e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities

eISSN: 1823-884x

Volume 22, Issue 2, DOI: https://doi.org/10.17576/ebangi.2025.2202.45

Article

Impact of Climate Change on Teaching and Learning: A Literature Review Perspective of Higher Education in Africa

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Received: 01 January 2025
Accepted: 02 May 2025

Abstract: The impact of climate change on teaching and learning affects the future development of the educational system. The rising temperature and other drastic weather conditions are not only a threat to our environment, but also to the psychological, mental, cognitive, social, and physical development globally. Recent data suggests climatic changes pose a significant challenge in academic development as they slow down academic activities and general performance. The study pays great attention to the need to invest in climate resilience for the improvement of teaching and learning in higher institutions in Africa. Given that universities and other higher education establishments are identified as major players in bringing about change, African universities must communicate these adaptation and mitigation strategies to their students. A systematic review of existing literatures based on the related key findings was considered as factors that could improve teaching and learning in Higher Education in Africa. Evaluated papers from selected African Higher institutions presented divergent perceptions on the results of mitigating climate change in African nations, offering a detailed view of strategy implementation. The consequences of climate change could be avoided in the future if dire attention is paid to it. This implies the need for developing skills and creating awareness to build a more sustainable future. African universities must consider the topic of climate change by encouraging initiatives to research climate change. Suggesting strategies that benefit employees, students, policy makers, and other stakeholders also goes a long way.

Keywords: Climate change; Education; Future Development; Higher Education; Teaching and Learning.

Introduction

Africa's experience with climate change has emphasized the continent's delicacy due to its inadequate competence for adaptation, which is why it is considered the continent's most persistent ecological and human disaster (Uzoechina, 2025). Climate change has a significant impact on teaching and learning, as they have resulted in several disruptions in the educational sector (Thenga, 2025). In the case of higher education in Africa, extreme weather, like a rise in global temperature, is one of the major concerns of the 21st century (Beckert, 2025). It is proven that the current trend in rising global temperatures increases extreme heat, indicating that if global actions are not taken, things will eventually get out of hand. An estimated 2.2% of all working hours and years of life will be lost by 2030 because of the sharp upsurge in global temperatures (Liang, Zhou, Zeng & Wang, 2024). More so, exposure to adverse heat also results in poor health conditions and attitudes towards teaching and learning activities. Recent studies indicate that warm temperatures pose a

threat to livelihood, productivity, and working conditions as climate change-related stress is a concerning global challenge that demands global solutions (Banu & Fazal,2025; Uzoechina, 2025).

The extent to which we can accurately alleviate and adjust in the long run is still a pipe dream; therefore, the influence of climate change hinges on the decisions we make today (Moellendorf, 2023). The impact of climatic changes recently observed proves that insufficient actions have been taken thus far, especially focusing on the educational sector, which plays a major role in the economic development of every nation's economy (Raihan, 2023). Despite the beneficial role of campuses in Higher institutions towards re-engineering climate change disruptions, the overwhelming expectations from unpredictable extreme weather events have remained a major global concern (Mishra, 2023). An instance of this situation was the recent global pandemic witnessed in 2020, which took the whole world by surprise, presenting the vulnerabilities of our educational systems and structures. All through the pandemic, it took higher institutions a while to adjust, and some of which had to temporarily close down for extended periods (Tilak & Kumar, 2022). This also required a lot of extensive planning to come up with online teaching methods, observing social distancing, mask wearing, and general adjustments to teaching and learning activities (Hassan, 2021).

The paper intends to focus on the implications and risk factors of climate change on higher education in Africa, considering what strategic measures could be offered to educators and learners to progress with effective and efficient teaching and learning activities. This will enable policymakers and governmental bodies to gain access to strategic means of sustainable solutions. Additionally, this literature paper could serve as an intervention measure to reduce the adverse impact of climate change on teaching and learning. The search strategy was conducted to retrieve the effects of climate change on teaching and learning productivity, focusing on the Google Scholar database and Scopus database, which contain abstracts of related academic journals. The analytical framework developed to guide the selection of studies addressing the topics of related interest was used in building the search strategies. Results indicated the need to learn from other countries where evidences are gathered, means to improve on, and seek sustainable solutions reflected from wider research studies. Furthermore, the United Nations Framework Convention on Climate Change (UNFCCC) needs African nations to formulate reports on public understanding and consideration of climate change. These nations' tasks are centred on communication, evidence, and learning (Adewole, 2025). Innovative research and development in this light can be provided to develop human capacity in the climate change field, as well as conduct cutting-edge research to address solutions to challenges associated with climate change.

