International Journal of Multidisciplinary
Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Influence of Gender on Awareness and Utilization of Virtual Learning Resources among Pre-Service Science Teachers of Colleges of Education in North Central Nigeria

Katcha M. A.[1], Dajal R.G.[2], Abubakar, Zainab[3]

Department of Science and Environmental Education, Faculty of Education, University of Abuja, Nigeria [1,2,3]

OrcID: https://orcid.org/0000-0002-1047-5945

ABSTRACT: This study examined the influence of gender on the awareness and utilization of virtual learning resources among pre-service science teachers in Colleges of Education in North Central Nigeria. A descriptive survey research design was employed to address two research questions and test two hypotheses. The population comprised of 12,274 pre-service science teachers (6,299 males and 5,975 females) in public Colleges of Education in North Central Nigeria. From this population, a sample of 390 pre-service science teachers were selected using 5% Glenn (2012) Sampling Size Distribution Table. The instrument used for data collection was a researcher's designed questionnaire for pre-service science teachers. The collected data were analyzed using both descriptive and inferential statistics. Demographic data were analyzed using frequency count and percentage, while mean and standard deviation were employed to address the research questions. A t-test at a 0.05 level of significance was used to test the null hypotheses. The findings revealed that both male and female pre-service science teachers demonstrated moderate awareness but show low utilization of virtual learning resources. Furthermore, there were no significant gender-based differences in either awareness or utilization. Based on these results, it was recommended that government agencies, Colleges of Education management, and Students' Union Governments organize interactive seminars for pre-service science teachers. These seminars should actively engage participants, enhance their knowledge, and improve their ability to utilize virtual learning resources effectively. By providing practical insights and fostering collaborative learning, these sessions can increase awareness and promote better utilization of available virtual learning tools by both gender.

KEYWORDS: Awareness, Utilization, Virtual Learning Resources, Influence, Gender, Pre-Service Science Teachers, Colleges of Education, North Central Nigeria.

I. INTRODUCTION

Science is widely regarded as the driving force behind modern development, bridging technological innovation and socio-economic advancement (Abubakar, Abiodun & Ogunode, 2021). Meanwhile, science education serves as a fundamental pillar of national progress, propelling advancements across various fields. It is recognized as essential for a nation's development and must be prioritized at all levels of education (Abubakar & Olamoyegun, 2023). The primary aim of science education is to cultivate scientifically literate individuals who possess strong competencies in rational thinking and decision-making (Ebele & Abubakar, 2019). This literacy has the transformative potential to not only reshape individual thinking but also drive societal change (Abubakar, 2024). Dajal, Sulaiman, and Abubakar (2018) describe science education as a discipline focused on the dissemination of scientific content, aspects of social science, and the methodologies of teaching science. Its goal is to foster a deeper understanding and integration into the scientific community.

In a recent time, the COVID-19 pandemic transformed education, ushering in virtual learning as a permanent fixture, often integrated with traditional methods in a Blended Learning model. This approach, combining face-to-face and online components, offers flexibility and control for instructors and learners. Virtual learning does not have a single definition, as new systems for this type of learning are constantly emerging, with learners continuously adopting tools like virtual learning platforms and other internet-supported applications. The term virtual learning is a teaching and learning environment or a shared online learning space that facilitates meaningful interaction, communication, view and engagement with learning resources between students and materials, students and lecturers or teachers and students that promotes exchange of meaningful ideas together at the same time all in an online setting (Abubakar, 2024). In this setting, both students and teachers participate virtually.

This interaction occurs through digitally delivered content, network-based services, and tutoring support, often utilizing various online tools and media, such as the Internet, intranets, extranets, simulations, games, virtual worlds, cloud services, satellite broadcasts, and web platforms (Schutt & Linegar, 2013; Pelet & Lecarte, 2013). Unlike traditional classroom learning, virtual learning expands beyond physical walls, leveraging internet facilities, platforms, satellite links, and related systems to access, analyze, create, exchange, and apply data, information, and knowledge in innovative ways (Lokie, 2011). More broadly, virtual learning is a shared online space that fosters meaningful interactions among students, teachers, and peers, allowing the exchange of ideas and collaboration in real-time, all in a digital environment. students can access vital materials through virtual learning resources such as online courses, e-books, simulations, and video lectures.

