

Needs and Prospects of a Virtual Science Laboratory in Open and Distance Education during and Post Covid-19 Pandemic

Adewoyin, A.D. and Ebabhi, A.M.
Distance Learning Institute, University of Lagos, Lagos, Nigeria
kingdavidonfire@gmail.com

ABSTRACT

Since the outbreak of the Covid-19 virus, a lot has been achieved in the effective dissemination of knowledge through Open and Distance Learning (ODL). However, one area of challenge is the use of Virtual Science laboratories (VSL). Hence, this study has examined the needs and prospects of virtual science laboratories in an ODL institute post-covid-19 era which is based on the theory of connectivism. A case study research design was adopted for this research. A sample size of 560 participants, which represents 30% of the population of Science Education learners, was considered. Data were collected using a structured questionnaire. Results showed that 77% of the respondents showed a positive response toward the need and prospects of VSL in ODL, while 16% had a contrary view. This result indicates that Virtual science laboratories will enhance the learning delivery system, research, and training during and post-pandemic.

Introduction

Currently, the global educational landscape is driven by technology. Since the outbreak of covid-19, which was first reported officially in December 2019 in Wuhan City of China (UNESCO, 2020) the world is left with no other option than to take the teaching-learning process online. Based on the advice of public health officials and governments of different countries, universities and colleges were closed down, and physical distancing was encouraged to curtail the spread of the virus. UNESCO (2020) stated that most governments have temporarily closed educational institutions to contain the spread of the covid-19 pandemic. Li and Lalani (2020) observed that covid-19 has resulted in pre-and post-primary schools shutdown in the same vein. Governments and corporate bodies worldwide are overwhelmed by the outbreak, and an accurate plan and precise actions must be provided for education to continue. This placed a severe limitation on the conventional teaching method, which primarily involves face to face interaction.

Consequently, e-learning became the technological tool for facilitating various teaching-learning processes which involve means of delivery, assessments and learner support. Although e-learning under the distance education mode has enhanced the teaching-learning process tremendously, particularly in building knowledge, it still has its challenges. One of such areas is the online facilitation of science laboratory practices. These practices involve the learners developing a range of communication and lifelong skills, experimental methods and synthesis of laboratory observations. Learners are encouraged to use the laboratory as a milieu to build and improve their learning habits and problem-solving skills required to comprehend the nature of science education. However, the physical traditional science laboratory has many constraints as reported in the work of Er-Demir (2011). The adoption of a virtual laboratory has been shown to be the major panacea to these problems. A virtual laboratory consisting of computer hardware and software, is designed to simulate, as closely as possible, traditional physical laboratory activities to impart comparable knowledge and skills to learners (Hatherly *et al.*, 2009). The virtual laboratory is employed; for biology, chemistry, mathematics, physics, and other science-related courses.

Thus, the virtual laboratory is an essential tool for sustaining a remote learning process for the science courses. Anderson (2020), in his paper 'A review of virtual science laboratory and justifications for adoption in Nigeria' sees the inadequate physical laboratory facilities in Nigeria's tertiary educational institutions as the basis for finding and adopting virtual science laboratories as an alternative. He posited the virtual laboratory as the standard e-learning tool to complement the inadequacies of the physical laboratory in Nigeria because there lies a brighter future. Therefore, the virtual laboratory offers the learners the opportunity to learn. Open and distance education provides the platform for virtual laboratories to ride on. The merits of using distance education cannot be overemphasized. The flexibility of distance learning programs provides opportunities for learners to pursue and complete their desired courses anywhere with computer and internet facilities. Distance education also provides a convenient learning

platform, thereby making a disciplined and self-motivated learner to learn at own pace. It equally makes individualized teaching possible. This is corroborated in the report of Fox (2020), who stated that a distance education platform is suitable for an individual approach to learning. Thus, the theoretical model for this research was based on connectivism. Gaskel (2015) reported that the theory strives to remove barriers to ensure equal opportunities for lifelong learners.

Since education is essential to the development of our societies, it has become imperative to identify the needs and prospects of virtual science laboratories in open and distance education during and post Covid-19 era.

Statement of the Problem

The only way out of this quagmire of the global lockdown with severe restrictions on human interaction is to adopt the Open and Distance Learning mode of education. However, the readiness of the teachers/facilitators and learners has been an area of concern when coming to using the virtual learning platform. Even though the pandemic came as a rude shock to most developed nations, it was relatively easy to adjust the teaching mode almost entirely to distance learning because the relevant ICT facilities, technical know-how and infrastructure are in place. Unfortunately, most developing nations like Nigeria are not well prepared. Many teachers/facilitators and learners are still novices in navigating the internet and effectively using computers. According to Hamsha (2011), adopting ICT competency standards and adequate training will help teachers incorporate ICT effectively in education. Most schools in Nigeria lack the facilities required for the online learning platform despite the obvious enormous advantages of using ICT in teaching and learning. More importantly, the need to augment e-learning to accommodate a virtual science laboratory for effective learning delivery. With the emergence of covid-19 and the ever-increasing population, the prospects of incorporating virtual laboratories into the online teaching of science subjects are very high. It is, therefore, imperative to study the need and give an account of the prospects of virtual science laboratories in open and distance education during and post- covid-19 pandemic.

