

V. INTERNATIONAL CAPPADOCIA SCIENTIFIC RESEARCH CONGRESS

November 5-7, 2023 / Cappadocia-Nevsehir

EDITOR
Prof. Dr. Halis BİLGİL

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AWARENESS OF DIGITAL ECO-LITERACY CONCEPTS, AVAILABILITY AND PERCEIVED IMPACT OF DIGITAL TECHNOLOGIES AMONG PRE-SERVICE SCIENCE TEACHERS OF FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

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ABSTRACT

This study investigated the awareness of digital eco-literacy concepts, availability and perceived impact of digital technologies among pre-service science teachers of FUT Minna. Descriptive survey research design was used for this study. This design was considered most appropriate because it is a method involving to seek and search for opinions of pre-service science teachers in Federal University of Technology Minna, Niger State through the use of questionnaire named **QADIEC** with a reliability coefficient of 0.87 using Cronbach alpha. The questionnaire comprised of two (2) section response patterns with a modified four-point awareness rating scale. The data collected was analyzed using the frequency count, percentages, mean (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. Decision rule regarding disagreeing and agreeing was based on a mean range of 0 - 2.49 as disagree/rejected and mean range of 2.50 - 4.0 as agree/accepted. The population for the survey study comprises of 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 moderate awareness with 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

1.0 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 are 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 in 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, waste management threats, which poses 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, naked electric wires found on the ground of the environmental ecosystem, have increasingly become reoccurring issues in environmental challenges that the 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 in relation to 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 behaviors 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 (Adedoja *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 centers, 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 behavior and sustainable development in Nigeria's digital age because it enables individuals to leverage digital tools and platforms for accessing environmental information, engaging in eco-friendly practices, and advocating for environmental conservation (Oluwafemi & Omoogun, 2018). Digital eco-literacy empowers citizens to make informed decisions and take actions that contribute to a more sustainable future (Adegoke & Oyelekan, 2020). In recent years, Nigeria has witnessed several developments in the promotion of digital eco-literacy. Non-governmental organizations, educational institutions, and government agencies have initiated programs to enhance digital eco-literacy skills, foster environmental consciousness, and encourage sustainable practices (Adegoke & Oyelekan, 2020). However, there is a need for continuous research, capacity-building efforts, and policy reforms to strengthen digital eco-literacy education and ensure its integration into various sectors of Nigerian society.

Digital eco-literacy concepts awareness refers to the level of knowledge, understanding, and consciousness among individuals in Nigeria regarding the intersection of digital technologies and environmental sustainability (Adegbite & Adegkunle, 2017). As Nigeria undergoes rapid digital transformation and faces pressing environmental challenges, promoting digital eco-literacy awareness becomes crucial for fostering sustainable development. Digital eco-literacy awareness plays a vital role in encouraging individuals to adopt environmentally responsible behaviors and leverage digital tools for sustainable practices (Olawumi & Akinbode, 2018). By raising awareness about the environmental impact of digital technologies and promoting best practices, Nigeria can harness the potential of the digital revolution to address ecological concerns and advance sustainable development goals.

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Recent developments in Nigeria have seen increased efforts to promote digital eco-literacy awareness. Non-governmental organizations, government agencies, and educational institutions have initiated awareness campaigns, workshops, and policy discussions to raise consciousness about the environmental implications of digital technologies (Iyamu & Abolarin, 2019). Future directions should focus on integrating digital eco-literacy awareness into educational curricula, fostering collaboration among stakeholders, and promoting sustainable digital practices through innovative strategies.

The availability of digital technologies within the environmental ecosystem refers to the integration of digital tools and systems in various aspects of environmental management, conservation, and sustainability (Spínola, 2015). These technologies have a profound impact on how we monitor, protect, and sustain our environment. Digital technologies, such as remote sensing, drones, and sensor networks, have transformed the way we monitor the environment. Similarly, satellite-based monitoring systems, like those from NASA and the European Space Agency, provide invaluable data for tracking changes in land use, deforestation, and climate patterns (Stone, 2017). These technologies aid in early warning systems for natural disasters. Digital technologies play a significant role in environmental education and outreach. Online courses, interactive apps, and virtual reality experiences allow individuals to learn about the environment and engage with environmental issues. Digital technologies are critical for policymakers and governmental bodies to monitor compliance with environmental regulations, just as Geographic Information Systems (GIS) help with spatial data analysis, and electronic record-keeping enhances transparency and accountability.

