Computer Based-Test as a Strategy for Forest Preservation: A Case Study of Universities in Ilorin Metropolis and Joint Admission Matriculation Board (JAMB), Nigeria

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Abstract

The study aimed at assessing the use of Computer-Based Tests (CBT) in Nigerian universities, focusing on institutions within the Ilorin metropolis. The objectives were to examine the role of paper usage in environmental degradation by estimating the amount of carbon and methane generated per ton of paper produced and to explore students' perceptions of CBT. Data were collected through direct administration of questionnaire using stratified sampling technique. Also, data from the Joint Admission Matriculation Board (JAMB) were used to estimate the number of students who sat for Post UTME between 2014 and 2023. A total of 400 students, representing 0.49% of the total population of the University of Ilorin, Kwara State University, and Al-Hikmah University, were sampled. Frequency, simple percentage, and correlation analyses were used to present and discuss the findings. The results showed a significant relationship between demographic characteristics and computer literacy levels of undergraduate students. Furthermore, there was a significant correlation between students' computer literacy levels and their performance in computer-based examinations, with a correlation coefficient of R =0.8. The study also found that the use of CBT for JAMB UTME examinations between 2014 and 2023 conserved approximately 66,750,168 sheets of paper (equivalent to 8,010.75 trees) and prevented the release of over 825,107.25 kg of carbon over ten years. The study concluded that CBT is a positive development for both the education system and environmental sustainability. The study therefore recommended that institutions adopt CBT technology to reduce paper usage.

Keywords: Computer Based Test, Climate Change, Computer literacy, Environmental Management.

Introduction

Examinations play a critical role in shaping classroom practices, influencing what is taught, how it is taught, and how students learn. They serve as powerful tools that impact both teaching and learning (Rehmani, 2003). Rehmani's view aligns with Havens (2002), who highlights that examinations are not only designed to measure educational or societal objectives, but also reflect the functionality and effectiveness of the educational system. Examinations gauge how well educational objectives have been met and how educational institutions serve the community and society at large (Shah, 2002). In essence, examinations function as a system for evaluating students' academic performance and the efficacy of their teachers.

In the modern era, Information Communication Technology (ICT) has become an integral part of everyday life, particularly in education, where familiarity with computers is now a necessity. The increasing use of technology across all sectors has revolutionized education, including the method of student assessment. One notable application of ICT in education is the widespread adoption of Computer-Based Testing (CBT) as a method for evaluating academic performance. Universities globally have embraced CBT, recognizing that institutions slow to adopt this technology risk falling behind in the global race for educational internationalization and technological advancement (Volery & Lord, 2000).

CBT represents a significant shift in educational assessment. As Jegede (2015) argues, CBT moves education away from rote memorization toward higher levels of comprehension and synthesis, which are essential for building and assessing critical-thinking skills. This shift not only enhances students' cognitive abilities but also introduces a more innovative approach to education, promoting out-of-the-box thinking. Additionally, CBT has administrative advantages for teachers, making the assessment process more efficient, while simultaneously helping students to develop their comprehension skills beyond memorization.

Beyond the pedagogical benefits, CBT also has significant environmental advantages, particularly in the context of forest preservation. Traditional paper-based examinations require substantial amounts of paper, contributing to deforestation and the depletion of natural resources. Paper production is a leading cause of global deforestation, and reducing the demand for paper by shifting to digital methods can play a role in forest conservation efforts. The adoption of CBT significantly reduces the need for paper, thereby minimizing the environmental impact associated with paper-based testing. This aligns with broader sustainability goals and contributes to the reduction of tree felling for paper production (EcoWatch, 2017).

By reducing the reliance on paper, CBT contributes to the preservation of forests, which are vital for maintaining ecological balance, biodiversity, and combating climate change. Forests act as carbon sinks, absorbing carbon dioxide from the atmosphere, and their destruction exacerbates global warming (Food and Agricultural Organization [FAO], 2015). The shift to digital testing is a small but meaningful step towards reducing deforestation and fostering environmental sustainability.

The adoption of CBT in education offers multiple benefits. It enhances student learning outcomes by promoting critical thinking, provides administrative efficiency for teachers, and contributes to global efforts in forest preservation by reducing paper consumption. As institutions continue to embrace this technology, they not only modernize their assessment systems but also support environmental conservation efforts, demonstrating that technological advancement and sustainability can go hand in hand.

