

The Role of Higher Education Institutions In Enhancing Research Skills And Collaborations For Plastic Pollution Mitigation in Nigeria

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Abstract: Higher education institutions in Nigeria are increasingly recognizing their vital role in enhancing research skills and collaborations to actively mitigate plastic pollution and enhance climate resilience in Nigeria. This book chapter provides a case-study of two Nigerian universities namely University of Nigeria, Nsukka and University of Calabar which are progressively enhancing climate resilience by encouraging research skills and collaborations in plastic pollution mitigation across campuses, communities, cities and companies in Nigeria. Through systematic literature review, participant observation and data collection from relevant sources, this study reveals the role of higher education institutions in Nigeria in enhancing research skills and collaborations in plastic pollution mitigation for climate resilience in Nigeria. This study further identifies plastic pollution education which can be enhanced through eco-poetry, eco-musicology and eco-photography as a valuable tool for mitigating plastic pollution in Nigeria. It also highlights the role of libraries in enhancing research skills and collaborations in Nigeria. It recommends more access to green financing to higher education institutions from multilateral organizations such as the World Bank Group(WBG) to facilitate deeper research on plastic pollution mitigation in Nigeria.

Keywords: Climate Change, Collaboration, Education, Mitigation, Plastic Pollution, Research Skills.

1. Introduction

Education is a powerful tool for impartation of desirable knowledge, research skills, and awareness creation towards plastic pollution mitigation for climate resilience in Nigeria(Anabaraonye,2017). It is a tool for transmission of ideas, innovations and systems of a people to enhance sustainability from generation to generation. Through strategic educational offering like climate change education, individuals in the society come to understand the peculiar changes in their immediate environment and be aware of the causes and how to mitigate the undesirable effects and learn strategies that are compliant with their culture(Anabaraonye et al,2020; Anabaraonye, Nji & Hope,2018). Climate change, environmental degradation, plastic pollution and other adverse effects of improper plastic waste management in Nigeria have necessitated the introduction of plastic pollution education which is meant to enable children and adults to respond to these environmental menace(Okolo, et al, 2023). Climate change education as well as environmental education is a great channel to educate people on the need for promoting awareness, by inculcating responsible and reasonable behaviour in them so that their attitude will be environment friendly (Anabaraonye,2017; Onnoghen, et al,2020). The impact of climate change is being felt in a profound way on Nigeria's educational sector and multi-stakeholder partnership will play a great role in enhancing climate resilience (Anabaraonye et al,2022). Climate change also affects sustainable economic growth (Onnoghen, Orji et al, 2024); thus mitigating

plastic pollution which has great impact on climate change will help to enhance Nigeria's sustainable economic growth (Anabaraonye, Olowoyeye, Anukwonke, 2023). Nigeria is a country which has the abundance of human and natural resources, including skills and talents which are needed to maximize the green entrepreneurial opportunities in plastic waste management for our sustainable development and economic growth locally, nationally and globally (Anabaraonye, et al, 2020; Anabaraonye, et al, 2022). In Nigeria, the use of sachet water, bottle water, bottle drinks, takeaway food packs, straws, cups, and spoons, among others in homes and occasions is alarming. These packages come in handy for most people and are widely accepted by many Nigerians. The wide acceptance is attributed to the fact that one doesn't really need to remain at the point of purchase or service to consume them. Nigerians eat and drink from this different packages comfortably anywhere as the need arises; hence the increase in the rate of plastic waste generation (Okolo et al, 2023). Plastic waste management is one of the pressing environmental challenges facing urban and rural areas in Nigeria in recent times. Nigeria's population is estimated to double by 2050 and that could mean more plastic waste hanging around and more plastic for recycling (Okolo, et al, 2023).

