EXPANDING STUDENT ENGAGEMENT IN SDG 13 'CLIMATE ACTION'

C. Lull, J.V. Llinares, M.D. Soriano

Universitat Politècnica de València (SPAIN)

Abstract

In September 2019, the UN Secretary-General called on all sectors of society to mobilize for a Decade of Action. The Decade of Action calls for accelerating sustainable solutions to all the world's biggest challenges by 2030. At the heart of Agenda 2030 for Sustainable Development are 17 Sustainable Development Goals (SDGs). SDGs aim to end poverty, protect the planet, and ensure peace and prosperity for all by 2030. The SDG 13 "Take urgent action to combat climate change and its impacts" has the target 13.3 "Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning". Nowadays, many universities are engaged in achieving SDGs. It is crucial that climate change is included as part of universities' teaching, and also the development of SDG 13 awareness activities for students. The objective of this study is to demonstrate the activity performed as part of a course in Meteorology that intends to increase students' awareness of the climate change problem. This action took place with students of the Bachelor's Degree in Environmental Sciences at the Universitat Politècnica de València (Spain). The prepared activity was entitled: Students committed to climate change. Its learning outcomes were to describe what happens to the temperature and CO_2 concerning climate change; explain how global warming is dominated by past and future CO_2 emissions; argue the importance of acting against global warming and cutting greenhouse gas emissions; and to enlighten students about the impact that our daily habits have on the environment. Performing this activity consisted in finding out about SDG 13 and the European CO2MVS initiative to accurately measure the amount of anthropogenic CO_2 emissions, and completing a questionnaire. The results obtained from the questionnaire show that 84% of university students are aware that climate change is happening now and it is caused mainly by human activities. Many students agreed with the following affirmations: a university must have a climate change policy (96%); a university must contribute in its operation to achieve the adaptation strategies to climate change set by the government (92%); a university must educate its students about the causes (100%) and impacts (100%) of climate change; a university should encourage its students to seek solutions to climate change problems (100%). A high percentage of the students (80%) confirmed that they adopt the necessary initiatives to reduce CO_2 as much as possible in their everyday lives. Twenty-four percent of them stated that they could not explain to other students the origin of CO_2 in the atmosphere, and 36% of the students did not have enough arguments to explain why adopting a wide range of technological measures and behavioral changes could limit the rise in the global average temperature to 2°C above pre-industrial levels. Finally, the students answered various open questions about how to reduce atmospheric CO_2 levels, individual actions to reduce the carbon footprint, social problems that climate change entails, and how citizens can be made aware of the importance of reducing CO_2. These results show the need to improve climate change knowledge in education.

Keywords: SDG, SDG 13, climate change, climate change education, education for sustainability, Higher Education, University.

1 INTRODUCTION

Climate change is a severe global threat [1] that affects lives and livelihoods, especially for the most vulnerable. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing climate change-related science. The Report of Working Group III, which is a contribution to the Sixth Assessment Report of the IPCC, mentions that the total net anthropogenic greenhouse (GHG) emissions have continued to rise during the 2010–2019 period, but the growth rate has slowed down [2]. The report of Working Group II mentions that "Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability" [3]. This report states quite confidently that climate change has caused major damages and irreversible losses in terrestrial, freshwater, coastal and open ocean marine ecosystems, and it will increasingly place pressure on food production and access, especially in vulnerable regions [3]. In addition, it also confidently states that climate change

affects people's physical health globally. However, this report mentions that some development and adaptation efforts have reduced vulnerability to climate change.

In 2015, the UN adopted 17 Sustainable Development Goals (SDGs) that are intended to be met by 2030 [4]. SDGs are the core of 2030 Agenda, which is a global action plan to seek sustainability in all countries. SDGs target all countries and individuals, and meet the social, environmental and economic challenges that our world face. They are a universal call to action to improve people's lives, to protect our planet, and to ensure that all people enjoy peace and prosperity (Figure 1).