The paper aims to address the implication of global climate change in Higher education and provide strategic measures to deal with unprecedented climate change.

The following research questions were considered:
-What are the impacts of climate change on teaching and learning activities in the Higher education sector?
-What measures could be considered in controlling climate change in African Higher Institutions?
The search strategy was created using keywords that replicated climate change, heat stress, teaching and learning productivity, and higher education to respond to these research questions and map out the body of literature that is now accessible globally. These key words were used for searches in the google database and Scopus database. Articles that focused on climate change impacting on Higher education were considerably eligible for this review.

Literature Review

1. Impact of Climate Change on Teaching and Learning in African Higher Institutions
Education plays a key role in poverty alleviation globally. It is also serving as a means through which the economy of every nation is progressive (Zhang, 2024). This implies that there is a need to protect every educational system from climate change, which is becoming increasingly concerning. It is evident that extreme weather conditions disrupt every educational system and structure, and sometimes, this could result in long-term school destruction to educational facilities and eventually, school closure, further affecting academic

growth and development (Mfon, 2024). Similarly, rising temperatures, especially in some part of Africa, which causes extreme heat, has also hindered teaching and learning activities in higher institutions, further resulting to discomfort, lack of concentration, and disinterest in class attendance (Leal, Dinis, Lange, Sierra, Vasconcelos, Henderson-Wilson & Carvalho, 2024). Detailed investigations prove that such cumulative consequences of climate change over time lead to significant learning losses, lower productivity by administrative staff and academicians, and possibly, disinterest in job expectations or delivery (Caruso, 2024). Regardless of these drastic implications, education remains underrated in the climate policy agenda reports. The recent climate report (2020) stated that education makes up only 1.3% of climate-related issues in alignment with education (Gounaridis & Newell, 2024).

Globally, severe disruptions caused by severe weather conditions have greatly impacted student achievement, which may not be easily ascertained (Leddin, 2024). Due to the terrible effects, investigators examined students' results by comparing pre-pandemic and post-pandemic data to determine the influence of this dreadful event on students' academic performance (Torres, 2024; Laminack, 2024). Torres (2024) noted that the unprecedented interruptions from face-to-face learning to online learning projected likely learning losses based on the report findings. Additionally, class absenteeism as a result of drastic weather conditions like floods, thunderstorms also contributed to a decline in students' academic progress (Gust, 2024; Zambezi, 2025). Further observations and reports regarding intensive heat also suggested that this greatly affected the cognitive and psychological well-being of students, causing a decline in their academic expectations as well as disinterest and discomfort to teach on the part of educators (Feistner, 2025; Corke & Steele, 2025).

The major effects of climate change on teaching and learning have resulted in the following risk factors:

i. Disruption of Students' studies: According to Ress (2021), climatic changes have resulted in the forced relocation and migration of families, thereby disrupting students' academic progress. This implies the need for a change of institutions and interruption of previous studies.
ii. Interrupted Students' Attendance: Extreme weather conditions often result in school closures, thereby preventing access to class attendance, further slowing down academic growth and progress (Smith, 2021).
iii. Destroyed Infrastructural Facilities: Because of stormy weather conditions and severe floods, basic infrastructural facilities have been destroyed in Higher institutions. Such instances like damaged buildings, destroyed electricity supply as well as other facilities. This will require more expenses for repairs and also affect the smooth progress of teaching and learning activities.
iv. Increased anxiety and mental stress on students: Climatic changes often cause increased anxiety and distress in students, further affecting their cognitive ability to learn effectively.
v. Impact on curriculum: Drastic climate changes in the form of very bad weather conditions over a period, affects the yearly planned curriculums in Higher Institutions.
vi. Challenge with Access to Infrastructural facilities and Learning materials: Climatic conditions causes a major hassle for students' access to infrastructural facilities, learning materials and access to technological equipment.
vii. Economic implications: Climatic changes reportedly have a significant impact on the educational system, which affects a huge part of every nation's economy. As such education

The educational sector of any economy is very crucial, and government of every nation plays a huge role in ensuring that it is managed effectively. However, climatic changes have increasingly been a huge concern over the years due to extreme weather conditions disrupting academic activities in higher institutions (Bawono, 2021).

