

## **Environmental Literacy and Climate Change Adaptation Practices Among University Students in University of Calabar, Cross River State, Nigeria.**

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### **Abstract**

Climate change remains one of the most significant environmental challenges affecting human societies, requiring individuals and institutions to develop effective adaptation practices. This study examined the relationship between environmental literacy and climate change adaptation practices among university students. The study adopted a correlational research design. The population consisted of 18,750 undergraduate students of the University of Calabar, Cross River State, Nigeria, during the 2025/2026 academic session. A sample of 377 students was selected using a multi-stage sampling technique. Data were collected using a structured questionnaire titled *Environmental Literacy and Climate Change Adaptation Practices Questionnaire (ELCCAPQ)*. The instrument was validated by experts and tested for reliability using Cronbach Alpha coefficient. Mean and standard deviation were used to answer the research questions, while Pearson Product Moment Correlation and multiple regression analysis were used to test the hypotheses at a 0.05 level of significance. The findings revealed that environmental knowledge, environmental attitudes, and environmental skills had significant relationships with climate change adaptation practices among university students. The study also found that environmental literacy significantly predicted students' climate change adaptation practices. The study concluded that environmental literacy is an important factor in promoting sustainable behaviours and improving students' capacity to respond to climate change challenges. It was recommended that universities should strengthen environmental education programmes, provide practical opportunities for students to engage in sustainability activities, and develop supportive institutional policies that encourage climate change adaptation practices.

**Keywords:** Environmental literacy, climate change, adaptation practices, university students, environmental education, sustainability.

### **Introduction**

Climate change has emerged as one of the most significant environmental challenges confronting humanity in the twenty-first century. Increasing floods, droughts, heatwaves, sea-level rise, biodiversity loss, desertification, and ecosystem degradation threaten environmental sustainability

and human well-being globally. Pörtner et al. (2022) reported that climate change is already affecting terrestrial, freshwater, and marine ecosystems, with implications for biodiversity, food security, water availability, and public health. Romanello et al. (2023) similarly noted that the growing impacts of climate change pose serious challenges to sustainable development, particularly in developing countries with limited adaptive capacity. Consequently, climate change adaptation has become increasingly important. While mitigation focuses on reducing greenhouse gas emissions, adaptation involves adjustments in human, ecological, and institutional systems to reduce vulnerability and strengthen resilience. Developing countries are particularly vulnerable to climate change because of their geographical exposure, limited economic resources, and dependence on climate-sensitive sectors. Individuals and communities exposed to climate-related hazards may experience greater difficulties in coping with their effects where adaptive capacity is limited (Sam & Neji, 2014). Adaptation practices include water conservation, sustainable waste management, afforestation, ecosystem restoration, disaster preparedness, renewable energy use, and sustainable consumption (Smit & Wandel, 2006; Pörtner et al., 2022).

Education is increasingly recognized as an important strategy for strengthening climate resilience and adaptive capacity. Higher education institutions have significant potential to develop sustainability competencies through teaching, research, innovation, and community engagement (Leal Filho et al., 2019). Giangrande et al. (2019) similarly emphasized the strategic role of universities in preparing future professionals, policymakers, scientists, and community leaders to address sustainability challenges. This position is consistent with the Sustainable Development Goals, particularly SDG 4 on quality education and SDG 13 on climate action, which recognize education as an important pathway to sustainable development and climate resilience (United Nations, 2015). Environmental education has therefore evolved beyond environmental awareness to developing the knowledge, attitudes, skills, values, and behaviours required for responsible environmental action. Ardoin et al. (2020) and Monroe et al. (2019) emphasized that effective environmental education should promote critical thinking, problem-solving, and active participation in addressing environmental challenges.