Literature Review

Environmental Implication of Computer Based Test

Computer Based Test has a very minute environmental effect compared to the traditional Paper Based Testing Method. County, Makeham, Kidd and Dovey (2002) asserted that manufacturing of paper requires a lot of natural resources including trees, water and energy; it also contributes to environmental pollution. In like manner, Miner (2010) stated that Canadian and United States' pulp and paper industries are the third largest polluter to air, water, and land in both countries and releases over 100 million kg of toxic pollution annually. Environmental Paper Network (2007) stated that, paper industry is the largest user of industrial process water per ton of end product. Furthermore, polluted water flowing from paper mills is of great environmental concern. This is because, a lot of harmful chemicals have been introduced to the water and these are of significant threat to the earth's system. Also, the environment and humans can absorb only a limited amount of toxins before biological systems deteriorate (Wargo, 2009). World Resources Institute (2005) as citied in Agaja (2019) explained that over 11 million hectares of tropical forest are cleared yearly and it is estimated that at present rate of use at least 225 million hectares of tropical forests was cleared in the year 2000. This is very similar to the findings of Stolberg, Borysova, Mitrofanov, Barannik and Eghtesadi (2003). Principal threats to water resources for humans

include water pollution; the contamination of surface water and groundwater reservoirs with chemicals and microorganisms, [the paper industry has significantly contributed to this].
Current updates show that the role of paper remains important in the digital age, with this ubiquitous material still used daily for many purposes worldwide. In fact, the global production of paper and cardboard totals more than 400 million metric tons each year (Statista Research Department, 2023). The most produced type of paper is packaging paper and board, which has been growing in demand in recent years due to the online shopping boom (Statista Research Department, 2023).

With the effect of climate change becoming more severe, it is important to understand the link between paper usage and global warming. According the Intergovernmental Panel on Climate Change [IPCC] (2001), climate change is a statistically significant variation in climatic conditions that persist for an extended period, typically decades or longer. It includes shifts in the frequency and magnitude of sporadic weather events as well as the slow continuous rise in global mean surface temperature. It is evident that climate change has come to stay and that major causative agents of climate change are carbon, methane and other greenhouse gases. Climate, water resources, biophysical and socioeconomic systems are interconnected in complex ways, so a change in any one of these induces a change in another (IPCC, 2001).

According to The Environmental Paper Network (2008), paper has the potential to decompose and produce methane, a greenhouse gas with 21 times the heat-trapping power of carbon dioxide. The quantity of methane produced by paper in landfills is 69 times greater than that produced by fossil fuel, electricity production and has 23 times the heat-trapping power of carbon dioxide (Environmental Paper Network, 2007). Hence, paper is the single greatest source of landfill methane (Environmental Paper Network, 2007).

Despite the prominent roles played by paper in higher institutions of learning, the cost of the descriptive is more than the financial implication. It is more environmentally expensive to utilize papers than it is financially (U.S Environmental Protection Agency, 2010; Sarantis, 2002). Zella (2016) citing Clark University in the U.S noted that the university uses 5,999,976 sheets of paper annually; which is approximately 720 trees per annum. Krishnamurthy (2008) stated that; on a global scale, over 13 million hectares of forest are destroyed annually, of which more than 40% is used in the paper production. Which means over 5.2 million hectares of forest are destroyed annually to produce paper. According to Ray and Nche (2013), one acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual need of 18 people". Converting this to hectares shows that; a hectare of forest absorbs 15 tons carbon dioxide and outputs 10 tons, which will cater for 45 individuals annually. Invariably, over 78 million tons of carbon dioxide is released into the earth's atmosphere at the primary stage of paper product.
Deforestation is a critical environmental factor influencing climate change because forests store approximately 50% of all terrestrial carbon dioxide stocks. However, more than 40% of industrial wood harvest is used for paper manufacturing in the US (Environmental Paper Network, 2007). According to the World Counts (2020), some of the environmental impacts of the paper production are:

i. 40% of the world's commercially cut timber is used for the production of paper.
ii. Pulpwood plantations and mills endanger natural habitats.
iii. Over 30 million acres of forest are destroyed annually.
iv. The pulp and paper industry are big contributor to the problem of deforestation and is partly to blame for the endangerment of some species that live in the forests.

v. The life cycle of paper is damaging to the environment from beginning to end. It starts off with a tree being cut down and ends its life by being burned, emitting carbon dioxide in the atmosphere.
vi. Paper production uses up lots of water. An A4 paper requires 10 liters of water per sheet.
vii. Most of the materials in landfills are made of paper. When paper rots, it emits methane, a greenhouse gas. When it is burned or composted, carbon dioxide is released into the atmosphere, contributing to the accumulation of greenhouse gases, albeit to a lesser extent compared to methane. Both processes affect the carbon cycle and have implications for climate change.

