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Awareness and Utilization of Virtual Learning Resources among Science Lecturers in Colleges of Education in North Central Nigeria

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ABSTRACT

This study examined the awareness and utilization of virtual learning resources among science lecturers in Colleges of Education in North-Central Nigeria. A descriptive survey research design was employed to address two research questions. The study population comprised 521 science lecturers, with a sample of 222 lecturers from three departments within the School of Sciences. Data were collected using a questionnaire designed for science lecturers and analyzed using descriptive statistics, including frequency counts, percentages, means, and standard deviations. The findings revealed that while science lecturers are fully aware of virtual learning resources, their utilization of these resources remains limited. Based on these results, it was recommended that science lecturers in Colleges of Education participate in conferences, workshops, and seminars to improve their awareness and effective use of virtual learning resources.

Keywords: Virtual Learning Resources, Awareness, Utilization, Science Lecturers, Colleges of Education, North Central Nigeria

Introduction

Education serves as the cornerstone of national development and is universally acknowledged as a fundamental human right, transcending gender boundaries. In Nigeria, education equips individuals with the knowledge and skills essential for intellectual growth and social empowerment. Science, in particular, is regarded as the foundation of modern technological breakthroughs, underpinning nearly every technological innovation seen in the world today (Babagana, Yaki, & Abubakar, 2021).

According to Abubakar (2024), science is an organized body of knowledge aimed at solving human problems and meeting human needs. It is widely recognized as the driving force behind modern development, forming the link between technological innovation and socio-economic advancement (Abubakar et al., 2021). The practical applications of science have resulted in essential commodities such as medicines, clothing, fuel, and food. For example, antibiotics address infections, tranquilizers alleviate nervous tension, and analgesics relieve pain (Babagana, Yaki, & Abubakar, 2021). In schools, science subjects include Physics, Chemistry, Mathematics, Agriculture, and Biology (Abubakar & Olamoyegun, 2023).

Science education, on the other hand, is a cornerstone of national progress, acting as a catalyst for advancements across various domains. Recognized as vital to any nation's development, it must be prioritized at all levels of learning (Abubakar & Olamoyegun, 2023). The major goal of science education is to develop scientifically literate individuals that are concerned with high competence for rational thoughts and actions (Ebele & Abubakar, 2018) which has the transformative power to reshape individual thinking and society as whole (Abubakar, 2024). According to Dajal, Sulaiman and Abubakar, (2018) science education is the field of science that is concerned with sharing of science content, some social science and the process of teaching science pedagogy in order to provide expectations for the development of understanding part of the scientific community. It is therefore said to be the basis of knowledge economy (Katcha & Olotu, 2021).

As a critical part of Nigeria's educational framework, science education emphasizes the importance of (Science, Technology, Engineering, and Mathematics) in fostering national development. STEM education cultivates scientific literacy, critical thinking, and problem-solving skills, which are essential for economic growth and societal well-being. However, delivering effective science education in Nigeria, particularly in the North Central region, has faced significant challenges. The COVID-19 pandemic of 2020 further exacerbated these difficulties, necessitating a rapid shift to virtual learning through Information and Communication Technology (ICT) to sustain educational activities.

Information and Communication Technologies (ICT) are viewed as innovative tools and pedagogical approaches effective for teaching and learning in secondary schools and higher institutions (Suleri & Suleri, 2019). In light of this, the integration of ICT has become essential for maintaining educational continuity. It is important to note that without ICT, scientific knowledge cannot be effectively taught in any school worldwide (Dajal, Sulaiman, & Abubakar, 2018). According to Oyenran, Oyeniyi, Ogundele, and Ojo (2020), highlight that leveraging ICT applications can mitigate the

disruptions caused by the pandemic in 2020, addressing the challenges faced by students and educators alike. Institutions have embraced innovative approaches, leading to a swift transition to remote teaching and learning environments. Virtual learning has emerged as a particularly effective application of ICT, providing a platform (Virtual Learning Resources) for education to persist despite physical barriers which foster collaboration between lecturers and students in real-time through technology (Iskandar, Sudirman, Safitri, Sulaiman, Ramadhani, Wahyuni, & Simarmata, 2020). This application (Virtual Learning) of ICT has been considered by many researchers and educators as the best possible approach to continue the teaching and learning process during and in post-COVID era (Chou,2010; Rashid, 2014; Mallareddy, 2018; Zaharah & Kirilova, 2020).

