

ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-IX

December 26-29, 2023 / Ankara, Türkiye

EDITORS

**Prof. Dr. Pinar ALTIOK GÜREL
Dr. Kenan BEŞALTI**

Volume-1

ISBN: 978-1-955094-86-3

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30.12.2023

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New York, USA

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Colfi Martinien ZOUNHIN TOBOULA Dèkandé Sylvestre TCHAGNONHOU Jérémie DOVONOU	Djibo Hamani University	REORIENTING TEACHER TRAINING FOR 21ST-CENTURY EDUCATION: A DECADE-LONG EXPLORATION OF ENGLISH LANGUAGE PEDAGOGY AT BENIN'S TEACHER EDUCATION COLLEGE
Shuaeeb, A. I. Bello, M. R. Idris, U. S. B. Laka, A. U. Saifullahi, M	Federal University of Technology Minna	AWARENESS OF DIGITAL ECO-LITERACY CONCEPTS AMONG PRE-SERVICE SCIENCE TEACHERS OF THE FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
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AWARENESS OF DIGITAL ECO-LITERACY CONCEPTS AMONG PRE-SERVICE SCIENCE TEACHERS OF THE FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

Shua'eb, A. I.

Department of Science Education, Federal University of Technology Minna, Niger State, Nigeria.

Bello, M. R. (PhD)

Department of Science Education, Federal University of Technology Minna, Niger State, Nigeria.

Idris, U. S. B. (PhD)

Department of Science Education, Federal University of Technology Minna, Niger State, Nigeria.

Laka, A. U.

Department of Science Education, Federal University of Technology Minna, Niger State, Nigeria.

Saifullahi, M.

Department of Science Education, Federal University of Technology Minna, Niger State, Nigeria.

ABSTRACT

This study investigated the awareness of digital eco-literacy concepts among pre-service science teachers of FUT Minna. The concepts under study include energy management, e-waste management and digital eco-citizenship concepts. Descriptive survey research design was used for this study. This design was considered most appropriate because it is a method involving seeking and searching for opinions of pre-service science teachers at the Federal University of Technology Minna, Niger State through the use of a questionnaire named **QADIEC** with a reliability coefficient of 0.87 using Cronbach alpha. The questionnaire comprised two (2) section response patterns with a modified four-point awareness rating scale. The data collected was analyzed using the frequency count, percentages, mean ($\bar{x}$) scores and standard deviation of each questionnaire item to answer the research questions with the aid of SPSS version 23. The decision rule regarding disagreeing and agreeing was based on a mean range of 0-2.49 as disagree/rejected and a mean range of 2.50-4.0 as agree/accepted. The population for the survey study comprises 525 with a sample of 217 pre-service science teachers in FUT Minna using Krejcie and Morgan's (1970) table. Based on the outcomes of

this research, it was concluded that there was high awareness and lack of practice regarding the concepts of Digital Eco-literacy among pre-service science teachers of FUT Minna. There is growing importance of understanding and addressing the environmental impact of digital technologies, as our society becomes increasingly dependent on digital tools and platforms, it is crucial to raise awareness and educate individuals about the environmental consequences of their digital actions. This research highlights the need for educational institutions, governments, tech companies, and environmental organizations to collaborate in promoting digital eco-literacy, by integrating these concepts into education, fostering critical thinking, and encouraging sustainable practices, we can work toward a more environmentally responsible digital future.

Keywords: Awareness, Digital Eco-literacy concepts, Digital Technologies & Pre-service Science Teachers.

Introduction

Environment is the most pivotal component of the universe which provides man with all the necessary materials needed for his survival and his lineage. Man depends on the environment for food, shelter, oxygen, etc.; yet, he destroys the environment. His remarkable development in science and technology, coupled with high population growth and the frequent exploration of natural resources is resulting in several environmental issues such as erosion, drought, climate change, increase in environmental temperature, etc. These affect every continent and country in the world and have been profoundly explained in the existing literature. Dan (2019), reported that the Sahel region of Africa is the most affected part of the world by the dwindling of natural resources. In Nigeria, the major causes of these environmental issues or problems have been identified as urbanization, overpopulation, deforestation, desertification and pollution (Isife, 2012). Therefore, improving the environment is the responsibility of all members of the society, including educational institutions, teachers and students.