Virtual learning takes place through online courses, web-based training, and technology-enabled instruction within Virtual Learning Environments (VLEs). A VLE is essentially a collection of tools designed to facilitates student's learning via an internet connection. Also known as course management systems (CMS), learning platforms (LP), or learning management systems (LMS). The integration of Learning Management Systems (LMS) in Nigerian tertiary institutions has transformed traditional classroom instruction into flexible, technology-driven education model which are used to enhance teaching and learning (Suleiman & Abubakar, 2025). These environments are flexible and interactive, allowing students to engage with other learners and access a wide range of resources (Pelet & Lecarte, 2013). Virtual learning, in particular, allows students to choose when and where they engage with their coursework, making it an ideal option for those seeking a fully online education. It is highly interactive, often mirroring classroom environments with schedules, rosters, course content, and instructor-led guidance. Students have access to a variety of virtual learning resources, including live and recorded lectures, and engage in online discussions with instructors and peers (Shubhrajyotsna, 2016). Virtual learning emerged as a critical tool, enabling real-time collaboration between educators and students while transcending the barriers of time and space. Virtual learning resources, encompassing online platforms, multimedia tools, and digital content, have transformed traditional teaching methodologies. These resources enhance accessibility, flexibility, and interactivity, enabling students to engage actively with educational materials. Students can utilize various tools for managing group activities, submitting assignments, and participating in assessments, enhancing their overall learning experience (Abubakar, Katcha & Dajal, 2025). 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). 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 (Abubakar et al., 2025).

Virtual learning resources provide numerous tools for administration, communication, and assessment, including features for managing student groups, uploading content, conducting assessments, and tracking progress. These tools facilitate greater interaction and engagement, enabling students to learn both through content and practical activities (Abubakar et al., 2025). Key advantages such as convenience, time savings, and cost reduction contribute to the widespread adoption of virtual learning among students (Shubhrajyotsna, 2016). For instructors, the flexibility to tutor anytime and anywhere, along with the ability to update materials in real-time, enhances teaching effectiveness. Virtual learning platforms also allow instructors to tailor content to students' needs and guide them towards appropriate resources (Rahayu & Wirza, 2020).

Modern education increasingly emphasizes learning that goes beyond teacher-centered, face-to-face interactions. With technological advancements and the integration of the internet, many institutions have shifted to virtual learning environments (Rachmadtullah & Sumantri, 2018; Rasmitadila et al., 2019). In science education, virtual learning has fostered more interactive, learner-centered classrooms, providing an environment that enhances motivation, reduces anxiety, and promotes practical engagement (Chou, 2010; Erben, 2013). This stands in contrast to traditional, teacher-centered learning, where the instructor holds the knowledge and controls the learning environment, often limiting student engagement and the development of critical thinking skills. The traditional approach to teaching which has been in use for centuries involves the transfer of information from the teacher who is more or less like a sage to students who are mere receptacles. These students who have become passive listeners are not actively involved in the teaching and learning process therefore interest in the lesson most times is lost (Katcha, Orji, Ebele, Abubakar & Babagana 2018). Research

indicates that virtual learning can be more effective than face-to-face education in fostering student outcomes (Means et al., 2013; Bernard et al., 2014; Vo et al., 2017; Abubakar, 2024). Research by Smith and Greene (2013) explored the use of e-learning technologies to enhance education. While the participants acknowledged the benefits of e-learning, these advantages were somewhat hindered by the technological challenges they faced. In a study carried out by Etuibon (2014) revealed that a significant influence on the academic achievement of chemistry students taught using ICT tools and those taught by conventional means. The results indicate that a significant influence existed in the scores of chemistry students taught utilizing ICT tools and the conventional group.

However, the effectiveness of virtual learning resources hinges on the quality of its design and the content's adaptability to the virtual resources. It is crucial that both students and instructors are aware of the available virtual learning resources to fully benefit from them. Awareness entails understanding the structure, content, and benefits of virtual learning resources (Olibie, Ezoem & Ekene, 2014). Awareness not only empowers individuals to engage with and effectively use new technologies but also ensures that virtual learning can reach its full potential in educational settings. Ultimately, awareness forms the foundation for the effective use of virtual learning resources. If pre-service teachers are unaware of these tools, they are unlikely to utilize them, let alone do so efficiently or correctly. Therefore, fostering awareness and digital literacy among both students and instructors is critical to the successful integration of virtual learning resources (Yustanti & Novita, 2019) in Colleges of Education in North Central Nigeria.

Virtual learning is broadly categorized into three types, they include synchronous learning which deal with real-time interaction facilitated by instructors using tools like webinars and virtual classrooms. It supports immediate feedback and dynamic discussions but requires stable internet and redesigned content. Asynchronous learning is self-paced learning through materials like videos, forums, and training modules. It offers flexibility and cost savings but relies on learner self-motivation and lacks real-time interaction. Blended learning combines synchronous and asynchronous elements to maximize their strengths. It integrates traditional and online learning, emphasizing effective use of technology for teaching.

