Doi: 10.30473/IDEJ.2022.64182.1110 ISSN: 2588-4476

Iranian Distance Education Journal

Vol. 4, No. 1, (New Series) Winter-Spring 2022 (P 21-35), Payame Noor University

Review Article

Secondary School Teachers' Access to Virtual Laboratory for Teaching Biology in Secondary Schools in Minna, Niger State

Gboyega Ayodeji Aladesusi *[1], Florence Daramola [2], Adesoye Oladunni Ajamu [3]

1. Associate Professor, University of Ilorin
2. Associate Professor, University of Ilorin
3. M.A. University of Ilorin

Received: 2021/06/22 **Accepted:** 2021/10/22

Abstract

This study determined the Biology teachers' access to the use of virtual laboratory in Secondary schools in Minna, Niger State. The study adopted descriptive research of the survey type. The population for the study consisted all secondary school Biology teachers in Minna, Niger State. 300 Biology teachers were purposively selected based on the available Biology teachers in Zone B senatorial district in Niger State. The instrument for data collection was an adapted questionnaire. Descriptive and Inferential statistics were used to answer the research question and test the stated hypotheses with the aid of stastistical product and service solution (SPSS) version 20.0 at 0.05 level of significant. The findings indicated 60.1 % of the biology teachers had access to virtual Laboratory and there is no significant difference in teachers' access to virtual laboratory for teaching biology based on gender and school type.

The study concluded that activities that would require the use of ICT-based resources in secondary school should be given to both male and female since the findings of this study revealed that there was no significant difference between male and female teachers. The study recommends that since ICT resources relies heavily on power supply, provision of solar power supply would facilitate constant supply of electricity for maximum utilization of ICT based resources and facilities for teaching Biology.

Keywords

Gender, ICT and Proprietorship.

Introduction

Information and communication technology (ICT) remains a driving factor that propels its modes of operation in all human activities. The role of ICT cannot be underestimated as new technologies grow in their modes of operation in every area of human life. The education sector in Nigeria is not exempted from this transition from analogue to the digital way of life. The integration of ICT into the classroom have changed the way and manner teaching are being presented to students at all levels. ICT brings about new methods of teaching and learning among the students and improve their ability to learn effectively (Abdulhamidovna, 2022). ICT is a tool that comprises electronic devices which are utilized for disseminating information and communication in different institutions and organizations. Such electronic devices include computers (software and hardware), networking, telephone, video, multimedia and internet. Application and utilization of these devices convert information, text messages, sounds and motion to common digital forms.

Therefore, ICT comprises computer and telecommunication facilities to store and retrieve information from various sources in order to transform information and ideas (Setyowati, et al., 2021). Information communication technologies (ICTs) are information handling tools that are used in producing, storing and exchanging of ideas. It is a powerful tool for participating in global markets, promoting political accountability, improving the delivery of basic services and

*Corresponding Author: aladesusigboyega@gmail.com

enhancing local development opportunities (Manaf et al., 2022). With ICTs students have a better understanding of complex topics and concepts and are more likely to recall information and use the ideas gained to solve problems outside the classroom.

Adarkwah, (2021) stated that the application of ICTs in the teaching-learning process can enhance the quality of education in several ways such as increasing learner motivation and engagement, facilitating the acquisition of basic skills, and enhancing teacher training. Since History is one of the major subjects being offered at both secondary and tertiary levels, its relevance and sustenance in the 21st century requires the adequate application of ICTs like video tapes, television and multimedia computer software that combine text, sound and colorful moving images which can be used to provide challenging and authentic content that will not only engage the student in the learning process but as well make learning concrete.

Information and Communication Technology found its place in every sphere of Nigeria's institution. Chuktu, (2021) viewed ICT as a broad-based technology (including its methods, management and application) that supports the creation, storage, manipulation and communication of information. Berdik et al., (2021) opined that information technology means a set of tools that helps you work with information and perform tasks related to information processing. Berdik et al., (2021) affirmed that the definition of French is more enriching than that of Nworgu, which was restricted to information processing and did not cover the communication aspect of ICT. Actually, the term originated as Information Technology (IT) until recently when it was thought that the communication component ought to be highlighted because of its significance. It was then that the concept transformed to Information and Communication Technology ICT (Sunday, & Vera 2018). The term ICT covers a whole range of applications, techniques and systems (Mohanta et al., 2018).

Vaezi,et.al, (2022) clearly postulate that ICT "refers to a broad field encompassing computer, communications equipment and the services associated with them." This means that ICT is not just considered as applications and systems but also as skill for life. In this sense, it is viewed in line with literacy and numeracy as a fundamental skill that every individual needs so as to live "confidently, effectively and independently in a modern or contemporary society (Clarke, 2016). ICT is also seen as a key skill for learning different subject areas (Sánchez-Cruzado et al., 2021). This identification of ICT as a skill for life informed its introduction in the school curriculum in the developed nations (Engeness, 2021).

ICT has three positions in the curriculum and these include learning about ICT, learning with ICT and learning through ICT. Learning about ICT refers to ICT concept as a subject of learning in the school curriculum while learning with ICT is concerned with the use of ICT as a medium to facilitate instruction (Adarkwah, 2021). This view was also shared by Adarkwah, (2021). the study maintain that "learning through ICT refers to the integration of ICT as an essential tool into a course/Curriculum, such that the teaching and learning of that course/curriculum is no longer possible without it". Despite that, most schools do not provide Information and communication technologies for teaching. ICT can be an instructional medium or a source for learning. It can also be integrated in the learning process so that learning takes place through the learner's interaction with the facilities.