Plastic Waste Management Global Market Report 2025

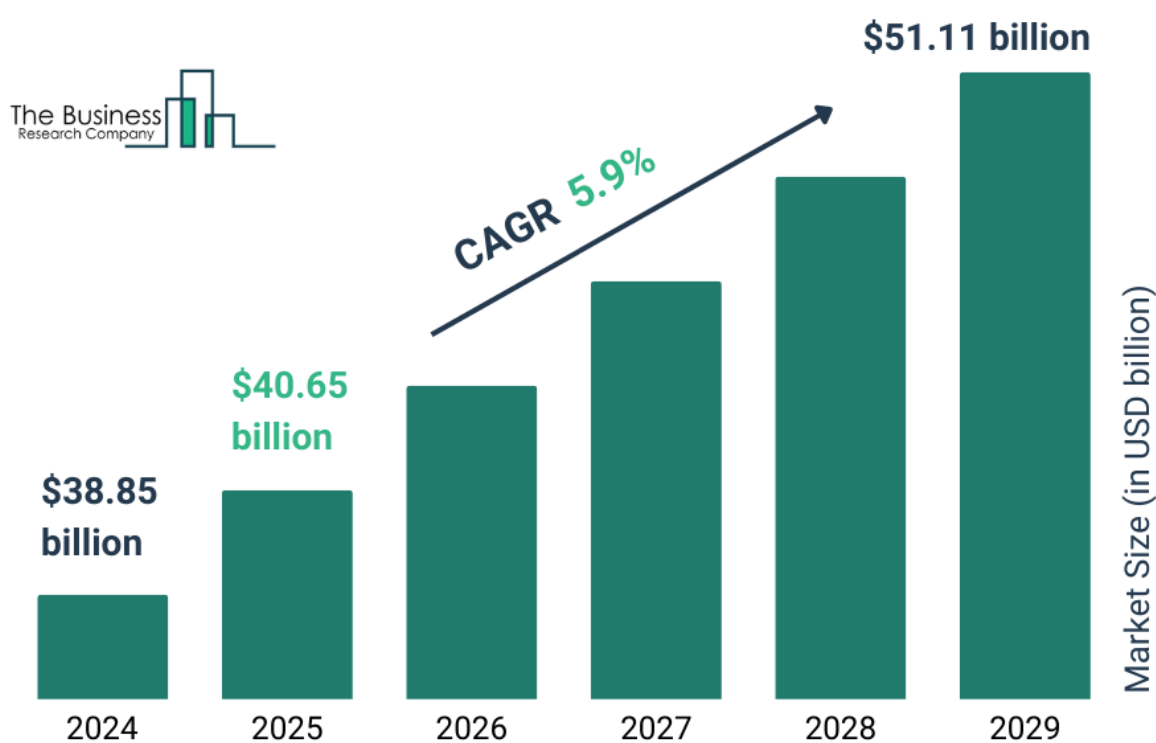


Figure 1: Plastic Waste Management Global Market Report 2025; Source: TBRC(2025)

The plastic waste management size is expected to see growth in the next few years. The growth in the forecast period can be attributed to strong economic growth in emerging markets, corporate initiatives for plastic waste, technological advancements, and increased use of plastics across various industrial sectors (TBRC, 2025). Plastic pollution education encourages people to take action towards improving life

and protecting the environment by reducing, recycling and reusing plastics(Nwafor,2024).Research skills, technology and plastic pollution education(including the use of poetry and music) can help create enduring solutions to plastic pollution and develop systems whereby communities can turn waste into wealth, a concept that helps to view waste management of all types as a resource rather than a refuse (Sosale et al., 2021; Anabaraonye, Nji & Hope, 2018; Onnoghen, Idika, et al,2024). Researchers have recently investigated the Effectiveness of TikTok in Promoting Public Awareness and Engagement on Climate Change Adaptation and Mitigation Measures in Nigeria(Nwafor, Aghaebe, et al, 2024). Promoting Anti-Plastic Pollution Innovations for Climate Change Awareness and Sustainable Development will enhance green entrepreneurship across campuses, companies, communities and cities in Nigeria(Nwafor, Bartholomew et al,2024; Onnoghen, Onwuzurike, & Anabaraonye, 2024). Plastic pollution education encourages people to take action towards improving life and protecting the environment by reducing, recycling and reusing plastics(Anabaraonye, Olowoyeye, Anukwonke,2023; Anabaraonye,2017). Researchers recently identified that mitigating the negative effects of plastic pollution which can be achieved through enhancing research skills and collaborations will go a long way to enhance sustainable economic growth in Nigeria(Anabaraonye, et al, 2023). Furthermore, plastic waste management is one of the green entrepreneurial opportunities that can be innovatively used to enhance climate resilience in Nigeria(Onnoghen, Onwuzurike, & Anabaraonye, 2024).Nature education research has been identified as a vital strategy for enhancing climate resilience in Nigeria (Onnoghen, Idika, et al,2024).This study therefore identifies the role of higher education institutions in enhancing research skills and collaborations for plastic pollution mitigation in Nigeria.