Key tools for virtual classrooms include video conferencing (that enables interactive, face-to-face sessions using platforms like Zoom), breakout rooms (facilitates small group collaboration), messaging apps and email (enhance communication and document sharing), social media e.g., Facebook (builds learning communities and shares resources) and YouTube (provides access to educational videos and open resources). These categories and tools showcase the adaptability of virtual learning in enhancing education while addressing diverse learner needs.

Gender differences in educational outcomes have been extensively studied and debated. Gender, being a social construct, is attributed to males and females and is shaped by social institutions and self-perceptions rather than enforced by laws (Owolabi in Abubakar, 2018). The causes of gender imbalance in science education are multifaceted, encompassing individual, school, attitudinal, environmental, and familial factors. While gender may not significantly affect computer use, employing computers in teaching has been found to enhance students' academic performance (Keziah, 2011).

Gender in science education has been a topic of ongoing discussion and reflection, particularly regarding how it impacts the experiences, expectations, and opportunities of students within educational settings. In Colleges of Education, where the next generation of educators is being trained, understanding gender's role is particularly important. It shapes not just how pre-service science teachers approach the subjects they will eventually teach, but also how they engage with pedagogy, technology, and their students. The participation and representation of both male and female students in science programs often mirror larger societal norms and disparities, influencing everything from career aspirations to self-confidence and engagement with the sciences.

For pre-service science teachers, gender dynamics can play a key role in shaping how they perceive and use resources, particularly emerging tools like virtual learning resources. Historically, science has been viewed as a male-dominated field, but there has been a concerted effort in recent years to encourage more gender-balanced participation, especially by empowering female students to engage with science on equal terms. Yet, even with these efforts, gender disparities persist not just in terms of enrollment in science education programs, but also in access to and utilization of innovative resources, like virtual learning platforms.

In Colleges of Education, pre-service science teachers are introduced to various pedagogical strategies and educational resources meant to enhance their teaching approaches. With the increasing integration of technology into education, it's important to consider whether gender influences how pre-service science teachers engage with these tools. Digital platforms like virtual learning resources, simulations, online tutorials, and collaborative technologies all have the potential to transform the way science is taught and learned. However, if access to or the use of these tools is unequal across gender lines, it could significantly affect the future development of educators and, ultimately, the quality of science education in the classroom.

By examining variables such as gender, the researchers aim to identify the influence of gender on the awareness and use of virtual learning resources. The findings of this study will provide insights into the current state of virtual learning in the region, offering recommendations to enhance its integration in teaching and learning processes. This is particularly crucial in a post-COVID era, where the blending of virtual and traditional learning approaches offers a sustainable pathway for educational continuity and development. Therefore, integration of virtual learning resources into the educational framework is crucial for equipping pre-service science teachers with the knowledge and skills necessary for their personal and professional development in a rapidly changing world. This study stands to add to the existing positions on gender studies in science education in terms of data on gender bias factors in virtual learning resources by Colleges of Education pre-service science teachers. Therefore, the study investigated the influence of gender on pre-service teachers' awareness and utilization of virtual learning resources in Colleges of Education in North Central Nigeria. These institutions are central to teacher training, producing professionals equipped to meet the demands of contemporary education.

STATEMENT OF THE PROBLEM

Teaching and learning in Nigerian classrooms from pre-primary schools through primary schools to secondary schools and tertiary institutions has been by the traditional method of face-to-face tuition. Teachers, through their training and experience, have become accustomed to this conventional teaching method. As noted by Katcha (2000), lesson delivery in classrooms across Sub-Saharan Africa predominantly follows this face-to-face approach.

However, the COVID-19 pandemic brought about unprecedented disruptions that transformed the educational ecosystem. Measures such as total lockdowns affected schools, markets, places of worship, social gatherings, and workplaces, leaving only medical facilities operational. In response, the Federal Government of Nigeria (FGN) issued directives for remote work and learning. Schools were instructed to conduct teaching, assignments, projects, tests, and examinations from home. These directives exposed significant challenges, especially for Basic, Secondary Schools and Colleges of Education in North Central Nigeria including inadequate capacity to utilize online platforms, limited internet access, and insufficient availability of devices like laptops, desktops, and smartphones for teachers and students.