Therefore ICT in education is considered as discipline, resource and key skill. Within these three broad areas, ICT offers enormous benefits to the society. This is based on the fact that ICT education and in education is concerned not only with equipping learners with knowledge and skills for the information age but also with boosting the economic and political status of the country Adarkwah, (2021). Recent report revealed that the readiness of ICT in the Sub-Saharan Africa is still very low with most countries experiencing strong lags in connectivity because of the insufficient development of ICT infrastructures. While the developed world continues to witness development of ICT, sub-Saharan Africa is still lagging behind due to poor quality services (Global ICT Chart Report: Guardian, Friday April, 2012 p.6). The report also ranged

African countries on the global ICT Chart. While Nigeria was ranked 112th on the global ICT Chart, other countries in the African continent like Mauritius, South Africa, Rwanda, Botswana, Kenya and Senegal were ranked 53rd, 71st, 82nd, 89th, 93rd and 100threspectively (Guardian, Friday April, 2012 p.6). The report indicated that African countries suffer from severe weaknesses in all components of the index of ICT which ranges from poor connectivity caused by expensive and poor-quality ICT infrastructure to very low levels of basic skills and a weak framework for technology (Guardian, Friday April, 2017 p.6).

The use of the interactive potential of ICTs allows us to substitute methodological approaches which have been developing for a while in pedagogy. Most of these virtual training systems, focused on collaborative work and construction of knowledge in a network, originate in theoretical frameworks built on the notion of constructivism, especially social constructivism. Virtual Learning Environments (VLEs) are spaces relying on a system of communication through a computer, in order to facilitate interaction between the participants and the tutor. Such interaction is key in educational processes present in the social construction of knowledge (Fateh et al., 2022). In an environment which encourages the construction of knowledge in a network, interactions are essential to achieve quality learnings (Schrire, 2006, Stacey & Rice, 2002). These virtual environments are used preferably in pre and postgrade formation, although they are starting to become valuable spaces to help in professional development, like continuous teacher training, making it necessary to analyze virtual interactions, in the particular context of the formation of that body of professionals. The research on interactions and collaborative work is done using different methods and reliability levels (De Wever, 2016).

A Virtual Learning Environment (VLE) is a software system that aims to help lecturers in the administration and management of instructional materials such as providing course notes, multiple choice quizzes and on-line communication (mailing lists, message boards and chat). Similar to the LMS, it is a set of teaching and learning tools designed to enhance learners' learning experiences through the use of computer resources and the Internet within the learning process. VLEs were originally designed for distant participants (learners and lecturers) but they are not restricted to distance education (Dillenbourg 2000). The essential features of a VLE package are made up of: electronic communication; online support for learners and lecturers; curriculum mapping; internet links to external curriculum resources; and, learner tracking (Weller, 2007).

The adoption of VLEs are widespread, for example, a report in 2003 shows that 86% of the institutions surveyed in the United Kingdom revealed that VLEs are currently been used in their institution (Weller 2007). The most popular VLEs currently available are Blackboard/WebCT, Moodle, LAMS and SAKAI15. Blackboard/WebCT is one of the leading commercial systems that are used worldwide. Moodle is an open source VLE that is increasingly popular (Weller, 2006) and SAKAI is a community source VLE. The term VLE is often used interchangeably with many e-learning systems such as those discuss in previous sections (LMS, LCMS and CMS) or Learning Support System (LSS) or Managed Learning Environment (MLE) or Learning Platform (LP) - all of which provide the means to conduct education through computer-mediated communication (CMC) (Denev, 2007).

Denev (2007) pointed out that the use of a particular term to describe an e-learning system largely depends on regional location For example, in the United States, LMS is the commonly used term while the United Kingdom and many European countries favoured the use of the terms VLE to describe e-learning systems. One difference between VLEs and LMSs is that LMSs are traditionally developed to handle complex organisational training programmes and are more expensive to implement (Bach et al. 2006, Pinner 2010). Also, the pedagogical practices within the VLEs tend to concentrate more on constructivism while pedagogical practices within the LMSs tend to involve a multifaceted pedagogical approach and provide more complex interactive control to enhance participants' learning experiences (Bach et al. 2006, Pinner 2010).

Federal Republic of Nigeria FRN (2012), in its draft resolution on National ICT Policy,

revealed that 70% of Nigerians who reside in the rural areas do not have access to advanced ICT services. In addition, some Nigerians who also reside in the urban areas were not served or underserved with ICT resources. Further recommendations indicated that efforts should be made to ensure universal access to and quality of service through the nationwide development of ICT infrastructure and services, especially broadband Internet access and related resources and applications.

In the drive towards ensuring access to ICT infrastructure, there should be development of a national fiber-optic backbone infrastructure that ensures high bandwidth availability, universal access funding and programs, Internet connectivity and telecommunications access network extensions; encouragement of private operators to rollout nationwide high speed broadband and data infrastructure; and use of appropriate and existing government structures (e.g. Post Offices, Schools, Libraries) as platforms for extending ICT to rural communities (FRN 2012) . All ICT industry participants should contribute toward supporting development of universal access.

Institutional factors such as school type have been identified as a means of improving existing attributes among students. Vannatta and Fordham (2004) in (Babalola, 2016), in their study are of the opinion that time committed to teaching and learning and amount of technology training available in an institution are reliable factors of technology use in classroom. They asserted that institution administrators should not only provide extensive training on educational technology, but should also facilitate a contribution to teaching improvement Also, Norris, Sullivan, Poirot, and Soloway (2003), pointed out the importance of access to technology; to which that speed up and energize students' performance in displaying their skills. Therefore, an understanding of institutional characteristics that influence student's adoption and integration of ICT into teaching is relevant.