2. Methodology

Materials used for this study were derived from online academic journals, magazines, articles, conference papers, textbooks, and educational materials from libraries. The researchers gathered a lot of materials for the research but summarized the characteristics of the papers that centered more on “ The Role of Higher Education Institutions In Enhancing Research Skills And Collaborations For Plastic Pollution Mitigation in Nigeria”. This enabled the researchers to generate the synthesis of views of other researchers on the subject matter.

3.1. Understanding Research Skills

Research skills refer to the set of competencies required to locate, evaluate, and utilize information to address specific questions or problems. Advanced academic research aims to contribute something new to the subject area, but at undergraduate level, students are usually expected to begin by researching other people’s ideas and contributions, mostly through reading (F.E, 2024; University of Galway,2024). Research skills refer to the ability to search for, locate, extract, organize, evaluate and use present information that is relevant to a particular topic. Academic research is a specific type of research: a process of detailed and methodical investigation into some area of study. It involves intensive search, investigation, and critical analysis, usually in response to a specific research question or hypothesis. It also usually involves a lot of reading (F.E, 2024; University of Galway, 2024). The point of all academic research is to be able to say something with authority about the subject in question, and involvement in activities like collaborative research, workshops and conferences help to foster such confidence or the special ability called research skills. University Lecturers are by their roles researchers who specialize in particular fields(Idika et al,2017). Developing research skills among academic staff is critical as it is the engine that keeps the higher education institutions to their mandate

as centers of ideas and innovation for the needed development. Having research skills calls for more 'doing' than 'memorizing'(Idika et al,2017). It is from this engaging character of these important skills that the researchers received their motivation to embark on this study to investigate how enhanced research skills with engaging collaborations can become a veritable tool for mitigating plastic pollution for climate resilience in Nigeria.

These research skills are multifaceted and involve various processes, including:

1. **Critical Thinking:** This involves the ability to evaluate information objectively, question assumptions, and consider different perspectives. Critical thinking is essential for forming sound arguments and drawing logical conclusions based on evidence.
2. **Information Literacy:** Research skills include knowing how to locate, access, and assess information from diverse sources such as books, journals, databases, and the internet. Being information literate means being able to distinguish between reliable and unreliable sources.
3. **Data Analysis:** Once information is gathered, the next step is often to analyze it. This involves organizing data, identifying patterns or trends, and drawing meaningful insights. Data analysis skills are particularly important in fields like science, economics, and social sciences.
4. **Communication:** Effective communication skills are crucial for conveying research findings clearly and persuasively. This includes writing skills for reports, papers, or articles, as well as presentation skills for sharing findings in conferences or meetings.
5. **Problem-Solving:** Research often involves encountering obstacles or unexpected challenges. Strong problem-solving skills are needed to overcome these hurdles, adjust methodologies, and find innovative solutions. In achieving meaningful and innovative results through research, the ability to follow the right principles, procedures, methodologies that are inherent in the process of research must be ensured.

Enhancing research skills for mitigating plastic pollution in Nigeria involves several key aspects, including

- I) **Curriculum development:** Integrating climate change mitigation and adaptation into the national curriculum to ensure students are equipped with the necessary knowledge and skills. Plastic pollution education should also be incorporated as part of the climate resilience strategies.
- II) **E-learning platforms:** Leveraging technology to support teaching and learning, particularly in higher educational institutions, to enhance access and flexibility.
- III) **Teacher training:** Providing educators with the necessary training and resources to effectively teach plastic waste management, climate resilience and adapt to new technologies.
- IV) **Student engagement:** Encouraging student participation in plastic pollution mitigation and climate resilience efforts through experiential learning and project-based approaches.
- V) **Community involvement:** Fostering partnerships with local communities to promote plastic pollution education, climate resilience and support the development of context-specific solutions.