Research Questions

1. How has Covid-19 impacted the education sector in Nigeria?
2. Why is a virtual science laboratory needed during a pandemic?
3. What aspects of an open and distance education can a virtual science laboratory enhance?
4. What are the conditions for implementing a virtual science laboratory in an educational institute?
5. How can virtual science laboratory impact the education sector during and post covid-19 era?

Research methods and participants

A case study research design was adopted for this research to gain an in-depth knowledge of the needs and prospects of a virtual laboratory. This study was limited to the University of Lagos, Distance Learning Institute. In this study, the sample size was 560, which represents 30% of the population of Science Education learners. The convenience sampling technique was deployed to choose 560 members of the population at random. The instrument used for data collection was a structured questionnaire. The questionnaire was developed through a Google research document and deployed online using learners' social media platforms. Cronbach reliability coefficient was used for this study because it helps to establish the internal consistency of the responses. Analyses were performed using mean and standard deviation. A criterion of the harmonized mean value of 3.00 was adopted. Any mean ranked from 3.00 and above was regarded as positive and accepted while the values of less than 3.00 were considered negative and rejected.

Findings

Research Question 1: How has covid-19 impacted the education sector in Nigeria?

Table 1: Determination of the extent of the impact of covid-19 on educational sector

S/N	Questionnaire Items	Mean	Std. Deviation
1	The impacts of the covid-19 pandemic include the prohibition of large gatherings and closures of schools	4.129	1.0888
2	The economic meltdown caused by the pandemic cut funds to the education sector in Nigeria	3.866	1.2667

3	The travel ban experienced during the outbreak has made continental knowledge sharing and transfer difficult.	3.882	1.2289
4	Social distancing, the new trend of education in Nigeria	4.021	1.1673
5	The new education world order is online learning, e-learning, and virtual classroom	3.991	1.1774
		3.977	

The decisions in Table 1 concerning the provided effects of covid-19 show that the pandemic impacted education in Nigeria. Meanwhile, the respondents have positively reacted. A significant number of the respondents' social distancing due to the covid-19 pandemic has grossly affected the education sector.

Research Question 2: Why is a virtual science laboratory needed during and post-pandemic?

Table 2: Virtual science laboratory as the sustainable measure for continued education

S/N	Questionnaire Items	Mean	Std. Deviation
1	A virtual science laboratory ensures the continuity of teaching and learning during and post a pandemic	3.952	1.2658
2	A virtual education requires a virtual science laboratory.	3.961	1.1745
3	Perhaps covid-19 is a blessing to Open and Distance Education that requires an efficient remote delivery system	3.948	1.2152
4	A virtual science laboratory complements the physical science laboratories	3.816	1.2745
5	Developing a virtual science laboratory is a perfect measure to take to ensure the locomotive domain of educational objective, during and posts a pandemic,	3.911	1.2798
		3.917	

The decisions in Table 2 based on the provided reasons show that during and post-pandemic, a virtual science laboratory; is needed. The response of the respondents is highly positive. The result showed that the respondents agreed that virtual science laboratories would ensure teaching and learning continuity during and after a pandemic.

Research Question 3: What aspects of an Open and Distance Education can a virtual science laboratory enhance?

Table 3: Aspects of Open and Distance Education that can be enhanced by Virtual Science Laboratory

S/N	Questionnaire Item	Mean	Std. Deviation
1	A Practical section during the lecture	4.071	1.1327
2	The practical section during the examination	3.596	1.3606
3	The research aspect of the institution	3.893	1.1915
4	A criterion for Institutional approval and course accreditation during and post a pandemic.	3.786	1.1920
5	Training aspect for the institution staff/lecturers.	3.796	1.2609
		3.828	

Table 3 summarily presents aspects of an Open and Distance Education that a virtual science laboratory can enhance, the respondents seem to have a mildly positive attitude to these aspects.

Research Question 4: What are the conditions to implement a virtual science laboratory in an educational institution?