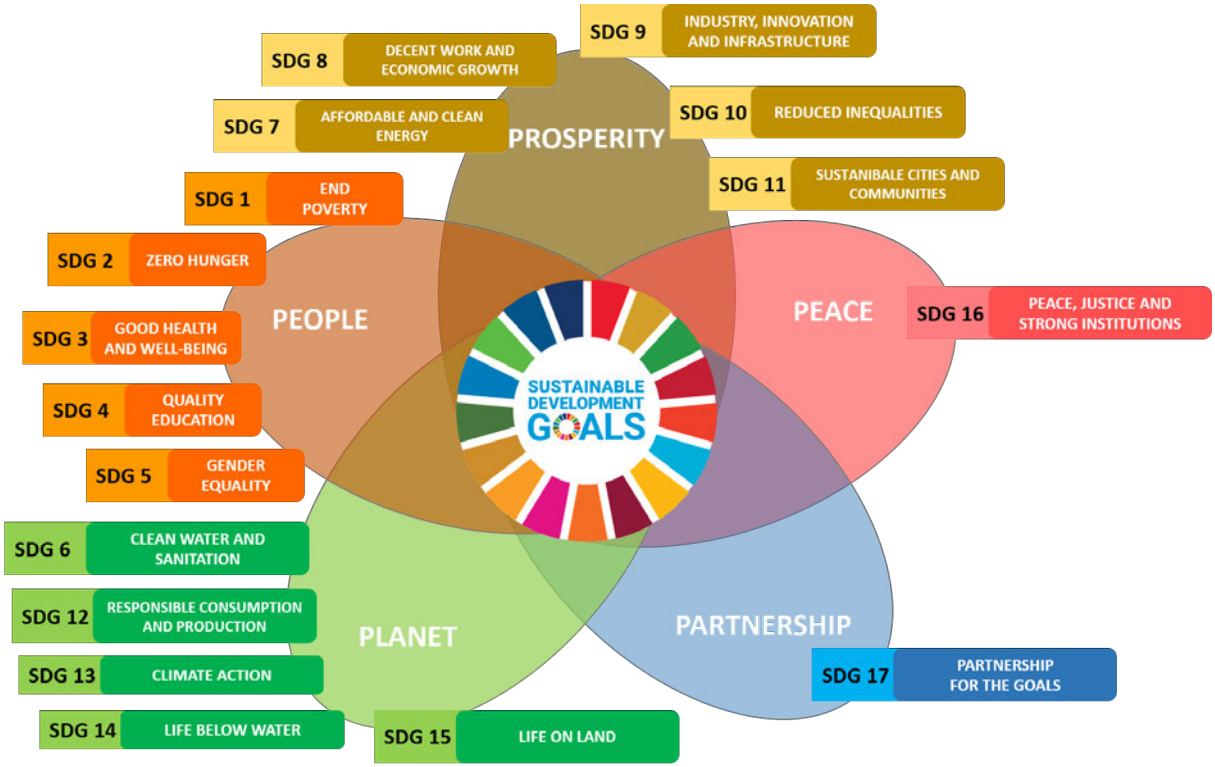

Figure 1. UN Sustainable Development Goals grouped in the 5 Ps.

The goal of SDG 13 (Climate Action) is to take urgent action to combat climate change and its impacts. In Spain, the Climate Change and Energy Transition Act was approved on May 13, 2021 [5]. Article 35.1 states that the Spanish education system will promote the involvement of Spanish society in response to climate change by reinforcing knowledge about climate change and its implications, with training for low-carbon and resilient technical and professional activity in the face of climate change, and by acquiring the necessary personal and social responsibility. Article 35.2 states that the Government will encourage universities to review how climate change is treated in the curricula that lead to official university degrees being passed. It is consistent with the competencies inherent to them, and ins the training of university teachers in this area.

Universities have the responsibility to contribute to develop innovative technologies for mitigation and adaptation to climate change as a result of their research and scientific activity. As part of Impact Rankings, Times Higher Education (THE) has obtained a ranking by considering how universities contribute to climate action. According to the THE methodology for SDG 13, this ranking explores universities' climate change research, their use of energy (e.g. low-carbon energy use), the presence of a university-wide climate action plan, their work with local or national governments to address climate change planning, and their preparations to deal with climate change consequences [6].

Climate change must be addressed in more depth in university classrooms by offering students the necessary expertise to mitigate it and be able to adapt to it. In 2017, the UN's Educational, Scientific and Cultural Organization (UNESCO) published the document "Education for Sustainable Development Goals. Learning Objectives" that provides guidance and suggestions for educators. These suggestions include the learning objectives that cover learning outcomes (including knowledge, skills, attitudes and behavior) to support each SDG being met [7]. For each SDG, the document establishes cognitive, socio-emotional and behavioral learning objectives, suggests topics to work with students, and provides

examples of learning approaches and methods. For SDG 13, the document suggests the learning objectives collected in Table 1.

Table 1. Learning objectives for SDG 13. Modified from UNESCO [7].

Cognitive learning objectives	To describe the current climate change as an anthropogenic phenomenon resulting from increased GHG emissions. To identify human activities that contribute to climate change. To enumerate the main ecological, social, cultural and economic consequences of climate change To explain prevention, mitigation and adaptation strategies to combat climate change.
Socio-emotional learning objectives	To explain the environmental, social, economic and ethical impacts of climate change. To illustrate and encourage others to protect the climate.
Behavioral learning objectives	To evaluate whether their private activities are climate-friendly and, if not, to revise them. To argue what personal acts can be made in favor of the people threatened by climate change.