2. Strategic Measures that could be taken to Control Climate Change in African Higher Institutions

Climate change can be expected to replicate and even cause increasing danger to humanity, increasing the risks of learning loss, economic loss, and scarcity of basic amenities (Mishra, 2023). Experiences with the pandemic in 2020 revealed the devastating implications on every aspect of the world's economy. On the part of the educational system, governments worldwide have suggested countless initiatives, some of which have been established (Adom, Makananisa & Simatele, 2025). An instance is the Coronavirus Aid, Relief, and

Economic Security (CARES) Act, funded by the United States of America in 2021. The US government appropriated these funds to help alleviate the pandemic's impact on Higher education. This act helped to address access to technology and other risk factors' implications affecting academic progress and growth in Higher education (McBride, 2025). Additionally, other governmental bodies contributed to funding educational agencies to meets students support in terms of mental health wellness and academic needs to improve the effectiveness of students learning and also support the capacity of the educational institutional institutions (Suleiman, 2025; Segarra & Williams, 2025 & Diaz, Trinidad, Augustin, Panganiban & Garcia, 2025).

Such actions serve as a reflection of expectations for other national policy makers and institutional administrators towards the improvement of teaching and learning activities globally. However, such actions are far-fetched in most developing economies of the world. As such, there remains a huge gap between the expectations of the governmental bodies/ policy makers and the willingness to carry out such expectations. In other words, the compounding issues of addressing government expectations, willingness of educators to adopt new teaching and learning methods, provision of funding to support students' academic progress and growth all remain unresolved.

For this reason, there is a need for an overhaul in the educational system globally. It is imperative to seek and implement strategic intervention measures that could serve as effective, resilient means to maintain academic progress, even with future climatic changes yet to be experienced. The following measures could serve as measures to minimize teaching and learning losses despite the challenging climatic catastrophe, to prevent students from falling too far behind when extreme weather conditions are experienced.

i. Support of student mental health: This involves the provision of resources and counselling to support students regarding anxieties, stress and psychological implications of climatic change.
ii. Educational Policy Interventions: Implementation of educational policy interventions to protect the educational structure and systems from climatic implications serves as an intervention measure. That way, students are more stable.
iii. Communal-based resilience intervention programs: Collaborating with community members around the institutions, who also serve as major stakeholders, is also important. By so doing, climate resilient strategies that support educational progress could equip students about adaptation strategies.
iv. Producing an empirically sound approach which includes frequent assessment of student progress evaluation. This will monitor students' improvements and efficiency as well observe the ability of educators to teach effectively.
v. Preparedness for unprecedented dramatic shifts in educational institutions: In anticipation of a future unprecedented climate change or extreme weather experience.

A review study of the innovative research development undertaken in African Higher Institutions was considered for the study:

South Africa

The school for climate studies at Stellenbosch University of South Africa unveiled the implementation of Africa-relevant research programs that respond to climate change impacts, adaptation, and mitigation responses, supporting human resilience (Serame & Afuye, 2024). This also facilitated the development of climate change curricula across other faculties in the university, as well as conducting and coordinating internal and external climate change training workshops and seminars.

The school is active in research and development, learning and teaching, collaboration, capacity building, and consultancy. These activities are structured to necessitate the improvement of the natural environment, health, and human security, as well as social justice development. Based on these developments, the school establishes Africa-related research programmes that concern climate change impact resilience. It also encourages climate change curricula through undergraduate and postgraduate modules.

Togo

The doctoral programme in climate change and disaster risk management was established at the university of Lome in Togo. The University aimed at educating students about challenges and the concerns posed by climate change as well as created awareness on the early signs and warnings to facilitate resilience and improve the adaptive capacity of socio-ecological systems affected by these changes (Konko, 2024). By so doing, students are exposed to dealing with the threats and finding collaborative means alongside communities to harness their inherent resilience to such hazardous concerns.