Similarly, Zella (2016) studied the economic and environmental implications of paper usage in higher institutions of learning using the Mwalimu Nyerere Memorial Academy-Zanzibar (Tanzania) as a case study. The result of the findings showed that a minimum of 27 trees worth of paper is consumed per semester when the school had 507 students (May to July), which implies that an average of 4.90-8.92 tons of carbon is released into the earth's atmosphere on semester basis. Projecting these estimates to universities that have estimates of 25,000 students shows that there will be an average consumption of 1,331 trees per semester and an average release of 241.62-439.84 tons of carbon per semester. Aside from the release of carbon, additional environmental impacts of deforestation include: energy consumption for logging, the destruction of natural ecosystems, reduced water quality, soil erosion, diminished habitats for plants and animals, and the elimination of old-growth forests. The sum of the environmental damage for the sourcing of raw materials to create pulp is a source of environmental concern (Environmental Paper Network, 2007).

Zella (2016) eventually concluded that, the use of paper contributes a lot to the issue of global warming and a lot of trees will be saved if paper usage is reduced. To this end, Ray and Nche (2013) made a case for the abolition of prints media for the safety of the dying environment.
In view of this, it is logical to assert that the use of Computer Based Testing Method will not only reduce the rate of deforestation, it will also contribute its quota to mitigating the effects of climate change. Furthermore, the issue of solid waste will be significantly reduced if the descriptive is adopted. Beyond these, paper in all its lifecycle is of serious detrimental effects to the environment because even when it decomposes, it releases methane; which has a much more severe greenhouse effect than carbon dioxide. Computer Based Test is environmentally friendly and should be considered as a tool for sustainable development in the education sector of all nations of the world.

Description of Study Area

The study area is Ilorin which is one of the 6 states in the North Central geopolitical zone of Nigeria. Ilorin is located between latitudes 8º24′ and 8º36′ North of the equator and longitudes 4º10′ and 4º36′ East of the Greenwich meridian (Figure 1) and has an estimated population of 766,000 (NPC, 2006). It is situated at a strategic point between the densely populated South-West and the sparsely populated middle belt of Nigeria. Ilorin is located in the transition zone between the deciduous woodland of the South and dry Savannah of Northern Nigeria (Jimoh, 2003). Ilorin is about 500km away from Abuja – the administrative capital of Nigeria, and about 350km away from Lagos –the business capital of Nigeria. For this reason, Ilorin can be linked from almost every part of Nigeria, especially through the Lagos-Kaduna expressway.