A major outcome of environmental education is environmental literacy, which refers to the capacity to understand environmental systems and apply environmental knowledge and competencies to responsible action. Roth (1992) described an environmentally literate individual as one capable of making informed environmental decisions and acting responsibly toward environmental conservation. Hollweg et al. (2018) further conceptualized environmental literacy as involving environmental knowledge, cognitive skills, attitudes, dispositions, and responsible behaviour, while McBride et al. (2019) emphasized the ability to critically evaluate environmental information, participate in environmental decision-making, and adopt sustainable lifestyles. Empirical evidence indicates that environmental literacy is associated with environmentally responsible behaviour. Otto and Pensini (2017) found that environmental knowledge and connectedness to nature are related to ecological behaviour, while Ardoin et al. (2020) reported that environmental education can strengthen conservation-oriented behaviours. Leal Filho et al. (2022) also observed that environmental competencies can enhance students' capacity to understand climate risks and engage in sustainability initiatives.

Despite the growing recognition of environmental literacy as a foundation for responsible environmental behaviour, there remains a need to examine its relationship with climate change

adaptation practices among university students. University students constitute an important population because they are future professionals, decision-makers, and community leaders whose knowledge, attitudes, and skills may influence environmental sustainability beyond the university environment. Understanding whether environmental knowledge, attitudes, and skills are associated with students' climate change adaptation practices is therefore important for strengthening environmental education and institutional sustainability initiatives. It is against this background that this study examined the relationship between environmental literacy and climate change adaptation practices among university students in the University of Calabar, Cross River State, Nigeria.

### **Concept of Environmental Literacy**

Environmental literacy has become an important concept in environmental education because it equips individuals with the knowledge, skills, attitudes, values, and competencies needed to understand environmental issues and participate in environmental conservation. The concept emerged alongside modern environmental education in the 1960s and 1970s and became more clearly articulated following the Tbilisi Declaration of 1977, which identified environmental knowledge, awareness, attitudes, skills, participation, and responsible action as major objectives of environmental education (UNESCO-UNEP, 1977). Roth (1992) described an environmentally literate individual as one who possesses the knowledge, skills, attitudes, and motivation required to make informed environmental decisions and take responsible actions. Building on this perspective, Hollweg et al. (2018) defined environmental literacy as the capacity to understand environmental systems, critically analyse environmental issues, evaluate solutions, communicate environmental concerns, and participate responsibly in environmental decision-making. Similarly, McBride et al. (2019) emphasized the ability to interpret environmental information and make decisions that contribute to sustainability, while Ardoin et al. (2020) viewed environmental literacy as a lifelong process that develops competencies for sustainable living and environmental stewardship.

Environmental literacy consists of interconnected dimensions, including environmental knowledge, attitudes and values, environmental skills, and environmentally responsible behaviour. Environmental knowledge provides the scientific foundation for understanding ecological processes, climate change, biodiversity, pollution, and environmental sustainability (Monroe et al., 2019). Environmental attitudes and values influence individuals' commitment to environmental protection and willingness to adopt sustainable practices (Otto & Pensini, 2017; Ardoin et al., 2020). Environmental skills include critical thinking, problem-solving, investigation, communication, and decision-making competencies that enable individuals to translate knowledge into practical environmental action (Hollweg et al., 2018). Responsible environmental behaviour represents the practical expression of environmental literacy through activities such as waste reduction, recycling, energy and water conservation, biodiversity protection, tree planting, sustainable consumption, and participation in environmental programmes (McBride et al., 2019). Thus, environmental literacy extends beyond awareness or knowledge to include the competencies and behaviours required for effective environmental management.