1.1 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 behaviors 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 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 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 to wonder if members of the university community are actually digitally and ecologically literate considering their exposure to learning experience relating to ecological management and environmental protection, hence the need to investigate the reason for these problems with a view to solving them. Therefore, this study aims to determine the awareness and practices of digital eco-literacy among Pre-service Science Teachers of Federal University of Technology, Minna. Despite the increasing integration of digital technologies in education, there is a lack of understanding in their usage regarding the ecological aspects of digital literacy among Biology teachers (Adebayo & Ajibola, 2018). This knowledge gap hinders their ability to effectively incorporate environmental sustainability concepts into their teaching practices.

1.2 Aim and Objectives of the Study

The aim of this research is to investigate the awareness of digital eco-literacy concepts among pre-service science teachers of Federal University of Technology Minna, Niger State. Specifically, the study sought to achieve the following objectives: To;

1. determine the level of awareness of digital eco-literacy among pre-service science teachers of FUT Minna.
2. determine the level of awareness of the availability of sustainable digital technologies among pre-service science teachers of FUT Minna.
3. examine the level of awareness on the perceived impact of digital technologies on the ecosystem among pre-service science teachers of FUT Minna.

1.3 Research Questions

1. what is the level of awareness of digital eco-literacy among pre-service science teachers of FUT Minna?
2. what is the level of awareness of the availability of sustainable digital technologies among pre-service science teachers of FUT Minna?
3. what is the level of awareness on the perceived impact of digital technologies on the ecosystem among pre-service science teachers of FUT Minna?

2

2.0 METHODOLOGY

Descriptive survey research design was used for this study. This design was considered most appropriate because it is a method involving to seek and search for opinions of pre-service science teachers in Federal University of Technology Minna, Niger State through the use of questionnaire.

The population for the survey study constituted all the pre-service science teachers in FUT Minna which comprises of 525 pre-service teachers.

Table 2.1: Distribution of Population by Level and Gender

S/NO.	LEVEL	GENDER		NO. OF PRE-SERVICE TEACHERS
		MALE	FEMALE	
1.	100	74	53	127
2.	200	64	50	114
3.	300	64	51	115
4.	400	66	35	101
5.	500	36	32	68
	Total	304	221	525

Field Survey (2023)

A two-stage sampling technique was employed to select the respondents. Judgemental (purposive) sampling was used to select pre-service teachers on the basis of 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 210 respondents. A structured survey questionnaires named **Questionnaire on the Awareness of Digital Eco-Literacy Concepts (QADIEC)** was designed on the basis of the concepts of Digital Eco-literacy to elicit information from pre-service science teachers of FUT Minna. The instruments comprise of two (2) section response patterns, section A comprises of the Demographic data of the respondents while section B comprises of 22 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 Educational Technology Department within SSTE because the students do 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, 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. Decision rule regarding disagreeing and agreeing of an item for **QADIEC** was based on a mean range of 0 - 2.49 as disagree/rejected and mean range of 2.50 - 4.0 as agree/accepted.

3.0 RESULTS

3.1 Analysis of Demographic Data

Table 3.1: Demographic Distribution of Respondents

Gender				
	Frequency	Percent	Valid Percent	Cumulative Percent
Male	123	58.6	58.6	58.6
Female	87	41.4	41.4	100.0
Total	210	100.0	100.0	

Level				
	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	

Table 3.1 above shows that the students in the sampled school is FUT Minna, School of Science and Technology Education (SSTE) Department of Science Education, they constituted 210 respondents which is the 100.0% 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 who were on 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 is 1.90%.

3.2 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:

3.2.1 Research Question 1: what is the level of awareness of digital eco-literacy among pre-service science teachers of FUT Minna?

Table 3.2: Mean (x) of respondents on the Awareness of Digital Eco-Literacy Concepts

S/NO.	ITEM	N	Mean (x)	SD	Decision
1.	Environmental ecosystem	210	3.23	0.82	Highly Aware
2.	Eco-literacy	210	2.16	1.10	Slightly Aware
3.	Digital literacy	210	2.41	1.20	Slightly Aware
4.	Digital Eco-literacy	210	1.70	1.03	Not Aware
5.	Biodiversity	210	3.02	0.92	Highly Aware
6.	Climate change	210	3.32	0.81	Highly Aware
7.	Waste management	210	3.27	0.84	Highly Aware
8.	Environmental conservation	210	3.27	0.77	Highly Aware
9.	Sustainable development	210	2.98	0.86	Moderately Aware
10.	Environmental sustainable practices/eco-conscious practices like energy conservation, waste management, and so on.	210	3.13	0.86	Highly Aware
Grand Mean			2.85	0.92	

The result presented in **Table 3.2** above revealed that the respondents agreed that items 1,5,6,7,8 and 10 were "Highly Aware", at the same time, having "Moderately Aware" in item 9. It was also recorded that items 2 and 3 were "Slightly Aware" and item 4, was "Not Aware" with a grand mean (x) of 2.85. This implied that there is moderate awareness among pre-service science teachers of FUT Minna on the concepts of Digital Eco-literacy.