Over the years, there have been a lot of controversies over school ownership as one of the crucial factors that determine effective learning activities which in turn determine student' academics performance. However, school ownership can be viewed from two main angles which include public and private. Public school is explained to mean any school controlled and supported by the state or federal government while private school is a school established, supported and controlled by religious/social organizations or other private groups/individuals (Oke & Maliki, 2009). The author further affirmed that Nigeria has witnessed drastic but lasting changes in its educational system and management. One of these was the return of schools to their original owners. These owners include the missions and private proprietors. The return of schools thereafter witnessed proposal and implementation of changes, including advertisement on improved teaching facilities, well-qualified teachers, improved teaching techniques and teacher-students collaboration. These schools, along with those owned by individuals are believed to provide a better environment for studying than public schools and thus record a better performance. The goal of these institutions in Nigeria today is to integrate online collaborative tools, a subset of information and communication technology to enhance the education of students in innovative ways.

Researches on gender differences on the use of ICTs were variously studied in favour of either male or female and both. Adegbija, Bola, Riaz and George (2013) found out gender disparity in ICT achievements in favour of the males than their females counterparts. Wilson (2017) noted that gender is one of the intervening variables in information retrieval processes. According to Colley (2013), male teachers more often search different aspects of ICT applications than the female teachers. It is generally accepted that gender is an issue in technology acceptance. Extensive researches have been studied to examine the user's attitude towards ICT and motivations of its usage in general. It is broadly perceived that women are not interested in technologies other than in an instrumental way. Whereas men envision science and technology as a source of fun, enjoyment and pleasure (Sorensen, 2002).

UNESCO (2003) opined that unless gender issues are fully incorporated into technology

analyses, policy development and programme design; women and men will not benefit equally from ICTs and their applications. Studies showed that males are more enthusiastic and positive about technology adoption than the females, while females tend to lag behind in Internet adoption (Greenspan, 2004). While Ono and Zavodny (2005) reported the significant and evolving gender differences in computer and Internet usage. Subsequently, Hotchkiss (2008) pointed out that differences existed between men and women in the use of many Internet applications.

In a similar vein, Shen, Zhang and Tarmizi (2009) found out that gender and cultural differences affect the users' interaction with ICT. The findings revealed that women are less participative in utilizing ICT for their social lives or work. The widening gap between men and women interactions with ICT is dependent on the specific national or ethnic culture that is socially constructed to have different impacts on both women and men. Anyira (2013) further showed that men and women search for information differently on the Internet. Hence, gender differences in the use of ICT are inconclusive. Research has shown that experience with the use of technology has an influence on intention to use and actual use of information technology (Thompson 2006). However some research reported that teachers‟ experience in teaching did not influence their use of computer technology in teaching (Niederhauser & Stoddart, 2001).

Olumorin, (2008) cited in (Babalola, 2016) further opined that teachers and students are in need of high quality skills and training that encompasses all necessary potential access to ICT. This is irrespective of type of institution and gender. The National Policy statement on Science Education noted that biology education should ensure adequate laboratory and field skills, meaningful and relevant knowledge to everyday life in matters of personal and community health and Agriculture, while ensuring reasonable and functional scientific attitude. To ensure the full realization of these interesting objectives, the contents and contexts of the syllabus place great emphasis on field studies, guided discovery, laboratory techniques and skills coupled with conceptual thinking. Unfortunately, available evidence has revealed that students' performance in biology has been quite discouraging (WAEC 2013-2017). Despite the fact that Biology is the simplest to comprehend among the science subjects, the level of academic achievement is nonetheless not much different from other science subjects among the students. In addition, most of the schools lack adequate equipment, insufficient laboratory conditions, limited time allocated for practical course, and overcrowded classroom environment which makes laboratory activities unconducive. These factors was not specifically tied to the simulated classroom in science teaching but recent emphasis in virtual learning open an avenue for making relevant trials on simulation models. Hence, if teachers' skills will be enhanced on science subject like biology teachers access to virtual laboratory in teaching Biology in Secondary schools in Minna needs to be investigated. Hence, if student knowledge will be grounded in Biology, there is need to examine teacher's access in the use of virtual laboratory for teaching irrespective of their school proprietorship and gender.

Purpose of the Study

The main purpose of this study is to investigate biology teachers' access to the use of virtual laboratory in Secondary schools in Minna, Niger State. Specifically, the study will:

1. Investigated teachers' access to virtual laboratory for teaching biology in secondary schools in Minna, Niger state;
2. Examined teachers' access to virtual laboratory for teaching biology based on school proprietorship and
3. Examined teachers' access to virtual laboratory for teaching biology based on gender.

Literature Review

Application of Virtual Laboratory for Teaching in Secondary Schools

The science education, which has a distinct place in the educational system with its content,

consists of three main disciplines named biology, chemistry and Physics (Kaptan, 2016). Being one of this three main disciplines, science of Biology contains lots of abstract concepts that causes frequent problems in conceptual instruction in the Biology lessons. Many students have difficulties in embodying abstract concepts therefore they also have difficulties in chemistry lessons which contains so many abstract concepts (Nakhleh, 1992). For this reason it is recommended that students configure the concepts of Biology lessons by their own. The places where students can learn and configure his or her own scientific knowledge are laboratories. Laboratory activities which are integral components of Biology lessons enables students to build up their own experience with concrete materials (Ayas and others, 2005; Taúdelen, 2004).