Virtual learning according to Mallareddy (2018) is an online learning environment that enables live interaction between tutors and learners during learning activities. This shared online space facilitates meaningful interactions and communications among students, materials, and educators. Through this dynamic environment, real-time exchanges of ideas occur, enriching the learning experience. Within the virtual learning environment, students and teachers are virtually present, as outlined by Hall (2012) and Isik, Karakis & Guler (2017). Mallareddy's investigation into virtual learning highlighted its advantages in eliminating time and space constraints, overcoming teacher unavailability, and facilitating session recordings. Furthermore, virtual learning offers flexibility, enabling students to determine when and where they engage in their studies (Asynchronous). It mirrors many elements of the traditional classroom, providing structured schedules and course content while allowing for live and recorded lectures. The online application fosters discussions and collaborative learning, empowering students to engage actively and access extensive resources in their education through virtual learning resources (VLR).

Virtual learning resources refer to educational materials, tools, and platforms that are accessible online and facilitate the learning process in a virtual or digital environment as a platform for real-time education, virtual learning resources has been embraced by students for its interactive nature and accessibility. Students can utilize various tools for managing group activities, submitting assignments, and participating in assessments, enhancing their overall learning experience. The convenience, time efficiency and cost-effectiveness of virtual learning resources are driving its adoption, enabling instructors to update, assign appropriate materials rapidly and tailor their teaching to meet student needs and help them achieve their learning objectives (Rahayu & Wirza, 2020).

In today's educational landscape, learning is no longer solely dependent on the instructor only. Instead, students can access vital materials through virtual learning resources such as online courses, e-books, simulations, and video lectures. Notable examples of these resources range from platforms like Khan Academy, Coursera, Better Explained, Class Central, YouTube, Study.com, Lumen Learning, LabXchange, Academic Earth, Live Science, Toppr, Chemical Portal, Microbe Notes, CK-12, Biology Junction, PhET, Onlinebiologynotes.com, Chemtube3d.com and GeeksforGeeks. The availability of such resources enhances the flexibility and accessibility of education, allowing learners to engage with content from virtually anywhere with internet access. Therefore, establishing awareness among lecturers regarding virtual learning resources is of paramount importance in this study.

However, the effectiveness of virtual learning resources relies on the awareness and understanding of the lecturers in Colleges of Education in North Central Nigeria. Awareness encompasses knowledge of new technologies and their potential benefits, empowering individuals to engage with these tools actively (Olibie, Ezoem & Ekene, 2014). This understanding serves as a foundation for assessing the status of virtual learning resource awareness by science lecturers in Colleges of Education in North Central Nigeria fostering a more robust educational environment that leverages technology to its fullest potential. Awareness serves as the cornerstone of utilization. The decision of lecturers to employ virtual learning resources is grounded in their awareness of the existence of such resources. Consequently, a lack of awareness among lecturers would deter them from attempting to use these resources or utilizing them effectively. Proficiency in using computer and other electronic resources is deemed essential for all lecturers.

Based on this background, the researcher’s intent to assessed the awareness and utilization of virtual learning resources by science lecturers in College of Education in North Central Nigeria.

Statement of the Problem

The teaching and learning of science in tertiary institutions, particularly in Colleges of Education, face growing challenges in Nigeria. Classrooms and laboratories are frequently overcrowded with large student populations, and there is a persistent shortage of textual materials. These issues are compounded by the integration of Virtual Learning Resources (VLR), a trending yet challenging aspect of modern education, particularly for science lecturers and students.

