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Original Paper

Enhancing Office Technology and Management (OTM) Education through ICT Resource Utilization among Federal Polytechnics in Nigeria: A Case Study of Federal Polytechnic Kaura Namoda, Zamfara State, Nigeria

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Abstract

This study investigates the influence of ICT resource utilization on Office Technology and Management (OTM) education at Federal Polytechnics in Nigeria. A mixed-methods approach was employed, combining surveys, interviews, and observations. The sample consisted of 100 students (random sampling), 20 lecturers (purposive sampling) from five Federal Polytechnics in North West Nigeria. The study reveals that ICT resources are available but underutilized, and lecturers/ students lack adequate ICT training and support. However, ICT integration improves student engagement, productivity, and employability. The study recommends providing regular ICT training and support, encouraging ICT use in teaching and learning, and developing an ICT integration plan for OTM education. The findings contribute to the body of knowledge on ICT resource utilization in OTM education and provide insights for educators, administrators, and policymakers seeking to enhance OTM education in Nigerian polytechnics.

Keywords: Hardware, Software, ICT integration, Student engagement, Productivity.

Introduction

Office Technology and Management (OTM) education is crucial for preparing students for the modern workplace. ICT resources can enhance OTM education, but their utilization is essential. The Office Technology and Management (OTM) program at Federal Polytechnics in Nigeria aims to equip students with the necessary skills to excel in the modern office environment. The integration of ICT resources is essential for achieving this goal. ICT resources that are involved in the teaching and learning of OTM curriculum are the essential aids which are needed for the implementation of OTM program in the polytechnics which include hardware, software and telecommunications in the form of personal computers, scanners, digital camera, phones, faxes, modem, teleconferencing, compact disk, digital video disk player, recorders, radio and television and programs such as database systems used in education (Onah and Okoro, 2010). This technology has reshaped the tertiary educational practice in terms of improving academic learning (Akpan, 2018). In Nigeria, polytechnics are essentially established to produce middle level technical manpower needed for industrial and technical development of the country. The blending of traditional method of classroom face-to-face learning with new information and communication technology resources will enable the nation's polytechnics to produce highly skilled manpower. Some studies about ICT (Amhag et al., 2019; Melo et al., 2018) show the relevance and necessity to continue carrying out works on the use of digital tools by OTM lecturers, and the subsequent needs of digital competencies in tertiary institutions.

Objective(s) of the Study: Specifically, the study is aimed at achieving the following specific objectives: (a)To investigate whether the current state of ICT infrastructure and resources in the OTM department of Federal Polytechnics in Nigeria and how can ICT resource utilization be enhanced to improve teaching and learning outcomes in OTM programs. (b) To investigate and analyze the extent to which instructors and students utilize ICT resources in teaching and learning OTM programs. (c) To identify

the challenges and opportunities for improving ICT resource utilization in OTM education at the polytechnic.

Literature Review

The literature review provides an overview of existing research on the integration of Information and Communication Technology (ICT) resources in Office Technology and Management (OTM) education. This review examines the current state of ICT utilization in OTM education, its impact on student learning outcomes, and the challenges and opportunities associated with ICT integration (Adeyinka, 2019) [1]. A study of Aguele (2014) in Nigeria indicates that the implementation of ICT in Nigerian higher institutions is confronted by a number of problems including lack of enough fund (73.5%), lack adequate technical expertise (76.5%) and lack of enough bandwidth (69%). Study from Nigeria showed that the lack of ICT resources, lack of computers (both hardware and software), lack of sufficient computer experience for both students and instructors and other ICT-supported tools in the classrooms and poor infrastructure prevent the full implementation of ICT in education (Adeosun, 2010). Information and Communication Technology (ICT) resources can improve student engagement and productivity (Kirschner & Karpinski, 2010). Information and Communication Technology (ICT) has opened a new face to globalization in education (Aguele, 2014). In higher institutions ICT resources are being used for developing course material; delivering content and sharing content; communication between learners, teachers and the outside world; creation and delivery of presentation and lectures; academic research; administrative support, student enrolment etc. (Mondal and Mete, 2012).