Beach and Stone (1988) express that the most efficient way of Biology education is through laboratories and they say that "Biology education without laboratory is like painting without colors and canvas or learning how to ride a bike by reading its operating manual" (Tezcan and Bilgin, 2004). "Laboratory method" is one of the learning methods and it is main function is to enable students to prove basic scientific facts in lab environment (Demirci, 1993). Laboratory activities, to some extent, eliminate learning discrepancies resulting from individual differences. Because all the equipments, tools and techniques used in the labs during the "learning by doing" process also contributes to individual instruction (Çilenti, 1988). Besides, laboratory method improves students' implication, critical thinking, scientific view and problem solving abilities (Aydo÷du, 1991; Odubunni and Balagun 1991; Serin, 2002).

However, it is known that laboratory applications which are very important in chemistry lessons do not get enough attention (Saka, 2002). Teachers may avoid using laboratories because of some different reasons like insufficiencies in traditional verification method, safety doubts of teachers in some risky experiments, some teachers' lack of self-confidence, inadequate effort and time required to perform experiments (Walton, 2002) therefore lab education do not reflect its full potential (Akgün, 1998). As a general evaluation It can be said that lab applications are very important for Biology education but because of some reasons they are not used efficiently. In Turkey, Biology Education curriculum of year 2007 is revised in order to satisfy the mentioned deficiencies (BalÕbey, 2008). The renewed curriculum is based on constructivist learning approach which argues that knowledge can be obtained by individuals' active interaction and meaning can be formed based upon their experiences (BalÕbey, 2008; Baki, 2008).

Consistent with this approach need for an alternative laboratory environment or mediums has emerged where students can conduct experiments whenever they require and at the same time where they can feel safe and comfortable when conducting risky experiments, enjoy while performing, see every details of the experimental process and can play an active role. Virtual Laboratories (VLs) are mediums that fulfill those indicated needs (Usal, Albayrak & Usal, 2004). In this context, literature review relevant to the subject was done, available virtual Biology laboratories that are in accordance with the constructivist approach are examined in order to find out their advantages and disadvantages. VL, which provide instruments for education to be done independent from place and time, carries instruction from closed walls of a classroom to anywhere with a computer and enables applications become more dynamic with simulations (Yang & Heh, 2007).

Secondary School Teachers' Access to Virtual Laboratory

Access to ICT infrastructure and resources in schools is a necessary condition to the integration of virtual laboratory in teaching and learnimg (Tella 2011). Effective adoption and integration of virtual laboratory into teaching in school depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Buabeng-Andoh (2012) posits that access to computers, updated software and hardware are key elements to successful adoption and integration of technology. Emmanuel, Chiaka and Edna (2014), conducted a study to examine the extent to which Information Communication Technology (ICT) is integrated into various school

subjects in the curriculum as well as students' utilization of and access to ICT, in order to establish a fact on its implications to e-learning. Their study also researched into relationship between levels of ICT access and levels of ICT usage among students. Their study indicated that utilization of ICT is determined by the level of ICT accessibility by the students.

These findings are in agreement with the study conducted by (Bhuasiri, 2012) who discovered that computer usage by students for learning purposes and other uses was very low, as well as their relatively low computer expertise. Also, the findings of this study converge with researchers like Osakwe (2010) and Ogwu and Ogwu, (2010) that poor access to ICT is responsible for poor integration of virtual laboratory in teaching and learning of school subjects. Since many students never got access to ICT as indicated in their frequency responses, the extent of utilization of the ICT tools was low. The integration of information and communication technologies can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas. To achieve these objectives, teachers need to be involved in collaborative projects and development of intervention change strategies, which would include teaching partnerships with ICT as a tool. According to Zhao and Cziko (2001) three conditions are necessary for teachers to introduce ICT into their classrooms: teachers should believe in the effectiveness of technology, teachers should believe that the use of technology will not cause any disturbances, and finally teachers should believe that they have control over technology. However, research studies show that most teachers do not make use of the potential of ICT to contribute to the quality of learning environments, although they value this potential quite significantly (Smeets, 2005).

Influence of Gender and School Proprietorship on the Use of Virtual Laboratory for Teaching Biology in Secondary Schools

Since the mid-20th century, gender and ICT have been very topical issues. Gender has most times been used interchangeably with sex. However there seems to be a slight difference between them. The English Oxford Living Dictionaries (2016) explains these differences when it states that the word sex refers to 'the state of being male or female' as it relates to biological differences, while gender refers to cultural or social differences. Information and communication Technologies (ICTs) on the other hand refer to all goods and services that provide access to information and allow for communication. Tech Target (2007-2017) defines ICT as any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, and satellite systems, as well as the various services and applications associated with them, such as videoconferencing, virtual learning and distance learning. The proliferation of these technologies is as a result of the Internet. That ICTs have had a positive effect on education cannot be overemphasized. The introduction of ICTs in education have led to what is popularly known as virtual learning.

Herron (2010) cited in Costley (2014) conducted a study to examine the experiences of pre-service teachers who used technology in mathematics lessons. The study showed that the use of technology had a positive effect on student's learning in mathematics. The students were more engaged during the lessons as they made use of technology. The authors thus concluded that technology can be used as a way to create a hands-on and meaningful mathematics lessons. Similarly, Blanskat, Blamire, and Kefala (2006) cited in EdTechReview February (2014) conducted a study which aimed at determining the impact of utilizing ICT in schools' achievements. The study measured the impact of ICT on students' outcomes. and tried to establish a link between the use of ICT and students' results in examination.

The findings showed that ICT has positive impact on students' performances in primary schools particularly in English language. Lewin et al, 2000 cited in EdTechReview February (2014) also pointed out that the use of ICTs in education allows students learn new analytical skills such as improvements in reading comprehension and develop some writing skills such as

spelling, grammar, punctuation, editing and re-drafting. Use of ICTs for teaching and learning encourage independent and active learning, and students' take responsibility for their own learning (Passey, 1999 in EdTechReview February, 2014). Students become motivated to learn and retention is enhanced in an ICT integrated classroom.

