**Faculty of Natural and Applied Sciences Journal of Computing and Applications**
**Print ISSN: 3026-8133**
www.fnasjournals.com
**Volume 2; Issue 2; March 2025; Page No. 50-55.**

# Knowledge and Readiness to Adopt Green Computing Practices Among Librarians and Academic Staff in a Private University in Delta State, Nigeria

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**Abstract**
This study investigated the knowledge and readiness of librarians and academic staff in private universities in Delta State, Nigeria, to adopt green computing practices. It aimed to assess their awareness levels, knowledge of green computing practices, and willingness to implement them. Using a descriptive survey research design, data was collected from 185 librarians and academic staff across Western Delta University, Oghara, and Michael and Cecilia Ibru University through questionnaires. The analysis was conducted using frequency and percentage. The study revealed that a significant number of respondents were unaware of green computing concepts and practices. However, despite this lack of awareness, they demonstrated a willingness to adopt green computing practices within their institutions. Based on these findings, the researchers recommended that university management should organize workshops, orientations, and seminars to educate librarians, academic staff, and other computer users on green computing, particularly focusing on proper disposal and recycling of computer hardware. Additionally, the National Universities Commission (NUC) should establish and enforce a green computing policy across Nigerian universities to promote sustainable computing practices. Implementing these recommendations will help bridge the knowledge gap and encourage environmentally friendly computing behaviours' in academic institutions.

**Keywords:** Green Computing, Energy Conservation, Computing Practice, Energy Consumption, Eco-Friendly

## Introduction

The Internet which is the world's largest network, requires computers and related devices to access vast amounts of information for knowledge development in libraries. Consequently, there has been a rapid growth of information technology (IT) and its associated communication tools in all library services and operations (Wawu, 2019). Computer users should be informed about the need of turning off the device when it is not being used or turning off the central processing unit and all other peripherals when the computer is not being used for a long time. Instead of throwing away broken or old equipment components, users should find a way to recycle them and put them to good use. As a result, everyone has to know these stuff to keep the environment friendly (Flinchbaugh & Murtha, 2019).

The term "green computing" describes methods of using computers and its peripherals that do little damage to the environment. Both when turned on and off, these devices are known to release gaseous pollutants and hazardous substances. Effective use of energy is also a part of it (Ahmad, 2021). Libraries that adopt green computing techniques want to lessen their impact on the environment by making better use of their computer technology. Computers that use less power and better ways of recycling and disposing are part of it. Consequently, there is a growing need for environmentally friendly technology that can save energy and is also simple to recycle or dispose of (Stec & Mazur, 2019). Users, libraries, governments, and businesses and industries must all work together to solve this problem. Green concepts, programs, structures, and regulations are the subject of great debate as a means to lessen our impact on the environment while simultaneously decreasing our energy consumption and carbon emissions, minimizing waste, and lowering our overall expenditures (Bello, 2015). Duplex printing, printing only when needed, turning off electronics when not in use, moving from desktop to laptop computers, using cloud computing, and virtualisation software are some of the environmentally responsible actions that many organisations, libraries, and individual computer users are now embracing (Campit, 2017). Environmental consciousness is on the rise across all sectors of society, from households to businesses to governments, and this trend is most noticeable on college campuses.


*Cite this article as*:
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Since they are responsible for 2% of all carbon emissions, Campit (2017) argues that making and using computer resources is energy intensive. Without proper measures to reduce or remove the associated environmental dangers, the increasing use of computer devices in today's global economy would only increase the severity of existing harm. Institutions and libraries use a lot of energy every day to run their electronics and electrical devices (Ogunbodede & Omehia, 2024). Unfortunately, this consumption also causes devices to become obsolete and broken, which adds to the problem of e-waste and the release of harmful gases like carbon dioxide. According to Yousef and Kollab (2023), a number of harmful compounds are present in electronic trash. These include lead, cadmium, mercury, arsenic, and cobalt.