Environmental literacy is particularly important among university students because they are future professionals, decision-makers, and community leaders whose knowledge and competencies can

influence sustainable development. Leal Filho et al. (2022) argued that universities have a significant responsibility to strengthen environmental literacy through teaching, research, innovation, and community engagement, while Giangrande et al. (2019) emphasized the contribution of higher education to sustainability competencies. Empirical evidence indicates that environmentally literate individuals are more likely to demonstrate responsible environmental behaviour, including conservation, recycling, energy efficiency, and participation in sustainability initiatives (Ardoin et al., 2020; Otto & Pensini, 2017). Environmental education is also important in promoting sustainable environmental practices because it provides opportunities to enlighten and sensitize individuals about their immediate environment. When environmental education is adapted to people's social, cultural, and educational contexts, it can encourage greater appreciation of the environment and promote its sustainable use (Sam et al., 2014). Within the context of climate change, environmental literacy can enhance individuals' ability to understand climate risks, evaluate adaptation options, and adopt appropriate responses (Leal Filho et al., 2022; Pörtner et al., 2022). However, Ezeudu and Ezeudu (2019) reported that although university students may demonstrate environmental awareness, many do not consistently translate knowledge into practical environmental actions. This gap provides a basis for examining environmental literacy, particularly environmental knowledge, attitudes, and skills, in relation to climate change adaptation practices among university students in Cross River State.

### **Climate Change Adaptation Practices**

Climate change adaptation refers to the actions, adjustments, and strategies adopted by individuals, communities, institutions, and governments to reduce vulnerability and manage the effects of climate change. The Intergovernmental Panel on Climate Change (IPCC, 2022) defines adaptation as adjustments in human and natural systems in response to actual or expected climatic changes and their effects. Unlike mitigation, which addresses the causes of climate change by reducing greenhouse gas emissions, adaptation focuses on managing its impacts, including flooding, drought, rising temperatures, changing rainfall patterns, and extreme weather events. Smit and Wandel (2006) noted that adaptation involves adjustments in ecological, social, and economic systems to cope with climatic stresses, while Füssel (2007) emphasized that adaptation and mitigation are complementary strategies for reducing climate risks. Adaptation may be anticipatory, reactive, autonomous, or planned, depending on when and how responses are undertaken. Its effectiveness is influenced by factors such as knowledge, available resources, social capacity, institutional support, and the vulnerability of affected populations (Adger et al., 2005).

At the individual and community levels, climate change adaptation involves practices that reduce vulnerability and strengthen resilience. Individual practices include water conservation, energy efficiency, tree planting, recycling, proper waste management, sustainable transportation, and responsible consumption. Community-level measures include early warning systems, environmental sanitation, flood-control measures, forest protection, climate-smart practices, emergency planning, evacuation strategies, and environmental awareness programmes. Berkes (2017) emphasized that local knowledge and community participation are important for effective adaptation because communities possess valuable experience concerning environmental changes and appropriate coping strategies. These practices not only reduce exposure to climate-related risks but also contribute to environmental sustainability and community resilience.

Among university students, climate change adaptation practices are particularly important because students constitute future professionals, decision-makers, and environmental advocates. Universities can promote adaptation through environmental education, sustainability programmes, student-led initiatives, recycling activities, tree planting, energy conservation, waste segregation, and environmental clubs. Although environmental knowledge and awareness can encourage responsible environmental behaviour (Kollmuss & Agyeman, 2002), knowledge alone may not always translate into practice because institutional support, environmental attitudes, availability of facilities, and social influence can affect behaviour. Therefore, strengthening climate change adaptation among university students requires not only environmental knowledge but also positive attitudes, practical environmental skills, supportive institutional environments, and opportunities for active participation in sustainability activities.

### **Research Hypotheses**

1. There is no significant relationship between environmental knowledge and climate change adaptation practices among university students in the University of Calabar, Cross River State.
2. There is no significant relationship between environmental attitudes and climate change adaptation practices among university students in the University of Calabar, Cross River State.
3. There is no significant relationship between environmental skills and climate change adaptation practices among university students in the University of Calabar, Cross River State.
4. Environmental literacy does not significantly predict climate change adaptation practices among university students in the University of Calabar, Cross River State.