Gender disparity has been seen in various fields such as business and politics. Education is not any better. The report further shows that girls' completion rates are generally lower than that of boys; some States in the North, such as Jigawa, record girls' completion rates as low as 7.8% (UNESCO, 2008 cited in British Council Gender in Nigeria Report 2012)). The net enrolment rate for girls is 22%, compared to 29% for boys. So there is every likelihood that girls will experience high dropout rates more than the boys. However, the influence of school proprietorship on the use of virtual laboratory for teaching cannot be undermined in Nigeria. Institutional factors such as school type have been identified as a means of improving existing attributes among students. Vannatta and Fordham (2004) in (Babalola, 2016), in their study are of the opinion that time committed to teaching and learning and amount of technology training available in an institution are reliable factors of technology use in classroom. They asserted that institution administrators should not only provide extensive training on educational technology, but should also facilitate a contribution to teaching improvement Also, Norris, Sullivan, Poirot, and Soloway (2003), pointed out the importance of access to technology; to which that speed up and energize students' performance in displaying their skills. Therefore, an understanding of institutional characteristics that influence student's adoption and integration of ICT into teaching is relevant.

Over the years, there have been a lot of controversies over school ownership as one of the crucial factors that determine effective learning activities which in turn determine student' academics performance. However, school ownership can be viewed from two main angles which include public and private. Public school is explained to mean any school controlled and supported by the state or federal government while private school is a school established, supported and controlled by religious/social organizations or other private groups/individuals (Oke & Maliki, 2009).

The author further affirmed that Nigeria has witnessed drastic but lasting changes in its educational system and management. One of these was the return of schools to their original owners. These owners include the missions and private proprietors. The return of schools thereafter witnessed proposal and implementation of changes, including advertisement on improved teaching facilities, well-qualified teachers, improved teaching techniques and teacher-students collaboration. These schools, along with those owned by individuals are believed to provide a better environment for studying than public schools and thus record a better performance. The goal of these institutions in Nigeria today is to integrate online collaborative tools, a subset of information and communication technology to enhance the education of students in innovative ways.

Asaolu and Fashanu (2012), discovered the acquisition and use of mobile phones to be more prevalent in private schools. The adopters of collaborative tools agreed to be more reachable and productive when using these technologies. In an interview conducted among several private schools, students showed high-end phones with Internet features and this could be a reflection of their parents' financial status .In California, universities and high schools which include the University of Minnesota, University of California and Middlebury High School are already exploring the use of the blog, wiki, twitter, ether pad, Google doc Facebook, YouTube, WhatsApp and so on for learning (Alexander, 2006). In the United States, there have been amazing acquisition and use of wireless technologies (Swett, 2002). Swett (2002) discovered that 90 percent of public universities and 80 percent of private universities have some level of mobile wireless technology. Based on the background provided and the nature of interwoven of these tertiary institutions, one could conclude that there is no disparity in the requirements needed by the students of these tertiary institutions to make them perform better. Olumorin, (2008) cited in

(Babalola, 2016) further opined that teachers and students are in need of high quality skills and training that encompasses all necessary potential use of ICT. This is irrespective of type of institution.

Methodology

The study adopted descriptive research of the survey type. It had been considered appropriate because the descriptive research method involves the systematic collection and analysis of knowledge collected from an outsized population that helps to explain the characteristics of population or event as they seem to support the phenomenon into account for this study without external manipulations by the researcher. The population for the study consisted all secondary school Biology teachers in Minna, Niger State. The target population consisted all secondary school Biology teachers in Zone B senatorial district in Niger state. Specifically, 300 Biology teachers were purposively selected based on the available Biology teachers in Zone B senatorial district in Niger State.

Research Instrument

The instrument for this study will be a researcher-designed questionnaire. The questionnaire will be structured in a simple language so as to enable the respondents to provide pertinent answers to the questions based on their knowledge and usage. The questionnaire contained three main sections which are Sections A, B and C. Section A contains personal information relating to the respondent bio-data such as the respondents' name of schools, type of school, gender and years of teaching experience. Section B seek to find out the respondent's access to virtual laboratory for teaching. The response mode for section B will be dichotomous response scale of Yes/No while section C will be the Likert four (4) response mode of Strongly Agree (SA) Agree (A) Disagree (D) and Strongly Disagree.

Validation of the Research Instrument

To determine the face and content validity of the research instrument in this study, the researcher's supervisor peruse the contents while 3 educational technology lecturers in the Department of Educational Technology, University of Ilorin, validated the questionnaire in order to determine the appropriateness, content coverage in terms of acceptability, adequacy and relevance to the stated objectives. Their comments, suggestions and corrections were used to produce the final draft of the instrument.

To test for the reliability of the instruments, the instruments were pilot-tested on 20 secondary school teachers in Ilorin Kwara State, Nigeria which was outside the scope of the study. Cronbach Alpha statistical instrument was used to establish the reliability coefficient of the instrument section by section. The results were 0.86 on the access to virtual laboratory and; 0.76 on teachers self-efficacy to use virtual laboratory for teaching; Hence, the results showed high internal consistencies of the items in the research instruments.

Procedure for Data Collection

The researcher, with the help of research assistants, administered the copies of the questionnaire to all Biology teachers in the Educational Zone in Minna (Zone B). One research assistant was recruited in each of the secondary school to assist with questionnaire administration. Ethical issues were considered in the administration of the instruments before the administration of the instrument to them. Ethical issues were considered in the administration of the instruments before the administration of the instrument to them. The biology teachers were allowed to respond to the instrument at their own convenience and the purpose of the study was explained to the undergraduates. Hence, information provided by the respondents was used for research purpose only and was treated with utmost confidentiality.

