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Assessing the integration of e-learning in the teaching and learning of chemistry in tertiary institutions in ebony state: a need for enhancing effective teaching and learning of chemistry

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ABSTRACT

Climate The everyday increasing inevitability of education in the face of the COVID-19 pandemic, the regard for chemistry as an abstract subject, and the need for effective teaching and learning of chemistry in the modern technological world necessitated the search for alternative methods. Although several studies have investigated the effects of E-learning processes, there is no work that assessed the integration of E-learning in the teaching and learning of Chemistry in tertiary institutions in Nigeria amid the current pandemic facing the world. Therefore, this research is carried out to provide answers to questions regarding the assessment of E-learning integration in the teaching and learning of chemistry in tertiary institutions in Ebonyi State, Nigeria. The research was conducted on lecturers and students of chemistry and chemistry education in which data were obtained *via* a questionnaire survey. After analysing the quantitative data obtained, the findings among others showed that the extent of E-learning integration in tertiary institutions in Ebonyi State is at the lowest limit. The outcomes likewise uncovered that coordinating E-learning in the instructing and learning of science in tertiary institutions will improve compelling educating and learning of the subject. Thus E-learning integration in tertiary institutions needs to be improved through effective implementation of E-learning policy, adequate fund allocations by the Federal government, and NGOs, and following close monitoring to avoid the Nigeria factor.
Keywords: E-learning, Chemistry, Assessing, Integration, Effective

INTRODUCTION

The primary goal of any educational system is to produce students that have been nurtured to meet the demands of civil society. The Nigerian Constitution enabled the National University Commission (NUC) to lay the least guidelines for all projects taught in Nigerian tertiary institutions. It is in accordance with the above mentioned that the commission made benchmarks for all projects in Nigerian colleges as contained in its Benchmark Minimum Academic Standard known as BMAS. Chemistry teaching is supposed to be result and students centred, and this can only be achieved when using the appropriate approach and resources in teaching the students. General chemistry is a compulsory requirement for students studying science and its related disciplines in the University. As a result, the population of students offering such courses is large, creating several impediments associated with teaching and learning. In the first instance, the class arrangement contravenes the stipulated class ratio benchmark of one lecturer to thirty students (1:30) by NUC. Also, an overpopulated class size creates a huge challenge to effective teaching and learning. This has consequently required the need to have a brain shift and change in outlook in the manner in which the course ought to be conveyed (Soub TFA et al. 2021). The predominant difficulties require the mix of electronic learning (E-learning) in the education and learning of Science as it appears to be an exit from this quagmire. One of the trending educational tools in the market today is the E-learning system, which is used as an alternative to traditional learning. E-learning connects two areas like learning and the use of technology. The internet has become one of the vital ways to make

available resources for research and learning for both lecturers and students to share and acquire information. E-learning encompasses the use of the internet and other important technologies to produce materials for learning, teach learners and also regulate courses in an institution with regards to web-based learning in education makes sense of Talent LMS, the model has been really clear taking note of that up until the mid-2000's, instruction was in a homeroom of understudies with the educator cycle (Chukwuneke CE et al. 2022). Actual presence was an easy decision, and some other kind of learning was a sketchy best case scenario. Then, at that point, the web occurred, and the rest became history. Today, E-learning is a quickly developing method, the impacts of which we can follow back to the 1980's and, surprisingly, a long time before that (as distance learning and broadcast courses), and its great deed have gone from one solidarity to another, turning into the most famous method for conveying preparing today. As made sense by New Times, the mechanical turn of events and the web has completely changed people on a few scales including educating and learning. The web has become one of the channels of discovery that opens the entryway for individuals all over the planet to get instruction for nothing, or for fewer expenses. The IT (data innovation) blasting and the web have made the way for general access to information, excellent instruction, and preparation. These simple access utilizing data frameworks and the web can work on relationship-building abilities for less expense. Information conveyance to certain individuals couldn't ever have been conceivable without the potential open doors presented by innovation and the web (Vallejo W et al. 2022).