The study was therefore, focused to establish the influence of gender on pre-service science teachers' awareness and utilization of virtual learning resources in Colleges of Education in North Central Nigeria. As a results of COVID-19 challenges and FGN directives, the use of VLR have become a new norm. Today, all schools, from Basic Education to tertiary institutions, are required to adapt to this new reality.

PURPOSE OF THE STUDY

The purpose of the study was to investigate the influence of gender on awareness and utilization of virtual learning resources among pre-service science teachers of Colleges of Education in North Central Nigeria. Specifically, the objectives of the study were to:

1. determine the level of awareness of virtual learning resources based on pre-service science teachers' gender in Colleges of Education in North Central Nigeria;
2. find out the level of utilization of virtual learning resources based on pre-service science teachers' gender 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 based on pre-service science teachers' gender in Colleges of Education in North Central Nigeria?

2. What is the level of utilization of virtual learning resources based on pre-service science teachers' gender in Colleges of Education in North Central Nigeria?

HYPOTHESES

The following null hypotheses were formulated and tested at 0.05 level of significance.

HO1: There is no significant difference in the awareness of virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria.

HO2: There is no significant difference in the utilization of virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria.

The study focused on NCE II pre-service science teachers in public Colleges of Education, including both Federal and State-owned institutions. All Colleges of Education in Nigeria are overseen by the National Commission for Colleges of Education (NCCE). The research was conducted within a zone comprising the Federal Capital Territory (FCT) Abuja and six states: Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau. The study investigated whether the gender of pre-service science teachers significantly influences their awareness and use of virtual learning resources for teaching science.

II. METHODOLOGY

This study employed a descriptive survey research design, focusing on pre-service science teachers in federal and state-owned Colleges of Education in North-Central Nigeria. The total population comprised 12,274 pre-service science teachers, including 6,299 males and 5,975 females, drawn from public Colleges of Education (NCCE, Department of Planning, Research & Statistics, 2020/2021). According to NCCE statistics (2023), the region includes 11 state-owned and three federal Colleges of Education spread across six states, Benue, Kogi, Kwara, Nasarawa, Niger, Plateau and the Federal Capital Territory (FCT), Abuja.

A sample of 390 pre-service science teachers from 13 Colleges of Education was selected using a multi-stage sampling procedure. In the first stage, purposive sampling ensured the inclusion of all 13 public Colleges of Education, as the study was limited to these institutions. In the second stage, simple random sampling was employed to select three departments (Biology, Physics, and Chemistry) from the seven departments in the School of Sciences, ensuring equal representation. The final sample size of 390 pre-service science teachers was determined using Glenn's 5% Sampling Size Table (2012) and was proportionally distributed across the institutions based on their respective populations. This methodology ensured a representative and balanced sample for the study. The apportionment formula is presented as follows:

Population in each School × Sample Size
_____

Total Population   1

Details presented in Table 1.

Table 1: Population and Sample Size Distribution of Pre-Service Science Teachers in Colleges of Education in North Central Nigeria

S/N	STATE	COLLEGES	POPULATION	SAMPLE
1.	BENUE	COE KATSINA-ALA	145	5
2.		COE OJU	221	7
3.	KOGI	FCE OKENE	620	21
4.		COE ANKPA	137	5
5.		COE (T) KABBA	31	1
6.	KWARA	COE ORO	228	8
7.		COE ILORIN	906	30
8.		COE LAFIAGI	175	6

9. NASSARAWA	COE AKWANGA	3228	107
10. NIGER	FCE KOTANGORA	470	16
11.	COE MINNA	3340	111
12. PLATEAU	FCE PANKSHIN	1761	58
13.	COE GINDRI	506	17
TOTAL		**11, 768**	**390**

This study employed a researcher-developed questionnaire, the PTAUVLRQ, specifically designed to assess the influence of gender on awareness and utilization of virtual learning resources among pre-service science teachers. The questionnaire was divided into two sections: Section A and B. Section A consisted of demographic information, while Section B focused on evaluating both awareness and utilization of virtual learning resources. For awareness, participants rated their level of understanding on a four-point scale: Fully Aware (FUA= 4), Aware (A= 3), Fairly Aware (FA= 2), and Not Aware (NA= 1). For utilization, responses were categorized as Frequently Used (FU= 4), Used (U= 3), Rarely Used (RU= 2), and Not Used (NU= 1).