Forti et al. (2020) found that only 17.4% of the 53.6 million metric tonnes (Mt) of e-waste that was produced globally was really collected and recycled correctly. In spite of a 9.2 Mt rise in total e-waste output during 2014, the quantity of e-waste actually recorded has climbed by 1.8 Mt. World Economic Forum (2019) estimates that e-waste generation would reach 120 million tons per year by 2050, more than doubling from its current level if no measures are implemented. It is essential to minimize the environmental and health dangers connected with e-waste, maximize resource recovery, and promote a circular economy approach by implementing efficient techniques for collection, recycling, and disposal (Yousef & Kollab, 2023). Reducing energy usage is the primary goal of green computing. This not only lessens the financial burden on institutions' energy budgets, but it also lessens the environmental impact, especially of their IT assets. Aside from the obvious financial benefits, green computing practices may aid banks in meeting regulatory requirements and even provide them a marketing advantage over rivals in the consumer and investor markets (Ahmad, 2021). Based on Rouse's (2017) research, there are four main ways to promote green computing: reducing the electrical consumption of computers and their peripherals while using them in an eco-friendly way; reusing or recycling old electronics; creating digital devices that use less energy; and minimizing waste during manufacturing to lessen the environmental impact of these processes.

**Objective of the Study**

The specific objectives of the study are:

i. Know the awareness level of green computing among librarians/academic staff in private universities in Delta State?
ii. investigate the level of librarians/academic staff awareness on green computing practices in private universities in Delta State?
iii. find out if librarians/academic staff in private universities in Delta State are readiness to adopt green computing practices?

**Research Questions**

The following research questions guided the study:

i. What is the level of librarians/academic staff awareness of green computing in private universities in Delta State?
ii. What is the level of librarians/academic staff awareness on green computing practices in universities?
iii. What is the level of readiness to green computing adoption among the librarians/academic staff?

Green computing is emerging as a prominent global trend. However, many computer users, particularly librarians, staff, and students, lack an understanding of its significance. Consequently, the adoption and implementation of green computing necessitate that computer users are educated on the principles of sustainable green computing, the attributes that define a green PC, and the computing practices that align with an environmentally friendly approach (Cordero et al., 2022). Awareness of green computing is essential for fostering the adoption of sustainable computing techniques. It pertains to a person's comprehension of the ecological consequences of technology and the methods by which these might be used in a more ecologically responsible way. This encompasses an understanding of the materials and processes involved in the manufacturing and disposal of computer goods, with the energy consumption of various devices and the possibilities for energy conservation strategies (Yousef & Kollab, 2023). A research by Ahmad et al. (2013) investigated the awareness of Malaysian academic personnel and students about green computing. The findings revealed that most staff and students lacked familiarity with essential concepts, ideas, and concerns pertaining to green computing. Ahmad (2021) performed a study assessing the knowledge, acceptability, and implementation of green computing among university personnel and students in Nigeria, revealing a reasonable degree of awareness.

In Nigeria, there has been little or no initiative to promote green computing owing to inadequate awareness and insufficient prioritization. While several firms in Europe and the United States endeavor to reduce carbon dioxide


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emissions, some people in African nations are seeking to capitalise on the situation. Nigerian dealers advocate for the importation of secondhand computers, which produce higher levels of carbon dioxide compared to new PCs (Batlegang, 2012).

The research conducted by Mubarak and Augie (2020) indicated that a significant proportion of computer users in Kebbi State, Nigeria, exhibit little or no understanding of green computing. Typically, they are not conscientious users of computers and their peripherals. Dookhitram et al. (2012) identified marginally elevated awareness levels among Mauritian students, although revealed a disparity between their awareness and actual actions. Despite students indicating a reasonable understanding and awareness of green ICT, their everyday behaviors' were incongruent with their self-assessments. Merely 18% of individuals powered off their laptops and other electrical devices while not in use, and the majority harbored misunderstandings about energy conservation methods.