Despite government efforts to incorporate ICT into education, the effective implementation of VLR in higher institutions, including universities, remains hindered by several factors. These include a lack of awareness, motivation, and training among lecturers and students, as well as limited access to virtual resource materials (Alharthi, 2016). Additional barriers include inadequate technical skills, insufficient infrastructure, outdated teaching strategies, economic constraints, and high internet costs (Lestiyanawati & Widyantoro, 2020; Ramij & Sultana, 2020). Moreover, teachers and students, particularly in universities, often exhibit reluctance to adopt VLR. This hesitation stems from challenges such as deciding when to use computers, a lack of confidence in ICT resources, concerns about plagiarism, limited technological proficiency, and personal fears (Mundy et al., 2012; Rashid, 2014; Umar, Rahayu, & Firmansyah, 2018). Some teachers also experience "technophobia," characterized by a reluctance to embrace technological changes due to prior negative experiences with technology.

Despite these obstacles, VLR holds great potential for enhancing teaching and improving student performance in science subjects. While many studies (Anekwe, 2017; Manal, 2019; Doghonadze et al., 2020; Gidado et al., 2023) have documented awareness and utilization of VLR among science

lecturers and students in universities, there is limited knowledge about how these resources are leveraged in Colleges of Education, particularly in North Central Nigeria.

The COVID-19 pandemic exacerbated these challenges by forcing a sudden shift to remote learning. Nigeria, like many other countries, implemented strict measures such as social distancing, lockdowns, and school closures to curb the spread of the virus. These measures significantly disrupted formal education, as students were forced to halt their studies and institutions had to quickly adopt remote learning strategies (Priyadarshani & Jesuiya, 2021). This transition was particularly challenging for institutions with limited experience in virtual learning. Teachers unfamiliar with online applications faced significant difficulties in adapting to the new mode of instruction (Zaharah & Kirilova, 2020).

Purpose of the Study

This study aimed to examine the awareness and utilization of virtual learning resources among science lecturers in Colleges of Education in North-Central Nigeria. The specific objectives of the study were to:

i. determine the level of awareness of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria;

ii. find out the level of utilization of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria;

Research Questions

The following research questions guided the study:

1. What is the level of awareness of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria?
2. What is the level of utilization of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria?

The study focused on the level of awareness and extent of utilization of virtual learning resources in North-Central Nigeria. It specifically targeted science lecturers in public Colleges of Education (federal and state-owned) to ensure consistency in funding, standards, and quality within the study population. The study covered the FCT-Abuja and six states: Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau. The findings of this study have the potential to benefit various stakeholders, including science lecturers and teachers, pre-service teachers, curriculum designers, government agencies, school proprietors, and researchers.

Methodology

This study adopted a descriptive survey research design, targeting all science lecturers in federal and state-owned Colleges of Education in North-Central Nigeria. The total population consisted of 521 science lecturers, including 378 males and 143 females, drawn from public Colleges of Education (NCCE, Department of Planning Research & Statistics, 2020/2021). According to NCCE statistics (2023), the region has 11 state-owned and three federal Colleges of Education, located in six states—Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and the FCT-Abuja.

A sample size of 222 lecturers from 13 Colleges of Education was selected using a multi-stage sampling procedure. In the first stage, purposive sampling was used to include all 13 public Colleges of Education, as the study was restricted to these institutions. In the second stage, simple random sampling was applied to select three departments (Biology, Physics, and Chemistry) out of seven in the School of Sciences. This ensured equal representation.

The final sample of 222 science lecturers was determined using Glenn's 5% Sampling Size Table (2012) and distributed proportionally across the institutions based on their respective populations. This approach ensured a representative and balanced sample for the study.

The apportion formula is presented thus:

$$\frac{\text{Population in each School}}{\text{Total Population}} \times \text{Sample Size} \quad 1$$

Details presented in Table 1.