Students registered for this programme are being exposed to interdisciplinary measures of assessing threats that encourage collaboration. They are also given opportunities to run doctoral research programmes for professional training.

Uganda

The Makare University Centre for Climate Research and Innovations (MUCCRI) was established in 2013 with the primary objective of promoting awareness about climate change and cultivating a knowledge base for innovative solutions (Matsapa, 2023). This was achieved through a research educational programme, policy advocacy, and outreach initiatives. MUCCRI plays a crucial role in keeping Makerere University and other Ugandan institutions informed regarding issues and challenges related to climate change.

The teams at MUCCRI are actively involved in research, training, and policy discussions across various domains, including climate science, adaptation, mitigation, governance, and finance. The centre has actively encouraged the participation of the entire University campus community in climate change awareness initiatives with the ultimate mission of heightening research and innovation and fostering a knowledge driven approach.

Ethiopia

Programs addressing the connection between climate change and development are eased by the Pan African University Institute of Water and Energy Sciences, which includes climate change, in partnership with other Ethiopian universities (Chishiba, 2024). The program's policy track proposes progressive instruction in the preparation and strategy aspects of energy, climate change, and water management, as well as an appreciation of the importance of moral and responsible governance.

Ethiopia’s Higher Institutions incorporated climate change adaptation and development courses in their post graduate programs (Masters and PhD) curricula in the health, natural science and social colleges. Additionally, major structures were established to facilitate climate change adaptation mitigation research, training and capacity building.

In support of these establishments, agreement policies were signed with the local universities, government bodies, research institutions, and NGOs, which were operated by joint doctoral research bodies and professional experts. The programmes were aimed to educate students. In this regard, students were highly equipped and competent as trained specialist in leadership and development studies both at national and international levels. The policies governing these establishments addressed issues regarding health, resource-stressed populations, rural transformations, food security, land use, soil conservation, water and drought management.

Nigeria

Alex-Ekwueme Federal University Ndufu-Alike (AEFUNA) is an established institution of the Centre for Climate Change and Development (CCD). In the areas of ecological sustainability, climate change, and green development, the Centre for Climate Change and Development looks for adaptive education, exploration, and policy endorsements (Abdulsalam & Magaji, 2024). To address the country's environmental complications and improve the green economy for sustainable growth and climate adaptation resilience, it seeks to unite Nigerian academics, public servants, non-governmental organizations, and private businesses.

It also facilitates space for strengthening relations between International and African scholars, to of comprehending the multifaceted challenges and opportunities that the green economy presents for poverty alleviation and inequality in Africa.

Methodology

With fewer restrictions to focus on more pertinent literature, such as findings from studies assessing the effects of climate change on workers' productivity and risk factors of global high temperatures on workers' health, the eligibility criteria were based on a selection of African higher institutions using the systematic review method. Using a systematic review, data were obtained from the Scopus database and Web of Science, which are online repositories comprising approximately 10,750 scientific journals that encompass a broad spectrum of research fields. The keywords considered for retrieving journals focused on articles with "climate change", "Africa", and "Higher Institutions" in their abstracts and titles. The retrievals also considered journal articles within the year range 2020- 2025. Risk factors of health workers conditions and its effects on teaching and learning activities.

Regarding the search result, 10, 750 records were identified from the initial data base search. After which duplicates of 2,217 records were screened out with 250 assessed for eligibility. Of the 250, 157 full text records were removed and 53 included.

1. Inclusion Criteria:
   i. -Studies published from 2020-2025
   ii. -Studies focused on climate change, weather, Higher Education, Teaching and Learning Performance.

2. Exclusion Criteria

Experimental Studies Involving Topics On Climate Change Only

Relevant studies were selected by screening the titles first, which was followed by the abstracts.
This implies that the study selection process was undertaken twice and information on the selected studies was extracted by the reviewer based on the following terms:

Author, Year of publication, Country, Region considered, Population study in Higher Institutions. The following steps were considered for the systematic review process:

i. Determining and outlining the research investigations.
ii. Locating the pertinent research.
iii. Research selection
iv. Gathering research
v. Using systematic review to choose studies.

The keywords reflecting climate change, heat stress, teaching and learning productivity, higher education was used for searches in the google database and Scopus database. Articles that focused on climate change impact on Higher education were considerably eligible for this review.

