



# Engineering Students' Perception of Online Learning During the Emergency Nationwide Lockdown in Nigeria

Zainab Olorunbukademi Abdulkareem<sup>1</sup> · Sulyman Age Abdulkareem<sup>2</sup> · Ismail B. Mustapha<sup>3</sup>

Received: 20 December 2021 / Accepted: 5 May 2022 / Published online: 14 May 2022  
© The Author(s), under exclusive licence to Springer Nature Singapore Pte Ltd 2022

## Abstract

The global pandemic forced the closure of learning institutions and an abrupt switch from physical (face-to-face) learning to e-learning. The Academic Staff Union of University postulates that e-learning will not work during the period. This paper evaluates the attitude of engineering students in a Nigerian private university to e-learning during the period of national lockdown in Nigeria. A questionnaire was designed to collect students' attitudes about learning efficiency, quality, and associated cost. Ease or difficulty of the transition to e-learning, digital skills requirement, commitment to e-learning, digital skills improvement, and preferred test mode were studied. In addition, the relationship between gender and preferred test mode was examined. 73 students responded to the questionnaire. A significantly lower percentage (4%) of the engineering students prefer the e-learning method, while a more significant percentage (62%) of the respondents prefer blended learning. Gender has no significant relationship with the preferred learning mode of the students. Moreover, the students found the e-learning approach to be expensive. Finally, there is still much to be done by Nigerian educational stakeholders to improve the experience of e-learning in Nigeria.

**Keywords** e-Learning · COVID-19 · Education · Engineering · Undergraduate students

## Introduction

On March 11 2020, the World Health of Organisation (WHO) declared COVID-19 as a pandemic [6, 19]. This declaration prompted countries worldwide to implement lockdown and ensure residents are physically distant to slow down the spread of the highly contagious virus [9]. The worldwide lockdown led to an unexpected impact on various parts of the economy, and the education sector is among the majorly impacted. Educational institutions across the world had to look for an urgent alternative to traditional physical

teaching and learning to ensure educational continuance. Physical lectures were substituted with digital learning using digital books, online lectures and examinations, teleconferencing and interactive online learning environments [9].

Nigeria enforced a national lockdown on March 19, 2020, to reduce the spread of COVID-19 in the country [14]. Therefore, all non-essential physical contacts and crowd were prohibited, including holding face-to-face teaching and learning in educational institutions. Consequently, for teaching and learning to continue, learning institutions transitioned from traditional face-to-face learning to e-learning. The transition was encouraged by the Nigeria minister of education by April 2020 during a meeting with administrative heads of tertiary institutions in Nigeria [7].

However, the adoption of e-learning in Nigeria generated some controversies from significant stakeholders. For example, the Academic Staff Union of University (ASUU) spokesman stated that e-learning would not work in Nigeria [17]. According to the spokesman, this scepticism was expressed because of inadequate infrastructure to support e-learning in Nigeria and lecturers lack the appropriate technical knowledge to develop e-learning materials that can be effectively used to train students. Some universities

✉ Zainab Olorunbukademi Abdulkareem  
abdulkareemzainab1@gmail.com

<sup>1</sup> Department of Telecommunication Science, Faculty of Information and Communication Technology, University of Ilorin, Ilorin, Nigeria

<sup>2</sup> Department of Information and Communication Science, Faculty of Information and Communication Technology, University of Ilorin, Ilorin, Nigeria

<sup>3</sup> Department of Computer Science, School of Computing, Universiti Teknologi Malaysia, 81310 Johor Baharu, Malaysia

in Nigeria proceeded to adopt e-learning to teach their students during the period of the shutdown. This paper investigates the perception of students who underwent e-learning through online video conferences during the lockdown in a Nigerian university to determine whether students faced any significant challenges during the period. In addition, this study investigates if there is any statistical difference in the preferred test mode of male and female respondents.