One of the major contradictions in the twenty-first century is the unique technological advancement and economic growth, which have contributed to devastating socio-environmental impacts on humanity despite accruing numerous benefits for people. In the quest for survival, humankind is significantly exposing the planet to severe biodiversity threats, climate change threats, and waste management threats, which pose issues to energy, ecology security, food, and politics which are impediments to sustainable development (Olawuyi, 2015). The African continent is also experiencing various and complex environmental challenges, including the threat of significant extinction of species due to the adoption of a global capitalist system that creates a production treadmill due to its increasing urge for enormous profits (Adenike & Foluke, 2021). The rising demand for products has led to the proliferation of this system in Africa due to its ability to avail products at a lower price. Nigeria is part of this environmental conundrum due to anthropogenic activities contributing to ecosystem degradation, biodiversity loss and reduction in agricultural production (Olawuyi & Olusegun, 2018). Northern Nigeria is under threat due to the Eastward rapid encroachment that threatens sustainable livelihoods while environmental degradation in the Niger Delta continues making the region prone to conflicts due to quests for resource control and environmental justice (Ekwueme et al., 2016). Life-consuming floods, erosions, waste-polluted environs, and naked electric wires found on the ground of the environmental ecosystem, have increasingly become reoccurring issues in environmental challenges that Nigeria has been associated with, in which these challenges raise the need for sustainability education that empowers

policymakers and stakeholders in Nigeria to urgently implement environmental protection measures (Babalola & Olawuyi, 2021). Environmental Education and eco-literacy can serve as a tool for propagating United Nations Sustainable Development Goals (SDGs) in Nigeria, especially those relating to ecological protection (biodiversity), resource conservation and climate change (Adenike & Foluke, 2021). Therefore, in this context, the concepts of ecology, literacy, environmental education, eco-literacy or ecological literacy or environmental literacy, digital literacy and digital eco-literacy are to be discussed concerning Nigeria's ecosystem as the centre of this research study.

Eco-literacy, also known as ecological literacy or environmental literacy, is the knowledge and understanding of ecological principles and concepts that enable individuals to make informed decisions and take responsible actions towards environmental sustainability (Aina, 2016). In Nigeria, as a country with diverse ecosystems and pressing environmental challenges, the concept of eco-literacy plays a vital role in promoting sustainable development. Eco-literacy is crucial for addressing environmental issues, conserving biodiversity, and promoting sustainable development in Nigeria (Ismaila & Salman, 2015). By fostering an understanding of ecological concepts and principles, individuals can make informed choices regarding natural resource management, waste disposal, energy consumption, and sustainable agricultural practices. Eco-literacy also enhances environmental stewardship and encourages the adoption of eco-friendly behaviours at individual, community, and societal levels (Olatoye, et al., 2017). In recent years, there has been an increased recognition of the importance of eco-literacy in Nigeria (Aina, 2016). Efforts have been made to incorporate eco-literacy into formal education systems, develop educational materials and resources, and promote public awareness campaigns on environmental issues (Aigbokhan & Adesina, 2017). However, there is still a need for continued research, curriculum development, and capacity-building initiatives to enhance eco-literacy among different segments of the population in Nigeria (Ogbeide & Ibude, 2018).

Digital literacy refers to the ability to use digital technologies effectively and responsibly to access, evaluate, create, and communicate information. In today's digital age, digital literacy is essential for individuals to fully participate in the social, economic, and educational opportunities enabled by technology. In Nigeria, a country experiencing rapid technological advancements, the concept of digital literacy is of utmost importance. Digital literacy is crucial for Nigeria's socio-economic development, knowledge acquisition, and digital inclusion because it enables individuals to navigate digital platforms, critically evaluate information, communicate effectively, and utilize digital tools for personal and professional growth (Onyebuchi & Ogwo, 2015). Digital literacy also plays a significant role in bridging the digital divide and fostering digital citizenship (Adedola et al., 2016). In recent years, Nigeria has witnessed efforts to enhance digital literacy across various sectors. The government, educational institutions, and non-governmental organizations have implemented initiatives to provide digital skills training, establish digital literacy centres, and promote digital inclusion programs (Ololube & Agbor, 2017). However, challenges such as limited access to technology and infrastructure gaps still exist, emphasizing the need for continued investment in digital literacy education and policy reforms (Oyewole et al., 2020).