The instruments underwent validation by experts from various departments at the University of Abuja, who provided valuable feedback to enhance clarity. To ensure the reliability of the questionnaire, a pilot test was conducted with 30 pre-service science teachers from FCT College of Education Zuba, a group not included in the main study. This pilot test aimed to assess the clarity, appropriateness, and comprehensibility of the items. Reliability was evaluated using a test-retest approach, where the same test was administered to the same participants twice, with a one-week interval between tests. The Pearson Product Moment Correlation Coefficient (PPMCC) was calculated to compare the initial and retest scores, yielding a high reliability coefficient of 0.96 for the PTAUVLRQ, confirming its suitability for data collection.

Data collection was carried out by trained research assistants, who also retrieved the completed questionnaires on-site. For data analysis, descriptive and inferential statistics were used. The demographic data were analyzed using frequency count and percentage, while mean and standard deviation were employed to answer the research questions. To test the null hypotheses, a t-test was used at 0.05 level of significance, allowing for the acceptance or rejection of the hypotheses.

The decision rules for interpreting the responses were as follows: 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).

III. RESULTS AND DISCUSSION

This section contains data on the research questions answered in this study.

DEMOGRAPHIC DATA

In this section, data on gender was presented. Out of the total sample of 390, twelve (12) questionnaires were invalid giving a total of 378 pre-service teachers responses.

Table 2: Distribution of Pre-Service Science Teachers based on Gender

	Gender	Frequency	Percentage (%)
Pre-service Science Teachers	Male	178	47.10
	Female	200	52.90
	Total	**378**	**100.00**

Table 2 presented the gender distribution of respondents. Among pre-service science teachers, 178 (47.10%) were male, while 200 (52.90%) were female, indicating a higher number of female pre-service science teachers.

ANSWER TO RESEARCH QUESTIONS

Research Question One: What is the level of awareness of virtual learning resources based on pre-service science teachers' gender 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 Awareness of Virtual Learning Resources Based on Male and Female Pre-Service Science Teachers in Colleges of Education in North Central Nigeria

Gender	N	Mean	Std. Deviation
Male	178	2.33	.240
Female	200	2.31	.256

Table 3 showed the level of awareness of virtual learning resources based on male and female pre-service science teachers in Colleges of Education in North Central Nigeria. From the analysis, the male respondents had a mean score of 2.33 with a standard deviation of 0.240 while female respondents had a mean score of 2.31 with a standard deviation of 0.256. Based on the decision rule, it showed that the pre-service science teachers are aware of virtual learning resources with the male pre-service science teachers showing a slightly higher mean response in the level of awareness of virtual learning resources than female pre-service science teachers in Colleges of Education in North Central Nigeria.

Research Question Two: What is the level of utilization of virtual learning resources based on pre-service science teachers' gender 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 4.

Table 4: Level of Utilization of Virtual Learning Resources based on Male and Female Science Students in Colleges of Education in North Central Nigeria

Gender	N	Mean	Std. Deviation
Male	178	1.90	.113
Female	200	1.88	.115

Table 4 showed the level of utilization of virtual learning resources based on male and female pre-service science teachers in Colleges of Education in North Central Nigeria. From the analysis, the male respondents had a mean score of 1.90 with a standard deviation of 0.113 while female respondents had a mean score of 1.88 with a standard deviation of 0.115. Based on the decision rule, it showed that pre-service science teachers rarely used virtual learning resources with the male pre-service science teachers showing a slightly higher mean response in the level of utilization of virtual learning resources than female pre-service science teachers in Colleges of Education in North Central Nigeria.

TEST OF HYPOTHESES

The following null hypotheses were tested at a 0.05 level of significance.

H_{0_1}: There is no significant difference in the awareness of the virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. To test for this hypothesis, t-test statistic was used and the results presented in Table 5.

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Table 5: t-test on the Difference in the Awareness of Virtual Learning Resources by Male and Female Pre-Service Science Teachers in Colleges of Education in North Central Nigeria

Gender	Number	Mean	S.D.	t-value	df	Sig(2-tailed)	Decision
Male	178	2.33	0.240				Not Significant
				.980	376	.328	
Female	200	2.31	0.256				

Sig value (p) > 0.05= Not Significant

Table 5 showed the significant difference in the awareness of virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. The mean awareness score for male was 2.33 with a standard deviation of 0.240, while for female it was 2.31 with a standard deviation of 0.256. The calculated t-value was 0.980 with 376 degrees of freedom, resulting in a significance value of 0.358, which is greater than the 0.05 level of significance. This showed that there was no significant difference. The null hypothesis was therefore accepted. This implied that there was no significant difference between male and female pre-service science teachers' awareness of virtual learning resources in Colleges of Education in North Central Nigeria.