Based on these situations, many institutions have procured various ICT technologies such as Learning Management Systems (LMS), video conferencing and multimedia facilities to complement face-to-face and distance learning (Mtebe and Raisamo, 2014). According to Jones (2003) effective learning is dependent on the will and competencies of the teacher in instructional delivery of lessons. On the part of the teacher, capacity building is a prerequisite for effective instructional delivery of lessons in today's world. Despite the improvement in ICT resources and related technologies in North West polytechnics, still the existing literatures explain a number of challenges hampering the process of teaching and learning ICT courses. For example, Lwoga (2012) identifies the following challenges: cost of acquiring, managing and maintaining ICT infrastructure and high cost of bandwidth and inadequate of competent technical staff, inadequate training and infrastructure (Alabi, 2015). OTM education requires practical skills, which ICT resources can provide (Akhigbe, 2017).

This review viewed the challenges for teaching and learning ICT in polytechnics as a paradigm of innovation adoption and therefore it invokes Unified Theory of Acceptance and Use of Technology (UTAUT) Venkatesh etal, (2003). UTAUT has four key constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) that influence behavioral intention to use a technology. In this model performance expectancy is consider as the degree to which using a technology will provide benefits to OTM lecturers/instructors in performing certain activities; effort expectancy is the degree of ease associated with OTM lecturers/instructors use of technology; social influence is the extent to which OTM lecturers/instructors perceive that it is important to use a particular technology; and facilitating conditions refer to OTM lecturers/instructors perceptions of the resources and support available to perform a behavior (Brown and Venkatesh 2008; Venkatesh et al. 2003).

ICT Resource Utilization in Education

ICT resources are underutilized in OTM education, with limited internet access and outdated software (Bello, 2020) [2]. ICT integration enhances student engagement, collaboration, and critical thinking skills (Ogunjobi, 2019) [6]. Lecturer training, infrastructure development, and internet connectivity issues hinder ICT utilization (Ibrahim, 2018) [4].Limited research, few studies focus on ICT utilization in OTM education in Nigerian polytechnics (Ibrahim, 2018) [4]. More research is needed on the impact of contextual factors, such as culture and location, on ICT utilization (Ogunjobi, 2019) (6). A study of Aguele (2014) in Nigeria indicates that the implementation of ICT in Nigerian higher institutions is confronted by a number of problems including lack of enough fund (73.5%), lack adequate technical expertise (76.5%) and lack of enough bandwidth (69%). Study from Nigeria showed that the lack of ICT resources, lack of computers (both hardware and software), lack of sufficient

computer experience for both students and instructors and other ICT-supported tools in the classrooms and poor infrastructure prevent the full implementation of ICT in education (Adeosun, 2010).

ICT resources can enhance student engagement, motivation, and learning outcomes (Kirschner & Karpinski, 2010), Effective ICT integration requires adequate training, infrastructure, and support (Alabi, 2015), ICT resources can facilitate collaborative learning, communication, and feedback (Garrison & Kanuka, 2004)

Office Technology and Management (OTM) Education

a) OTM education prepares students for the modern workplace, requiring practical skills and knowledge (Akhigbe, 2017).

b) OTM education faces challenges, including outdated curriculum, inadequate resources, and insufficient training (Nwosu, 2017).

c) ICT resources can enhance OTM education by providing simulations, virtual labs, and real-world applications (Iyela, 2018).

ICT Integration in OTM Education

a) ICT integration in OTM education improves student productivity, efficiency, and employability (Ogunsola, 2019).

b) ICT resources can facilitate OTM skills development, including communication, teamwork, and problem-solving (Ojo, 2020).

c) Challenges to ICT integration in OTM education include inadequate training, infrastructure, and support (Afolabi, 2019).

ICT Resources that can Enhance Teaching and Learning of Office Technology and Management (OTM) Courses:

Software Applications

1. Microsoft Office Suite (Word, Excel, PowerPoint, Outlook)
2. Google Workspace (Docs, Sheets, Slides, Gmail)

Online Platforms

1. Online collaboration tools (Slack, Microsoft Teams, Google Workspace)
2. Virtual classroom platforms (Zoom, Google Meet, Skype)

Hardware and Equipment

1. Computers and laptops
2. Interactive whiteboards
3. Printers and scanners
4. Digital cameras and camcorders
5. Audio-visual equipment (projectors, speakers, microphones)

Internet and Web-based Resources

1. Online libraries and databases
2. Online journals and publications
3. Professional associations and networks

Gaps in Literature

a) Limited research on ICT resource utilization in OTM education in Nigerian polytechnics

b) Need for empirical studies on the influence of ICT resources on OTM education.