Digital eco-literacy refers to the combination of digital literacy and ecological literacy, encompassing the knowledge, skills, and attitudes required to navigate digital technologies in an environmentally sustainable manner (Eneh & Ndujiuba, 2016). As Nigeria experiences increasing digitalization and environmental challenges, the concept of digital eco-literacy becomes essential for promoting sustainable development. Digital eco-literacy plays a crucial role in fostering environmentally responsible behaviour and sustainable development in Nigeria's digital age because it enables individuals to leverage digital tools and platforms for

digital technologies, and contributing to global efforts to mitigate the ecological footprint of the digital world. Digital eco-citizenship begins with adopting sustainable digital habits.

Statement of the Problem

Environmental issues have become increasingly significant in recent years, necessitating a focus on eco-literacy awareness and knowledge to promote sustainable behaviours and attitudes. However, there is a lack of comprehensive research examining the specific viewpoints and approaches of pre-service science teachers towards digital eco-literacy awareness in this region. As global environmental concerns continue to escalate, the need for comprehensive environmental education becomes imperative to foster sustainable practices and attitudes among future generations (Smith, 2018; Johnson et al., 2020). Considering the importance of digital eco-literacy and the need for a digital ecologically literate society, the Nigerian government through the National University Commission (NUC), introduced a general and compulsory course titled Environmental Education and Sustainable Development which is to provide every person with opportunities to acquire knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment for sustainable development. One common problem associated with the Federal University of Technology Minna in Niger State is poor energy management and e-waste management especially in and around students' hostel which often results in the pollution of the hostel environment and blockage of drainages, leaving electrical appliances turned on in the daylight (like bulbs, fans, air conditions, etc.) even when not in use. This may make someone wonder if members of the university community are digitally and ecologically literate considering their exposure to learning experiences relating to ecological management and environmental protection, hence the need to investigate the reason for these problems to solve them. Therefore, this study aims to determine the awareness and practices of digital eco-literacy among Pre-service Science Teachers of the Federal University of Technology, Minna. Despite the increasing integration of digital technologies in education, there is a lack of understanding of their usage regarding the ecological aspects of digital literacy among pre-service science teachers (Adebayo & Ajibola, 2018). This knowledge gap hinders their ability to effectively incorporate environmental sustainability concepts into their teaching practices.

Aim and Objectives of the Study

This research aims to investigate the awareness of digital eco-literacy concepts among pre-service science teachers of the Federal University of Technology Minna, Niger State. Specifically, the study sought to achieve the following objectives:

1. to examine the level of awareness of the concept of energy management among pre-service science teachers of FUT Minna.
2. to examine the level of awareness of the concept of e-waste management among pre-service science teachers of FUT Minna.
3. to examine the level of awareness of the concept of digital eco-citizenship among pre-service science teachers of FUT Minna.

Research Questions

The following research questions are raised:

1. What is the level of awareness of the concept of energy management among pre-service science teachers of FUT Minna?

2. What is the level of awareness of the concept of e-waste management among pre-service science teachers of FUT Minna?
3. What is the level of awareness of the concept of digital eco-citizenship among pre-service science teachers of FUT Minna?

Research Methodology

Descriptive survey research design was used for this study. This design was considered most appropriate because it is a method involving seeking and searching for opinions of pre-service science teachers at the Federal University of Technology Minna, Niger State through the use of a questionnaire. The population for the survey study constituted all the pre-service science teachers in FUT Minna which comprises 525 pre-service teachers. A two-stage sampling technique will be employed to select the respondents. Judgemental (purposive) sampling will be used to select pre-service teachers based on their academic level (i.e. 100-500). From the selected levels, a simple random sampling technique will be applied to select pre-service teachers who will participate in the study using Krejcie and Morgan's (1970) table to obtain 217 respondents. A structured survey questionnaire named **Questionnaire on the Awareness of Digital Eco-Literacy Concepts (QADIEC)** was designed based on the concepts of Digital Eco-literacy to elicit information from pre-service science teachers of FUT Minna. The instruments comprise two (2) section response patterns, section A comprises the Demographic data of the respondents while Section B comprises 13 items to address the research questions. Thus, QADIEC is presented in a modified four-point awareness rating scale which is composed of Very Much Aware (VMA) =4 points, Moderately Aware (MA) =3 points, Slightly Aware (SA) =2 points and Not Aware (NA) =1 point. The instrument was vetted for face and content validity by four (4) experts from the Department of Science Education and Educational Technology Department, Federal University of Technology, Minna. The researcher reconstructed the instrument based on the suggestions of the experts.