Numerous studies have shown that E-learning is a more effective way of teaching and learning in our modern technological world and in the era of the present COVID-19 pandemic and also that E-learning integration is at the lowest limit. The examination completed by upgrading understudies' learning and comprehension of the purpose of a library in government colleges in Nigeria, through the coordination of E-learning in instructing educational experience of E-learning, demonstrated that E-learning is an irreplaceable apparatus for improving, educating, and advancing as well as comprehension of "Purpose of Library" by understudies in Bureaucratic colleges in Nigeria as reported in literature (Schwerter J et al. 2022). Geoffrey and Irene (2013) carried out a study on a framework for the integration of E-learning in higher education institutions in developing countries. The results revealed that the requirement for E-learning integration was identified as; the use of projection equipment, use of E-learning methods to teach, and face-to-face methods to administer tests and exams; incorporation of 3D pictures; audio and videos in classrooms; harmonization of course content for E-learning and face to face during design phase among others, which when integrated into the teaching and learning processes in tertiary institutions will enhance students effective learning. These results suggest that the use of the Go Koan E-learning platform may produce an improvement in students' level of knowledge acquisition carried out a study on the challenges and prospects of using E-learning among English as a Foreign Language (EFL) Students' at Bisha University, it went further to ascertain the barriers to effective integration of E-learning in the teaching and learning of chemistry (Williams DP, 2022).

With the quest of developing countries to meet the demands of civil society, E-learning focuses on effective teaching and learning processes within a limited time frame. E-learning National Commission (2020) characterizes it as courses that are explicitly conveyed through the web to someplace other than the homeroom and it's anything but a course conveyed by means of a DVD or Disc ROM, videotape, or over a TV slot. It is intelligent in that you can likewise speak with your educators, teachers, or different understudies in your group. Here and there it is conveyed live, where you can "electronically" lift your hand and cooperate progressively and some of the time a talk has been pre-recorded. It proceeded to portray it as picking up using electronic advances to get to instructive educational plans beyond a conventional homeroom. Generally speaking, it alludes to a course, program or degree conveyed totally on the web. While, Lawless (2018) sees E-learning, or electronic learning, as the conveyance of learning and preparing through computerized assets however in light of formalized learning, it is given through electronic gadgets like PC's, tablets, and, surprisingly, phones that are associated with the web. This makes it simple for clients to learn whenever, anyplace, with scarcely any, limitations she finished up. Fundamentally, E-learning is preparing, learning, or instruction conveyed online through a PC or some other advanced gadget (Husin NA et al. 2022).

Therefore, this research aims to assess E-learning integration in the teaching and learning of chemistry in tertiary institutions in Ebonyi state with regards to improving effective teaching and learning of the course. This research was carried out to provide answers to questions concerning E-learning integration in the teaching and learning of chemistry in tertiary institutions in Ebonyi state; as a panacea to enhancing effective teaching and learning of chemistry, providing evidence of its relevance for lecturers and students in tertiary institutions using a descriptive survey design with the use of developed validated questionnaire. In agreement with previous studies that showed the necessity of E-learning integration in teaching and learning with regard to enhancing effective learning by students, in this study, the following hypotheses were tested at an alpha significance level of 0.05 (Talent LMS 2020).

- **Hypothesis 1:** There is no huge contrast between the mean scores of science instructors and understudies

on the accessibility of E-learning offices for compelling educating and learning of chemistry.

- **Hypothesis 2:** There is no huge contrast between the mean scores of chemistry instructors and understudies on the degree to which E-learning is coordinated for the compelling educating and learning of chemistry.
- **Hypothesis 3:** There is no huge contrast between the mean scores of science instructors and understudies on the effect of E-learning coordination for compelling educating and learning of chemistry.
- **Hypothesis 4:** There is no huge contrast between the mean scores of science instructors and understudies on hindrances to compelling use of E-learning for the viable education and growing experience of chemistry.

MATERIALS AND METHODS

On the basis of the study above, mean and standard deviation were used in analysing the responses of the respondents on the assessment of E-learning integration in the teaching and learning of chemistry in tertiary institutions with regards to enhancing students learning of the course. The validated questionnaire highlighted the "availability of E-learning equipment for teaching and learning of chemistry, the extent of E-learning integration for effective teaching and learning of the course, the impacts of E-learning in the teaching and learning of the course, the barriers to effective teaching and learning of chemistry". The population of this study was composed of all academic chemistry lecturers and 100 level science students offering chemistry as a course from various science related programs (ranging from departments of "physical sciences, science education, engineering, biological sciences, agriculture, basic medical sciences) and 200 levels students of chemistry and chemistry education from Alex Ekwueme Federal University Ndufu-Alike Ikwo, Ebonyi State (Singh J et al. 2022). Their total population is 2225, which is comprised of 33 lecturers and 2192 students (2127 100-level science students offering Chemistry and 65 two-hundred levels student of Chemistry and Chemistry Education, respectively). The questionnaires were directly distributed to 124 students (100 and 200 levels of chemistry and chemistry education) of Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State on the basis of purposive sampling, and were collected after prompt answers have been given, the questionnaire was also emailed to 30 Chemistry lecturers who were also sampled purposively and were available for the study and the questionnaire also was returned through the same channel. Purposive examining procedure was utilized in choosing Alex Ekwueme Federal University Ndufu Alike Ikwo, Ebonyi State out of different foundations/colleges in Ebonyi State in light of the fact that, the college is a microcosm of the world colleges in Ebonyi State; having the same facilities, features and are equally financed by one body, availability of professionally and academic conscious and qualified lecturers in the institution, willingness of the required chemistry lecturers and students to participate in the study, scarcity of such teaching and learning approach on students' learning in Chemistry using E-learning in the institution (Madouni A, 2022).