The Findings

Research Findings focused on climate change impact on teaching and learning activities in African Universities. Based on the content analysis, 80% of the reviewed studies believed that the current climate change curricula at Higher Institutions are inadequate to equip students with basic climate awareness, skills and knowledge regarding adaptation and mitigation strategies. This outcome was further supported by 40% of studies reviewed which buttressed the lack of technology or pedagogical resources as well as lack of interest by the Institution's administrative management. It was additionally noted from the findings of studies reviewed, that majority of Higher Institutions in Africa perceive that the topic of climate change is not necessary also agreeing with the lack of desire or interest from students amongst other reasons. However, regarding how climate change should be taught in Universities, reviewed studies indicated that only a few

percentages of faculties show interest in the study. Most Higher Institutions in Africa prefer the need to conduct conferences and seminars occasionally where such awareness on climate change mitigation strategies will be discussed. This is followed by other challenges, such as the perception that education on climate change awareness seems too abstract or that its impacts are too long-term. Such misconceptions or notions from gathered research investigations are some of the reasons why the impact of climate change in Higher Institutions is not been addressed.

Discussion

According to Dyke, Mathew and Agnes (2020) the most affected people because of climate change are those living in the rural settlements and greatly reliant on climate-sensitive sectors such as agriculture and health, posing critical challenges for natural development. The negative implications of such climate change factors therefore demand quick actions to update and upgrade resilience to unprecedented weather conditions. Regarding climate change awareness, it is perceived from scholars that when taught in higher institutions, there are likely chances that what is taught is being applied across the institutions and communities (Tang, 2021; Mavuso et al.,2022).). This implies that additional resources be made available by the government to other higher educational bodies or higher institutions without such educative program awareness. This will further pave way to improve adaptable teaching methods so as not to be taken unawares. Well-developed and established academic systems and models to support effective attitude toward teaching and learning activities in higher institutions should be considered by the institutional administrators. Consequently, to improve academic progress and outcomes of learners especially in the developing economies, effective and efficient student support structures should be implemented.

In other words, findings from the study suggest the publications of outcomes stating strategic intervention measures for climate change which could be reported and disseminated on social media platforms, through workshop programs, symposiums and conferences jointly organised by Higher institutions, NGOs, community leaders and other key stakeholders. Such collaborative joint forces bridge the communication and awareness gap which hinders the effective education on climate change resilience.

Conclusion

Recommendations for the study addresses how institutional administrators, governmental bodies, policy makers, communal members could jointly work hand in hand in collectively responding to the concerning risk factors posed by climate change occurrences. To do this, it is imperative to implement flexible and adaptive curricula, leverage on the possibility of a well-organized educational system associated to climate change and execute operative climate change policies to affect significant change. More so, suggestions of online integration in teaching and learning could be considered as this will also assist with critical thinking and problem-based approach enhancing effective teaching and learning of climate change education in a way that promotes aligning curriculum with virtual and physical classroom teaching methods.

Communities and higher education institutions should be made conscious of a clear obligation and willingness to participate in climate change initiatives. Workshops for training and capacity building, strategic planning, required courses on climate change, and career centres in African higher education institutions should all come after this. More so, major lessons can be learnt from suggested higher institutions in Africa with implementing climate change policies and programmes in their educational curricula. Overall, the research study has identified some of the main challenges faced by African Higher Institutions. While some of these institutions have provided establishments to mitigate climate change, the study has exposed the substantial disparity on the perceived outcomes from research investigations regarding the lack of interest in climate change awareness and education in most of the African Higher Institutions. The study further exposed more climate change-related issues of concern which includes land degradation, food insecurity, economic losses, and productivity reduction amongst others. However, if researchers in these Higher Institutions that lack interest in climate change consider the desire and need to be well informed, the general opinion on the need to adapt training programs will be greatly improved.

Acknowledgement: The first author appreciate the financial contribution of the second author towards the presentation of this paper at Climate Change and Economic Management for a Sustainable Future conference in Durban, South Africa, February 25-28, 2025.

Informed Consent Statement: Informed consent does not apply for this paper.

Conflict of Interest: The authors declare no conflicts of interest. Funding: The authors received no financial support for the publication.

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