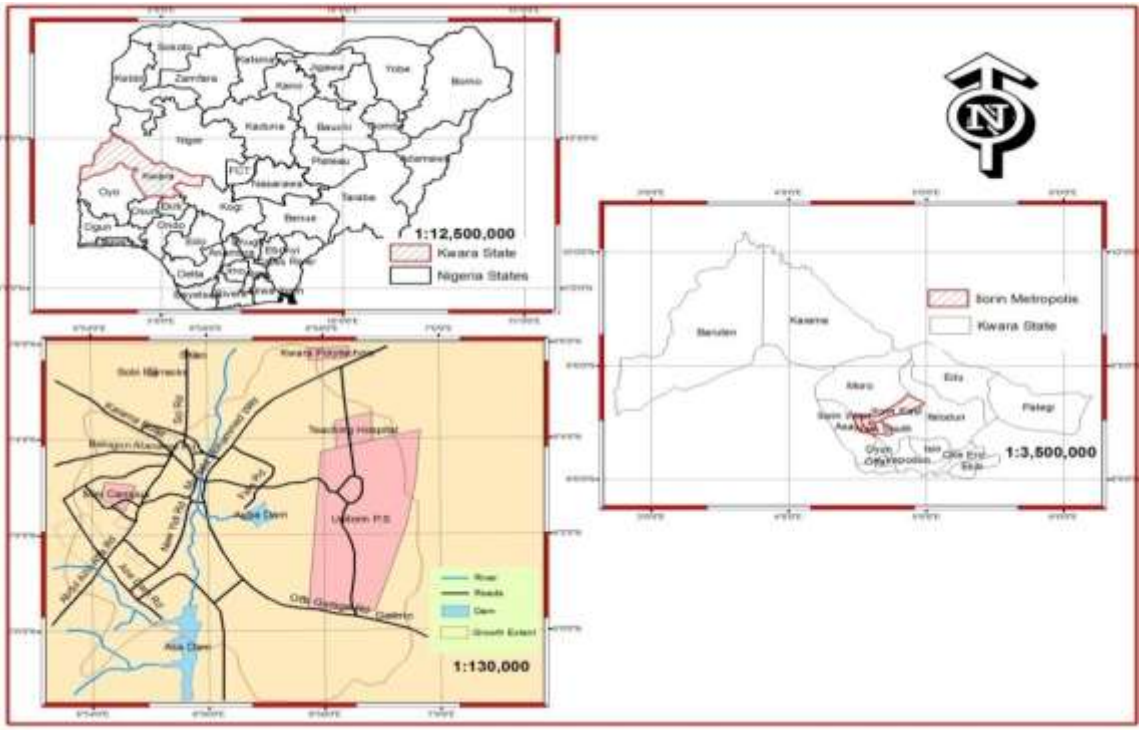

Figure 1: Map of Ilorin with inserted map of Nigeria

Source: Kwara State Ministry of Housing and Urban Development

Ilorin enjoys a humid tropical type of climate which is characterized by the tropical wet and dry season with a mean temperature ranging from 25^{o} C to 28^{o} C while the annual rainfall is about 1150 millimeters, the least amount of rainfall occurs in January, the average in this month is 10mm. Most of the precipitation falls in September, averaging 232mm. The climate rests on the two prevailing winds blowing across the country at different times of the year. These winds include; the dry Northeast trade wind from the Sahara Desert and the Southwest trade wind of the Atlantic Ocean (Ajibade & Ojelola, 2004). The elevation of Ilorin varies from 273m to 333m in the western side with isolated hill (Sobi Hill) of about 394m above the sea level while on the eastern side it varies from 273m to 364m (Ajibade & Ojelola, 2004). The lowest level is along the river valley of Asa and Oyun while the highest point is Sobi Hill. Precambrian igneous metamorphic rocks of basement complex that are neither porous nor permeable underlie Ilorin (Iroye, 2017).

Materials and methods

The study made use of primary data, which was obtained through a Student Perception Questionnaire (SPQ), an instrument designed by the researcher to provide answers to the research questions. The three universities in Ilorin metropolis are University of Ilorin, Kwara State University and Al-Hikmah University. The sample size of this research was determined using Taro Yamane formula with 95% confidence level. The sample size was distributed among the universities according to the percentage of the total population (Table 1).

Table 1 : Sample size

Institutions	Sample Frame	Sample Size %	Sample Size
University of Ilorin	44,819	72.50%	290
Kwara State University	11,000	17.79%	71
Al-hikmah University	6,000	9.71%	39
Total	**61,819**	**100%**	**400**

Source: Author's fieldwork, 2019

The study sampled a total of 400 students; representing 0.49% of the total population. The students were randomly sampled using stratified sampling techniques to afford every member of the population equal chances of being sampled. Students were sampled based on their faculty and department. The data were analyzed using the frequency, simple percentage and correlation statistical technique.

The study also made use of secondary data, which were obtained from JAMB website, books and internet sources. Since the inauguration of JAMB in 1978, it has been administering UTME through Paper Pencil Test (PPT) to students seeking admission into Nigerian public and private mono-technic, colleges of education, polytechnics and Universities. It became necessary to appraise the scale and impact of the adoption of CBT on afforestation and greenhouse gases by estimating the number of trees conserved through the use of JAMB CBT examinations from 2014 to date. Data collected from the Joint Admission Matriculation Board (JAMB) showed that 16,687,542 sat for the UTME exams between 2014 and 2024 (jamb.gov.ng). Prior to this time JAMB UTME exams were Pencils, Papers Test (PPT), a candidate will make use of at least four sheets of paper per subject; three for the question paper and one for answer sheet.

Result of the Findings

Demographic Characteristics of the Respondents

Majority of the respondents (61%) were female, while 39% of the respondents were male as seen in Table 2. 48% of the respondents fall between the age range of 21 – 30 years of age, 36% of the respondents were within the age bracket of 20 years and below while only 65 respondents (16%) were found between the ages of 31 through 40. Majority of the respondents (63%) attended a private secondary school, while the remaining 38% attended government owned secondary schools, as shown in Table 2. A larger percentage (46%) of the respondents hailed from households with 3-5 members, 36% of the respondents (144) were from households with 6 – 8 members while only 7% were from households with 9 – 12 members and 11% of the respondents (44) were from households with 13 – 15 members (Shown in Table 2). Majority (31%) of the respondents estimated their household income to range between ₦50,000 – ₦150,000, 24% of the respondents estimated their household income to range between ₦150,000 – ₦250,000 while 19% of the respondents estimated their household income to range between ₦250,000 – ₦350,000 and 26% state their household income to be above ₦350,000.

Table 2: Demographic Characteristics of the Respondent

SEX	**Frequency**	**Percentage (%)**
Male	158	39
Female	242	61
Total	400	100.00
AGE	**Frequency**	**Percentage (%)**
20 years and Below	143	36
21 – 30 years	192	48
31 – 40 years	65	16
Total	400	100.00
Type of Secondary School Attended	**Frequency**	**Percentage (%)**
Government School	I53	38
Private School	247	62
Total	400	100.00
Household Size	**Frequency**	**Percentage (%)**
3 – 5	186	46
6 – 8	144	36
9 – 12	26	7
13 – 15	44	11
Total	400	100.00
Household Income	**Frequency**	**Percentage (%)**
N50,000 - N150,000	125	31
N150,000 - N250,000	95	24
N250,000 - N350,000	78	19
Above N350,000	102	26
Total	400	100.00

Source: Author's fieldwork, 2019

Relationship between Demographic Characteristics and Computer Literacy

The result of the findings shows that there is a statistically significant relationship between the demographic characteristics of the students and their computer literacy. The study made use of age, sex, type of secondary school attended, household size and estimated household income as demographic characteristics. These characteristics are the independent variables upon which their computer literacy level depends. Table 3 presents the relationship between the demographic characteristics of the respondent and their computer literacy level.