## Literature Review

### Challenges Associated e-Learning

Approximately 50% of the qualified students applying for tertiary admission in public and private tertiary institutions across Nigeria get admitted yearly [10]. Hence, there are still millions of students who get turned down yearly. E-learning can be used to improve the learning for all students. However, some challenges have been identified in literature to affect the adoption of e-learning in Nigeria. E-learning requires some basic digital infrastructure, such as phone, laptop or computer and internet facilities to work and some basic technical knowledge to be successful. However, there is low technical knowledge and high cost of hardware and supporting facilities, such as the internet in Nigeria [13]. A significant number of students may not be able to engage in e-learning due to the unaffordability of e-learning infrastructures.

A critical infrastructure contributing to successful engagement with e-learning is access to quality and affordable internet services. Specifically, a high-quality internet facility is required when courses are streamed live in multimedia format. Like most developing countries, Nigeria still struggles with the quality of available internet services and the relatively high cost of the services compared to the standard of living of the populace [5, 15]. Hence, internet access is a common impeding factor that affects the adoption of internet-related technology in the country [2, 4]. Therefore, students may have difficulty having access to quality internet to engage in online learning, predominantly if they do not reside in major Nigerian cities, where most digital technology is concentrated. Consequently, some students may be disadvantaged and may have difficulty performing well in courses administered online.

The irregular power supply in the country is another major setback for the adoption of e-learning in Nigeria [15]. There is a need for electricity to power devices used in e-learning, and other supporting services such as Wi-Fi internet require electricity. Nigeria does not generate enough electricity to cater for all its population, and occasionally, the country experiences electricity grid collapse [18]. Therefore, some households are off the electricity grid entirely,

and some others are shut out of electricity for days. Consequently, students in these households will have difficulty engaging in online learning.

Furthermore, e-learning has no physical contact with fellow students and lecturers. Hussein et al. [8] and Michal et al. [11], revealed that a disadvantage of e-learning is that some students have significantly reduced concentration during e-learning. Therefore, for students to succeed in e-learning, the students will have to be proactive and self-motivating, because the physical encouragement received from other students is usually absent in the digital space.

Herein, we examined the perception of Nigerian students using students' ranking of the effectiveness of e-learning, the level of ease of transition to e-learning, the technical knowledge required for e-learning, the quality and cost of internet facilities, interactions with fellow students and lecturers, e-learning effects on their technical skills and the preferred learning mode post lockdown.

### Related Studies

Olalekan examines the perception and readiness of Nigerian students towards e-learning during the COVID-19 pandemic. The study results show that most of the respondents report high familiarity and readiness for e-learning. Respondents of the study believe they have the technical skills and proficiency required to engage with e-learning successfully. However, the students believe that the high cost of data, inconsistent internet access, poor power supply, and inadequate access to computer and e-library resources are significant challenges to e-learning. Another study conducted in India, a developing country, on the impact of e-learning on higher education students during the pandemic also found internet inconsistency a significant challenge for e-learning [9]. Also, the study specifically highlighted that student in the rural areas face the most significant challenges related to engaging with e-learning and suggested specific interventions to create a more conducive e-learning environment for this disadvantaged group.

Abbasi et al. [1] investigated the perception of students of medicine and dentistry in a private medical college in Pakistan during the period of National lockdown. The study reports that of most of the students, 77% of the respondents have negative perceptions about e-learning, and 86% of the students believe e-learning have a minor impact on their learning. Consequently, students in the study prefer face-to-face learning to online learning and are not ready for the transition to online learning. Another study conducted to examine medical students' perception of online learning during the pandemic in Poland [11] found no significant difference in the ability of face-to-face and e-learning to improve knowledge, and most of the students found e-learning enjoyable. However,

respondents' reports reduce the effectiveness of e-learning to improve skills reduced class activities and social interactions. Since there is very little background information provided on the infrastructure put in place to support e-learning in both studies, it is difficult to conclude the reason for the difference in results of both studies.