Ho₂: There is no significant difference in the utilization of virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. To test for this hypothesis, t-test statistic was used and the results presented in Table 6.

Table 6: t-test on the Difference in the Utilization of Virtual Learning Resources by Male and Female Pre-service Science Teachers in Colleges of Education in North Central Nigeria

Gender	Number	Mean	S.D.	t-value	df	Sig(2-tailed)	Decision
Male	178	1.90	0.113				Not Significant
				1.105	376	.270	
Female	200	1.88	0.115				

Sig value (p) > 0.05= Not Significant

Table 6 showed the significant difference in the utilization of virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. The mean utilization score for male was 1.90 with a standard deviation of 0.113, while for female it was 1.88 with a standard deviation of 0.115. The calculated t-value was 1.105 with 376 degrees of freedom, resulting in a significance value of 0.270, which is greater than the 0.05 level of significance. This showed that there was no significant difference. The null hypothesis was therefore accepted. This implied that there was no significant difference between male and female pre-service science teachers' utilization of virtual learning resources in Colleges of Education in North Central Nigeria.

DISCUSSIONS OF FINDINGS

The finding of this study revealed that male and female pre-service science teachers are aware of virtual learning resources but, male pre-service science teachers showed a slightly higher mean response in the level of awareness of virtual learning resources than the female Pre-service science teachers in Colleges of Education in North Central Nigeria. This finding lends a support from Nwana, Egbe and Ugwuda (2017) who revealed that, the students in the distance education programme of the National Open University of Nigeria are aware of majority of the e-learning materials. Similarly, Evbakoe and Martins (2020) submitted that secondary school students in Benin metropolis are aware of the instructional media that can be used to learn Mathematics. On the contrary, Olibie, Ezoem and Ekene (2014) pointed out that a greater percentage of the students were unaware of what constitutes virtual learning and its' benefits. The findings implied that the students lacked much knowledge of what virtual learning resources entail and the benefits to their curriculum

offerings. Besides, the extent of awareness was higher for female than male students. There is the implication that this trend would result in gender gap in virtual learning resources against male students in the future.

The study also revealed no significant difference in the awareness of the virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. This finding agrees with Evbakoe and Martins (2020) who showed that there is no difference in the awareness of instructional media for learning Mathematics by male and female science students. The finding also conforms to the study of Abubakar (2024) who discovered that there is no significant difference in the achievement of male and female SS II biology students taught using virtual learning strategy. The reason for the non-significant differences in the level of awareness could be as a result of equal knowledge that both male and female pre-service science teachers have on virtual learning resources and the potential benefits of using them. This finding disagrees with Suleri and Suleri (2019) who showed that there was a significant relationship between gender and CCL, though; female respondents have more inclination towards CCL than their male counterpart. Similarly, Maison and Lika (2021) submitted that there is a significant influence of perceptions and attitudes on students 'awareness in doing assignments online. The dissimilarities in the findings of the studies could be as a result of different locations and sample size used in both researches.

The study also revealed that science students rarely used virtual learning resources but, male pre-service science teachers showed a slightly higher mean response in the level of utilization in Colleges of Education in North Central Nigeria. This finding agrees with Nwana, Egbe and Ugwuda (2017) who revealed that, the students in the distance education programme of the National Open University of Nigeria rarely used e-learning materials. The reason for the utilization of VLR was because both were exposed to similar training experiences in the various institutions.

The study also revealed no significant difference in the utilization of the virtual learning resources by male and female pre-service science teachers in Colleges of Education in North Central Nigeria. This finding correlates the finding of Lukmon (2019) who submitted that, there is no significant difference in students' utilization of e-learning resources based on gender and age. Similarly, this finding lends a support to that of Abubakar (2024) who submitted that there was no significant difference between the achievements mean scores of male and female students' taught Biology using Virtual Learning Instruction. The finding is in agreement with the study of Katcha et al., (2018) who revealed that there was no significant difference in the mean scores of male and female students taught using MMIA. Also, the finding correlates with the finding of Abubakar (2024) who submitted that, both male and female biology students did not differ significantly in their mean retention scores using GIS. The similar observed findings obtained were possibly due to the same knowledge that both male and female pre-service science teachers have on virtual learning resources and the potential benefits of using them. On the contrary, Yousef and Basem (2021) revealed that there are statistically significant differences in the students' Academic Achievements during the implementation of the E-learning strategy in COVID-19 pandemic which showed that the GPA of male students is affected more than the female students by just a slight difference. The finding disagrees with the study of Gidado, Abalaka & Diffand (2023) who submitted that there is significant difference in the perception of lecturers on the challenges of implementation of virtual classroom learning.