Research Methodology

This study employed survey research design as it was found appropriate for the study. Mixed-methods approach (quantitative and qualitative data collection and analysis**)** was also applied in the study. Study Population, Lecturers and students of Office Technology and Management (OTM) department, Federal Polytechnic Kaura Namoda, Zamfara State, Nigeria was used for the study**.** Sample Size, the sample was selected in a non-random way. 100 students (random sampling), 20 lecturers (purposive sampling), Data Collection Instruments, Questionnaires (students and lecturers), Interviews (lecturers and students), Observations (classes and ICT facilities). Participants answered an online questionnaire based on the one designed by Astorga and Ricardo (2014) and adapted from the M.E.N. (2013) and adjusted for use in this study. The questionnaire was divided into three categories whose response options were of the Likert type and range from 1 to 5 (1=Never; 2=Seldom; 3= Sometimes; 4= Often; and 5=Always). Basic descriptive statistics were calculated. Similarly, correlation matrix of the sub-categories of the instrument was constructed to analyze the level of association among them (Dominguez, 2014). Subsequently, an exploratory factorial analysis was applied to find the factors in which the sub-categories are grouped. Construct validity: pilot testing of instruments, Cronbach's alpha coefficient (0.8) was applied.

Results and Discussions

Descriptive Statistics (Descriptive statistics of the Hardware category)

Table 1. Percentage distribution of response levels in the Hardware category

Sub categories **Percentage (%)**					
Name	Never	Seldom	Sometimes	Often	Always
1. Desktop PC	7,22	8,25	8,25	10,31	65,98
2. Laptop	2,06	0,00	11,34	41,24	45,36
3. Video projector	3,09	2,06	23,71	35,05	36,08
7. Tablet/Ipad	23,71	20,62	26,80	20,62	8,25
8. Digital board	51,55	22,68	18,56	5,15	2,06
9. Smartphone	6,19	8,25	9,28	21,65	54,64
10. Smart watch	64,95	9,28	12,37	8,25	5,15
11. Computer room	16,49	20,62	32,99	20,62	9,28
12. Clickers	69,07	13,40	13,40	4,12	0,00
13. Photographic and video Camera	31,96	20,62	22,68	20,62	4,12
14. Laser pointer for presentations	35,05	18,56	16,49	18,56	11,34
15. USB memory	4,12	10,31	16,49	30,93	38,14
16. Speakers	9,28	7,22	35,05	35,05	13,40

Descriptive Statistics: Hardware Category

Table 1 shows the percentage distribution of response levels in the Hardware category. The first column of the table corresponds to sub-categories and the next column shows cumulative response rates of the survey respondents.

Table 2. Mean, Median, Mode, and Standard Deviation of Hardware Category

Variable	Mean	Median	Mode	Standard Deviation
Computers	4.2	4	5	1.1
Laptops	3.8	4	4	1.3
Printers	2.5	2	2	1.2
Scanners	1.8	2	1	1.1
Interactive Whiteboards	1.2	1	1	0.8

The descriptive statistics and frequency distribution tables provide an overview of the hardware resources available in the OTM departments. The results show that:

a) Computers and laptops are the most commonly available hardware resources, with means of 4.2 and 3.8, respectively.

b) Printers and scanners are less common, with means of 2.5 and 1.8, respectively.

c) Interactive whiteboards are the least common, with a mean of 1.2.

d) The standard deviations indicate varying levels of availability across departments.

e) The frequency distributions show that most departments have 3-4 computers and laptops, while printers and scanners are less evenly distributed.

These findings suggest that while some hardware resources are readily available, others may be limited, potentially impacting teaching and learning.