Chisadza et al. [5] investigated the effects of a switch to online learning during COVID-19 on the academic performance of second-year economics students in a university in South Africa. The study results show that students who have poor internet facilities while engaging in online learning have weak academic performance. Internet-related challenges negatively affected students' transition to online learning. Availability of quality internet is an essential requirement for e-learning, poor or absence of internet connection will automatically put some prospective participants at a disadvantage. However, in Africa, the high cost of data in comparison to the standard of living of the resident continues to be a challenge that can hinder the successful adoption of e-learning in the region [5].

## Methodology

This study utilizes a quantitative approach to investigate undergraduate students' perception of online learning during the emergency lockdown. Second, an investigation into whether students preferred learning mode is associated with their respective gender was conducted. After a cross-sectional survey of the literature, a structured questionnaire made up of ten closed-ended questions was formulated. The questionnaire includes questions about students' perception and experience using e-learning during COVID-19. The online questionnaire was developed using google forms and sent out to the WhatsApp departmental group made up of all students in the college of engineering in the university. All the students received an invite to participate in the study. Frequencies and percentages of responses to all questions were calculated.  $G$  likelihood ratio test ( $G$ -test) was used to evaluate the relationship between gender and preferred test mode.  $G$ -test examines the fitness of the expected variable count to the observed count when the association between two variables is observed.  $G$ -test formula for table of  $i$  cells in the contingency table given by

$$G = 2 \sum f_i \ln \left( \frac{f_i}{\hat{f}_i} \right),$$

where  $f_i$  is the observed frequency and  $\hat{f}_i$  is the expected frequency in cell  $i$  of the contingency table. The test is significant when  $p < 0.05$ .

## Results and Discussion

### Participation Description

A total number 148 engineering students enrolled in the school for the 2019/2020 academic session. At the end of the data collection phase, only 73 students responded to the questionnaire, which is approximately 50% of the students. 49 of the participants are male, which is 67.1% of the sample, and the remaining 24 participants are female, making 32.9% of the sample. Table 1 presents the distribution of responses of participants in this study.

### Devices Used to Engage with Online Learning

Students mainly use phones/tablets and laptops to engage in online learning, with a combined percentage of 75%. This result is similar to the results of [1], where 76% of the respondent uses a mobile phone to engage with e-learning. The preference of students to use handheld devices may be because of the ease of use. Specifically, these devices allow students to engage in online classes using stored energy when there is no power supply in Nigeria.

### Learning Efficiency

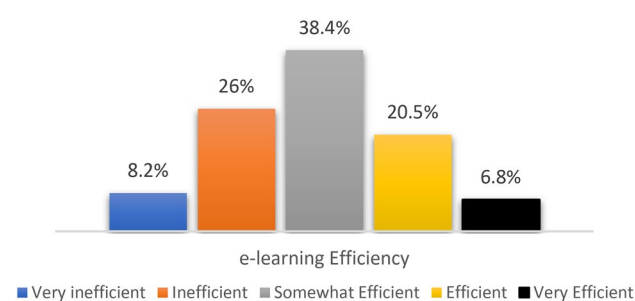
Only 27.3% of the respondents found e-learning efficient or very efficient, as shown in Fig. 1. This is similar to the result of a study conducted in Pakistan by Abbasi et al. [1], where 86% of the respondents found e-learning to contribute minorly to their learning. For e-learning to be effective, it needs to provide a commensurate knowledge transfer and proficiency as traditional face-to-face learning [12]. However, several engineering courses involve practical and hands-on experience, which is mainly difficult or impossible to simulate during e-learning. Therefore, significant cutback in practical and interaction with engineering apparatus and equipment may be the reason why respondents in this study found the e-learning approach inefficient.