### **Methodology**

#### **Research Design**

The study adopted a correlational research design. This design was considered appropriate because it examined the relationship between environmental literacy and climate change adaptation practices among university students. It enabled the researcher to determine whether students' environmental knowledge, attitudes, and skills were related to their adoption of climate change adaptation practices without manipulating the variables. The population of the study consisted of 18,750 undergraduate students of the University of Calabar, Cross River State, Nigeria, during the 2025/2026 academic session. The population comprised students from different faculties and departments across the university. The population figure was obtained from the 2025/2026 undergraduate student enrolment records of the University of Calabar.

Table 1: The distribution of the population is presented below:

| S/N | Faculty                      | Population of Students |
|-----|------------------------------|------------------------|
| 1   | Faculty of Science Education | 2,850                  |

| S/N | Faculty                                 | Population of Students |
|-----|-----------------------------------------|------------------------|
| 2   | Faculty of Science                      | 3,200                  |
| 3   | Faculty of Social Sciences              | 2,900                  |
| 4   | Faculty of Arts and Humanities          | 2,450                  |
| 5   | Faculty of Management Sciences          | 2,700                  |
| 6   | Faculty of Environmental Sciences       | 1,850                  |
| 7   | Faculty of Agriculture and Forestry     | 1,600                  |
| 8   | Faculty of Medicine and Health Sciences | 1,200                  |
|     | <b>Total</b>                            | <b>18,750</b>          |

*Source: University of Calabar, 2025/2026 academic session admission list.*

### **Sample Size and Sampling Procedure**

A sample size of 392 undergraduate students was determined from the population of 18,750 students using Taro Yamane's (1967) formula at a 5% level of precision. The value was rounded to the nearest whole number, giving a final sample size of 392 students.

A multi-stage sampling technique was used to select the respondents. At the first stage, the University of Calabar was selected as the study area. At the second stage, the undergraduate student population was stratified according to the eight faculties represented in the study: Faculty of Science Education, Faculty of Science, Faculty of Social Sciences, Faculty of Arts and Humanities, Faculty of Management Sciences, Faculty of Environmental Sciences, Faculty of Agriculture and Forestry, and Faculty of Medicine and Health Sciences. At the third stage, the sample of 392 students was proportionately allocated to the faculties based on their respective student populations. At the fourth stage, students within the selected faculties were selected using simple random sampling to ensure that eligible undergraduate students had an equal opportunity of being included in the study. This procedure ensured adequate representation of students across the different faculties of the University of Calabar.

The study was conducted in the University of Calabar, Cross River State, Nigeria, which served as the area of study and comprised undergraduate students from various faculties. Data were collected using a structured questionnaire titled Environmental Literacy and Climate Change Adaptation Practices Questionnaire (ELCCAPQ), which was designed to obtain information on environmental knowledge, environmental attitudes, environmental skills, and students' climate change adaptation practices. The instrument was validated by experts in environmental education and measurement and evaluation before administration to the respondents. The data collected were analysed using mean and standard deviation to answer the research questions, while Pearson Product Moment Correlation (PPMC) was used to test the first three hypotheses and multiple regression analysis was used to test the fourth hypothesis at the 0.05 level of significance.

## **TESTING OF RESEARCH HYPOTHESES**

### **Hypothesis One**

There is no significant relationship between environmental knowledge and climate change adaptation practices among university students.

**Table 2: Pearson Product Moment Correlation Analysis of the Relationship between Environmental Knowledge and Climate Change Adaptation Practices**

| Variables                           | N   | Mean | SD   | r-cal | p-value | Decision |
|-------------------------------------|-----|------|------|-------|---------|----------|
| Environmental Knowledge             | 392 | 3.42 | 0.58 | 0.624 | 0.000   | Rejected |
| Climate Change Adaptation Practices | 392 | 3.36 | 0.61 |       |         |          |

#### **Interpretation:**

The result presented in Table 2 showed that the calculated correlation coefficient between environmental knowledge and climate change adaptation practices was 0.624, with a p-value of **0.000**. Since the p-value was less than the 0.05 level of significance, the null hypothesis was rejected. This indicated that there was a significant positive relationship between environmental knowledge and climate change adaptation practices among university students. The positive correlation suggests that higher levels of environmental knowledge were associated with greater engagement in climate change adaptation practices.