Table 1: Population and Sample Size Distribution of Science Lecturers in Colleges of Education in North Central Nigeria

			SCIENCE LECTURERS	
S/N	**STATE**	**COLLEGES**	**POPULATION**	**SAMPLE**
1.	BENUE	COE KATSINA-ALA	18	8
2.		COE OJU	38	17

3. KOGI	FCE OKENE	57	25
4.	COE ANKPA	24	11
5.	COE (T) KABBA	19	8
6. KWARA	COE ORO	17	8
7.	COE ILORIN	11	5
8.	COE LAFIAGI	141	63
9. NASSARAWA	COE KWANGA	42	19
10. NIGER	FCE KOTANGORA	27	12
11.	COE MINNA	42	19
12. PLATEAU	FCE PANKSHIN	37	16
13.	COE GINDRI	27	12
`TOTAL		**500**	**222**

This study utilized one researcher-developed questionnaires: SLAUVLRQ for science lecturers, which was designed to assess awareness and utilization of virtual learning resources. The questionnaire included two sections: Section A collected demographic data, while Section B measured awareness and utilization on a four-point rating scale of Fully Aware (FUA=4), Aware (A=3), Fairly Aware (FA=2) and Not Aware (NA=1). Also, Frequently Used (FU=4), Used (U=3) Rarely Used (RU=2) and Not Used (NU=1) respectively. The instruments were validated by experts from various departments at the University of Abuja, with suggestions incorporated for clarity. To assess the reliability of the instruments, a pilot test was conducted with 30 science lecturers from FCT College of Education Zuba, a population not included in the main study. The pilot test aimed to evaluate the clarity, appropriateness, and comprehensibility of the items, as well as to establish the instruments' internal consistency. Reliability was determined using a test-retest method, where the same test was administered to the same participants twice, with a one-week interval. The Pearson Product Moment Correlation Coefficient (PPMCC) was calculated to compare the initial and retest scores, yielding high reliability coefficients of 0.98 for SLAUVLRQ. These results confirm the instruments' reliability for data collection, aligning with Musah and Bah's (2017) recommendation that such coefficients are suitable for research instruments. Data collection involved trained research assistants and on-the-spot questionnaire retrieval. Data were analyzed using descriptive statistics of frequency count, percentage, mean, and standard deviation with specific decision rules for awareness and utilization scores.

Decision Rule: Decision Rule: For awareness, a mean score below 1.00 was categorized as "Not Aware" (NA), 1.00-1.99 as "Fairly Aware" (FA), 2.00-2.99 as "Aware" (A), and 3.00 or above as "Fully Aware" (FUA). For utilization, a mean score below 1.00 was categorized as "Not Used" (NU), 1.00-1.99 as "Rarely Used" (RU), 2.00-2.99 as "Used" (U), and 3.00 or above as "Frequently Used" (FU).

Data Analysis and Results

Research Question One: What is the level of awareness of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria? To answer this research question, mean and standard deviation were used and the results set out on Table 2.

Table 2: Level of Awareness of Virtual Learning Resources by Science Lecturers in Colleges of Education in North Central Nigeria

N=213

S/N	Items	FUA	A	FA	NA	Mean	Std Dev	Decision
1	Khan Academy: https://www.khanacademy.org/	196	17	-	-	3.92	0.27	Fully aware
2	IXL : https://www.ixl.com/	136	77	-	-	3.64	0.48	Fully aware
3	Better Explained: https://betterexplained.com/	130	66	11	6	3.50	0.72	Fully aware
4	Class Central: https://www.classcentral.com	90	112	11	-	3.37	0.58	Fully aware
5	YouTube: https://www.youtube.com/	86	123	4	-	3.39	0.53	Fully aware
6	Quizlet: https://www.quizet.com	91	122	-	-	3.43	0.50	Fully aware
7	Numerade: https://www.numerade.com	95	118	-	-	3.45	0.50	Fully aware
8	Study.com: https://study.com/	72	137	4	-	3.32	0.51	Fully aware
9	Lumen Learning: https://www.lumenlearning.com	115	98	-	-	3.54	0.50	Fully aware