### Quality and Cost of Internet

Most respondents (83.5%) have at least an adequate internet connectivity strength to engage in online learning, as shown in Fig. 2a. This can be attributed to the fact that respondents used in this research are based in major cities in Nigeria,

**Table 1** Responses of engineering undergraduate students on experience and perception about e-learning during the national emergency lockdown in Nigeria

| Online learning perspectives questions |   | Response and respective frequency distribution |                         |                                |                       |                            |
|--|---|--|-------------------------|--------------------------------|-----------------------|----------------------------|
| 1.                                     | Devices used to Engage with e-learning  | Phone/tablet 55 (75%)                          | Laptop 55 (75%)         | Desktop 7 (10%)                |                       |                            |
| 2.                                     | How efficient or not was e-learning compared to physical learning?                              | Very inefficient 6 (8.2%)                      | Inefficient 19 (26%)    | Somewhat efficient 28 (38.4%)  | Efficient 15 (20.5%)  | Very efficient 5 (6.8%)    |
| 3.                                     | How good or poor was internet connectivity required to engage with e-learning?                  | Very poor 4 (5.5%)                             | Poor 8 (11%)            | Fair 34 (46.6%)                | Good 15 (20.5%)       | Very good 12 (16.4%)       |
| 4.                                     | How cheap or expensive was e-learning for you?  | Very expensive 13 (17.8%)                      | Expensive 38 (52.1%)    | Somewhat expensive 11 (15.1%)  | Cheap 8 (11%)         | Very cheap 3 (4.1%)        |
| 5.                                     | How difficult or easy is it for you to transition from physical learning to e-learning?         | Very difficult 5 (6.8%)                        | Difficult 21 (28.8%)    | Somewhat difficult 25 (34.2%)  | Easy 20 (27.4%)       | Very easy 2 (2.7%)         |
| 6.                                     | How easy or difficult was it for you to commit to online learning?                              | Very difficult 8 (11%)                         | Difficult 27 (37%)      | Somewhat difficult 20 (27.4%)  | Easy 13 (17.8%)       | Very Easy 5 (6.8%)         |
| 7.                                     | How sufficient or not was the level of your technical proficiency required for online learning? | Very insufficient 0 (0%)                       | Insufficient 6 (8.2%)   | Somewhat sufficient 25 (34.2%) | Sufficient 30 (41.1%) | Very sufficient 12 (16.4%) |
| 8.                                     | How will you rate the level of your interactions with fellow students during e-learning?        | Very low 12 (16.4%)                            | Low 24 (32.9%)          | Average 20 (27.4%)             | High 14 (19.2%)       | Very high 3 (4.1%)         |
| 9.                                     | How will you rate the level of your interaction and lecturer feedback during e-learning?        | Very low 8 (11%)                               | Low 33 (45.2%)          | Average 26 (35.6%)             | High 5 (6.8%)         | Very high 1 (1.4%)         |
| 10.                                    | Which of these learning modes do you prefer?  | Online 3 (4.1%)                                | Face-to-face 25 (34.2%) | Blended 45 (61.6%)             |                       |                            |



**Fig. 1** Students' perception about efficiency of online learning

where internet connections are at their best in the country. However, students are required to purchase a higher volume of data to connect successfully to online learning, which is mainly expensive in comparison to the standard of living of the country, Nigeria. Consequently, 85% of students found internet connection costs to be at least somewhat expensive, as illustrated in Fig. 2b. In addition, the quality of the internet is often reported as an impeding factor for the online learning as most students experienced interruption during e-learning classes [5, 16].