Data Analysis Techniques

The results of the administered researcher-designed questionnaire were analyzed and interpreted using descriptive and inferential statistics. Frequency counts, percentages, mean score and standard deviation were used to answer research questions while independent t-test were used to test for hypotheses while analysis of variance (ANOVA) was used to test for hypothesis 4 . Data collected were coded and analyzed using Statistical Product and Service Solution (SPSS) for windows at 0.05 level of significance.

Results

Research Question One: do teachers' have access virtual laboratory for teaching biology in secondary schools in Minna, Niger state?

In answering this research question, data collected on analysis of teachers on their access to virtual laboratory through various channels were analyzed and the result is as presented in table 1.

Table 1. Teachers' Access to Virtual Laboratory for Teaching Biology in Secondary Schools in Minna

S/N	I have access to virtual laboratory	Yes %	No %	Total %
1	At home	63.2%	36.8%	100%
2	In my office	43.1%	56.9%	100%
3	In the Library	65.6%	44.4%	100%
4	On my mobile phone	72.6%	27.4%	100%
5	Through dedicated ICT laboratory	82.3%	18.7%	100%
6	Through WIFI	84.1%	15.9%	100%
7	In the lecture room	77.2%	23.8%	100%
8	Anywhere in the school premises	23.8%	77.2%	100%
9	In the school laboratory	22.6%	78.4%	100%
10	On prepared compact disk	66.9%	39.1%	100%
	Average	**60.1%**	**39.9%**	**100%**

Bench Mark = 50.0%

Table 1 present how Biology teachers access virtual laboratory for teaching and the results were presented in table 1. Out of the 261 respondents, 84.1% have access to virtual laboratory through dedicated ICT laboratory while 15.9% do not have access to virtual laboratory through dedicated laboratory. 82.3% have access to virtual laboratory on their mobile phones, while virtual laboratory is not accessible to 18.7% of the respondents. virtual laboratory is accessible to 77.2% while 23.7% of the respondent do not have access to virtual laboratory through WIFI. Virtual laboratory is accessible to 65.6% but not accessible to 44.4 Also, virtual laboratory is accessible to 63.2% while is not accessible to 36.8%. virtual laboratory is accessible to 23.8% respondents but not accessible to 77.2%. Others follows suit the average percentage was 60.5% using 50% as benchmark it can then be inferred that 65.5% of the respondent have access to virtual laboratory.

Hypotheses Testing

Based on research questions 2-3 research hypothesis 1-2 were developed. The results related to hypotheses one to three formulated for the study in chapter one were as shown in subsequent tables. All hypotheses were tested at 0.05 level of significance.

Ho1: There is no significant difference between male and female teachers' access to virtual laboratory for teaching biology;

Table 2. test of Male and Female between male and female teachers' access to virtual laboratory for teaching Biology

Gender	No	X̄	SD	Df	T	Sig. (2-tailed)
Male	125	9.01	3.32	259	.39	.70
Female	136	8.90	2.60			
Total	**261**					

Table 2 indicated that t (259) = .39, p = .70. This means that the stated null hypothesis was accepted. This was as a result of the t-value of .39 resulting in .70 significance value which was greater than 0.05 alpha value.

By implication, the stated null hypothesis was established thus: There is no significant difference between male and female between male and female teachers' access to virtual laboratory for teaching Biology. In other words, based on the earlier mean score of the Biology teachers' on table 2, both male and female Biology teachers had access to virtual laboratory.

H02: There is no significant difference in teachers' access to virtual laboratory for teaching biology based on school ownership

To determine whether there is any significant difference significant difference in teachers' access to virtual laboratory for teaching biology based on school ownership, the null hypothesis is tested by using t-test. This we have in Table 3.

Table 3. Significant Difference in Teachers' Access to Virtual Laboratory for Teaching Biology Based on School Type

Gender	No	X̄	SD	Df	T	Sig. (2-tailed)
Public	174	13.02	3.60	259	.25	.65
Private	87	6.17	2.48			
Total	**261**					

According to Table 3, t (259) = .95, p = .35. That is, the result of t-value of .945 resulting in .35 significance value was greater than 0.05 alpha value. This means that the stated null hypothesis is accepted.

By implication the stated null hypothesis was established thus: There is no significant difference in teachers' access to virtual laboratory for teaching biology based on school type. Based on the earlier mean score in table 3, this means that Biology teachers from public school had more access to virtual laboratory than their private counterpart.

Discussion

Access to virtual laboratory by Biology teachers was examined using research question 1. Such access includes: access to virtual laboratory at home, access to virtual laboratory in my office, access to virtual laboratory in the library, on my mobile phones, through dedicated laboratory and so on. The result of the mean affirmed that the biology teachers access virtual laboratory for teaching. The findings of this study negate with Federal Republic of Nigeria FRN (2013), in its draft resolution on National ICT Policy, revealed that 70% of Nigerians who reside in the rural areas do not have access to advanced ICT services. The finding also contradict with the previous findings of (Bhuasiri, 2012) who discovered that computer usage by students for learning purposes and other uses was very low, as well as their relatively low computer expertise. Also, the findings of this study contradict Osakwe (2010) and Ogwu and Ogwu, (2010) whose study

reported that poor access to ICT is responsible for poor integration of virtual laboratory in teaching and learning of school subjects. Since many students never got access to ICT as indicated in their frequency responses, the extent of utilization of the ICT tools was low.