Green ICT is available as an online course in Australia via the Australian National University and the University of New South Wales, aimed at enhancing understanding of green computing, along with the initiative to include green ICT education into the university curriculum (Harris, 2011). Green computing practices include several tactics, such as using energy-efficient equipment, integrating designs that enable recycling, and advocating for the utilization of renewable energy sources. The primary objective of green computing methods is to reduce the carbon footprint and resource use of information and communication technology (ICT) while enhancing their social and economic advantages (Ahmad, 2021). By implementing sustainable green computing practices, institutions, libraries, and organizations may mitigate environmental consequences and promote more effective and responsible utilization of IT resources, so contributing to a greener future. Kirvin (2022) identifies the green computing tactics used by libraries, colleges, and organizations as follows: implementation of smart technology, deactivating IT equipment while not in use, and shutting down servers, CPUs, and other devices during prolonged periods of idleness. Energy-intensive peripherals, such as laser printers, should be activated just when necessary; implement strategic scheduling for computer use, pick energy-efficient computers and displays, monitor temperature to reduce cooling requirements, and ensure proper disposal of electronic trash. In response to the adverse effects of computers, academic institutions are currently implementing green computing practices to decrease energy usage, carbon footprint, and ICT waste, while maximizing recycling and reuse to lower energy costs (Mubarak & Augie, 2020). This research aims to examine the awareness and preparedness to implement green computing practices among librarians and academic personnel at a private institution in Delta State, Nigeria.

**Methodology**

A descriptive survey approach was employed for this study. 185 librarians/academics staff from WDU and MCIU makes up the study's population. A self-made questionnaire with the title 'awareness and readiness to adopt green computing practices questionnaire' 175 of the one hundred and eighty questionnaires that were delivered were judged to be usable. The research used the total enumerative and accidental sampling strategy. The tool for gathering data was a questionnaire. The data were analysed using the mean, frequency, and percentage statistics.

**Results**

**Research Question 1**: What is the level of librarians/academic staff awareness of green computing in private universities in Delta State?

**Table 1: Level of librarians/academic staff awareness of green computing concept**

| Level of awareness of the concept of green computing | Aware(%) | Unaware(%) | Decision |
|---|---|---|---|
| Computers are made of poisonous materials | 23 (13) | 152(87) | Unaware |
| Monitors release toxic chemicals if disposed in a landfill | 53(30) | 122(70) | Unaware |
| Using ENERGY-STAR computer product increases electricity | 87(50) | 88(50) | Unaware |
| Increased computer use contributes to global warming | 45(26) | 130(74) | Unaware |
| A discarded computer leaks lead and mercury into environment | 91(52) | 84(48) | Aware |
| Laptops consume more power than desktops | 65(37) | 110(63) | Unaware |
| PC recycling minimizes e-waste in Landfills | 91(52) | 84(48) | Aware |
| PC recycling increases environmental pollution | 53(30) | 122(70) | Unaware |
| Turning off the PC saves more energy than putting it sleep mode | 164(93) | 11(6) | Aware |
| Recycling computer hardware helps to keep the environment clean | 61(34) | 114(65) | Unware |
| 17- inch monitor uses more energy than 14-inch Monitor | 81(46) | 94(54) | Unaware |


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Table 1 shows that a large numbers of the librarians/academic staff were unaware of the concept of green computing in their institutions. (87%) were not aware that computers are made of poisonous materials. This was followed by (70%) who stated that they don't have the knowledge that PC recycling increases environmental pollution and that monitors releases toxic chemicals if disposed in a landfill.

**Research Question 2**: What is the level of librarians/academic staff awareness on green computing practices in these private universities?

**Table 2: Level of librarians/academic staff awareness on green computing practices in libraries**

| Green computing practices | Aware(%) | Unaware(%) | Decisions |
|---|---|---|---|
| Practicing green computing reduces energy consumption | 66 (38) | 109(62) | Unaware |
| Turn off the computer when not in use. | 152(87) | 23(13) | Aware |
| Switch the computer to "low power consumption" mode every time. | 54(31) | 121(69) | Unaware |
| Be careful to use e -books and e-learning tools | 62(35) | 113(65) | Unaware |
| Recycling computer hardware help to protect the environment | 43(25) | 132(75) | Unaware |
| Using solar energy to power a computer | 79(45) | 96(55) | Unaware |
| Turning off the PC saves more energy than putting it on sleep mode | 34(19) | 141(72) | Unaware |
| Read the content of the Green IT Handbook that is provided with ICT equipment | 123(70) | 52(30) | Aware |
| Green computing practices is fundamental and a major concern of the modern world | 73(42) | 102(58) | Unaware |
| Use of recycled paper and reduce paper consumption. | 54(31) | 121(69) | Unaware |
| Green computing is an eco-friendly computing practice aimed at reducing carbon emission | 45(26) | 130(74) | Unaware |
| Using Google's Blackle search engine is faster and saves energy | 73(41) | 102(58) | Unaware |
| Green manufacturing helps in reducing wastage | 83(47) | 92(53) | Aware |

Table 2 shows level of librarians/academic staff awareness on green computing practices. 141(72%) were not aware that turning off the PC saves more energy than putting it on sleep mode. 130(74%) were not aware that Green computing is an eco-friendly computing practice aimed at reducing carbon emission. This implies that the bulk of the respondents were not aware of green computing practices in their universities.