IV. CONCLUSION

In conclusion, this study provides an in-depth analysis of the impact of gender on the awareness and utilization of virtual learning resources (VLR) among pre-service science teachers in Colleges of Education in North-Central Nigeria. The findings indicated that both male and female pre-service science teachers exhibit moderate awareness and low utilization of virtual learning resources, with no significant gender-based differences in either awareness or utilization.

V. RECOMMENDATIONS

1. Educational development department should develop awareness campaigns that specifically target both male and female science lecturers and students. Highlight the benefits of virtual learning resources and address any gender-related disparities in awareness.
2. Government agencies, Colleges of Education management, or Students' Union Government should organize interactive seminars for pre-service science teachers to engage them actively, update their knowledge and improve their utilization of virtual learning resources in North Central Nigeria. These sessions can provide

practical insights, increase their awareness, demonstrate effective utilization of these resources, and encourage collaborative learning.

3. College of Education administration/Student affairs department should provide incentives or recognition for pre-service science teachers who actively and creatively utilize virtual learning resources in their learning processes.

REFERENCES

1. Abubakar, Z. (2018). Effects of Group Investigation Strategy on secondary school students' retention of Biology concepts in Kwali Educational Zone of FCT-Abuja. Unpublished Masters dissertation, Department of Science & Environmental Education, University of Abuja, Nigeria.

2. Abubakar, Z. & Olamoyegun, S.O. (2023). Adequate Funding Panacea for Development of Science Education Programme in Nigeria Educational Institutions. Best Journal of Innovation in Science, Research and Development, 02(7), 494-504

3. Abubakar Z.; Abiodun A.A. & Ogunode N. J. (2021). Administration of Science Programme in Nigerian Public Secondary Schools: Problems and way Forward. Central Asian Journal of Literature, Philosophy and Culture, 02(11), Pp 58-65

4. Abubakar, Z., (2024). Effect of virtual learning strategy on biology students' achievement in Gwagwalada Area Council, FCT-Abuja. American Journal of Integrated STEM Education, 1(2), 1-10. Retrieved from https://publishingjournals.org/stem/article/view/43

5. Abubakar, Z., (2024). Impact of Group Investigation Strategy on Retention in Biology Concepts among Secondary School Students in Kwali Area Council, Abuja. *Zamfara International Journal of Education (ZIJE) The Official Journal of the Faculty of Education Federal University Gusau, Zamfara State, Nigeria,* 4(2), 2814 – 1369. DOI: https://www.doi.org/10.5281/zenodo.13354963

6. Abubakar, Zainab, Katcha M.A & Dajal R.G, (2025). Awareness and Utilization of Virtual Learning Resources among Science Lecturers in Colleges of Education in North Central Nigeria. *International Journal of Research Publication and Reviews*, 6 (1), 1742-1751. Retrieved from www.ijrpr.com

7. Bernard, R.M., Borokhovski, E., Schmid, R.F., Tamim, R.M., & Abrami, P.C. (2014). A metaanalysis of blended learning and technology use in higher education: From the general to the applied. *Journal of Computing in Higher Education,* 26 (1), 87–122. https://doi.org/10.1007/s12528-013-9077-3

8. Chou, C, C. (2010). Students' perceptions and pedagogical applications of e-learning tools in online course. 5(4), 524-525

9. Dajal, R.G.; Suleiman M. B. & Abubakar Z. (2018). Improving the teaching and learning of science through Information and Communication Technology (ICT). *Academic Journal of Research and Development (AJORAD)* 8(1), 159-167.

10. Ebele, F.U & Abubakar Z., (2019). Effects of group investigation strategy on secondary school student's academic achievement in Biology in Kwali educational zone of FCT-Abuja. *International Journal of Innovative Research & Development (IJIRD) 8(12),* 113-119. Available at https://www.internationalcorner.com/index.php/ijird_ojs/issue/view/8750

11. Erben, T. (2013). Calling All Foreign Language Teachers. Hoboken: Taylor and Francis.

12. Etuibon, R. U. (2014). Implications of innovative chemistry teaching on students' achievement. Uyo: Science Education Department, University of Uyo.

13. Evbakoe P. I., & Martins N. I., (2020). Awareness and Availability of Instructional Media for Learning Mathematics by Public Secondary School Students in Benin Metropolis: Counselling Implication. *KIU Journal of Social Sciences. Kampala International University* ISSN: *2413-9580*; 6(2), 335–342.