The aim of the learning activity presented in this communication is to educate meteorological students and empower them to gain a better understanding of climate change processes, and their impacts on the natural environment and human societies, as well as possible strategies for climate change mitigation and adaptation.

2 METHODOLOGY

The experiment was carried out with the students enrolled for the Abiotic Environment in subject the second year of their Bachelor's Degree in Environmental Sciences at the Universitat Politècnica de València (UPV; Spain) for academic year 2021-2022. Forty-seven students had enrolled for this subject. Soil sciences, Meteorology and Hydrology are taught for this subject. The teaching innovation described in this work was carried out in Meteorology classes. The activity prepared by lecturers was entitled: Students committed to climate change. The performed activity consisted in first reading the learning outcomes of the activity. Then the students read information about SDG 13 and the UN Climate Change Conference (COP26). Next they read the article "CO2MVS, a European initiative to accurately measure the amount of CO_2" written in Spanish by science journalist Jeremy Wilks at es.euronews.com [8]. The next step was to complete a questionnaire. The questionnaire had 14 multiple-choice questions (questions 1-14) and one in the 'Yes/No' format (question 15). Finally, they answered three open questions.

3 RESULTS

The questionnaire was answered by 53.19% of the Meteorology students. The questions and the questionnaire answers are presented in Table 2.

The vast majority of the students (84%) stated that "Climate change is happening now, mainly caused by human activities" (Question 1). However, 8% of them answered that they do not know if climate change is happening now or not. Foncubierta-Rodríguez et al. [9] carried out a study in relation to the generational portrait of Spanish society in the face of climate change. Their sample included 1958 valid surveys. One of the questions asked: "Do you think the world's climate is changing?". They found that young people were generally more aware of climate change.

In our study, a high percentage (80.0%) of our students agreed with the statement: "the consequences of climate change will be very serious" (Question 2). According to the results of the Eurobarometer/ climate change (June 2021), 93% of the surveyed people consider that climate change is a serious problem with 78% believing it to be very serious [10]. Over 81% of people in Spain think that climate change is a very serious problem [11]. Considering the previous answer, it is surprising that only 48% strongly agreed with the idea that a university must have a climate change policy or a climate action plan (Question 3). For example, Harvard University has a climate action plan. Of the goals in this plan we find fossil fuel-neutral by 2026 and fossil fuel-free by 2050. According to President Drew Faust's statement "Harvard must remain vigorous in supporting students, faculty, and staff who are championing ideas, expertise, and action related to climate change" and "we had achieved our goal of reducing the University's greenhouse gas emissions 30 percent from 2006 levels, inclusive of growth" [12].

Many students (92%) agreed that a university's operation must contribute to achieve the adaptation strategies to climate change set by the government (Question 4). The report "SDGs in Spanish Universities Report results: a UPV proposal to measure their degree of compliance" [13], prepared by the UPV Center for Development Cooperation, collects some information about what is done at the UPV. Initiatives are promoted, such as actions, related campaigns, projects or programs, about the fight against climate change and its effects (environmental, social, political, etc.) The UPV offers academic/training in the environment and/or mitigation of climate change effects; for example, natural disaster-preparedness, or mainstreams these issues into all or some of its degrees, masters and doctoral programs. At the UPV, some R&D&i and transfer programs focus on combat climate change and mitigate its effects. In its regulatory or institutional documents, the UPV includes objectives related to the fight against climate change. The UPV participates locally, nationally, regionally or internationally in the debate and/or preparation of institutional policies that focus on combating climate change and mitigating its consequences. The UPV collaborates with its local environment by means of activities or programs that intend to reverse the climate change process or to enhance communities' resilience to its harmful effects. The UPV participates in alliances with other universities, in the private sector, civil society organizations, NGOs, etc., whose goals include fighting against climate change and mitigating its impact. The UPV is adhered to a global initiative for a Zero-Carbon World together with many Universities and Colleges, and has assumed the proposed objectives by being committed to be carbon-neutral by 2050.

Eighty per cent of the students strongly agreed with all this, while 20% agreed with the assertion which suggests that a university must educate its students in the causes and impacts of climate change (Questions 5 and 6). Sixty per cent of the students strongly agreed with this, whereas 40% agreed with the assertion about a university encouraging its students to seek solutions to climate change-related problems (Question 7). We expected 100% of the students to answer that they strongly agreed because they were studying at a technical university.