Furthermore, this finding agreed with the previous findings of Cabero (2004) whose study affirmed that the flexibilization time-space accounted for by the integration of ICT into teaching and learning processes contributes to increase the interaction and reception of information. Such possibilities suggest changes in the communication models and the teaching and learning methods used by teachers, giving way to new scenarios which favour both individual and collaborative learning. This findings is consistent with the previous study of Chiaka and Edna (2014), whose study indicated no relationship between levels of ICT access and levels of ICT usage among students. Their study indicated that utilization of ICT is determined by the level of ICT accessibility by the students. However, this study contradict the study of (Bhuasiri, 2012) who discovered that computer usage by students for learning purposes and other uses was very low, as well as their relatively low computer expertise. Also, the findings of this study converge with researchers like Osakwe (2010) and Ogwu and Ogwu, (2010) that poor access to ICT is responsible for poor integration of virtual laboratory in teaching and learning of school subjects. Since many students never got access to ICT as indicated in their frequency responses, the extent of utilization of the ICT tools was low.

Biology teachers' access in the use of virtual laboratory for teaching biology in Minna was examined using research question 1 and hypothesis 1, the result of the analysis indicated that Biology teachers' had access to virtual laboratory and there was no significant difference between male and female teachers in their access to the use of virtual laboratory for teaching biology. The findings of this study is consistent with the previous study of Adegbija, Bola, Riaz and George (2013) who found out gender disparity in ICT achievements in favour of the males than their females counterparts. Wilson (2017) noted that gender is one of the intervening variables in information retrieval processes. According to Colley (2013), male teachers more often search different aspects of ICT applications than the female teachers. It is generally accepted that gender is an issue in technology acceptance. Extensive researches have been studied to examine the user's attitude towards ICT and motivations of its usage in general. It is broadly perceived that women are not interested in technologies other than in an instrumental way. Whereas men envision science and technology as a source of fun, enjoyment and pleasure (Sorensen, 2002).

Biology teacher's access to the use of virtual laboratory for teaching based on proprietorship and significant difference in the teachers' access towards the use of virtual laboratory for teaching biology based on school proprietorship was examined using research question 3 and hypothesis 2. The study indicates that no significant difference existed in teachers' access to virtual laboratory for teaching biology based on school type . The study agreed with the previous findings Asaolu and Fashanu (2012), discovered the acquisition and use of mobile phones to be more prevalent in private schools. The adopters of collaborative tools agreed to be more reachable and productive when using these technologies. However this study contradict the study of Swett (2002) who discovered that 90 percent of public universities and 80 percent of private universities have some level of mobile wireless technology. Based on the background provided and the nature of interwoven of these tertiary institutions, one could conclude that there is no disparity in the requirements needed by the students of these tertiary institutions to make them perform better. Olumorin, (2008) cited in (Babalola, 2016) further opined that teachers and students are in need of high quality skills and training that encompasses all necessary potential use of ICT. This is irrespective of type of institution.

Conclusion and Recommendation

This study study concluded that Biology teachers has access to Virtual laboratory hence it should be properly integrated into teaching and learning. This study therefore recommended that

Nigerian secondary schools should make adequate provisions of free use of the ICT resources most especially the internet facilities for all teachers most especially Science related subjects teachers' in order to give them full access to ICT resources to ease their instructional productivity.

References

[1] Abdulhamidovna, S. H. (2022). Effective Organization and Importance of Mother Tongue and Reading Literacy Lessons in Primary Schools. International *Journal of Innovative Analyses and Emerging Technology*, 2(4), 45-50.

[2] Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. Education and Information Technologies, 26(2), 1665-1685.

[3] Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. Education and Information Technologies, 26(2), 1665-1685.

[4] Berdik, D., Otoum, S., Schmidt, N., Porter, D., & Jararweh, Y. (2021). A survey on blockchain for information systems management and security. Information Processing & Management, 58(1), 102397.

[5] chemistry students in collaborative settings in Minna, Niger State (Unpublished Thesis). Science Education Department, Federal University of Technology, Minna, Nigeria.

[6] Cherniss, C. (2000). Emotional intelligence: What it is and why it matters. In annual meeting of the Society for Industrial and Organizational Psychology, New Orleans, LA (Vol. 15). Retrieved from http://www.talentsmart.com/media/uploads/pdfs/eq-what-it-is.pdf

[7] Chokri, B. (2012). Factors influencing the adoption of the elearning technology in teaching and learning by students of a university class. European Scientific Journal, 8(28).

[8] Chuktu, O. (2021). Influence of Infrastructural Support Services Management and Secondary Schools Goal Attainment in Calabar Education Zone of Cross River State, Nigeria. British Journal of Education, 9(5), 1-10.

[9] Çilenti, K.(1988). E÷itim Teknolojisi ve Ö÷retim, KadÕo÷lu MatbaasÕ, Ankara. Dalgarno, B. (2004). Characteristics of 3D Environments and Potential Contributions to Spatial Learning, Doctorate Thesis, University of Wollongong.

[10] Clarke A (2016). Teaching adults ICT skills. Glasgow: Learning Matters Limited. pp.12-23 college students' learning. Innovations in Education and Teaching International, 46(4), Computers and Education, 52, 402-416.

[11] Colley, A. (2003). Gender differences in adolescents' perceptions of the best and worst aspects of computing at school. Computers in Human Behavior, 19(6), 673-682.