Table 3: Relationship between Demographic Characteristics and Computer Literacy

Regression Statistics	
Multiple R	0.84056694
R Square	0.70655279
Adjusted R Square	0.70282884
Standard Error	0.5590277
Observations	400

Source: Author's fieldwork, 2019. ***r=0.84

The relationship between demographic characteristics and computer literacy is R^2=0.84, which implies that there is a strong positive relationship between the demographic characteristics of students and their computer literacy level (Table 3).

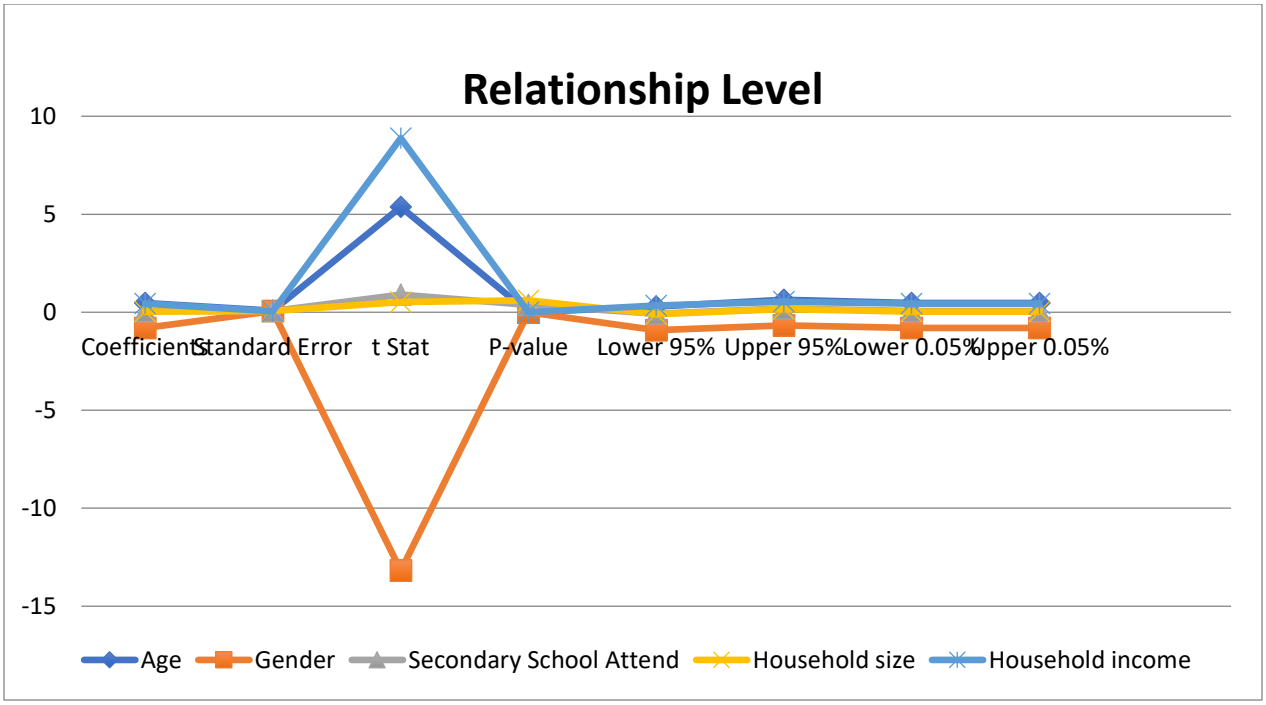

Figure 2: Relationship Between Demographic Characteristics and Computer Literacy
Source: Author's fieldwork (2019)

Figure 2 shows that household income is the highest influencing factor of computer literacy where R^2=0.8. This could be because households that earn more can afford to own more computing devices than others who earn less. Household size is the closest to Household income in terms of direct correlation to computer literacy level (R^2=0.6). This can imply that the two-work hand in hand, this is because the larger the household, the more resources they will need to survive. Hence, the household income is relative to household size in terms of value. The correlation between household size, household income and computer literacy are not farfetched as it is in agreement with Fust-Bowe (2005) and Adeyinka and Mutula (2008) findings that the environment in which students grow and socio-economic characteristics of parents are major influence on the level of computer literacy among undergraduates at the University of Bostwana.