When the students were asked if they were taking the necessary initiatives to reduce their carbon footprint as much as possible in their day-to-day lives, 52% agreed and 28% strongly agreed (Question 8). This is surprising considering that young people are generally more concerned about SDG 13. There is still much to do as 4% indicate that they are not doing their best to reduce their carbon footprint and 18% answered that they do not know if their initiative can reduce their carbon footprint.

In relation to Questions 9 and 10, students should receive more information about climate change figures if we consider that 48% of them knew that levels of both CO_2 and other greenhouse gases had risen to record levels in 2019. The previous year, the result was 79.4% [14], and 44% knew that CO_2 levels were 18% higher between 2015 and 2019 than in the previous 5 years.

Many students (96%) knew that climate change is affecting every country and can have very negative effects on people's lives and the economy (Question 11).

Of all the students, 64% mentioned that they have sufficient arguments to reason the adoption of technological measures and behavioral changes to limit the rise in the global average temperature to 2ºC above pre-industrial levels (Question 12). The result was almost the same the previous year [14].

Almost 80% of the students answered that they could explain to other students the origin of CO_2 in the atmosphere (Question 13) and the consequences of increased CO_2 in the atmosphere (Question 14).

Only 46% of the students have read or seen on TV, in the press or on the Internet information about the importance of accurately measuring CO_2 (Question 15).

Table 2. Students' questions and answers in the questionnaire about SDG 13.

1. Which of the following three statements do you personally believe is correct?	a) Climate change is happening now, caused mainly by human activities. (84%) b) Climate change is happening now, but is caused mainly by natural forces. (4%) c) Climate change is not happening now. (4%) d) Do not know / do not answer (8%)

2. The consequences of climate change will be very serious.	a) Strongly disagree b) Disagree c) Don't know d) Agree (20%) e) Strongly agree (80%)
3. A university must have a climate change policy.	a) Strongly disagree b) Disagree c) Don't know (4%) d) Agree (48%) e) Strongly agree (48%)
4. A university's operation must contribute adapt the climate change strategies set by the government.	a) Strongly disagree b) Disagree (4%) c) Don't know (4%) d) Agree (36%) e) Strongly agree (56%)
5. A university must educate its students about the causes of climate change.	a) Strongly disagree b) Disagree c) Don't know d) Agree (20%) e) Strongly agree (80%)
6. A university must educate its students about the impacts of climate change.	a) Strongly disagree b) Disagree c) Don't know d) Agree (20%) e) Strongly agree (80%)
7. A university should encourage its students to seek solutions to the problems caused by climate change.	a) Strongly disagree b) Disagree c) Don't know d) Agree (40%) e) Strongly agree (60%)
8. The carbon footprint represents the total volume of GHG produced by human beings' economic and daily activities. A personal carbon footprint is that caused by a single individual in their daily life when moving, consuming, eating and using resources like energy. The environmental NGO The Nature Conservancy estimates that each inhabitant on our planet generates an average of almost 4 tons of CO_2 per year. In countries like the USA this amount is quadrupled per person per year. I implement the necessary initiatives to reduce it as much as possible in my day-to-day life.	a) Strongly disagree b) Disagree (4%) c) Don't know (16%) d) Agree (52%) e) Strongly agree (28%)
9. Did you know that the levels of CO_2 and other GHG in the atmosphere increased to record levels in 2019?	a) Strongly disagree (4%) b) Disagree (4%) c) Don't know (44%) d) Agree (36%) e) Strongly agree (12%)
10. Did you know that carbon dioxide levels were 18% higher from 2015 to 2019 than in the previous 5 years according to the WHO World Climate Report 2015-2019?	a) Strongly disagree (4%) b) Disagree c) Don't know (52%) d) Agree (40%) e) Strongly agree (4%)

11. Did you know that climate change is affecting every country on every continent, it is disrupting national economies and affects lifes, weather systems are changing, sea levels are rising, and weather events are increasingly more extreme?	a) Strongly disagree b) Disagree c) Don't know (4%) d) Agree (52%) e) Strongly agree (44%)
12. As an Environmental Sciences student, do you think you have sufficient arguments to explain why the adoption of a wide range of technological measures and behavioral changes could limit the rise in the global average temperature to 2ºC above pre-industrial levels?	a) Strongly disagree 4% b) Disagree 4% c) Don't know 28% d) Agree 40% e) Strongly agree 24%
13. Do you think you could explain to other students the origin of CO_2 in the atmosphere?	a) Strongly disagree b) Disagree c) Don't know 24% d) Agree 48% e) Strongly agree 28%
14. Do you think you could explain to other students what the problem is with increasing CO_2?	a) Strongly disagree b) Disagree c) Don't know 20% d) Agree 60% e) Strongly agree 20%
15. Have you read or seen on TV, in the press or on the Internet, information about the importance of accurately measuring CO_2?	Yes (36%) No (64%)