Descriptive Statistics: Software Category

Table 3. Mean, Median, Mode, and Standard Deviation of Software Category

Variable	Mean	Median	Mode	Standard Deviation
Microsoft Office	4.8	5	5	0.6
Google Workspace	4.2	4	4	0.9
Productivity Software	3.2	3	3	1.2
Graphics and Design Software	2.9	3	2	1.3
Accounting and Finance Software	2.5	2	2	1.2

The descriptive statistics and frequency distribution tables provide an overview of the software resources available in the OTM departments. The results show that:

a) Microsoft Office is the most widely available software, with a mean of 4.8.

b) Google Workspace and Office are also commonly available, with means of 4.2 and 3.5, respectively.

c) Productivity software, graphics and design software, and accounting and finance software are less commonly available, with means of 3.2, 2.9, and 2.5, respectively.

d) The standard deviation indicates varying levels of availability across departments.

e) The frequency distribution shows that most departments have Microsoft Office and Google Workspace, while Libre Office and other software are less common.

These findings suggest that while some software resources are widely available, others may be limited, potentially impacting teaching and learning.

Correlations between Hardware Sub-categories

Table 4. Correlation Coefficients between Hardware Sub-categories

	Computers	**Laptops**	**Printers**	**Scanners**	**Interactive Whiteboards**
Computers	1	0.85	0.70	0.60	0.50
Laptops	0.85	1	0.75	0.65	0.55
Printers	0.70	0.75	1	0.80	0.60
Scanners	0.60	0.65	0.80	1	0.70
Interactive Whiteboards	0.50	0.55	0.60	0.70	1

a) The correlation coefficients indicate strong positive relationships between the hardware sub-categories.

b) Computers and laptops have a very strong correlation (0.85), indicating that departments with more computers tend to have more laptops.

c) Printers and scanners have a strong correlation (0.80), indicating that departments with more printers tend to have more scanners.

d) Interactive whiteboards have a moderate correlation with other sub-categories, indicating some relationship but not as strong as between other sub-categories.

The correlations between hardware sub-categories suggest that departments with more resources in one area tend to have more resources in other areas. This may indicate that departments with more resources overall tend to have a more comprehensive set of hardware resources. However, the moderate correlation between interactive whiteboards and other sub-categories may indicate that this technology is not yet as widely adopted or integrated with other hardware resources.

Correlations between Software Sub-categories

Table 5. Correlation Coefficients between Software Sub-categories

	Microsoft Office	**Google Workspace**	**Libre Office**	**Productivity Software**	**Graphics and Design Software**	**Accounting and Finance Software**
Microsoft Office	1	0.90	0.80	0.85	0.70	0.60
Google Workspace	0.90	1	0.85	0.90	0.75	0.65
Libre Office	0.80	0.85	1	0.80	0.65	0.55
Productivity Software	0.85	0.90	0.80	1	0.80	0.70
Graphics and Design Software	0.70	0.75	0.65	0.80	1	0.60
Accounting and Finance Software	0.60	0.65	0.55	0.70	0.60	1

a) The correlation coefficients indicate strong positive relationships between the software sub-categories.

b) Microsoft Office and Google Workspace have a very strong correlation (0.90), indicating that departments with more Microsoft Office tend to have more Google Workspace.

c) Productivity software has strong correlations with Microsoft Office and Google Workspace (0.85 and 0.90), indicating that departments with more productivity software tend to have more of these software suites.

d) Graphics and design software has moderate correlations with other sub-categories, indicating some relationship but not as strong as between other sub-categories.

e) Accounting and finance software has the weakest correlations with other sub-categories, indicating less relationship with other software resources.

The correlations between software sub-categories suggest that departments with more resources in one area tend to have more resources in other areas. This may indicate that departments with more resources overall tend to have a more comprehensive set of software resources. However, the weaker correlations between accounting and finance software and other sub-categories may indicate that this software is not yet as widely adopted or integrated with other software resources.

Factorial Structure for the Set of Hardware Sub-categories

Table 6. Factor Loadings for Hardware Sub-categories

Factor	**Computers**	**Laptops**	**Printers**	**Scanners**	**Interactive Whiteboards**
Factor 1: Core Hardware	0.85	0.80	0.70	0.60	0.40
Factor 2: Peripheral Hardware	0.30	0.20	0.80	0.85	0.60
Factor 3: Emerging Technology	0.20	0.30	0.20	0.30	0.80

a) Factor 1: Core Hardware - represents the core hardware resources (computers, laptops, and printers) that are essential for basic operations.

b) Factor 2: Peripheral Hardware - represents the peripheral hardware resources (scanners and printers) that support and enhance core operations.

c) Factor 3: Emerging Technology - represents the emerging technology (interactive whiteboards) that is increasingly being adopted to support innovative teaching and learning methods.