- VI) **Research and development:** Encouraging research on climate resilience and plastic pollution education to inform policy and practice, and to develop new technologies and strategies.
- VII) **Policy support:** Ensuring that policies and frameworks support the integration of climate resilience in education and the use of technology to enhance teaching and learning.

3.2. The Role of Universities in Enhancing Research Skills in Nigeria

Universities play three essential roles in contemporary society: education and training, scientific research, and public service (Askari, Mazouz & El Refae, 2018). According to Goetz (2019), Griffiths argues that the main goal of a university is scientific exploration, commonly known as 'research'. Universities are fully dedicated to the advancement of knowledge, which inevitably necessitates research. Mbachu and Unachukwu (2022) describe research as a systematic investigation into a concept, system, or problem undertaken to gain valuable insights or identify solutions. Research is vital to all aspects of our daily lives. The results of research contribute to the advancement and growth of a nation, enhance students' critical and analytical thinking skills, expand our current knowledge, and provide individuals with skills that are beneficial in various situations and enable them to tackle new challenges more effectively (Onyebinama & Chima-James, 2024). Academic research is a primary focus for institutions globally, including Nigeria. Faculty members within the academic sphere contribute to research through guiding students as thesis advisors and conducting their own research (Onyebinama & Chima-James, 2024). The academic staff of the university now considers research as a fundamental aspect of their responsibilities (Stensaker et al, 2017). The current aim for many university leaders is to raise a university's academic prestige and status to that of an internationally recognized world-class institution through their open access research paper publications among others (Ridwan, 2015). Many academic institutions and research organizations in Nigeria have scholars engaged in a variety of research endeavors, leading to publications in local academic journals (Ridwan, 2015; Nwokedi & Nwokedi, 2018). The dissemination of faculty members' research findings in reputable scientific journals, which must also be publicly accessible, plays a significant role in the assessment of institutions worldwide today (Dementer, 2020). However, scholars in developing countries like Nigeria face challenges in their professional advancement, such as lack of mobility and increased teaching responsibilities, which impede their capacity to publish extensively and facilitate access to their research findings (Onyebinama & Chima-James, 2024). Research exercise involves intellectual skills, technology/ICT skills and mechanical activities, and the university lecturers are at the center of research activities, carrying out research publications as the most significant indicator of their productivity (Idika et al, 2017). Research skill development among academic staff is the engine that keeps universities to their mandate as centers of ideas and innovation for the needed development. This explains why graduate school programs in Universities all over the world receive the much attention that are accorded them by all in the society (Idika et al, 2017). Beyond enhancing research skills, ethical compliance in research practice is also necessary and has become an issue of great importance for education stakeholders in

Nigeria (Idika & Ojini,2019). Ethical issues are very important in enhancing research skills not only for higher education institutions in Nigeria but also top universities around the globe(Idika & Ojini,2019). There is great need to enhance research skills and collaborations among University students(both undergraduate and post-graduate) and academic staff especially as it relates to climate resilience and plastic pollution mitigation in Nigeria. Furthermore, ethical issues and compliance should be put into consideration when conducting research on plastic pollution mitigation in Nigeria. This will ensure our escape from the catastrophic effects of plastic pollution and environmental degradation threatening to undermine sustainable development in Nigeria.