[12] Cook, J. (2002). The Role of Dialogue in Computer-Based Learning and Observing Learning: An Evolutionary Approach to Theory. *Journal of Interactive Media in Education*, 5. www-jime.open.ac.uk/2002/5

[13] Costley, K.C. (2014)The Positive Effects of Technology on Teaching and Student Learning. retrieved from http://files.eric.ed.gov/fulltext/ED554557.pdf

[14] Dahlberg, L. (2004). Internet Research Tracings: Towards Non-Reductionist Methodology, JCMC 9 (3) http://www.ascusc.org/jcmc/vol9/issue3/dahlberg.html

[15] Daramola, O. P. (2011) Community Participation and Sustainable Urban Environmental Management in Nigeria: A Review. In Salami, A. T. and Orimoogunje, O. O. I. (eds) Environmental Research and Challenges of Sustainable Development in Nigeria. Ile-Ife: Obafemi Awolowo University Press, pp 596-610.

[16] Davis, F. D. (1989). Perceived usefulness, ease of use and usage of information technology.

[17] Davis, F.D., Bagozzi, R.P., & Warshaw, P.R (1992). Extrinsic and intrinsic motivation to use computers in work-place. Journal of Applied Social Psychology, 22(14),1111-1132

[18] De Wever, B. , Schellens, T. , Valcke, M. & Van Keer H. (2006) Content analysis schemes

to analyze transcripts of online asynchronous discussion groups: A review, Computers & Education, 46, 6–28

[19] Dede, C.J., Salzman, M, Loftin R.,B.(1994). The Development Of A Virtual World For Learning Newonian mechanics. Multimedia, Hypermedia, And Virtual Reality-Models, sYstems, and Application First International Conference, Moscow-Russia.

[20] Demirci, B. (1993). Ça÷daú Fen Bilimleri E÷itimi ve E÷itimcileri, H. U. Journal of Education,9, 155-157

[21] Denev, D. (2007). LMS vs. LCMS vs. CMS vs. VLE or e-learning vs. e+learning. Retrieved ,from http://moodle.org/mod/forum/discuss.php?d=65417.

[22] Dillenbourg, P. (2000). Virtual learning environments. Learning in the new millennium: building new education strategies for schools, Workshop on Virtual Learning Environments, University of Geneva.

[23] Doran, M. S., & Klein, J. D. (1996). The effects of learning structures on student achievement and attitude using a computer simulation. Paper presented at the National Convention of the Association for Educational Communications and Technology, Indianapolis. (ED 397788).

[24] Eastman J. R., & Baldwin, A., J. (2009). Transferring Best Practice From Undergraduate Practical Teaching To Secondary Schools: The Dynamic Laboratory Manual, Acta Didactica Napocensia, 2,(1), 1-8.

[25] EdTechReview (2014) Advantages of using ICT in learning-teaching process from http://edtechreview.in/trends-insights/insights/959-advantages-of-usingict-in-learning-teaching-processes environment. Turkish Online Journal of Distance Education, 13(1), 183-199.

[26] Engeness, I. (2021). Developing teachers' digital identity: towards the pedagogic design principles of digital environments to enhance students' learning in the 21st century. European Journal of Teacher Education, 44(1), 96-114.

[27] Ergül, S & Binici, U. (2006). "Bir Sanal Laboratuvar Örne÷i" GazlarÕn Difüzyonu ve Graham Difüzyon YasasÕ'nÕn Bilgisayar Destekli Ö÷retimi, VII. National Science and Mathematics Education Congress, 7-9 September, Ankara, 459.

[28] Ezenwa, V. I. & Yaki, a. A. (2013). The efficacy of innovative instructional technique for

[29] Falode, O. C. (2014). A Bates' actions evaluation of virtual physics laboratory package for secondary school students in Nigeria. (Unpublished Ph.D Thesis). Department of Educational Technology, University of Ilorin, Nigeria.

[30] Fateh, S., Reid, J., Ayangbola, O., Phelps, A., Zakher, S., Rushton, G., & Kirbulut, Z. D. (2022). Oral Presentation: ELL Students' Discursive Moves that Lead to Knowledge Construction in a POGIL-based Chemistry Class. In 16th Annual Tennessee STEM Education Research Conference January 13-14, 2022 (p. 70).

[31] Federal Republic of Nigeria (FRN, 2013). National policy on education. Abuja: NERDC.

[32] Kawu, H. (2015). Effects of virtual laboratory on the achievements of secondary school

[33] Manaf, H. A., Mohamed, A. M., & Harvey, W. S. (2022). Citizen Perceptions and Public Servant Accountability of Local Government Service Delivery in Malaysia. International Journal of Public Administration, 1-10.

[34] Mohanta, B. K., Panda, S. S., & Jena, D. (2018). An overview of smart contract and use cases in blockchain technology. In 2018 9th international conference on computing, communication and networking technologies (ICCCNT) (pp. 1-4). IEEE.

[35] Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compaña, M. (2021). Teacher digital literacy: The indisputable challenge after COVID-19. Sustainability, 13(4), 1858.

[36] science teaching and learning in secondary schools. International Journal of Behavioural Sciences, 4(1), 92-101.

[37] Setyowati, W., Widayanti, R., & Supriyanti, D. (2021). Implementation Of E-Business Information System In Indonesia: Prospects And Challenges. Int. J. Cyber IT Serv. Manag, 1(2), 180-188.
[38] Sunday, C. E., & Vera, C. C. E. (2018). Examining information and communication technology (ICT) adoption in SMEs: A dynamic capabilities approach. Journal of Enterprise Information Management.
[39] Vaezi, M., Azari, A., Khosravirad, S. R., Shirvanimoghaddam, M., Azari, M. M., Chasaki, D., & Popovski, P. (2022). Cellular, wide-area, and non-terrestrial IoT: A survey on 5G advances and the road towards 6G. IEEE Communications Surveys & Tutorials.