The designed questionnaire for this study was validated by experts from the department of science education and education measurement and evaluation from the sampled institution. The study was carried out within "Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State (Wu L et al. 2022). The study was made on a sample of 30 chemistry lecturers and 124 students of chemistry and chemistry education programs in 100 and 200 levels respectively, summing up to 154 respondents. The questionnaire which was designed on a 4-Likert type scale was administered to the respondents within a specific time frame. The Pearson product-moment correlation was used to analyse the data of the pilot test conducted with 15 respondents outside the sampled institution after careful administration and collection of the questionnaire, the answers to the research questions, and hypotheses posed were analyzed and interpreted. To evaluate the hypothesis, Z-test was employed and tested at an alpha level of 0.05. All statistical analyses were carried out on SPSS version 26 for windows (Figures 1 and 2).

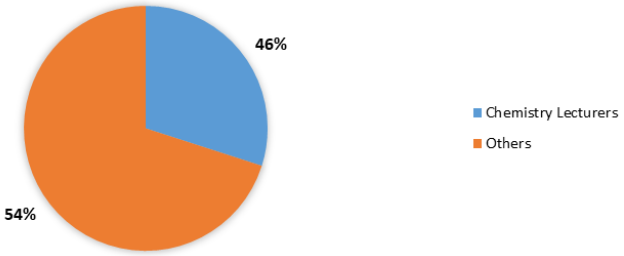

Figure 1: Distribution of respondents by programs.

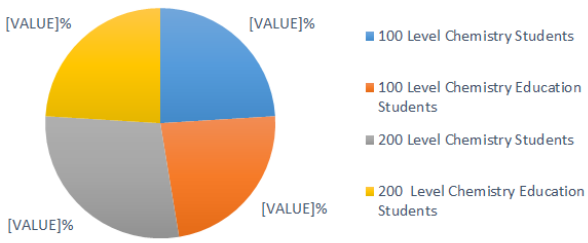

Figure 2: Distribution of Chemistry lecturers to other respondents.

The distribution of the respondents by the programs and that of the chemistry lecturers is given in Figures 1 and 2. The research tool consisted of two sections: A and B. Section (A) elicited information on personal data from

respondents, while section (B) extracted information on E-learning in the teaching and learning of chemistry. The questionnaire was structured on a four-point (4-point) scale of “very high extent, high extent, low extent, very low extent likewise responses like: Highly available, moderately available, scarcely available, and strongly agree, agree, disagree, strongly disagree”, which were weighted 4,3,2, and 1 respectively (Sathish RAH et al. 2022).

RESULTS

A total of 154 responses were received from the survey, of which 46% of respondents were chemistry lecturers from the department of chemistry, Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State, while the remaining 54% of responses were gotten from 100 and 200 levels chemistry and chemistry education students from the same University as shown in Figures 1 and 2. This low level of participation of the students of chemistry and chemistry education in the survey could massively be attributed to the low level of enrolment of students into chemistry and chemistry education programs in Nigeria tertiary institutions. To combat this discipline imbalance, it is necessary for secondary school students and their parents to be encouraged and re-oriented on the career significance of these programs and counsels them to participate in chemistry and chemistry education programs (Sinaga P et al. 2022).