3.3. The role of higher education institutions' libraries in enhancing research skills for plastic pollution mitigation in Nigeria

The Library is a vital link between the user and the information they require, while the active players in achieving this aim are librarians. Librarians down the ages have been charged with the responsibility of information dissemination, managing information resources, and the library users. One of the management practices in the library is the preservation and conservation of library resources which is aimed at ensuring the longevity of the library resources(Ewa et al,2024). Most of the library resources are made up of plastics, such as computer hardware, printer, plastic chairs and tables, nylon plastic handbook, and waste bins. Libraries therefore play a great role in enhancing research skills and technology towards plastic pollution mitigation and education in higher education institutions in Nigeria(Zobundžija & Dolaček-Alduk, 2021). Libraries can serve as a repository of information on plastic waste management. Libraries can collate data and information on plastic waste management, recycling initiatives, and best practices globally and make them available to users through their resources. Libraries can be involved in research on plastic waste management(Zobundžija & Dolaček-Alduk, 2021). They can provide materials and resources for researchers to study the impact of plastic waste on the environment, develop new technologies for recycling, and create biodegradable alternatives. It is good to mention that the Nnamdi Azikiwe Library, University of Nigeria, Nsukka has a special climate change research section called the African Climate Change Adaptation Initiative(ACCAI).ACCAI has the role of promoting research and information dissemination in the field of climate change adaptation and mitigation including plastic pollution education for environmental sustainability (UNN,2021).Library research skills have been identified as a necessary skill for graduate students thereby enhancing information literacy and climate literacy (Hoffman, Anti-Nisha.Feng & Stanley,2008).Researchers, Libraries and Librarians can play a great role towards enhancing and assessing research skills and technology across various higher education institutions for mitigating plastic pollution in Nigeria(Ewa et al,2024). It is ultimately important to address plastic pollution in the library environment. There is a great need to this menace of plastic pollution in the University Library community. New innovative solutions for reducing our dependency on plastic products such as the use of environmentally friendly alternatives, along with increasing recycling of plastic waste should be carried out in the library environment(Ewa et al,2024). Thus, the introduction of the green initiatives such as eco-poetry, eco-musicology and eco-photography can go a long way in reducing the menace of plastic pollution in libraries in Nigeria (Anabaraonye, Nji & Hope, 2018; Okolo et al,2024; Onnoghen,Nwafor et al, 2024).Music can be used in a special way (during advocacy projects initiated by librarians) to teach students both in a formal or informal setting about plastic recycling, tree planting strategies and the use of renewable

energy which are some of the climate change adaptation and mitigation strategies (Onnoghen, Nwafor, et al, 2024).

4.1. Case Study One: The University of Nigeria, Nsukka, Nigeria

A good example of the multi-stakeholder partnership projects to enhance research skills towards plastic pollution mitigation in Nigeria can be seen at the University of Nigeria, Nsukka. The University has collaborated with multilateral organizations, non-governmental organizations and passionate individuals to celebrate the world environment day events being held across cities, campuses and countries in June annually. Each year, World Environment Day is hosted by a different country where the official celebrations take place (UNEP, 2022; Anabaraonye, et al, 2022). The United Nations Environment Programme having declared the theme “Only One Earth ” for World Environment Day 2022 presented an unprecedented opportunity for plastic pollution education and mitigation globally. Thus, the Institute of Climate Change Studies, Energy and Environment, University of Nigeria, Nsukka in collaboration with other organizations organized an educational event on the 8th of June, 2022 to commemorate the World Environment Day 2022 featuring the recitation of inspiring world environment day poetry, seminars by climate change professionals and networking opportunities for the youths from around the world (Anabaraonye, et al, 2022).



Fig 2: A lady trading on plastic waste she picked from the UNN library environment



Fig 3: Littered plastic waste in the UNN library environment

Similarly, in educating the students, research and publications, the faculty of agriculture along with the Centre for Climate Change, Institute for Climate Change Studies and Resource and Environmental Policy Research Centre (REPRC) in the University of Nigeria, Nsukka have increasingly take the responsibility to progressively prioritize carbon neutrality and develop climate change modules in educational content in the University in seminars, conferences, workshops, policy initiatives and its implementations (UNN, 2021; Anabaraonye, et al, 2022). These initiatives, educational centers and university library established by the University of Nigeria, Nsukka are all geared towards enhancing research skills for enhancing climate resilience including plastic pollution mitigation in Nigeria (UNN, 2016; UNN, 2021).