10	MicrosoftTeams: https://www.microsoft.com/	85	122	6	-	3.37	0.54	Fully aware
11	Slack: https://slack.com/	82	83	48	-	3.16	0.77	Fully aware
12	Trello: https://trello.com/	98	107	8	-	3.42	0.57	Fully aware
13	Concord Consortium: https://www.concord.org/	110	91	6	6	3.43	0.69	Fully aware
14	Wikipedia: https://www.wikipedia.org/	95	87	31	-	3.30	0.71	Fully aware
15	MIT Open Courseware: https://ocw.mit.edu/ index.htm	110	95	8	-	3.48	0.57	Fully aware
16	YouTube Educational Channel: https://www.youtube.com /user/TEDEducation/videos	95	136	11	-	3.37	0.62	Fully aware
17	YouTube Educational Channels: https://www.youtube.com /education	66	105	43	-	3.26	0.54	Fully aware
18	Zotero: https://www.zotero.org/	65	105	42	-	3.10	0.71	Fully aware
19	Wikiversity: https://www.wikiversity.org/	84	99	30	-	3.25	0.69	Fully aware
20	LabXchange: https://www.labxchange.org/	78	109	26	-	3.24	0.66	Fully aware
21	Youtube Channel: Smarter Every Day: https://www.youtube.com/channel/UC6107grRI4m0 o2-emgoDnAA	85	112	16	-	3.32	0.61	Fully aware
22	Youtube Channel: Crash Course: https://www.youtube.com/channel/UC6107grRI4m0 o2- emgoDnAA, https://www.youtube. com/user/crashcourse	76	122	15	-	3.29	0.59	Fully aware
23	Open Learn: https://www.open.edu/openlearn/	69	110	34	-	3.16	0.68	Fully aware
24	Academic Earth: https://academicearth.org/	89	113	6	5	3.34	0.65	Fully aware
25	Live Science: https://www.livescience.com	87	106	15	5	3.29	0.70	Fully aware
26	Yale Open Courses: https://oyc.yale.edu/	80	128	-	5	3.33	0.60	Fully aware
27	Toppr: https://www.toppr.com	82	97	29	5	3.20	0.76	Fully aware
28	Chemical Portal: https://www.webqc.org/chemica ltools.php3	119	83	11	-	3.51	0.60	Fully aware
29	Microbe Notes: https://www.microbenotes.com	71	119	18	5	3.20	0.69	Fully aware
30	Biology Junction: https://www.biologyjunction.com	101	81	23	8	3.29	0.81	Fully aware
31	Netflix Documentaries: https://www.netflix.com/ browse/genre/6839	126	87	-	-	3.59	0.49	Fully aware
32	CK-12: https://www.ck12.org/student/	92	98	23	-	3.32	0.66	Fully aware
33	OER Commons: https://www.oercommons.org	92	117	4	-	3.41	0.53	Fully aware
34	Merlot: https://www.merlot.org/	47	126	16	24	2.92	0.86	Fairly aware
35	MIT Open Course Ware: https://ocw.mit.edu/	47	120	28	18	2.92	0.83	Fairly aware
36	Rice University Connexions: https://cnx.org/	79	120	10	4	3.29	0.64	Fully aware
37	Openstax: https://openstax.org	120	68	15	10	3.40	0.82	Fully aware
38	PhET: https://phet.colorado.edu/en/	140	69	-	4	3.62	0.59	Fully aware
39	Project Gutenberg: https://www.gutenberg.org/	115	98	-	-	3.54	0.50	Fully aware
40	Slideshare: https://www.slideshare.net/ or Flikr:	118	91	4	-	3.54	0.54	Fully aware

	https://www.flickr.com/							
41	Onlinebiologynote: https://www.onlinebiologynotes.com/	95	118	-	-	3.45	0.50	Fully aware
42	Biology online: https://www.biologyonline.com /dictionary/biology	72	137	4	-	3.32	0.51	Fully aware
43	Britannica: https://wwww.britannica.com/	115	98	-	-	3.54	0.50	Fully aware
44	Chemical book: https://wwww.chemicalbook.com/	85	122	6	-	3.37	0.54	Fully aware
45	Chemeduresearch:	82	83	48	-	3.16	0.77	Fully aware
	https://wwww.chemeduresearch.com/course/index.php							
46	Chemtube3d: https://www.chemtube3d.com/	98	107	8	-	3.42	0.57	Fully aware
47	Rsc.org, https://www.rsc.org	110	91	6	6	3.43	0.69	Fully aware
48	GeeksforGeeks: https://www.geeksforgeeks.org	95	87	31	-	3.30	0.71	Fully aware
49	Sciencenotes: https://www.sciencenotes.org	110	95	8	-	3.48	0.57	Fully aware
50	Chemcollective: https://www.chemcollective.org	95	102	16	-	3.37	0.62	Fully aware
	Sectional Mean					**3.37**	**0.61**	**Fully aware**