#### **Hypothesis Two**

There is no significant relationship between environmental attitudes and climate change adaptation practices among university students.

**Table 3: Pearson Product Moment Correlation Analysis of the Relationship between Environmental Attitudes and Climate Change Adaptation Practices**

| Variables                           | N   | Mean | SD   | r-cal | p-value | Decision |
|-------------------------------------|-----|------|------|-------|---------|----------|
| Environmental Attitudes             | 392 | 3.51 | 0.55 | 0.671 | 0.000   | Rejected |
| Climate Change Adaptation Practices | 392 | 3.36 | 0.61 |       |         |          |

#### **Interpretation:**

The result in Table 3 revealed that the calculated correlation coefficient between environmental attitudes and climate change adaptation practices was **0.671**, with a p-value of **0.000**. Since the p-value was less than the 0.05 level of significance, the null hypothesis was rejected. This indicated that there was a **significant positive relationship** between environmental attitudes and climate change adaptation practices among university students. The finding suggests that students with more positive environmental attitudes tended to demonstrate greater engagement in climate change adaptation practices.

#### **Hypothesis Three**

There is no significant relationship between environmental skills and climate change adaptation practices among university students.

**Table 4: Pearson Product Moment Correlation Analysis of the Relationship between Environmental Skills and Climate Change Adaptation Practices**

| Variables                           | N   | Mean | SD   | r-cal | p-value | Decision |
|-------------------------------------|-----|------|------|-------|---------|----------|
| Environmental Skills                | 392 | 3.39 | 0.60 | 0.589 | 0.000   | Rejected |
| Climate Change Adaptation Practices | 392 | 3.36 | 0.61 |       |         |          |

**Interpretation:**

The analysis presented in Table 4 showed that the calculated correlation coefficient between environmental skills and climate change adaptation practices was **0.589**, with a p-value of **0.000**. Since the p-value was less than the 0.05 level of significance, the null hypothesis was rejected. This indicated that there was a **significant positive relationship** between environmental skills and climate change adaptation practices among university students. The result suggests that students with stronger environmental skills were more likely to engage in appropriate climate change adaptation practices.

**Hypothesis Four**

Environmental literacy does not significantly predict climate change adaptation practices among university students.

**Table 5: Multiple Regression Analysis of Environmental Literacy Dimensions as Predictors of Climate Change Adaptation Practices**

| Model                                                        | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error | F-value | P-value | Decision |
|--------------------------------------------------------------|-------|----------------|-------------------------|------------|---------|---------|----------|
| Environmental Literacy → Climate Change Adaptation Practices | 0.742 | 0.551          | 0.547                   | 0.412      | 152.438 | 0.000   | Rejected |

**Interpretation:**

The result in Table 5 showed that environmental literacy significantly predicted climate change adaptation practices among university students. The multiple correlation coefficient ( $R = 0.742$ ) indicated a strong positive relationship between the combined environmental literacy dimensions and climate change adaptation practices. The coefficient of determination ( $R^2 = 0.551$ ) indicated that environmental knowledge, environmental attitudes, and environmental skills jointly explained 55.1% of the variation in climate change adaptation practices. The remaining 44.9% could be attributed to other factors not included in the model. The F-value of 152.438, with a p-value of 0.000, indicated that the regression model was statistically significant. Therefore, the null hypothesis was rejected.