This encouragement and orientation can be done by organizing seminars, and public lectures, giving incentives and stipends to students, and organizing chemistry (science) project exhibitions. After computing and analysing the data obtained from the respondents with regards to the research questions posed, the mean and standard deviations of the responses were obtained. Hence, the correlation and regression between the main variable (the students’ responses and the lecturers’ responses to the questions posed for the assessment of E-learning in the teaching and learning of chemistry in tertiary institutions in Ebonyi state) were obtained respectively. The summary of the findings derived from the result of the statistical analysis of the mean scores used for the research questions and Z-test statistics used for the hypotheses in this study are presented as follows: E-learning facilities are not available for effective teaching and learning of chemistry in tertiary institutions in Ebonyi State (Chidiadi E et al. 2020). Also, there is no statistical difference between the mean scores of chemistry lecturers and students’ responses on the availability of E-learning facilities for effective teaching and learning of chemistry in tertiary institutions in Ebonyi State. The degree to which E-learning is coordinated for the powerful instructing and learning of science is likewise at the most reduced limit. Besides, there is no massive contrast between the mean scores of Science instructors and understudies’ reactions to the degree of E-learning joining for the successful educating and learning of science in tertiary organizations in Ebonyi State. Coordinating E-learning in the education and learning of science will significantly upgrade compelling instructing and learning of the course in tertiary foundations in Ebonyi State. Additionally, ‘there is no huge contrast between the mean scores of science speakers and understudies’ reactions on the effect of coordination of E-learning for the powerful educating and learning of science in tertiary foundations in Ebonyi State (Kituyi G et al. 2013).

The hindrances to the coordination of E-learning for the viable educating and learning of science in tertiary foundations in Ebonyi state are very disturbing. What’s more, there is no massive distinction between the mean scores of science instructors and understudies on the obstructions to the coordination of E-learning for the powerful educating and learning of science in tertiary establishments in Ebonyi State (Satyawan IM et al. 2021).

Statistical Package for Social Sciences (SPSS) Windows and the result of the test is displayed in Tables 1 and 2. Assuming equal variances, the p-value was 0.774, which is greater than the 0.05 level of significance. Assuming unequal variances, the t-test produced a p-value of 0.866, which is far greater than the level of significance. The null hypotheses were all accepted, substantially concluding that there is no statistically significant difference in the responses of the respondents to “the availability of E-learning facilities for the teaching and learning of chemistry, the extent to which E-learning is integrated into the teaching and learning of chemistry, the impacts of E-learning integration, the barriers of E-learning integration for the teaching and learning of chemistry in tertiary institutions in Nigerian universities (Ja'ashan MMNH, 2020).

Table 1: Assessment of E-learning integration in the teaching and learning of chemistry assuming equal variances.

Equal variances	Variable 1	Variable 2
Mean	1	1.042226
Variance	0	0.042226
Pooled variance	1.998	

Observations	30	124
df	152	
t Sat	-1.46938	
P (T ≤ t)	0.774	
t Critical	3.36292	

Table 2: Assessment of E-learning integration in the teaching and learning of chemistry assuming unequal variances.

Unequal variances	Variable 1	Variable 2
Mean	1	1.042226
Variance	0	0.042226
Observations	30	124
df	51	
t Sat	-1.24835	
P (T ≤ t)	0.866	
t Critical	3.1419	

DISCUSSION

The entirety of the discoveries of this study show the need to incorporate E-learning in the instructing and growing experience of science and likewise the whole Nigerian school system as an approach to improving understudies learning of the course's. The examined information, uncover the craving of both the science speakers and understudies to have E-learning incorporated in the instructing and learning of science in tertiary establishments (Pagram P et al. 2006). They concur among different effects that the incorporation of E-learning in the instructing and educational experience of 'science' will assist with presenting understudies to computerized proficiency and learning; understudies will turn out to be great masterminds, inventive and imaginative as a main priority/activity; understudies will be presented to electronic innovation and applications; It will help understudies to learn and investigate all alone; understudies will be set to get data connected with their learning; expands understudies' viewpoints in fluctuating setting; opens understudies to the happenings outside their locale; empowers understudies tackle both scholar and individual troubles autonomously; increments understudies excitement and moral to learn; Empowers understudies view the genuine article outside the homeroom to acquire encounters and information, helps understudies speedy maintenance of data and helps understudies responsibility and dynamic cooperation in picking up having acquired a developed degree of understanding and information (Sverdlyka Z et al. 2012). The above discoveries authenticate that of who uncovered that eLearning empowers understudies to become scholars/students/ daring people in a shielded climate; they learn not to depend on the instructors, be responsible for themselves, and become autonomous, which shows computerized proficiency; important employable abilities in an advanced world are learned; fitting internet-based conduct; great advanced citizenship; digital security; working with a virtual group; advanced and worldwide business; expands the skylines of numerous understudies as it opens them to the world external their urban communities (Savage AJ et al. 2022).