Perception of Students on the Use of Computer Based Test

Majority of the respondents (73%) had access to computer before they gained admission into the university. Only 27% of the respondents (107) did not have access to computer prior to their studentship. 65% of the respondents claimed to have been through one form of computer training or the other while 35% have not been through any. Again, 87% of the respondents studied computer as a subject at secondary school level, only 13% (52) did not study computer in secondary school. This notwithstanding, 26% of the respondents were very good (highly proficient) with Microsoft office suite, 35% were good (proficient), 31% were fair (that is they were not we grounded in the usage of the software package). 6% and 2% of the respondents were poor in the usage of Microsoft Office Suite. Invariably, 61% of the respondents were proficient with Microsoft Office Suite while the remaining 39% were not proficient with Microsoft office. Also, only 3% of the respondents were veteran computer literates, 11% were expert while 30% were professionals, 37% were amateurs and 19% were novice. These implies that 56% of the respondents were below professional level and are somewhat referred to as illiterates (Table 4).

Majority (56%) of the students were below professional computer operators. This implies that 224 students representing more than half of the respondents stated that they were either amateurs or novices. This result is in agreement with Oladunjoye and Benwari (2014); stating that there is a high level of computer illiteracy among Nigerian undergraduates. However, it is difficult to reconcile the findings because Oladunjoye and Benwari (2014) did not reduce their findings to quantity. But then, the statement "high" denotes something above average or something above 50%. Seeing that this study has 56% illiteracy level shows that there is a lot to be done with computer literacy in high schools and colleges. Furthermore, there should be more practical sessions of computer studies in the three (3) stated citadels of learning. Personal interaction with some of the students showed that, most of them offer computer studies in secondary but they were not equipped with the practical knowledge required for real time application.

Similarly, Oladunjoye and Benwari (2014) attributed the cause of high computer illiteracy level among Nigerian undergraduates to family background, exposure and secondary school system. These assert the fact that family background is a major determinant of computer literacy. However, gender seems to be the least demographic factor influencing computer literacy. Gender is inversely related to computer literacy, which implies that gender is not a factor affecting computer literacy. This is contrary to the position of Adagunodo and Idowu (2004) justifying the fact that; male students are generally more proficient in the use of computers than their female contemporaries. The variation between the findings is primarily due to the rapid development in technology such that smart phones are evenly distributed amidst both genders. Also, it could be due to the increased gender equality awareness.

More than half (63%) of the respondents agreed that computer based-test is a positive technological development that will reduce the usage of paper in academic institutions. 37% disagreed with computer-based test being a positive development; this could be due to their phobia for technology or may be influenced by their computer literacy level, as about 56% of the respondents were below the professional level and 39% were fair to poor with the usage of Microsoft office suite (Table 4). This finding agrees with Beder (1994), stating that; sustainable development relies on technological change to achieve its aims but requires governments and corporate entities to take the tough steps that are required to force radical technological innovations rather than the technological fixes that have been evident till date. Invariably, the adoption of this technology by citadels of learning will reduce the consumption of paper, which will, in the long run, reduce the paper waste generation and the menace of deforestation.

Majority (61%) of the respondents agreed that computer-based test reduces performance while 39% disagreed to such (Table 4). This result is not surprising; this is because of little or no human interference with the scoring process. Lecturers may consider students with idea of questions, but the computer will not do such because it has predefined answers and anything contrary to that is seen as wrong. Only few (39%) of the respondents agreed that CBT makes exams tougher, while 61% disagreed with the statement. These results also suggest that the computer literacy level of the students has a significant influence on their perception of CBT. 56% of the respondents were below the professional level and 39% were fair to poor with the usage of Microsoft office suite; which means the 39% that agreed that CBT makes exams tougher fall into the 39% that are not acclimatized with Microsoft Office suite and the 56% that are below the professional level in computer proficiency (Table 4).

Table 4. Perception of Students Computer Based Test

Access to computer before university studentship	**Frequency**	**Percentage (%)**
Yes, I had access to Computer	293	73.25
No, I didn't have access to Computer	107	26.75
Grand Total	**400**	**100**
Former Computer Training	**Frequency**	**Percentage (%)**
Yes, I had a former computer training	260	65
No	140	35
Grand Total	**400**	**100**
Computer Studies in Secondary School	**Frequency**	**Percentage (%)**
Yes, I studied computer in secondary school	348	87
No, I didn't	52	13
Grand Total	**400**	**100**
Proficiency with Microsoft Office	**Frequency**	**Percentage (%)**
Very good	105	26.25
Good	140	35
Fair	124	31
Poor	22	5.5
Very poor	9	2.25
Grand Total	**400**	**100**
Computer literacy Level	**Frequency**	**Percentage (%)**
Veteran	14	3.5
Expert	42	10.5
Professional	120	30
Amateur	147	36.75
Novice	77	19.25
Grand Total	**400**	**100**
I prefer all my courses to be CBT	**Frequency**	**Percentage**
Strongly Agree	91	22.75
Agree	161	40.25
Disagree	109	27.25
Strongly Disagree	39	9.75
Grand Total	**400**	100
CBT is tedious and reduces performance	**Frequency**	**Percentage**
Strongly Agree	83	20.75