4.2. Case Study Two: University of Calabar, Calabar, Cross River State, Nigeria

The University of Calabar (UNICAL) established a green office known as "The University of Calabar Carbon Innovation Centre" (UCCIC), that has a director, deputy director and adhoc staff from various departments who render services that help to achieve its mandate which includes enhancing research skills towards plastic pollution mitigation for climate resilience in Nigeria. The University of Calabar partnered with the British High Commission on Forest Preservation towards climate change adaptation and mitigation for sustainable development in Nigeria (Ifeanyichukwu, 2022; Odok, 2021). The University of Calabar recently signed a memorandum of understanding with the Nigerian Conservation Foundation (NCF) to develop partnership and collaboration in the area of preservation and conservation of Gorilla wildlife in Cross River State and its environs. In 2022, University of Calabar took a positive step first towards becoming a nature positive University. They pledged and committed to carrying out a baseline of the institution's impact on nature, setting smart nature-positive targets among others (Ifeanyichukwu, 2022). In 2023, The University of Calabar Carbon Innovation Center (UCIC) and the Sustainable Earth Institute at the University of Plymouth in the United Kingdom concluded arrangements to partner on global perspectives on climate change mitigation and adaptation. The workshop titled "Global Perspectives on Climate Change Mitigation and Adaptation" was hosted by University of Plymouth in the United Kingdom between November 13-17, 2023, aimed at fostering the sharing of knowledge, ideas, and research on climate change and climate actions (Okoro, 2023). Some notable lecturers at the University of Calabar in recent times have been greatly involved in enhancing research skills and collaborations towards mitigating plastic pollution for climate resilience in Nigeria (Orji et al, 2024).

and the University of Calabar in 2022, the University of Calabar has been recognized as a Green Campus by the British High Commission in Calabar, Cross River State, Nigeria.



Fig. 4: University of Calabar Tree plantations (clean and green)



Fig. 5: University of Calabar plastic waste dumping site

4.4. Enhancing research skills among academics for mitigating plastic pollution in Nigeria

To enhance research skills among academics in higher education institutions for mitigating plastic pollution in Nigeria, the following areas should be considered:

1. Research Design and Methodology:

- a) **Qualitative and Quantitative Research:** Ability to design and conduct both qualitative and quantitative research after locating and articulating what clear and specific problem there is to solve, including data collection, surveys, interviews, and experiments.
- b) **Interdisciplinary Approaches:** Integration of various academic fields such as environmental science, chemistry, engineering, policy studies, and social sciences to understand plastic pollution's impacts and solutions.

2. Data Analysis and Interpretation

- a) **Statistical Analysis:** Skills in using statistical tools (e.g., SPSS, R, or Python) to analyze environmental data and draw meaningful conclusions.
- b) **Geospatial Analysis:** Use of GIS tools to map plastic pollution sources and track plastic waste distribution over time.

3. Sustainability and Environmental Impact Assessment

- a) **Life Cycle Assessment (LCA):** Evaluating the environmental impact of plastic materials from production to disposal, assessing alternatives.

- b) Carbon Footprint Analysis: Measuring the emissions associated with plastic production, disposal, and potential solutions.

4. Innovation and Technology Adoption

- a) Technology for Waste Management: Understanding and researching the adoption of technology for plastic waste management, such as recycling technologies, biodegradation processes, or waste-to-energy systems.
- b) Circular Economy Models: Knowledge of technologies that support the reuse and recycling of plastics in a circular economy framework.
- c) Alternative Materials: Research into bioplastics, biodegradable plastics, or other innovative materials as substitutes for traditional plastics.

5. Policy and Regulatory Knowledge

- a) Policy Development: Understanding and contributing to the development of policies and regulations that address plastic pollution, such as extended producer responsibility (EPR), and waste management legislation.
- b) Environmental Law and Governance: Knowledge of local and international laws regulating plastic use and waste management.