Additionally, the assertion of the above finding sets that Internet learning obliges everybody's requirements; Talks can be taken quite a few times; offers admittance to refreshed content; E-learning considers a speedy conveyance of Illustrations, it is Versatile E-Learning helps in making and imparting new preparation, approaches, ideas, and thoughts. Whether it is for formal

schooling or amusement, eLearning is an extremely speedy approach to learning; it is predictable as eLearning empowers instructors to earn a higher college education of inclusion to impart the message in a steady manner for their interest group. This guarantees that all students get a similar sort of preparation with this learning mode. The stand of Mt. Albert Syntax school (2007), additionally adjust to this finding as she expresses that E-learning charges understudies to assortment and diverse advantages as it improves realization which prompts higher scholarly accomplishments, expands understudies interest in learning; empowers understudies' admittance to assets outside the quick study hall among others. Further backings of the finding by, believe that the mix of ICT in learning guidelines readies the understudies for deep-rooted learning in a period of digitalization and data blast that must be seriously gotten to electronically. So the consideration of ICT in educating learning he closes is a superior approach to making our understudies free scientists as they are instructed and made to obtain every one of the required abilities to deal with and oversee ICT devices and offices and effectively and proficiently access digitalized data sources further verified this finding as indicated in her recorded significance of E-learning, which expresses that E-learning stages permit educators to remain associated with their understudies beyond school hours to trade assets, recordings, thoughts, approaches, and academic practices; the enormously wide range of assets like recordings messages, introductions, and tests that they can use to adjust their coaching techniques to the learning styles of their understudies; the utilization of new advancements gives educators the opportunity to explore in their helping practice and the capacity to make changes on the off chance that something doesn't work; online stages that are presently accessible day in and day out permit instructors to create and make their materials as per their timetables and at whatever point they need to; online stages permit instructors to help their understudies outside the homeroom where they don't get to know one another, and to give them extra directions on subjects like workmanship, singing, chess, and cooking. It offers educators the chance to lead understudies to progress both during and after school; the capacity to get steady input from their understudies about whether they grasp the material, assuming it is intriguing to them, and so forth. Online stages give an enormous assortment of appraisal apparatuses; can assist them with saving time and permit them to zero in on their own self-advancement; E-learning stages including virtual homerooms support instructors to move along: Online stages permit instructors to remain associated with partners from everywhere the world, as well as to share thoughts and gain motivation, Present-day stages bring more advantages of E-learning to instructors, similar to the capacity to make sound and video accounts of their illustrations and afterward to watch, investigate, and ponder similar accounts a while later and noticing different teachers in your school or through various web-based courses can be extremely useful (Araujo JL et al. 2022). Speakers/Instructors can look at changed showing styles, rehearses, and so forth. They can turn out to be more mindful of what sort of educators they are need and deficiency of E-learning offices/packs/hardware where they exist show the real condition of tertiary institutions in Ebonyi state with regards to procurement of innovative gear and offices in a period of arising innovation and data blast that has made the world a worldwide town. Taking a gander at the information gathered, there were basically no PCs for classroom computer-based learning and guidance; Projectors for virtual learning; video conferencing offices; gear for E-library; web and web offices for web/online learning and preparing; remotely coordinating gadgets; video sets tapes; public location frameworks; study halls TV's, advanced radio and satellite TV (Figure 3).

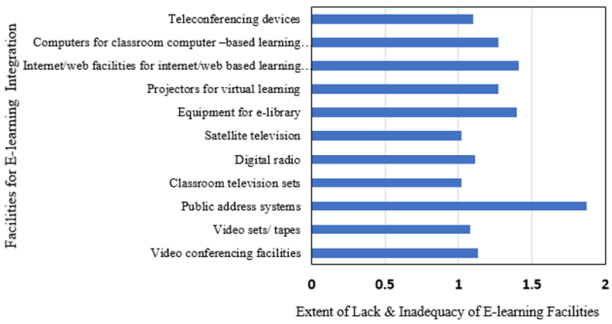

Figure 3: Degree of need and deficiency of mechanical offices/units/gear for coordinating E-learning in instructing growing experience of "chemistry".