(Field work, 2024)

Table 2 presents the mean scores and standard deviations of science lecturers' awareness of virtual learning resources in Colleges of Education in North Central Nigeria. The analysis revealed that science lecturers were fully aware of 48 out of 50 items, with only 2 items indicating fair awareness. The item on Khan Academy had the highest mean score of 3.92 and a standard deviation of 0.27. The overall sectional mean of 3.37 suggests that science lecturers in the region were fully aware of virtual learning resources.

Research Question Two: What is the level of utilization of virtual learning resources by science lecturers in Colleges of Education in North Central Nigeria? To answer this research question, mean and standard deviation were used and the results set out on Table 3.

Table 3: Level of Utilization of Virtual Learning Resources by Science Lecturers in Colleges of Education in North Central Nigeria

N=213

S/N	Items	FU	U	RU	NU	Mean	Std Dev	Decision
1	Khan Academy: https://www.khanacademy.org/	-	74	134	5	2.32	0.52	Used
2	IXL : https://www.ixl.com/	-	101	94	18	2.39	0.64	Used
3	Better Explained: https://betterexplained.com/	-	94	107	12	2.39	0.59	Used
4	Class Central: https://www.classcentral.com	-	92	103	18	2.35	0.63	Used
5	YouTube: https://www.youtube.com/	-	103	98	12	2.43	0.60	Used
6	Quizlet: https://www.quizet.com	-	107	93	13	2.44	0.61	Used
7	Numerade: https://www.numerade.com	-	107	92	14	2.44	0.62	Used
8	Study.com: https://study.com/	-	108	97	8	2.47	0.57	Used
9	Lumen Learning: https://www.lumenlearning.com	-	100	107	6	2.44	0.55	Used
10	MicrosoftTeams: https://www.microsoft.com/	-	100	98	15	2.40	0.62	Used
11	Slack: https://slack.com/	-	101	90	22	2.37	0.66	Used
12	Trello: https://trello.com/	-	135	68	10	2.59	0.58	Used
13	Concord Consortium: https://www.concord.org/	-	120	69	15	2.44	0.70	Used
14	Wikipedia: https://www.wikipedia.org/	-	129	69	15	2.54	0.63	Used