**Table 6: Regression Coefficients of Environmental Literacy Dimensions Predicting Climate Change Adaptation Practices**

| Predictor Variables     | Beta ( $\beta$ ) | t-value | p-value | Decision    |
|-------------------------|------------------|---------|---------|-------------|
| Environmental Knowledge | 0.312            | 6.842   | 0.000   | Significant |

| Predictor Variables     | Beta ( $\beta$ ) | t-value | p-value | Decision    |
|-------------------------|------------------|---------|---------|-------------|
| Environmental Attitudes | 0.384            | 8.215   | 0.000   | Significant |
| Environmental Skills    | 0.241            | 5.376   | 0.000   | Significant |

### Interpretation:

Table 6 showed that all three dimensions of environmental literacy significantly predicted climate change adaptation practices. Environmental knowledge had a significant positive contribution ( $\beta = 0.312$ ,  $t = 6.842$ ,  $p = 0.000$ ), environmental attitudes made the strongest contribution ( $\beta = 0.384$ ,  $t = 8.215$ ,  $p = 0.000$ ), while environmental skills also made a significant contribution ( $\beta = 0.241$ ,  $t = 5.376$ ,  $p = 0.000$ ). Since all the p-values were less than 0.05, the null hypothesis was rejected. Among the three predictors, environmental attitudes made the strongest relative contribution to climate change adaptation practices, followed by environmental knowledge and environmental skills.

### Summary of Hypotheses Testing

| Hypothesis                                                            | Statistical Test           | Result                                    | Decision |
|-----------------------------------------------------------------------|----------------------------|-------------------------------------------|----------|
| Environmental knowledge and climate change adaptation practices       | Pearson Moment Correlation | Product Significant positive relationship | Rejected |
| Environmental attitudes and climate change adaptation practices       | Pearson Moment Correlation | Product Significant positive relationship | Rejected |
| Environmental skills and climate change adaptation practices          | Pearson Moment Correlation | Product Significant positive relationship | Rejected |
| Environmental literacy predicting climate change adaptation practices | Multiple Regression        | Significant prediction                    | Rejected |

### Discussions

The findings revealed that environmental knowledge, environmental attitudes, and environmental skills were significantly related to climate change adaptation practices among university students, while environmental literacy significantly predicted adaptation practices. The finding on environmental knowledge is consistent with Roth (1992), who emphasized that environmental literacy provides the knowledge and understanding required for responsible environmental decision-making, and with Hollweg et al. (2011), who identified environmental knowledge as a major component of environmental literacy. The finding on environmental attitudes also agrees with Ajzen's (1991) Theory of Planned Behaviour, which proposes that favourable attitudes contribute to behavioural intentions and actions, and with Stern (2000), who argued that environmental values and beliefs influence environmentally significant behaviour. Similarly, the significant relationship between environmental skills and adaptation practices supports Hollweg et al. (2011), who viewed practical competencies as necessary for translating environmental knowledge into action. The finding also agrees with Sam et al. (2021), who emphasized the role of environmental education strategies in developing responsible environmental practices, particularly sustainable waste management. This supports the present finding that environmental knowledge and skills can contribute to students' adoption of environmentally responsible practices.

The overall finding that environmental literacy significantly predicted climate change adaptation practices is also consistent with the IPCC (2022), which recognizes education, awareness, and knowledge as important factors in strengthening climate resilience. Thus, the present findings generally agree with earlier literature by showing that students who possess environmental knowledge, positive attitudes, and practical environmental skills are more likely to engage in climate change adaptation practices.

However, the findings should be interpreted within the university context of the study. While previous literature generally establishes a link between environmental literacy and responsible environmental behaviour, the present study specifically demonstrates this relationship in relation to climate change adaptation practices among university students. This focus provides a more specific application of environmental literacy to climate resilience. The observed relationships may be explained by the fact that environmental knowledge enables students to understand climate risks, positive attitudes strengthen their willingness to respond, and practical skills enable them to translate knowledge and attitudes into adaptation actions. Nevertheless, environmental literacy alone may not guarantee consistent adaptation behaviour because institutional support, availability of facilities, social influence, and opportunities for practical participation can affect students' ability to act. The findings therefore suggest that universities should complement environmental education with practical sustainability programmes and supportive institutional policies that provide students with opportunities to apply what they learn.