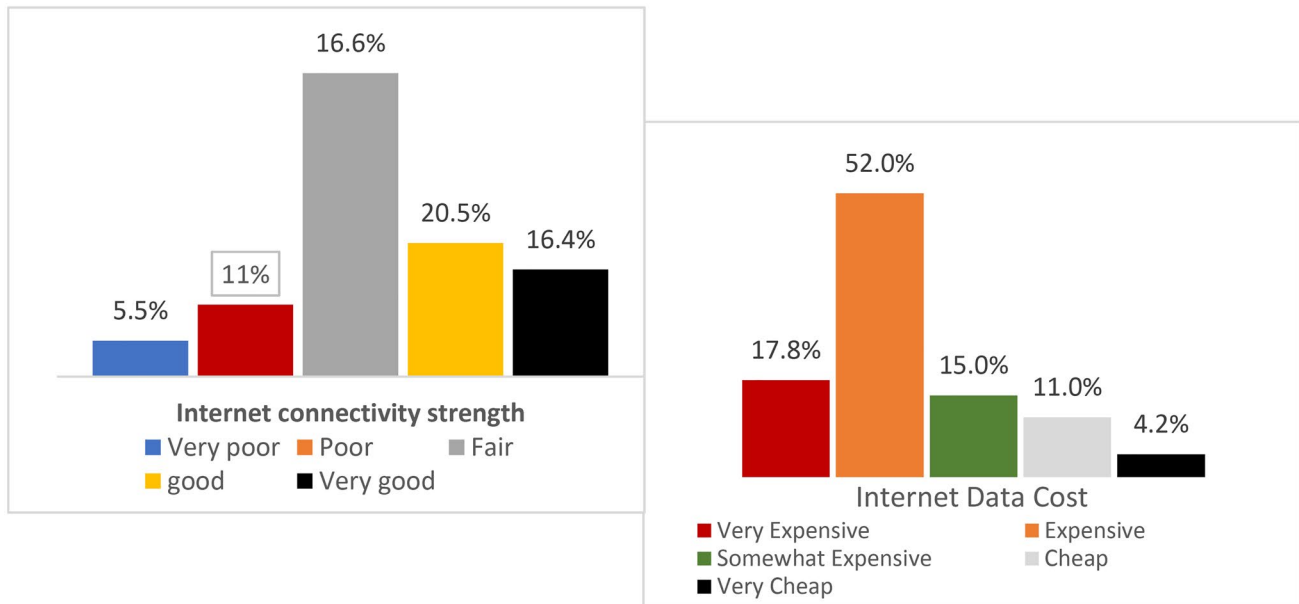


Fig. 2 Students' perception about a internet connectivity and b internet cost

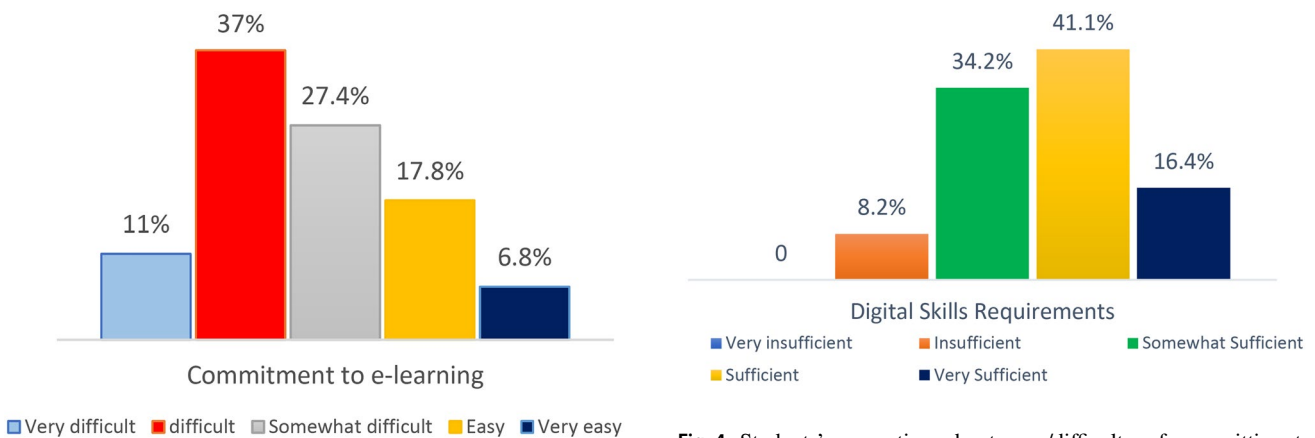


Fig. 3 Student' perception about ease/difficulty of commitment to e-learning

Fig. 4 Students' perception about ease/difficulty of committing to e-learning

### Ease or Difficulty of Transition to Online Learning

Only 22 (30.1%) found it easy/very easy transitioning from traditional face to face learning to online learning as shown in Fig. 3. This can be attributed to the abrupt and unplanned change to e-learning; hence, there was very little time allowed for the students to prepare for the new learning mode. Inadequate planning is one of the reasons ASUU feared e-learning in Nigeria would fail [17].

### Commitment to Online Learning

Most of the students (75.4%) found it somewhat difficult to commit to online learning, as depicted in Fig. 4. This is because the course administrator has no close supervision and regulation compared to a physical class. Also, communal support is not very strong in the online environment, and it is not strictly regulated like physical classes. Students' absences can be easily excused as bad internet connectivity, even when that might not be. Studying remotely, away from direct contact with other students and lecturer(s) can result in isolation and reduced engagement in studies [1, 11].

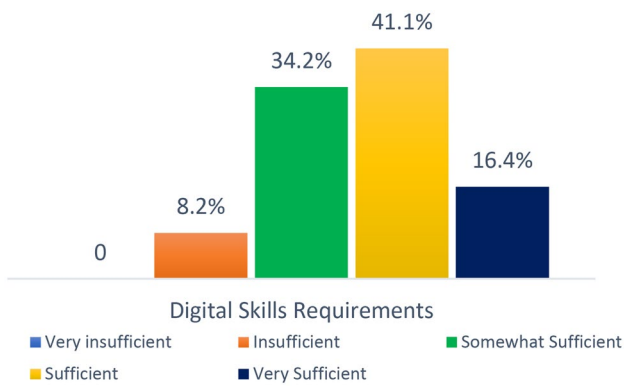


Fig. 5 Students' perception about level of digital skills required for e-learning