In determining the reliability of the instrument (questionnaire), the researcher piloted the questionnaire to 28 students from the Educational Technology Department within SSE because the students did not form part of the study. The pilot study enabled the researcher to determine the clarity, readability, appropriateness and adequacy of the instrument and the scores obtained from pilot testing were computed using Cronbach alpha in which the result obtained gives a reliability coefficient of 0.87 for the QADIEC. The data collected was analyzed using the frequency count, percentages, charts, mean ($\bar{x}$) scores and standard deviation of each questionnaire item to answer the research questions with the aid of Statistical Package for Social Sciences (SPSS) version 23. The decision rule regarding disagreeing and agreeing on an item for QADIEC was based on a mean range of 0 - 2.49 as disagree/rejected and a mean range of 2.50 - 4.0 as agree/accepted.

Results

Analysis of Demographic Data

Demographic Distribution of Respondents

	Frequency	Percentage	
		%	Valid Percent
Male	123	59	59
Female	87	41	41
Total	210	100%	100%

Students Level of Study				
	Frequency	Percent	Valid Percent	Cumulative Percent
200	60	28.6	28.6	28.6
300	50	23.8	23.8	52.4
400	40	19.0	19.0	71.4
500	60	28.6	28.6	100.0
Total	210	100.0	100.0	

Age Bracket				
	Frequency	Percent	Valid Percent	Cumulative Percent
15-18	03	1.40	1.40	1.40
19-22	70	33.3	33.3	34.80
23-26	101	48.1	48.1	82.90
27-30	32	15.2	15.2	98.10
30-Above	04	1.90	1.90	100.0
Total	210	100.0	100.0	

The table above shows that the student in the sampled school is FUT Minna, School of Science and Technology Education (SSTE) Department of Science Education, they constituted 210 respondents which is 100% of the sample. The number of male respondents is 123, which is 58.6% and the number of female respondents is 87, which is 41.4%. The questionnaire was administered to all levels except 100L which was used to test for reliability; 200L (30.0%), 300L (18.57%), 400L (41.43%) and 500L (10.00%). Their ages ranged between 15-18 years is 1.40%, 19-22 years is 33.3%, 23-26 years is 48.1%, 27-30 years is 15.2% and for above 30 years 1.90%.

Analysis of Research Questions

The data collected were analyzed using mean and standard deviation to answer the given study questions. The following were the questions and the analysis:

Research Question 1: What is the level of awareness of the concept of energy management among pre-service science teachers of FUT Minna?

Analysis of Mean (x) of Respondents on the Energy Management

S/NO.	ITEM	N	Mean (x)	Standard Dev SD	Decision
1.	Energy management involves energy consumption and conservation	210	3.23	0.82	Highly Aware
2.	Digital devices (like laptops, smartphones, drones, CCTV, webcams, and so on) consume energy	210	3.24	0.84	Highly Aware
3.	Digital device usage affects energy consumption and the environmental ecosystem	210	3.06	0.83	Highly Aware
4.	Energy-saving features or apps (like optimizing apps, battery saver apps, and so on) available on your digital devices	210	3.25	0.80	Highly Aware
5.	Sustainable energy management practices involve optimizing energy use and adopting renewable energy sources	210	2.98	0.88	Moderately Aware
	Grand Mean		3.15	0.83	

The result presented in the table above revealed that the respondents agreed that items 1,2,3, and 4 were "Highly Aware", at the same time, having "Moderately Aware" in item 5 with a grand mean (x) of 3.15. This implied that there is high awareness among pre-service science teachers of FUT Minna on the concept of energy management.

Research Question 2: What is the level of awareness of the concept of e-waste management among pre-service science teachers of FUT Minna?