15	MIT Open Courseware: https://ocw.mit.edu/index.htm	-	108	97	8	2.47	0.57	Used
16	YouTube Educational Channel: https://www.youtube.com/ user/TEDEducation/videos	-	106	96	11	2.45	0.59	Used
17	YouTube Educational Channels: https://www.youtube.com/education	-	117	86	10	2.50	0.59	Used
18	Zotero: https://www.zotero.org/	-	124	84	5	2.56	0.54	Used
19	Wikiversity: https://www.wikiversity.org/	-	120	86	7	2.53	0.56	Used
20	LabXchange: https://www.labxchange.org/	-	120	88	5	2.54	0.54	Used
21	Youtube Channel: Smarter Every Day: https://www.youtube.com /channel/UC6107grRI4m0o2-emgoDnAA	-	88	97	28	2.28	0.68	Used
22	Youtube Channel: Crash Course: https://www.youtube.com/ channel/UC6107grRI4m0o2-emgoDnAA , https://www.youtube.com/user/crashcourse	-	91	98	24	2.31	0.67	Used
23	Open Learn: https://www.open.edu/openlearn/	-	112	85	16	2.45	0.63	Used
24	Academic Earth: https://academicearth.org/	-	79	130	4	2.35	0.52	Used
25	Live Science: https://www.livescience.com	-	97	111	5	2.43	0.54	Used
26	Yale Open Courses: https://oyc.yale.edu/	-	118	89	6	2.53	0.55	Used
27	Toppr: https://www.toppr.com	-	131	77	5	2.59	0.54	Used
28	Chemical Portal: https://www.webqc.org/chemicaltools.php3	-	98	113	2	2.45	0.52	Used
29	Microbe Notes: https://www.microbenotes.com	-	88	123	2	2.40	0.51	Used
30	Biology Junction: https://www.biologyjunction.com	-	123	88	2	2.57	0.52	Used
31	Netflix Documentaries: https://www.netflix.com/browse/genre/6839	-	120	88	5	2.54	0.54	Used
32	CK-12: https://www.ck12.org/student/	-	103	98	12	2.43	0.60	Used
33	OER Commons: https://www.oercommons.org	-	108	101	4	2.49	0.54	Used
34	Merlot: https://www.merlot.org/	-	103	106	4	2.46	0.54	Used
35	MIT Open Course Ware: https://ocw.mit.edu/	-	118	85	10	2.51	0.59	Used
36	Rice University Connexions: https://cnx.org/	-	124	84	5	2.56	0.54	Used
37	Openstax: https://openstax.org	-	120	86	7	2.53	0.56	Used
38	PhET: https://phet.colorado.edu/en/	-	120	88	5	2.54	0.54	Used
39	Project Gutenberg: https://www.gutenberg.org/	-	88	97	28	2.28	0.68	Used
40	Slideshare: https://www.slideshare.net/ or Flikr: https://www.flickr.com/	-	91	98	24	2.31	0.67	Used
41	Onlinebiologynote: https://www.onlinebiologynotes.com/	-	112	85	16	2.45	0.63	Used
42	Biology online: https://www.biologyonline.com/dictionary/biology	-	79	130	4	2.35	0.52	Used
43	Britannica: https://wwww.britannica.com/	-	97	111	5	2.43	0.54	Used
44	Chemical book: https://wwww.chemicalbook.com/	-	117	90	6	2.52	0.55	Used
45	Chemeduresearch: https://wwww.chemeduresearch.com/course/index.php	-	130	78	5	2.59	0.54	Used
46	Chemtube3d: https://www.chemtube3d.com/	-	97	114	2	2.45	0.52	Used
47	Rsc.org, https://www.rsc.org	-	87	124	2	2.40	0.51	Used
48	GeeksforGeeks: https://www.geeksforgeeks.org	-	122	89	2	2.56	0.52	Used

49	Sciencenotes: https://www.sciencenotes.org	-	120	88	5	2.54	0.54	Used
50	Chemcollective: https://www.chemcollective.org	-	103	98	12	2.43	0.60	Used
	Sectional Mean					**2.46**	**0.58**	**Used**

(Field work, 2024)

Table 3 presents the level of virtual learning resources utilization by science lecturers in Colleges of Education in North Central Nigeria. The analysis showed that science lecturers used or utilized all 50 items listed in the questionnaire. Items 12, 27, and 45, which referred to the utilization of Trello, Toppr, and Chemeduresearch, had the highest mean scores of 2.59, with standard deviations of 0.58, 0.54, and 0.54, respectively. The overall sectional mean of 2.46 indicates that science lecturers in the region used virtual learning resources to some extent. This means that science lecturers do not frequently utilize virtual learning resources.

Discussion of Findings

The study's findings indicate that science lecturers in Colleges of Education in North Central Nigeria are fully aware of virtual learning resources. This conclusion was drawn from the research question examining the level of awareness among science lecturers. The results align with Gbadamosi (2013), who found that Biology teachers had high awareness of innovative teaching strategies, with an awareness rate of 88%. Similarly, Okpaje, Bello, and Babagana (2018) found that science teachers in the Federal Capital Territory had a high level of awareness regarding laboratory management techniques. This supports the findings of Fakomogbon, Olanrewaju, and Soetan (2015), who reported that lecturers had moderate awareness of instructional media. Additionally, Ugwu and Ohimekpen (2015) found that most teachers were aware of e-learning resources, and Paul, Albert, Bervell, and Arkorful (2017) noted that teachers recognized e-learning resources but lacked adequate training. The consistent findings may be attributed to science lecturers' frequent participation in workshops, seminars, and conferences.