### Digital Skills Requirement

Most respondents (57.5%) believe their technological skills are sufficient to navigate online learning, as shown in Fig. 5. Besides, 34.2% of the students have somewhat sufficient digital skills to navigate online learning. This can be expected, since the respondents have significant experience working on the computer, because passing a computer-administered test is a compulsory requirement before admission into the university. Some of their courses require advanced computer expertise, such as computer programming and simulation; hence, they are quite familiar with the computer environment. Only 6 (8.2%) of the students do not have the required technical skills required to navigate the online learning platform. This result agrees with the work of Olayemi et al. [16], where the majority of the respondents also report having the required technical skills to engage with e-learning.

### Interactions with Students and Lecturers

Students' interactions with fellow students and lecturers are an important aspect of education. To improve inter-student communication during video streaming sessions, students are often divided into subgroups, and lecturers are available for at least 10 min at the end of each online session for questions and clarifications. From the results, 49.3% of respondents and 53.2% of respondents have low/shallow interactions with fellow students and lecturers, respectively, as illustrated in Fig. 6. Perhaps spontaneous communication, which is fostered by physical contact, is eliminated during the online learning period. This supports the finding of Michał et al. [11], which found low social interactions as a challenge of e-learning.

### Preferred Learning Mode

Students were asked their preferred learning mode, and their responses are relayed in Fig. 7. 61.6%, 34.2% and 4.1% of