3.2.2 Research Question 2: what is the level of awareness on the availability of sustainable digital technologies among pre-service science teachers of FUT Minna?

Table 3.3: Mean (x) of respondents on the Sustainable Digital Technologies Availability

S/NO.	ITEM	N	Mean (x)	SD	Decision
11.	There is availability of digital technologies within the markets or industry	210	3.13	0.89	Highly Aware
12.	There is availability of eco-friendly technologies like electrical energy-efficient devices (laptops, smart phones, drones, and so on), solar power systems, biogas, and so on	210	3.23	0.82	Highly Aware
13.	There is availability of digital google map used for location detection	210	3.33	0.89	Highly Aware
14.	There is availability of digital weather forecast/gauge apps and features	210	3.20	0.89	Highly Aware
15.	There is availability of solar power systems and solar power devices like solar MP3 devices, solar mobile phones, solar power torchlights, and so on	210	3.42	0.72	Highly Aware
16.	There is availability of wireless networks and wireless devices like the wireless ear pods, wireless earpiece, wireless MP3 devices, and so on	210	3.39	0.74	Highly Aware
17.	There is availability of sensor detective devices/apps, like fingerprint sensor, face recognition sensor, voice recognition, and so on	210	3.14	0.87	Highly Aware
Grand Mean			3.26	0.83	

The result presented in **Table 3.3** above revealed that the respondents agreed that items 11,12,13,14,15,16 and 17 were "Highly Aware" with a grand mean (x) of 3.26. This implied that there is high awareness among pre-service science teachers of FUT Minna on the on the availability of sustainable digital technologies.

3.2.3 Research Question 3: what is the level of awareness on the impact of digital technologies on the ecosystem among pre-service science teachers of FUT Minna?

Table 3.4: Mean (x) of respondents on the Impact of Digital Technologies on the Ecosystem

S/NO.	ITEM	N	Mean (x)	SD	Decision
18.	Human activities such as deforestation, mining exploration, chemical fishing and so on degrade the environmental ecosystem	210	3.31	0.77	Highly Aware
19.	Eco-friendly technologies have less negative/adverse effects on ecosystem	210	3.01	0.89	Highly Aware
20.	Looking at electronic or digital screen for a long period of time can cause impairment known as myopia (blurred vision)	210	3.12	0.86	Highly Aware
21.	Wearing protective glasses protects the eye from myopia	210	3.08	0.86	Highly Aware
22.	Digital devices emit heats/radiation rays that causes cancer when exposed for a long period of time.	210	3.05	0.93	Highly Aware
	Grand Mean		3.11	0.86	

The result presented in **Table 3.4** above revealed that the respondents agreed that items 18,19,20,21 and 22 were "Highly Aware" with a grand mean (x) of 3.11. This implied that there is high awareness among pre-service science teachers of FUT Minna on the impact of digital technologies on the ecosystem.

3.3 Summary of Findings

1. The respondents unanimously agreed that there is moderate awareness among pre-service science teachers of FUT Minna on the concepts of Digital Eco-literacy which may likely impact the improvement of a sustainable environment ecosystem.
2. The respondents unanimously agreed on the high awareness among pre-service science teachers of FUT Minna on the availability of sustainable digital technologies which may also likely impact the improvement of a sustainable environmental ecosystem.
3. The respondents unanimously agreed that there is high awareness among pre-service science teachers of FUT Minna on the impact of digital technologies on the ecosystem.

3.4 Conclusion

Based on the outcomes of this research, it was concluded that there is high awareness with 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 "(Adela *et al.*, (2018); Kim *et al.*, (2017); Lee and Kim (2017)."

3.5 Recommendations

some general recommendations based on common findings in this area:

1. Digital eco-literacy concepts should be integrated into formal education systems at various levels. Create curricula that teach students about digital sustainability, online environmental impacts, and how to use digital tools responsibly.
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.

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