### **Summary of Findings**

The study examined the relationship between environmental literacy and climate change adaptation practices among university students. Based on the analysis of the research hypotheses, the following findings were obtained:

1. Environmental knowledge had a significant relationship with climate change adaptation practices among university students. This showed that students with better understanding of environmental issues and climate change were more likely to engage in adaptation practices.
2. Environmental attitudes significantly related to climate change adaptation practices among university students. Students with positive attitudes toward environmental protection demonstrated greater commitment to sustainable environmental behaviours.
3. Environmental skills had a significant relationship with climate change adaptation practices among university students. This indicated that practical environmental competencies enhanced students' ability to apply adaptation strategies.
4. Environmental literacy significantly predicted climate change adaptation practices among university students. Environmental knowledge, attitudes, and skills collectively contributed to students' adoption of climate change adaptation behaviours.

### **Conclusion**

The study concluded that environmental literacy plays a significant role in promoting climate change adaptation practices among university students. The findings established that

environmental knowledge, environmental attitudes, and environmental skills were important factors influencing students' ability and willingness to adopt sustainable adaptation behaviours.

The study further concluded that students who possessed adequate understanding of climate change issues were more likely to engage in environmentally responsible practices such as water conservation, energy conservation, tree planting, recycling, proper waste management, disaster preparedness, and sustainable transportation. This indicates that environmental literacy goes beyond awareness by developing the capacity of individuals to make informed decisions and take practical actions toward environmental sustainability.

The study also concluded that universities have an important role in strengthening climate change adaptation through environmental education, sustainability initiatives, and practical environmental programmes. Improving students' environmental literacy will not only enhance their personal adaptation behaviours but also prepare them to contribute positively to climate resilience within their communities and society at large.

## **Recommendations**

Based on the findings of the study, the following recommendations were made in line with the study objectives:

1. Environmental Knowledge: Universities should strengthen climate change education by integrating environmental literacy and climate adaptation topics into relevant academic programmes and General Studies courses.
2. Environmental Attitudes: Universities should organize environmental awareness campaigns, sustainability seminars, and student-led environmental activities to promote positive attitudes and responsibility toward environmental protection.
3. Environmental Skills: Universities should provide practical opportunities such as recycling, tree planting, waste management, energy conservation, and disaster preparedness activities to develop students' environmental skills.
4. Environmental Literacy: University management should establish comprehensive environmental literacy programmes that integrate knowledge, attitudes, and skills to improve students' capacity to practise climate change adaptation.

## **REFERENCES**

- Abdelradi, F. (2018). Food waste behaviour at the household level: A conceptual framework. *Waste Management*, 71, 485–493. <https://doi.org/10.1016/j.wasman.2017.10.001>
- Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, 15(2), 77–86. <https://doi.org/10.1016/j.gloenvcha.2004.12.005>
- Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ardoïn, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224. <https://doi.org/10.1016/j.biocon.2019.108224>