**Research Question 3**: What is the level of readiness to green computing adoption among the librarians/academic staff?

**Table 3: Readiness of librarians/academic staff to adopt towards green computing in their respective universities**

| Readiness to adopt | Ready(%) | Not ready(%) | Decision |
|---|---|---|---|
| Adopt green computing practices | 156(89) | 19(11) | Ready |
| Turn off my computer when not in use to save energy | 151(89) | 24(14) | Ready |
| Use screen saver function | 132(75) | 43(25) | Ready |
| Use the system sleep function | 135(77) | 40(23) | Ready |
| Reduce the time spent using computers | 162(93) | 13(7) | Ready |
| Print on both sides of the paper | 87(50) | 88(50) | Not ready |
| Save documents on disk rather than print them on paper | 45(25) | 130(74) | Not ready |
| Print only when necessary | 156(89) | 19(11) | Ready |
| Reuse printed papers for testing printers | 129(74) | 46(26) | Ready |
| Use re-writeable storage media | 143(82) | 32(18) | Ready |
| Recycle unwanted lithium (laptop) batteries | 54(31) | 121(69) | Not ready |
| Recycle unwanted computer equipment | 61(35) | 114(65) | Not ready |
| Buy new computer device only when necessary | 165(94) | 10(6) | Ready |
| Use environmentally friendly alternatives | 171(98) | 4(2) | Ready |

Table 3 shows librarians/academic staff were ready to adopt green computing. A large proportion of the respondents 171(98%) were ready to use environmentally friendly alternatives. This was followed by 165(94%) who agreed to buy


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new computer device only when necessary. This implies that the librarians/academic staff were ready to adopt green computing in their respective institutions.

**Discussion**

The study shows that a large number of the librarians/academic staff were unaware of the concept of green computing in private universities in Delta State. This study is in agreement with that of Mubarak and Augie (2020) whose study revealed that greater percentage of the computer users in Kebbi State, Nigeria possess none little or no awareness of green computing. In a related study, Ahmad et al. (2013) indicated that a majority of Malaysian academic staff and students were unfamiliar of key concepts, ideas, and issues related to green computing. The study revealed that librarians/academic staff were not awareness of green computing practices. A large number of the respondents were not aware that turning off the PC saves more energy than putting it on sleep mode. This finding is in conformity with Dookhitram et al. (2012) who found that their respondents have moderate knowledge and awareness of green computing but their daily practices were inconsistent with their self-report. Only 18% turned off their computers and other electrical appliance when not in use. The study shows librarians/academic staff were ready to adopt green computing. This finding is in agreement with Molla and Licker (2005) who in a survey investigating end users` green computing readiness in the university of technology in Malaysia, involving students, academic staff and administrative staff found that users are ready for green computing implementation only that they have some slack in adopting the practices.

**Conclusion**

This study highlighted a significant lack of awareness and understanding of green computing among librarians and academic staff in private universities in Delta State. Additionally, the study found that many respondents were unaware of basic energy-saving practices, such as the benefits of turning off PCs instead of using sleep mode. Despite this gap in awareness, the study revealed a positive inclination toward adopting green computing practices among librarians and academic staff. Based on these findings, it is evident that increasing awareness and providing practical guidance on green computing practices could facilitate a more sustainable approach to computing in academic environments.

**Recommendations**

- Workshop, orientation and seminars should be organized by the university management on proper disposal and recycling of computer hardwires among lecturers, librarians and computer users as the concept of green computing is still new to them.
- The National University Commission (NUC) should put in place a green computing policy across universities in Nigeria and ensure that it is implemented.

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