Figure 3 above makes sense to better the state and degree at which the tertiary establishments in Ebonyi state work with regards to mechanical offices which by each standard should be an introduction to incorporating E-learning in the educating educational experience of 'science' in the tertiary foundation under study. The fact that calls for genuine consideration make there is no addition expressing the reality, that the circumstance a sorry one. As seen, even those offices and gear that were accessible were additionally terribly insufficient. For example, PC sets, public address equipment (loudspeakers), projectors, and advanced radio sets. The consequence of the discoveries uncovered the chief factors that will militate against incorporating E-learning for the improvement of understudies' getting the hang of during the instructing and growing experience of 'science" which include: Unfortunate securing and acquirement of innovation foundation, hardware, and offices because of significant expense; lacking financing of E-learning in the college; epileptic public power supply; over-head cost of utilizing and keeping up with creating set; insufficient prepared staff in E-learning applications and use, fruitless execution on the utilization

of ICT/E-learning strategy in training and unfortunate upkeep culture on the current mechanical packs. Every one of the variables was demonstrated at a mean of more prominent than the 2.5 benchmarks separately (Figure 4).

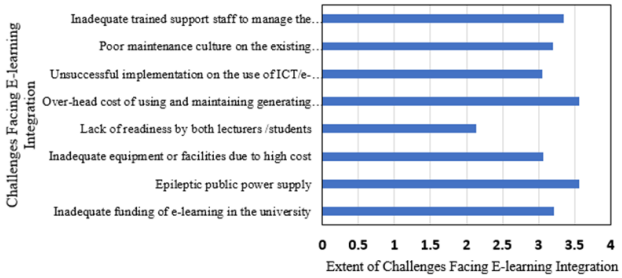

Figure 4: Challenges facing integrating e-learning in the teaching-learning of chemistry.

The above factors have additionally been featured by Laleye (2015) when he asserted that the fruitful joining of ICT in the educational system relies to a great extent upon the demeanor of instructors towards the intended current advances in educating and learning. To the extent that the mentality of instructors stays hallowed, different elements as per; the on-going shortfall of ICT informative materials, incapable arrangement execution, and absence of other foundations and hardware to help to educate and learn are all deficient in the learning systems. As such, the above challenges have likewise been referred to by the Federation of Learning Worldwide (FLI) as genuine difficulties confronting advanced education in Nigeria on ICT proficiency information incorporation with scholastic courses and projects as well as expressing that the chief variables militating against the combination of ICT with learning guidelines include: lacking ICT apparatuses like Personal Computers (PC's) for undergraduate learning; insufficient ICT offices in the E-library; poor and wasteful web and poor ICT abilities of some school personnel.

However, the null hypotheses tested show that 'there is no statistically significant difference between the mean scores of chemistry lecturers and students 'responses to the "availability of E-learning facilities for teaching and learning of chemistry, extent of integration of E-learning for effective teaching of chemistry, impacts of E-learning integration in the teaching and learning process of chemistry, barriers to effective teaching and learning of chemistry in tertiary institutions in Ebonyi state". The certification of this speculations means that both science instructors and learners need the mix of E-learning in the instructing and growing experience of "science" as they see it as an apparatus that will help all (science instructors and undergraduates), in that it will upgrade the educating and learning of the course which will thus improve the comprehension of the course by the understudies/learners. This is in accordance with the finding of a review, that assessed learning fulfilment and the viability of eLearning in scene engineering development studio courses yet revealed by New Science News (2015), which demonstrates that "learners were profoundly happy with web-upgraded instructing". The truth of the matter is that the Science instructors and the learners have shown an uplifting perspective towards the incorporation of E-learning in the instructing and growing experience of science in tertiary institutions, the mass presently falls on the government and policymakers in the Nigerian school system. It is on the above premise that an end would be drawn.

CONCLUSIONS

There is a pacing need to integrate e-learning in the teaching and learning of chemistry in tertiary institutions for both university students and lecturers so as to enhance effective teaching and learning of courses. From this study, it is pertinent to know that E-learning is a key device for improving educating and learning of 'Science' in tertiary organizations. Consequently, the incorporation of E-learning in the education growing experience of Science subsequently ought to be viewed as a need and not an extravagance that ought to be covered with empty talk as it has been demonstrated that its coordination will achieve great educational conveyance that will upgrade understudies' powerful learning of the course and likewise different courses. Besides, with COVID assaulting, E-learning stays a significant device for keeping up with the required social removing as understudies will be advantaged to concentrate secretly, get better evaluation regardless, and keep in contact with their instructors. One can then comprehend the reason why President Donald Trump in the wake of Coronavirus, showed his expectation to boycott the proceed with the stay of unfamiliar understudies in the US proposing the utilization of E-learning on how to stop the spread of the infection. So, incorporating E-learning into our school system will go far in decongesting our auditoriums and furthermore assist with decreasing the spread of the feared Coronavirus which no question we are going to live with until such a period.