Agree	160	40
Disagree	136	34
Strongly Disagree	21	5.25
Grand Total	**400**	**100**
CBT makes exam tougher	**Frequency**	**Percentage**
Strongly Agree	38	9.5
Agree	120	30
Disagree	202	50.5
Strongly Disagree	40	10
Grand Total	**400**	**100**
Flaws of CBT	**Frequency**	**Percentage**
Times is Too Short	139	34.75
It doesn't give room for comprehensive expression	137	34.25
It doesn't give room for mathematical workings	30	7.5
It is stressful due to the long queue	94	23.5
Grand Total	**400**	**100**
CBT Doesn't require reading	**Frequency**	**Percentage**
Strongly Agree	52	13
Agree	138	
Strongly Disagree	138	34.5
Disagree	72	18
Grand Total	**400**	**100**
Most preferred method of Assessment	**Frequency**	**Percentage**
CBT	191	47.75
PPT	209	52.25
Grand Total	**400**	**100**

Source: Author's fieldwork, 2019

From the respondents, 35% opined that CBT's major flaw is inadequate time to answer the questions. Furthermore, 34% were of the opinion that CBT does not give room for comprehensive expression, 7% felt CBT is disadvantaged in terms of mathematical expression. While others (24%) were of the opinion that CBT exams come with the stress of waiting on a long queue before finally writing the exams (Table 4). It is logical to think that students that complained of time are those that fall below the professional level of computer proficiency; this is because they are not well exposed to computing mechanisms, which will result in sluggish operation of the system.

Most (53%) of the respondents were of the opinion that Computer Based Test require diligent reading while the remaining 47% agreed and opined that Computer Based Test does not require serious and diligent reading (Table 4). About 47.5% of the students agreed that CBT require diligent reading; hence we can attribute this to be the reason why most of them have issues with computer-based test. Compared to written exams where a student can paraphrase ideas to answer questions, CBT does not give for that; this is why majority of the students stated that computer-based test reduces performance and makes exams tougher. 48% of the respondents prefers CBT exams while the remaining 52% prefers PPT. Although there is a very thin line in-between, this disparity could be as a result of the perceived flaws. 63% of the respondents stated that CBT is desirable but only 48% prefer CBT (Table 4), this shows that the respondents will prefer to take CBT examinations but for some constrains that were perceived as the flaw of the system. This is contradictory to the findings of Sanni and Mohammad (2015); Tella and Bashorun (2012), that majority of the students at Post UTME level preferred CBT. This could be due to the fact that as

students begin to raise the ladder of academics and specialize in a particular field of studies, they tend to find the system inadequate to meet their expression needs. This implies that majority might prefer CBT for general courses like GNS and GSE. The conflict between the results of the findings could also be due to the attitude of students towards Computer Based Test and their level of computer literacy.

Computer Based Test (CBT) and Environmental implication

Invariably, the adoption of Computer Based Test (CBT) technology by citadels of learning would reduce the consumption of paper, which would in the long run reduce the paper waste generation and the menace of deforestation. Data collected from the Joint Admission Matriculation Board (JAMB) shows that 3,060,551 sat for the UTME exams between 2014 and 2015. Prior to this time JAMB UTME exams were written with pencils and papers, a candidate would make use of at least two sheets of paper; one for the question paper and the other for answer sheet. This implies that 6,121,102 (equivalence of 734.5 trees) sheets of paper were conserved in the year 2014 and 2015 through the usage of Computer Based Test (Table 4)

Table 4: Estimated Paper & Number of Trees Conserved Through the use of JAMB CBT Exam Between 2014 and 2023

Jamb Exam Year	Number of Verified Candidates	Estimated Number of papers Conserved (Assuming 4 sheets per candidates)	Estimated Number of Trees Preserved (average 8,333 sheets per tree)	Estimated of carbon (average of 103kg per tree)
2014	1,632,172	1,632,172 x 4 = 6,528,688	783.47	80,697.41
2015	1,428,379	1,428,379 x 4 = 5,713,516	685.6	70,616.8
2016	1,850,000	1,850,000 x 4 = 7,400,000	888.02	91,466.06
2017	1,718,425	1,718,425 x 4 = 6,873,700	824.8	84,954.4
2018	1,662,762	1,662,762 x 4 = 6,651,048	798.2	82,214.6
2019	1,800,000	1,800,000 x 4 = 7,200,000	864.02	88,994.06
2020	1,900,000	1,900,000 x 4 = 7,600,000	912.02	93,938.06
2021	*1,338,687*	*1,338,687* x 4 = 5,354,748	643	66,229
2022	1.761, 338	1.761, 338 x 4 = 7,045352	845.48	87,084.44
2023	1,595,779	1,595,779 x 4 = 6,383,116	766.01	78,899.03
Total	16,687,542	16,687,542 x 4 = 66,750,168	8,010.75	825,107.25