Table 4: Determination of the requisites for implementing a virtual science laboratory

S/N	Questionnaire Items	Mean	Std. Deviation
1	Availability of forensic reports of situational needs of the institution	3.939	1.0832
2	Ability to hire the expertise needed for implementation and maintenance of the platform	4.011	1.2258
3	Level of technical know-how among the target audience has to be substantial	3.786	1.2914
4	Funding has to be steady and adequate.	3.863	1.3708
5	Ability to compete with global standard practices in a virtual platform.	3.854	1.2547
		3.890	

Table 4 depicts the positive attitude of the respondents, which affirms the itemized conditions to implement a virtual science laboratory in an educational institution.

Research Question 5: How can virtual science laboratories impact the education sector during and post covid-19 era?

Table 5: Exploration of the prospective information about a virtual science Laboratory in the education sector.

S/N	Questionnaire Items	Mean	Std. Deviation
1	It ensures the delivery of science education despite the spread of covid-19.	4.011	1.1458
2	Research centers have been able to manage data sharing virtually for the time being	3.696	1.2677
3	Academic sessions can be completed as a result of the controlled platform	3.929	1.1006
4	It will enhance the teaching and learning of science-oriented subjects during and posts the pandemic	3.875	1.3779
5	The virtual science laboratory will ensure the continuity of teaching and learning in the face of any crisis	4.125	1.1039
		3.927	

Table 5 depicts the positive attitude of the respondents, which affirms the itemized impact of a virtual science laboratory in the education sector during and post the covid-19 era.

Discussion

Virtual science laboratory is one of the most researched topics in recent times. This study has analyzed the needs and the prospect of virtual science laboratories during and post covid-19 pandemic. From the findings on the pandemic's impact on the education sector, more than 79% of the sampled population agreed to the significant relationship between education and covid-19 during and post-pandemic while 15% disagreed. The implication is that during the pandemic, covid-19 has impacted the education sector in Nigeria in different ways, including the prohibition of large gatherings and closures of schools and restriction to online learning, e-learning, and virtual classroom. This agrees with the review of Gamage *et al.* (2020) who reported that the advent of the coronavirus pandemic caused universities to take necessary steps by transforming their teaching, including laboratory workshops into an online or blended mode of delivery.

Looking at the need for a virtual science laboratory during and post-pandemic. The distribution of the respondents largely agreed that the virtual science laboratory is a sustainable measure for continuous education. Examining the magnitude of the affirmative reactions; it can be deduced that virtual education requires a virtual science laboratory. Perhaps covid-19 is a blessing to Open and Distance Education, requiring an efficient remote delivery system. This correlates with Wijenayaka and Iqbal's (2021) study ongoing virtual with practical chemistry amidst the covid-19 pandemic. It was reported that most of the respondents saw the virtual platform as a way out for continuous education. Furthermore, Hatherly (2018), posited a virtual laboratory consisting of computer hardware and software is designed to simulate, as closely as possible, traditional physical laboratory activities to impart comparable knowledge and skills to distance learners.

The positive response on aspects of Open and Distance Learning enhanced by virtual science laboratory during and post-pandemic connotes that the practical classes can be effective. Also, institutional approval and course accreditation during and post a pandemic can be guaranteed. Training aspects for the institution's staff/lecturers will be ensured. Correspondingly Çivril (2018), showed that virtual laboratories, remote laboratories and virtual computing laboratories are seen as 21st-century technologies for imparting scientific knowledge and skills on learners.

On the conditions to implement a virtual science laboratory in an educational institution, expertise for implementation and maintenance of the platform, technical know-how and funding were agreed upon as requisites. Jili *et al.* (2021) agreed that institutions of higher learnings should acquire suitable information and communication technology equipment and develop the requisite facilities, implement rules and regulations for the availability, and adequate maintenance of virtual science laboratories. Wijenayaka and Iqbal, (2021) also affirmed that developing virtual resources in house or at least in direct connection to the course syllabus may be a more viable approach in broadening the applicability of virtual teaching tools,

Virtual science laboratory has impacted the education sector during and is capable of the same impacts post-pandemic. The indications are that it ensures the delivery of science education despite the pandemic, academic sessions can be completed due to a controlled platform like this. The virtual science laboratory ensures the continuity of teaching and learning in the face of pandemics. Furthermore, Radhamani *et al.* (2021) reported that virtual science laboratories will ensure the continuity of teaching-learning, providing alternative ways for skill training from home and that the incorporation of virtual laboratories within classroom education has brought transformations in teaching laboratory courses.

Conclusion

Distance Learning needs a virtual science laboratory to facilitate her learning delivery system. This kind of platform will adequately give the institution the edge to surpass its competitors and, at the same time, meet the standard of 21st-century schools for national development. COVID-19 is here, and there must be continuity in education for the common good during and post-pandemic since learning is a life-long endeavour.

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