All the more in this way, the surmising is that E-advancing as an apparatus and the interaction has turned into a worldwide instructive peculiarity that has been embraced by practically every one of the countries of the world and dug in their school system. Aside from the way that it is in accordance with arising advancements, it is efficient for both the instructor and the student; it makes assets promptly accessible to both the mentor and the guided; it permits students and instructors to work at their own speed in this way saving space, labour supply, and cost and it upgrades the two understudies and speakers educating and learning strategies and styles as they are presented to a large number which takes into consideration correlation of thoughts which thusly, works on the two teachers and understudies' abilities. Most importantly, e-learning is

basically schooling made simple which has broken the obstruction of belief; race, sex, and status.

The Nigerian government, her bureaucratic service of instruction, and other related organizations like the Public College Commission (NUC) in this way, have no choice but to embrace and oblige practically speaking E-learning in her schooling system or be abandoned in the comity of countries when the present-day schooling system is being examined. The public authority ought to comprehend that deliberately ignoring this worldwide change in training is like getting ready for the destruction day. As a matter of fact, a country that won't prepare her young today in accordance with worldwide prescribed procedures in instruction can prevail with regards to making her tomorrow stale and a captive to different countries that fell in the line of progress. Various proposals are favoured in view of the discoveries of the review. Numerous recommendations are preferred based on the findings of the study.

- As a proposal, it is recommended that the national administration of Nigeria ought to really incorporate E-learning into Nigerian's schooling system through sufficient subsidizing and portion of assets to our colleges; whenever distributed should be followed with close observation to guarantee that it is executed as well, on account of Nigerian element".
- The branch of science in tertiary establishments on whose shoulder rest the arrangement of instructors for the educating of "science" in these colleges/ organizations ought to join forces with the ICT Unit of the college to create a guide for the formation of E-learning stages.
- The national legislature of Nigeria ought to think of a powerful execution of an E-learning strategy. Revering it in the instructive strategy of the nation isn't sufficient yet authorizing and supporting the execution in each part of the country's school system ought to be her fundamental concern.
- In Federal colleges the executives on their part ought to stick heads and oblige E-Learning in the instructing and growing experience in the colleges as a worldwide practice for change.
- The government and colleges the executives ought to think of programs for preparing and retraining staff in the space of powerful mechanical activities and use.
- Operators and controllers of this E-learning offices/ hardware when given ought to be made to take liabilities and this must be finished by profoundly supporting their upkeep culture comparable to this training.

At last, educators ought to think about this pattern in instruction and get arranged in fact and academically to take web-based education into thought. Thusly, understudies need to get an adequate number of abilities that will assist them with actually profiting from the benefits E-learning is giving. Nevertheless, the implications of this study buttressed that the findings of this study have provided empirical evidence for the integration of E-learning in the teaching and learning process of chemistry. It has some implications for lecturers/teachers, students, policymakers, curriculum developers as well as various examination bodies.

One of the implications of this study is that chemistry lecturers could promote effective and non-abstract learning in chemistry by developing and sustaining students' zeal, passion, and knowledge explosion in chemistry. This can be achieved through the use of E-learning tools in the teaching process. The integration of E-learning during the teaching and learning process has different approaches embedded in it that will encourage and enhance students of different backgrounds to learn chemistry effectively.

Furthermore, the integration of E-learning in teaching students will assist the lecturers/teachers in providing a learning environment that will be conducive to the teaching and learning of chemistry.

For curriculum planners, this study suggested a meticulous reappraisal of chemistry curriculum implementation strategies to ensure the incorporation of activities that will encourage the integration of E-learning in teaching chemistry.

Hence, future studies would capture the effectiveness of E-learning integration in the teaching and learning of chemistry among post-graduate students in Nigerian universities.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no hinges of interest to this study.

COMPLIANCE WITH ETHICAL STANDARDS

This article does not measure up any human or animal subjects.

FUNDING

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DATA AVAILABILITY STATEMENT

The manuscript has in any way no associated data.