14. Gidado, B.K; Abalaka H. A & Diffand A.D. (2023). The implementation of virtual learning pedagogy as perceived by lecturers and students of public and private universities in North Central Nigeria. *International Journal of Current Science.* 13 (1), 682-689.

15. Katcha, M. A. (2007). The Effect of Gender on Students' Achievement in Ecological Concepts Using Vee-Diagram Instructional Strategy. *African Journal of Studies in Education*

16. Katcha, M. A.; Orji, A.B.C.; Ebele F.U.; Abubakar Z.; & Babagana M. (2018)**.** Effects of mind-mapping instructional approach on senior secondary school biology students' achievement in evolution in Minna, Niger State, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED)* 14(2), 146-154.

17. Lokie, J. M. (2011). Examining student achievement and motivation using internet-based inquiry in the classroom. Open Access Theses and Dissertations from the College of Education and Human Sciences. Paper 102. Retrieved on 4th April 2023 from http://digitalcommons.unl.edu/cehsdiss/102

18. Lukmon, A.K. (2019). Utilization of E-Learning Resources among Tertiary Students in Ogun State, Nigeria. *Makerere Journal of Higher Education*, 11 (2), 139-147. http://dx.doi.org/10.4314/majohe.v1li2.4.

19. Maison, D. A. K. and Lika, A., (2021). Investigates on the Perception, Attitude, and Student Awareness in Working on Online Tasks During the Covid-19 Pandemic at the University of Jambi. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*. JPSI 9 (1), 108-118.

20. Means, B., Toyama, Y., Murphy, R., & Baki, M., (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. Teachers College Record, 115(3).

21. NCCE, (2012). Pre-NCE Minimum Standard for Nigeria Certificate in Education. 2012 edition.

22. NCCE, (2023). Digest of Statistics on Colleges of Education and other NCE- Awarding Institute in Nigeria. Vol. 14.

23. Nwana S.E., Egbe C. I., & Ugwuda, S.O (2017). Awareness and Usage of E-Learning Materials among Students of National Open University of Nigeria. *World Journal of Education*. 7(6), 75-80.

24. Olibie, E. I., Ezoem, M. N. & Ekene, U. S. (2014) Awareness of Virtual Learning among Students of two Nigerian Universities: Curriculum Implications. *International Journal of Development and Economic Sustainability*, 2(1), 48-62.

25. Pelet, J. E & Lecat, B. (2013) Virtual worlds as the next asset of virtual learning environments for students in business! *International Journal of Virtual and Personal Learning Environments*, 3(2), 59-76

26. Rahayu, R.P & Wirza, Y. (2020) Teachers' Perception of Online Learning during Pandemic Covid-19 in Indonesia. *Jurnal Penelitian Pendidikan*, 20 (3), 392– 406.

27. Schutt, S & Linegar, D. (2013). We learn as we go: What five years playing with virtual worlds has taught us. *International Journal of Virtual and Personal Learning Environments*, 4(2), 124-136

28. Smith, J. J., & Greene, H. C. (2013). Pre-service teachers use e-learning technologies to enhance their learning. *Journal of Information Technology Education Research*, 12(4), 121-140. Retrieved from http://www.jite.org/documents/Vol12/JITEv12ResearchP121- 140Smith1223.pd

29. Suleiman, M.B. & Abubakar Z. (2025). An Assessment on the Effectiveness of Learning Management Systems (LMS) in Enhancing E-Facilitation in Nigerian Tertiary Institutions. *Journal of Institutional Research, Big Data Analytics and Innovation.*1(1), 188-194.

30. Suleri, J. I. and Suleri, A. J. (2019). Comparing Virtual Learning, Classical Classroom Learning and Blended Learning. European Journal of Sustainable Development Research, 3(1), em0072. https://doi.org/10.20897/ejosdr/3970

31. Vo, H.M., Zhu, C., & Diep, N.A. 2017. The effect of blended learning on student performance at course-level in higher education: A meta-analysis. Studies in Educational Evaluation, 53, 17–28. https://doi.org/10.1016/j.stueduc.2017.01.002

32. Yousef A. A. & Basem S. (2020). Impact of E-learning strategy during COVID-19 pandemic on the Students' Academic Achievement at Al-Quds Open University Palestine. *International Journal of Higher Education*. 9(6). https://doi.org/10.5430/ijhe.v9n6p44

INTERNATIONAL JOURNAL OF

MULTIDISCIPLINARY RESEARCH
IN SCIENCE, ENGINEERING AND TECHNOLOGY