A pragmatic approach for assessing climate change led risks-A case study in the south-western coastal Bangladesh. *International Journal of Disaster Risk Reduction*, 8, 32–49. <https://doi.org/10.1016/j.ijdr.2013.12.009>



- Akhan, N. E., Çiçek, S., & Kocaağa, G. (2022). Critical and creative perspectives of gifted students on global problems: Global climate change. *Thinking Skills and Creativity*, 46. <https://doi.org/10.1016/j.tsc.2022.101131>
- Ali, S., Ying, L., Nazir, A., Abdullah, Ishaq, M., Shah, T., Ye, X., Ilyas, A., & Tariq, A. (2021). Rural farmers perception and coping strategies towards climate change and their determinants: Evidence from Khyber Pakhtunkhwa province, Pakistan. *Journal of Cleaner Production*, 291. <https://doi.org/10.1016/j.jclepro.2020.125250>
- Anthony, J., Domantay, A., Froilan, C., Leochico, D., Aurea, P., Salvador, G. S., Moila, V., Raymond, P., Capistrano, V. E., Miguel, G., Christopher, L., Myles, D., Rosario, D., Austin, J., Pagalanan, J., Palaylay, A., Jovanni, F., & Philip, C. (2021). Knowledge and attitudes of future physicians in the Cordillera region of the Philippines towards climate change: A pre-pandemic cross-sectional study. *The Journal of Climate Change and Health Knowledge*, 4. <https://doi.org/10.1016/j.joclim.2021.100063>
- Asante, F., Guodaar, L., & Arimiyaw, S. (2021). Climate change and variability awareness and livelihood adaptive strategies among smallholder farmers in semi-arid northern Ghana. *Environmental Development*, 39. <https://doi.org/10.1016/j.envdev.2021.100629>
- Ballew, M. T., Pearson, A. R., Goldberg, M. H., Rosenthal, S. A., & Leiserowitz, A. (2020). Does socioeconomic status moderate the political divide on climate change? The roles of education, income, and individualism. *Global Environmental Change*, 60. <https://doi.org/10.1016/j.gloenvcha.2019.102024>
- Bandura, A., & National Inst of Mental Health. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall, Inc.
- Black, L., Li, K., & Shendell, D. G. (2022). Expanding awareness of climate change, sustainability, and environmental health through an introductory short online course for high school students. *Explore*, 18(3), 381–383. <https://doi.org/10.1016/j.explore.2022.03.006>
- Bollettino, V., Alcayna-Stevens, T., Sharma, M., Dy, P., Pham, P., & Vinck, P. (2020a). Public perception of climate change and disaster preparedness: Evidence from the Philippines. *Climate Risk Management*, 30. <https://doi.org/10.1016/j.crm.2020.100250>
- Bollettino, V., Alcayna-Stevens, T., Sharma, M., Dy, P., Pham, P., & Vinck, P. (2020b). Public perception of climate change and disaster preparedness: Evidence from the Philippines. *Climate Risk Management*, 30. <https://doi.org/10.1016/j.crm.2020.100250>
- Brennan, M. E., & Madden, D. L. (2023). The evolving call to action for including climate change and environmental sustainability themes in health professional education: A scoping review. *The Journal of Climate Change and Health*, 9. <https://doi.org/10.1016/j.joclim.2022.100200>
- Calculi, C., D'Uggento, A. M., Labarile, A., & Ribecco, N. (2021). Evaluating people's awareness about climate changes and environmental issues: A case study. *Journal of Cleaner Production*, 324. <https://doi.org/10.1016/j.jclepro.2021.129244>
- Chowdhury, M. A., Hasan, M. K., Hasan, M. R., & Younos, T. B. (2020). Climate change impacts and adaptations on health of internally displaced people (IDP): An exploratory study on coastal areas of Bangladesh. *Heliyon*, 6(9). <https://doi.org/10.1016/j.heliyon.2020.e05018>
- Combest-Friedman, C., Christie, P., & Miles, E. (2012). Household perceptions of coastal hazards and climate change in the central Philippines. *Journal of Environmental Management*, 112, 137–148. <https://doi.org/10.1016/j.jenvman.2012.06.018>
- Crost, B., Duquenois, C., Felter, J. H., & Rees, D. I. (2018). Climate change, agricultural production and civil conflict: Evidence from the Philippines. *Journal of Environmental Economics and Management*, 88, 379–395. <https://doi.org/10.1016/j.jeem.2018.01.005>
- Domantay, J. A. A., Leochico, C. F. D., Salvador, P. A. G. S., Ciriaco, V. M., Abad, P. R., Capistrano, V. E., Cruz, G. M., Darang, L. C., Del Rosario, D. M., Gadgad, J. A., Pagalanan, J., Palaylay, A., Perez, F. J., & Torres, C. P. (2021). Knowledge and attitudes of future physicians in the Cordillera region of the Philippines towards climate change: A pre-pandemic cross-sectional study. *The Journal of Climate Change and Health*, 4. <https://doi.org/10.1016/j.joclim.2021.100063>
- Filho, W. L., Yayah Ayal, D., Wall, T., Shiel, C., Paco, A., Pace, P., Mifsud, M., Lange Salvia, A., Skouloudis, A.,