Mean (x) of respondents on the E-Waste Management

S.NO.	ITEM	N	Mean (x)	SD	Decision
6.	E-waste management is important as it helps in the conservation of the ecosystem	210	3.10	0.80	Highly Aware
7.	Digital technology contributes to the generation of electronic waste (e-waste)	210	3.02	0.86	Highly Aware
8.	Responsible e-waste disposal mechanism for environmental conservation involves the (reduce, reuse and recycle)	3R=210	2.90	0.84	Moderately Aware
9.	Responsible disposal of digital devices when they are no longer of use includes removal of some parts like batteries, and personal information, checking for appropriate recyclers, checking for reuse or donation, and so on	210	3.01	0.90	Highly Aware
Grand Mean			3.01	0.85	

The result presented in the table above revealed that the respondents agreed that items 6,7 and 9 were "Highly Aware", at the same time, having "Moderately Aware" in item 8 with a grand mean (x) of 3.01. This implied that there is high awareness among pre-service science teachers of FUT Minna on the concept of e-waste management.

3.2.3 Research Question 3: what is the level of awareness on the concept of digital eco-citizenship among pre-service science teachers of FUT Minna?

Mean (x) of respondents on the Digital Eco-Citizenship

S/NO.	ITEM	N	Mean (x)	SD	Decision
10.	Digital eco-citizenship involves using digital technologies in ways that minimize their negative impact on the ecosystem	210	3.10	0.87	Highly Aware
11.	There are digital platforms and reliable information sources (like Facebook, Instagram, Twitter, Google, and so on) where you can learn about ecosystem management	210	3.20	0.79	Highly Aware
12.	There are digital and online activities, initiatives or campaigns related to activism on deforestation, wildlife preservation, water resource management and sustainable agriculture.	210	3.14	0.80	Highly Aware
13.	There are Government policies regarding the use of eco-friendly and non-eco-friendly technologies within the ecosystem	210	2.90	0.84	Moderately Aware
Grand Mean			3.09	0.83	

The result presented in the table above revealed that the respondents agreed that items 10,11 and 12 were "Highly Aware" and at the same time, having "Moderately Aware" in item 13 with

a grand mean ($\bar{x}$) of 3.09. This implied that there is high awareness among pre-service science teachers of FUT Minna on the concept of digital eco-citizenship.

Conclusion

Based on the outcomes of this research, it was concluded that there is high awareness of the concepts of Digital Eco-literacy among pre-service science teachers of FUT Minna, and there is growing importance of understanding and addressing the environmental impact of digital technologies. As our society becomes increasingly dependent on digital tools and platforms, it is crucial to raise awareness and educate individuals about the environmental consequences of their digital actions. This research highlights the need for educational institutions, governments, tech companies, and environmental organizations to collaborate in promoting digital eco-literacy. By integrating these concepts into education, fostering critical thinking, and encouraging sustainable practices, we can work toward a more environmentally responsible digital future "(Adela et al., (2018); Kim et al., (2017); Lee and Kim (2017)."

Recommendations

Some general recommendations based on common findings in this study include:

1. Digital eco-literacy concepts should be integrated into formal education systems at various levels by creating a curricula that teach students about digital sustainability, online environmental impacts, and how to use digital tools responsibly. Also, there should be collaboration between environmental organizations, tech companies and educational institutions through which a multidisciplinary research approach like this can be encouraged and may provide more effective measures in addressing digital eco-literacy challenges.
2. Critical thinking when it comes to digital consumption should be encouraged. Teach individuals to assess the environmental impact of their digital activities, such as the carbon footprint of streaming services or the energy efficiency of electronic devices.
3. Public awareness campaigns about the environmental consequences of digital technologies should be launched/raised. Use social media, workshops, and educational events to inform the public about the issues and potential solutions.
4. Tech companies should be encouraged to adopt sustainable practices and transparently report their environmental impact in which consumers can be able to make informed choices about the products and services they use. Also, they should prioritize the creation of user-friendly tools that allow individuals to measure and track their digital footprint which can help users understand the environmental impact of their online activities and make adjustments.
5. Governments can implement regulations and incentives to promote digital sustainability. This could include tax incentives for green data centres, carbon pricing for internet services, and regulations on e-waste management. Also, innovation in green technology should be supported for sustainability, such as renewable energy sources for data centers and energy-efficient hardware design.

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