Finally, the students answered three open questions. In the question “How can atmospheric CO_2 be reduced?”, many students gave ideas like Glasgow 2021 commitments, such as the need to reduce fossil fuels for recyclable and more sustainable energies, companies should reduce their emissions, and public transport should be used more than private transport. They also mentioned the need to demand new legislation and more demanding laws to protect the environment, the need to change from a consumerist and affluent society like today’s to a more aware and sustainable society.

The question “What individual steps do you take to reduce your carbon footprint?” obtained the following answers: reducing electricity use, eating less red meat, walking short distance rather than using transport, apply the three Rs, generate less waste and separate waste properly.

In the last open question, the students had to indicate the different social problems that climate change entails. The vast majority mentioned increasing social problems, such as bigger differences in social classes, lack of food, reducing agricultural production due to soil pollution and poorer quality water. Everything will lead to worsen the population’s health, as well as climatic imbalances like torrential rain in places where it never occurred before, droughts, etc.

4 CONCLUSIONS

It is necessary for university students to thoroughly acquire the necessary knowledge to understand climate change and its social, economic, and environmental consequences, and for such knowledge to lead them to make a socio-personal commitment to mitigate and adapt to climate change.

ACKNOWLEDGEMENTS

This work has been sponsored by the Vice-Rectorate for Organization of Studies, Quality and Accreditation of the Universitat Politècnica de València (Valencia, Spain) as part of the UPV’s Educational Innovation and Improvement Projects (Reference PIME 20-21/224) entitled “Moving towards Sustainable Development Goals at the UPV: the poliODS Project”.

REFERENCES

[1] J. Birkmann *et al.*, “Understanding human vulnerability to climate change: A global perspective on index validation for adaptation planning,” *Sci. Total Environ.*, vol. 803, p. 150065, 2022.

[2] IPCC, “Climate change. Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,” 2022.

[3] IPCC, “Climate change. Summary for Policymakers. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,” 2022.

[4] UN General Assembly, “Resolution adopted by the General Assembly on 25 September 2015: 70/1. Transforming our world: The 2030 Agenda for Sustainable Development.” United Nations, 2015.

[5] Official State Gazette, “Spanish Climate Change and Energy Transition Act 7/2021,” 2021.

[6] Thimes Higher Education, “The World University Rankings.” [Online]. Available: https://www.timeshighereducation.com/world-university-rankings/impact-rankings-2022-climate-action-sdg-13-methodology. [Accessed: 19-Apr-2022].

[7] UNESCO, “Education for Sustainable Development Goals. The Global Education 2030 Agenda,” 2017.

[8] J. Wilks, “CO2MVS, una iniciativa europea para medir con precisión la cantidad de CO2,” *Euronews*. [Online]. Available: https://es.euronews.com/green/2021/11/15/co2mvs-una-iniciativa-europea-para-medir-con-precision-la-cantidad-de-co2. [Accessed: 19-Apr-2022].

[9] M. J. Foncubierta-Rodríguez, R. Ravina-Ripoll, and J. A. López-Sánchez, “Generational portrait of spanish society in the face of climate change. A question to consider for the green economy under the well-being approach,” *Energies*, vol. 14, no. 4, 2021.

[10] “Climate Change - julio 2021 - Eurobarometer survey.” [Online]. Available: https://europa.eu/eurobarometer/surveys/detail/2273. [Accessed: 24-Apr-2022].

[11] “Climate Change-Spain-Special Eurobarometer 513. March-April 2021.” [Online]. Available: https://webgate.ec.europa.eu/ebsm/api/public/deliverable/download?doc=true&deliverableId=75878. [Accessed: 24-Apr-2022].

[12] D. Faust, “Harvard’s Climate Change Efforts - Harvard University President,” 2018. [Online]. Available: https://www.harvard.edu/president/news-faust/2018/harvards-climate-change-efforts/. [Accessed: 24-Apr-2022].

[13] Centro de Cooperación al Desarrollo. UPV., “Los ODS en las Universidades españolas: una propuesta de la UPV para medir su grado de cumplimiento,” 2020.

[14] C. Lull, J. V. Llinares, M. D. Soriano, and F. Ramón, “Raising awareness of the SDG 13 climate action at university,” *EDULEARN21 Proc.*, vol. 1, pp. 5152–5161, 2021.