- Moggi, S., LeVasseur, T., Vinuesa Antonio, G., Azeiteiro, U. M., Ioannis, N., & Kovaleva, M. (2023). An assessment of attitudes and perceptions of international university students on climate change. *Climate Risk Management*, 39. <https://doi.org/10.1016/j.crm.2023.100486>
- Graziano, K., Pollnac, R., & Christie, P. (2018). Wading past assumptions: Gender dimensions of climate change adaptation in coastal communities of the Philippines. *Ocean and Coastal Management*, 162, 24–33. <https://doi.org/10.1016/j.ocecoaman.2018.01.029>
- Ha, J. W., Jeon, E. C., & Park, S. K. (2023). Status of environmental awareness and participation in Seoul, Korea and factors that motivate a green lifestyle to mitigate climate change. *Current Research in Environmental Sustainability*, 5. <https://doi.org/10.1016/j.crsust.2023.100211>
- Haugestad, C. A. P., Skauge, A. D., Kunst, J. R., & Power, S. A. (2021). Why do youth participate in climate activism? A mixed-methods investigation of the #FridaysForFuture climate protests. *Journal of Environmental Psychology*, 76. <https://doi.org/10.1016/j.jenvp.2021.101647>
- Hess, D. J., & Maki, A. (2019). Climate change belief, sustainability education, and political values: Assessing the need for higher-education curriculum reform. *Journal of Cleaner Production*, 228, 1157–1166. <https://doi.org/10.1016/j.jclepro.2019.04.291>
- Hundera, H., Mpandeli, S., & Bantider, A. (2019). Smallholder farmers' awareness and perceptions of climate change in Adama district, central rift valley of Ethiopia. *Weather and Climate Extremes*, 26. <https://doi.org/10.1016/j.wace.2019.100230>
- Iturriza, M., Labaka, L., Hernantes, J., & Abdeltawad, A. (2020b). Shifting to climate change aware cities to facilitate the city resilience implementation. *Cities*, 101. <https://doi.org/10.1016/j.cities.2020.102688>
- Iturriza, M., Labaka, L., Ormazabal, M., & Borges, M. (2020a). Awareness-development in the context of climate change resilience. *Urban Climate*, 32. <https://doi.org/10.1016/j.uclim.2020.100613>
- Jürkenbeck, K., Spiller, A., & Schulze, M. (2021). Climate change awareness of the young generation and its impact on their diet. *Cleaner and Responsible Consumption*, 3. <https://doi.org/10.1016/j.clrc.2021.100041>
- Lagbas, A. J., & Di. Habito, C. (2016). Ecosystem services of coastal and fisheries resources: Perspectives of high school students in Municipality of Panukulan, Polillo Island, Quezon, Philippines. *Journal of Marine and Island Cultures*, 5(2), 145–158. <https://doi.org/10.1016/j.imic.2016.09.005>
- Liu, Y., & Chen, J. (2021). Future global socioeconomic risk to droughts based on estimates of hazard, exposure, and vulnerability in a changing climate. *Science of the Total Environment*, 751. <https://doi.org/10.1016/j.scitotenv.2020.142159>
- Mercado, R. M. (2016). People's risk perceptions and responses to climate change and natural disasters in BASECO compound, Manila, Philippines. *Procedia Environmental Sciences*, 34, 490–505. <https://doi.org/10.1016/j.proenv.2016.04.043>
- Milovanovic, J., Shealy, T., & Godwin, A. (2022). Senior engineering students in the USA carry misconceptions about climate change: Implications for engineering education. *Journal of Cleaner Production*, 345. <https://doi.org/10.1016/j.jclepro.2022.131129>
- Molthan-Hill, P., Worsfold, N., Nagy, G. J., Leal Filho, W., & Mifsud, M. (2019). Climate change education for universities: A conceptual framework from an international study. *Journal of Cleaner Production*, 226, 1092–1101. <https://doi.org/10.1016/j.jclepro.2019.04.053>
- Nyang'au, J. O., Mohamed, J. H., Mango, N., Makate, C., & Wangeci, A. N. (2021). Smallholder farmers' perception of climate change and adoption of climate smart agriculture practices in Masaba South Sub-county, Kisii, Kenya. *Heliyon*, 7(4). <https://doi.org/10.1016/j.heliyon.2021.e06789>
- Oliver, M. C., & Adkins, M. J. (2020). “Hot-headed” students? Scientific literacy, perceptions and awareness of climate change in 15-year olds across 54 countries. *Energy Research and Social Science*, 70. <https://doi.org/10.1016/j.erss.2020.101641>
- Ouariachi, T., Olvera-Lobo, M. D., & Gutiérrez-Pérez, J. (2017). Gaming climate change: Assessing online climate change games targeting youth produced in Spanish. *Procedia - Social and Behavioral Sciences*, 237, 1053–1060. <https://doi.org/10.1016/j.sbspro.2017.02.154>
- Pachauri, R. K., Allen, M. R., Barros, V. R., Broome, J., Cramer, W., & Christ, R. (2014). Climate change 2014:

- Synthesis report. *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 151.  