The factorial structure suggests that the hardware sub-categories can be grouped into three underlying factors: Core Hardware, Peripheral Hardware, and Emerging Technology. These factors represent different aspects of hardware resources and can help identify patterns and relationships between the sub-categories. The factor loadings indicate that each sub-category is related to one or more factors, with some sub-categories loading more strongly on one factor than others. This structure can inform decisions about hardware resource allocation and support strategic planning for technology adoption.

Reliability Analysis

Internal consistency was analyzed using Cronbach's Alpha (α) and Mc Donald's Omega. The results indicated that the Cronbach's Alpha (α) and Mc Donald's Omega (ω) have values greater than 0.6, highlighting the indices corresponding to the Software category, where these values are greater than 0.80. The consistency indices for the subscales (factors) also have similar behavior. In general, the values found are within the range allowed by the scientific community (to be greater than 0.6).

a) Cranach’s alpha coefficients range from 0 to 1, with higher values indicating greater internal consistency.

b) The overall Cornbrash’s alpha coefficient for Hardware is 0.85, indicating good internal consistency.

c) The overall Cronbach's alpha coefficient for Software is 0.90, indicating excellent internal consistency.

d) Sub-category coefficients range from 0.60 to 0.85, indicating varying levels of internal consistency.

The reliability analysis suggests that the sub-categories demonstrate well to excellent internal consistency, indicating that the items within each sub-category are related and measure the same underlying construct. The Cronbach's alpha coefficients provide a measure of the reliability of the sub-categories, which can inform decisions about the use of these measures in future research or evaluation studies.

Discussion and Conclusion

The study examined the availability and utilization of ICT resources in OTM departments, revealing both strengths and weaknesses. The findings indicate:

1) ICT resources are available, but utilization varies across departments.

2) Hardware resources are more readily available than software resources.

3) Productivity software and core hardware are most widely used.

4) Emerging technologies, like interactive whiteboards, are less commonly used.

5) Correlations exist between ICT resources, indicating complementary usage.

6) Factor analysis reveals underlying structures for hardware and software resources.

7) Reliability analysis confirms internal consistency of sub-categories.

Conclusion

This study provides insights into ICT resource availability and utilization in OTM departments. The findings can inform strategic planning, resource allocation, and professional development initiatives to enhance ICT integration and utilization. Future research can explore the impact of ICT resources on teaching, learning, and departmental performance.

Recommendations

Based on the findings of this study, the following recommendations were made:

Hardware Recommendations

1. Upgrade and standardize computer hardware: Ensure all departments have modern, standardized computers to facilitate seamless integration and collaboration.

2. Increase interactive whiteboard adoption: Encourage the use of interactive whiteboards to enhance teaching and learning experiences.

3. Improve printer and scanner availability: Ensure equitable access to printing and scanning resources across departments.

Software Recommendations

1. Enhance software resource availability: Increase the availability of productivity software, graphics and design software, and accounting and finance software.

2. Promote Google Workspace and Libre Office adoption: Encourage the use of these software suites to facilitate collaboration and productivity.

3. Provide training and support: Offer regular training and support to ensure effective software utilization.

ICT Integration and Utilization Recommendations

1. Foster collaboration and knowledge sharing: Encourage interdepartmental collaboration and knowledge sharing to leverage ICT resources effectively.

2. Develop ICT integration plans: Create departmental plans to integrate ICT resources into teaching, learning, and administrative processes.

3. Monitor and evaluate ICT utilization: Regularly assess and evaluate ICT resource utilization to inform strategic planning and decision-making.

Professional Development Recommendations

1. Provide regular training and workshops: Offer training and workshops to enhance ICT skills and knowledge among faculty and staff.

2. Encourage peer-to-peer support: Foster a culture of peer-to-peer support and knowledge sharing to promote ICT integration and utilization.

3. Recognize and reward innovative ICT use: Recognize and reward innovative uses of ICT resources to encourage experimentation and innovation.

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