Source: Author's fieldwork, 2024

Zella (2016) citing Clerk University (2015) and Chave *et al*. (2014) noted that a fully mature tree is equivalent of 8,333 sheets of paper, and an average of 103kg of carbon is released from a tree when lumbered. This implies the adoption of Computer Based Test for JAMB UTME exams help to prevent the release of 296,447.62 kg of carbon in just two years. 296,447.62 kg of carbon is capable of contributing significantly to increased temperature on the earth. JAMB has also averted the release of over 10,000kg of methane that would have been generated from the decomposition of their exam papers between 2014 and 2023 (Table 4). This is in line with Environmental Paper Network (2008) reporting that paper has the potential to decompose and produce methane, a greenhouse gas with 21 times the heat-trapping power of carbon dioxide. The quantity of methane produced by paper in landfills is 69 times greater than that produced by fossil fuel, electricity

production and has 23 times the heat-trapping power of carbon dioxide. Hence, paper is the single greatest source of landfill methane (Environmental Paper Network, 2007).

Krishnamurthy (2008) stated that; on a global scale, over 13 million hectares of forest are destroyed annually, of which more than 40% is used in the paper production. Which means over 5.2 million hectares of forest are destroyed annually to produce paper. According to Ray and Nche (2013), "One acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual need of 18 people". Converting this to hectares shows that; a hectare of forest absorbs 15 tons carbon dioxide and outputs 10 tons, which will cater for 45 individuals annually. Invariably, over 78 million tons of carbon dioxide is released into the earth's atmosphere at the primary stage of paper product.

This technological development can be appraised as a key to sustainable development. This is because, the global warming experienced today is the result of the industrial revolution of the 20th century; hence, the effect of the present-day actions will tell on the coming generation. Computer Based Test will play a major role in the release of greenhouse gases, this will in turn maintain the serenity of the earth's climatic system. This assertion is in agreement with Environmental Paper Network (2007); U.S Environmental Protection Agency, 2010; Ray and Nche (2013). Stolberg *et al* (2003) all reporting that the sudden increase in the level of water pollution is alarming. Further stating that water supply is reducing against the increasing demand for the descriptive. This calls of adopting the Principle of Efficiency and Effectiveness in the management of water as an environmental resource. It is impossible to effectively utilize water when paper production is on the increase. This is among other reasons because; paper is the highest consumer of water per ton of end product (Environmental Paper Network, 2007). Furthermore, Miner (2010) stated that paper industries are the third largest polluter of air, water, and land, and releases over 100 million kg of toxic pollution annually. This invariable implies that the usage of paper is not only harmful to the environmental system but is also of significant threat the existence of life on the planet. Paper usage is considered a threat to existence of life on earth because; the environment and humans can absorb only a limited amount of toxins before biological systems deteriorate (Wargo, 2009). To this end, Computer Based Testing method is indeed a positive development not only in the educational sector but it is also a promising tool for sustainable development.

Conclusion

In view of these findings, the study concludes that there is a significant relationship between demographic characteristics and computer literacy level of students. The findings indicate that household income and size are major determinants of computer literacy, with higher-income households more likely to have access to computing devices. Additionally, the study reveals a high level of computer illiteracy among undergraduates, which is consistent with previous studies attributing this issue to family background and secondary school systems. Also, computer-based test is a positive development to the education system and to environmental sustainability. Computer-Based Tests (CBTs), while they offer environmental benefits by reducing paper usage and contributing to sustainable development, many students perceive them as challenging due to their limited proficiency in using computers. This perception is influenced by factors such as inadequate exposure to practical computer skills during secondary education.

Recommendations

Based on the findings of the study the following recommendations are made:

i. The implementation of more practical sessions for computer studies in secondary schools and colleges is necessary to improve students' proficiency levels before entering university.
ii. Also, provision of initiatives that provide computing devices or internet access for low-income households, thereby bridging the gap in digital literacy based on socioeconomic status is essential.
iii. In addition, improvement of CBT systems by addressing issues like time constraints and comprehensive expression limitations identified by students is important. This could involve providing additional training or support materials for those struggling with these aspects.
iv. Lastly, a continuous promotion of CBTs as part of broader environmental sustainability efforts within educational institutions is important as it will help in highlighting their role in reducing paper waste and supporting sustainable development goals.

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