[https://www.ipcc.ch/site/assets/uploads/2018/05/SYR\\_AR5\\_FINAL\\_full\\_wcover.pdf](https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf)
- Paul, A., Deka, J., Gujre, N., Rangan, L., & Mitra, S. (2019). Does nature of livelihood regulate the urban community's vulnerability to climate change? Guwahati city, a case study from north east India. *Journal of Environmental Management*, 251. <https://doi.org/10.1016/j.jenvman.2019.109591>
- Qazlbash, S. K., Zubair, M., Manzoor, S. A., Haq, A., & Baloch, M. S. (2021). Socioeconomic determinants of climate change adaptations in the flood-prone rural community of Indus Basin, Pakistan. *Environmental Development*, 37, 1–10. <https://doi.org/10.1016/j.envdev.2020.100603>
- Reismann, L., Weber, A., Leitzmann, M., & Jochem, C. (2021). Climate-specific health literacy and medical advice: The potential for health co-benefits and climate change mitigation. An exploratory study. *The Journal of Climate Change and Health*, 4. <https://doi.org/10.1016/j.joelim.2021.100072>
- Senevirathne, M., Amaratunga, D., Haigh, R., Kumer, D., & Kaklauskas, A. (2022). A common framework for MOOC curricular development in climate change education - Findings and adaptations under the BECK project for higher education institutions in Europe and Asia. *Progress in Disaster Science*, 14. <https://doi.org/10.1016/j.pdisas.2022.100222>
- Sjöblom, P., Wolff, L. A., Vuorenpää, S., & Grahn, R. (2022). Primary school students and climate change—an interview study in Finland and Tanzania. *Journal of Cleaner Production*, 380. <https://doi.org/10.1016/j.jclepro.2022.135099>
- Tran, B. X., Nguyen, T. H., Phung, D. T., Nguyen, L. H., Pham, H. Q., Vu, G. T., Le, H. T., Latkin, C. A., Ho, C. S. H., & Ho, R. C. M. (2021). Gaps in awareness of climate variability and its impacts on society among health professionals and community workers in Vietnam: Implications for COVID-19 and other epidemic response systems. *International Journal of Disaster Risk Reduction*, 59. <https://doi.org/10.1016/j.ijdrr.2021.102212>
- Tsagkaris, C., Moysidis, D. V., Papazoglou, A. S., Louka, A. M., Kalaitzidis, K., Ahmad, S., & Essar, M. Y. (2021). Detection of SARS-CoV-2 in wastewater raises public awareness of the effects of climate change on human health: The experience from Thessaloniki, Greece. *The Journal of Climate Change and Health*, 2. <https://doi.org/10.1016/j.joelim.2021.100018>
- Valenzuela, V. P. B., Esteban, M., Takagi, H., Thao, N. D., & Onuki, M. (2020). Disaster awareness in three low risk coastal communities in Puerto Princesa City, Palawan, Philippines. *International Journal of Disaster Risk Reduction*, 46. <https://doi.org/10.1016/j.ijdrr.2020.101508>
- Zeeshan, M., Sha, L., Tomlinson, K. W., & Azeez, P. A. (2021). Factors shaping students' perception of climate change in the western Himalayas, Jammu & Kashmir, India. *Current Research in Environmental Sustainability*, 3. <https://doi.org/10.1016/j.crsust.2021.100035>