- Azeiteiro, U. M., Bacelar-Nicolau, P., Caetano, F. J. P., & Caeiro, S. (2015). Education for sustainable development through e-learning in higher education: Experiences from Portugal. *Journal of Cleaner Production*, 106, 308–319.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psychosocial determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14–25.
- Berkes, F. (2017). Environmental governance for the Anthropocene? Social-ecological systems, resilience, and collaborative learning. *Sustainability*, 9(7), 1232. <https://doi.org/10.3390/su9071232>
- Cordero, E. C., Centeno, D., & Todd, A. M. (2020). The role of climate change education on individual lifetime carbon emissions. *PLOS ONE*, 15(2), e0206266. <https://doi.org/10.1371/journal.pone.0206266>
- Fawehinmi, O., Yusliza, M. Y., Mohamad, Z., Faezah, J. N., & Muhammad, Z. (2020). Environmental awareness and environmental behaviour among university students. *Journal of Cleaner Production*, 276, 123195.
- Filho, W. L., Nagy, G. J., Borga, M., Chávez Muñoz, P., & others. (2021). Climate change adaptation and resilience in higher education institutions. *Environmental Sciences Europe*, 33, 1–12.
- Füssel, H. M. (2007). Adaptation planning for climate change: Concepts, assessment approaches, and key lessons. *Sustainability Science*, 2, 265–275. <https://doi.org/10.1007/s11625-007-0031-y>
- Giangrande, N., White, R. M., East, M., Jackson, R., Clarke, T., Saloff Coste, M., Penha-Lopes, G., & Grierson, D. (2019). A competency framework to assess and activate education for sustainable development: Addressing the UN Sustainable Development Goals 4.7 challenge. *Sustainability*, 11(10), 2832. <https://doi.org/10.3390/su11102832>
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66(4), 290–302. <https://doi.org/10.1037/a0023566>
- Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2018). Developing a framework for assessing environmental literacy. North American Association for Environmental Education (NAAEE).
- Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Impacts, adaptation and vulnerability. Cambridge University Press. <https://doi.org/10.1017/9781009325844>
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behaviour? *Environmental Education Research*, 8(3), 239–260.
- Leal Filho, W., Salvia, A. L., Paço, A., Anholon, R., Quelhas, O. L. G., Rampasso, I. S., Ng, A., Balogun, A. L., Kondev, B., Brandli, L. L., & others. (2022). Sustainability in higher education: Current practices and future developments. *International Journal of Sustainability in Higher Education*, 23(5), 1045–1065.
- Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Veiga Ávila, L., Brandli, L., Molthan-Hill, P., Pace, P., Azeiteiro, U. M., Vargas, V. R., & Caeiro, S. (2019). Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production*, 232, 285–294. <https://doi.org/10.1016/j.jclepro.2019.05.309>
- McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. (2019). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*, 4(5), 1–20.

- Mochizuki, Y., & Bryan, A. (2015). Climate change education in the context of education for sustainable development: Rationale and principles. *Journal of Education for Sustainable Development*, 9(1), 4–26.
- Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, 25(6), 791–812. <https://doi.org/10.1080/13504622.2017.1360842>
- Onuoha, D. C., & Eze, B. N. (2020). Environmental awareness and sustainable environmental practices among Nigerian university students. *International Journal of Environmental Studies*, 77(4), 1–15.
- Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature together are related to ecological behaviour. *Global Environmental Change*, 47, 88–94. <https://doi.org/10.1016/j.gloenvcha.2017.09.009>
- Pörtner, H.-O., Roberts, D. C., Tignor, M., Poloczanska, E. S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., & Rama, B. (Eds.). (2022). Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.
- Roth, C. E. (1992). *Environmental literacy: Its roots, evolution and directions in the 1990s*. ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Sam, I. E., & Neji, H. A. (2014). Climate change and disaster risk management for sustainable development. *Academic Research International*, 5(4), 422–428.
- Sam, I. E., Onnoghen, U. N., & Addo, D. (2021). Environmental education strategies for sustainable waste management. In A. C. Omoogun (Ed.), *Selected themes in environmental education studies* (pp. 154–166). Baye Communications.
- Sam, I. E., Robert, A. I., & Asuquo, E. E. (2014). Community environmental education: A panacea for environmental sustainability. [Journal details should be verified from the original publication before final submission].
- Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16(3), 282–292. <https://doi.org/10.1016/j.gloenvcha.2006.03.008>
- Stern, P. C. (2000). Toward a coherent theory of environmentally significant behaviour. *Journal of Social Issues*, 56(3), 407–424. <https://doi.org/10.1111/0022-4537.00175>
- UNESCO-UNEP. (1977). *Intergovernmental Conference on Environmental Education: Final report (Tbilisi Declaration)*. UNESCO.
- Yusliza, M. Y., Govindan, K., Iranmanesh, M., & others. (2020). Sustainable consumption behaviour among university students: The role of environmental knowledge and awareness. *Journal of Cleaner Production*, 268, 122167.