6. Collaboration and Networking

- a) Collaborative Research: Ability to work with other academics, government agencies, NGOs, and the private sector to address plastic pollution.
- b) Public Awareness and Education: Ability to disseminate research findings to the public and policymakers, raising awareness about plastic pollution and its environmental consequences.

7. Climate Change and Resilience

- a) Climate Impact Assessment: Assessing the link between plastic pollution and climate resilience, focusing on how plastics affect ecosystems, biodiversity, and climate change.
- b) Climate Adaptation Strategies: Developing and promoting strategies that mitigate the impact of plastic pollution on climate resilience, particularly in vulnerable regions like Nigeria.

8. Grant Writing and Funding

- a) Funding Acquisition: Ability to secure research funding through grants and collaborations to study plastic pollution and climate resilience.

- b) **Project Management:** Skills in managing research projects, including budgeting, timeline management, and effective allocation of resources.

9. Community Engagement and Social Science Research

- a) **Behavioral Research:** Understanding human behaviors and societal practices contributing to plastic pollution, and developing strategies to modify these behaviors.
- b) **Social Impact Assessment:** Understanding the socio-economic effects of plastic pollution on communities, particularly in developing nations like Nigeria.

10. Technology Transfer and Scaling Solutions

- a) **Scaling Solutions:** Identifying technologies and practices that can be scaled up for widespread impact, especially in low-resource settings.
- b) **Entrepreneurship in Sustainability:** Research into developing and promoting sustainable business models that reduce plastic pollution. Green entrepreneurial opportunities in plastic waste management should be further explored and examined.

Recommendations

- 1.Higher education institutions in Nigeria should revise their research methodology curricula to ensure they are comprehensive and equip students with the necessary research competencies to mitigate plastic pollution.
- 2.Higher education institutions in Nigeria should connect learners to research collaboration opportunities through active learning, allowing students to learn by doing and making research in plastic pollution mitigation more authentic and exciting.
- 3.Higher education institutions in Nigeria should invest in infrastructure like libraries and technology such as AI to provide students with access to the necessary resources for research.
- 4.Higher education institutions in Nigeria should provide opportunities for faculty to develop their research skills in plastic pollution mitigation through workshops, seminars, and conferences.
- 5.Multilateral Organizations such as the World Bank Group and World Health Organization can support research in higher education institutions in Nigeria by providing research grants and funding for research projects in the field of plastic pollution mitigation for sustainable development.
- 6.Higher education institutions in Nigeria should encourage research collaborations in the field of plastic pollution mitigation between faculty and students, as well as between different departments and institutions.

7.Higher education institutions in Nigeria should utilize technology, including e-learning platforms and academic social media, to enhance research activities in the field of plastic pollution mitigation.

8.Students of higher education institutions should consciously develop their critical thinking skills, which are essential for conducting sound research in the field of plastic pollution mitigation in Nigeria.

9.The Federal Ministry of Education should enhance research skills in higher education institutions in Nigeria by integrating cultural values and norms into curricula, ensuring that research is relevant to the local environment and addresses real-life problems including plastic pollution.

10.Vice- Chancellors and Rectors of higher education institutions in Nigeria should create incentives for faculty to engage in research, such as promotions and increased funding for research-active faculty especially in the field of plastic pollution mitigation.

Conclusion

Enhancing research skills in Nigerian higher education institutions requires a multi-pronged approach, including strengthening curricula, providing adequate resources, and fostering a culture of research. This includes improving research methodology instruction, making research more visible and accessible to students, and encouraging collaboration between faculty and students. Additionally, investing in infrastructure like libraries and technology, and supporting research grants can contribute to a more robust research environment. Research skills and research collaborations play a great role in enhancing plastic pollution mitigation in higher education institutions in Nigeria. Libraries and Librarians along with other academics in various fields at the higher education institutions in Nigeria should play their part towards enhancing research skills and collaboration towards plastic pollution mitigation for sustainable development in Nigeria. The World Bank Group should also provide access to green financing to higher education institutions for enhancing research skills and collaborations towards plastic pollution mitigation in Nigeria.

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Availability of data and materials

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Author Contributions

All authors contributed to the paper's development, writing and approved the final manuscript submission.

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