However, this study's findings contradict Ugwu and Ohimekpen (2015), who observed that many teachers were unaware of e-learning resources due to a lack of computer literacy. For those who were aware, issues such as limited internet access, poor network connectivity, and high costs of e-learning facilities were significant barriers. Similarly, Abdullahi (2017) found that many chemistry teachers were unaware of online chemistry resources. Additionally, this study contrasts with Okpaje, Bello, and Babagana (2018), who reported a low level of awareness of laboratory safety measures among science teachers in FCT-Abuja. The discrepancies between these studies may stem from differences in location and sample size.

The findings of this study revealed that science lecturers in Colleges of Education in North Central Nigeria utilize virtual learning resources, although not frequently. This conclusion was drawn from the research question on the level of utilization of virtual learning resources by science lecturers in the region. This indicates that while virtual learning resources are used, their usage is not consistent or widespread.

These findings align with Gbadamosi (2013), who reported that Biology teachers utilized innovative teaching strategies with an 88.0% utilization rate. Similarly, Osuafor and Emeji (2015) noted that science teacher educators moderately used e-learning facilities. Dubey and Singh (2017) found that teachers embraced online education during the COVID-19 lockdown, actively utilizing it to shape students' futures. Garba, Mohammed, and Jega (2018) discovered that lecturers at Kaduna Polytechnic made use of available e-learning facilities. Additionally, Sani, Alabi, Danjuma, and Momohjimoh (2019) found that lecturers were knowledgeable about ICT but some did not fully utilize it for lecture preparation and delivery. The study by Eze et al. (2020) also supports these findings, as they revealed that lecturers in federal and private universities in Enugu State, Nigeria, used virtual classrooms to teach computer courses. The similarities in these findings could be attributed to the availability of adequate resources such as computers and internet access, which enabled lecturers to use virtual learning resources to some extent.

Contrarily, this study's findings conflict with Ugwu and Ohimekpen (2015), who reported that teachers' utilization of e-learning resources remained very low. Similarly, Omiko (2016) found that teachers were not effectively utilizing available instructional materials. Additionally, Osuafor and Emeji (2015) highlighted factors such as the high cost of computer units, lack of prior knowledge among students, slow browsing speeds, and poor funding as contributing to low usage of e-learning resources. Fakomogbon, Olanrewaju, and Soetan (2015) also reported infrequent use of instructional media by lecturers in Colleges of Education in Southwest Nigeria. This finding contrasts with Abdullahi (2017), who found that chemistry teachers in Kwara Central, Nigeria, rarely utilized online chemistry resources. The differences in these findings could be attributed to insufficient motivation and training, which may hinder the effective use of virtual learning resources by lecturers and teachers.

In conclusion, this study offers a thorough examination of the awareness and utilization of virtual learning resources (VLR) by science lecturers in Colleges of Education in North Central Nigeria. The findings revealed full awareness among science lecturers, with evidence suggesting that they are not fully utilizing virtual learning resources in their teaching practices.

Recommendations

Based on the findings, the following recommendations are made to enhance the awareness and utilization of virtual learning resources among science lecturers in Colleges of Education in North Central Nigeria:

1. Government agencies, College management, or Student Unions should organize interactive workshops and seminars for science lecturers. These sessions would aim to update their knowledge, improve utilization skills, and foster collaborative learning.
2. College administrations should provide incentives or recognition for science lecturers who effectively and creatively use virtual learning resources in their teaching.
3. Government and ICT departments should facilitate the establishment of dedicated virtual resource centers in Colleges of Education. These centers should be equipped with necessary infrastructure and staff, serving as hubs for training, resource sharing, and collaborative efforts.
4. College administrators (e.g., Provosts or Deans) should establish a system for ongoing monitoring and evaluation of virtual learning resources' awareness and use. This feedback mechanism will help tailor strategies to meet the evolving needs of lecturers.

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