AUTHOR CONTRIBUTIONS

Onyinye J Ikenyirimba: conceptualization, analysis, writing, and drafting the manuscript Chidebe Chijioke Uwaleke: supervision, administration, analysis, and resources, Emmanual Nwigboji: validation, review, editing, writing.

REFERENCES

Eteng I, Akpotuzor S, Akinola SO, Agbonlahor I (2022). A Review on Effective Approach to Teaching Computer Programming to Undergraduates in Developing Countries. Sci Afr. 16:e01240.

Soub TFA, Alsarayreh RS, Amarin NZ (2021). Students' Satisfaction with Using E-Learning to Learn Chemistry in Light of the COVID-19 Pandemic in Jordanian Universities. Int J Instru. 14(3):1011-1024.

Chukwuneke CE, Ibewuike IA, Agboola BO (2022). Navigating analytical chemistry laboratories during COVID-19: perspective of a Nigerian university. J Chem Educ. 99(3):1527-1532.

Vallejo W, Uribe DC, Fajardo C (2022). Google Colab and Virtual Simulations: Practical e-Learning Tools to Support the Teaching of Thermodynamics and to Introduce Coding to Students. ACS omega. 7(8): 7421-7429.

Schwerter J, Wortha F, Gerjets P (2022). E-learning with multiple-try-feedback: Can hints foster students' achievement during the semester?. Educ Technol Res Dev. 70(3):713-736.

Williams DP (2022). vPBL: Developing a Facilitated Remote Approach to Problem Based Learning. J Chem Educ. 99(4):1642-1650.

Husin NA, Razak NA, Khairi MSH, Nazeri NSM (2022). Full enforcement of e-Learning during first movement control operation of COVID-19 pandemic: are Malaysian university students ready? J E Learn Knowl Soc. 18(1): 87-93.

Talent LMS (2020). What is E-learning? Is it important in education?

Singh J, Kumar V, Kumar D (2022). Combating the Pandemic with ICT-Based Learning Tools and Applications: A Case of Indian Higher Education Platforms. Int J Virtual Pers Learn Environ (IJVPLE). 12(1):1-21.

Madouni A (2022). New patterns of learning during the Pandemic Crisis of 2019. Technium Soc Sci J. 28(2022): 630-638.

Wu L, Hsieh PJ, Wu SM (2022). Developing effective e-learning environments through e-learning use mediating technology affordance and constructivist learning aspects for performance impacts: Moderator of learner involvement. The Internet and Higher Education, 100871.

Sathish RAH, Nethravathi PS (2022). Perspectives, Challenges and Opportunities of E-Learning in Higher Education-A Brief Review. Int J Manag Sci Eng Manag. 6(1):231-242.

Sinaga P, Setiawan W (2022). The Impact of Electronic Interactive Teaching Materials (EITMs) in E-Learning on Junior High School Students' Critical Thinking Skills. Think Ski Creat. 46:101066.

Chidiadi E, Onwubiko F, CAI, C.L.N (2020). Enhancing students' learning and understanding of the use of library in federal universities in Nigeria through the integration of e-learning in the teaching-learning process: A survey. Lib Philos Pract. 1-33:1-9.

Kituyi G, Tusubira I (2013). A framework for the integration of e-learning in higher education institutions in developing countries. Int J Educ Dev. 9(2):1-8.

Satyawan IM, Wahjoedi W, Swadesi IKI (2021). The effectiveness of online learning through Undiksha e-learning during the COVID-19 pandemic. J Technol Educ. 5(2):191-199.

Ja'ashan MMNH (2020). The Challenges and Prospects of Using E-learning Among EFL Students in Bisha University. Arab World Engl J. 11(1):124-137.

Pagram P, Pagram J (2006). Issues in E-learning: A Thai case study. Electro J Info Sys 26(1):1-8.

Sverdlyka Z, Klynina T, Fedushko S, Bratus I (2012). Youtube Web-Projects: Path from Entertainment Web Content to Online Educational Tools. In Developments in Information & Knowledge Management for Business Applications. Springer Nature, Berlin, Germany. 2012.1-718

Savage AJ, McNamara PW, Moncrieff TW, O'Reilly GM (2022). E-learning in emergency medicine: A systematic review. Emerg Med Australas. 34(3):322-332.

Araujo JL, Morais C, Paiva JC (2022). Student participation in a coastal water quality citizen science project and its contribution to the conceptual and procedural learning of chemistry. Chem Educ Res Pract. 23(1):100-112.