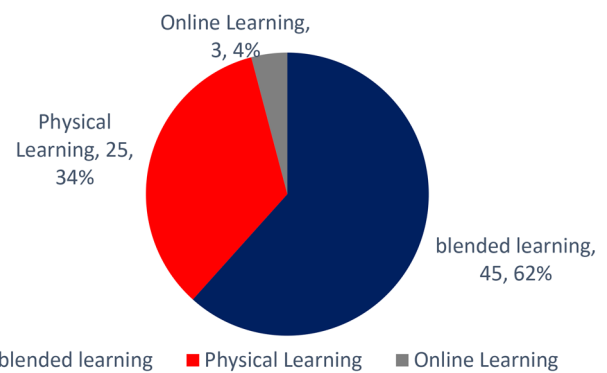


Fig. 7 Students' preferred learning mode

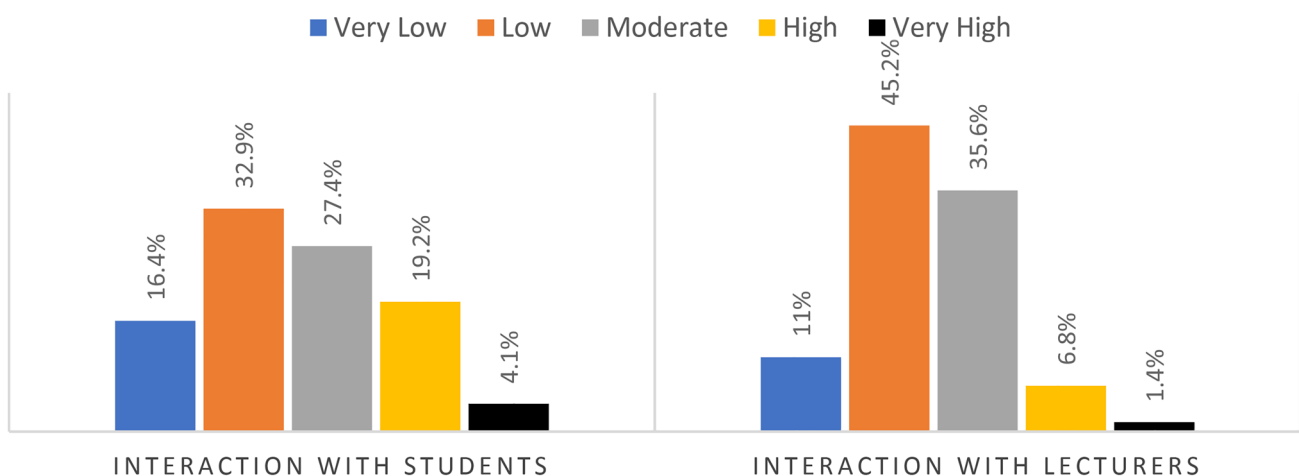


Fig. 6 Perception of students' level of Interaction with student/lecturer during e-learning

**Table 2** Gender \* preferred test mode contingency table

|                | Preferred test mode |                 |                | Total |
|----------------|---------------------|-----------------|----------------|-------|
|                | Physical learning   | Online learning | Mixed learning |       |
| Gender         |                     |                 |                |       |
| Male           |                     |                 |                |       |
| Count          | 17                  | 3               | 29             | 49    |
| Expected count | 16.8                | 2.0             | 30.2           | 49.0  |
| Female         |                     |                 |                |       |
| Count          | 8                   | 0               | 16             | 24    |
| Expected count | 8.2                 | 1.0             | 14.8           | 24.0  |
| Total          |                     |                 |                |       |
| Count          | 25                  | 3               | 45             | 73    |
| Expected count | 25.0                | 3.0             | 45.0           | 73.0  |

**Table 3** G-test results

|                  | Value | Df | Asymptotic Significance (two-sided) |
|------------------|-------|----|-------------------------------------|
| Likelihood ratio | 2.545 | 2  | 0.280                               |
| N of valid cases | 73    |    |                                     |

them prefer blended learning, physical learning, and online learning, respectively. Only 4.1% of the respondents preferring *e*-learning may be ascribed to the exclusion of practical experience, an essential aspect of engineering education. Moreover, most of the respondents prefer blended learning. This may be because blended learning affords them the advantages of both learning modes. With blended learning, the engineering students will enjoy a mix of hands-on opportunities offered by physical learning and flexibility offered by *e*-learning.

### Gender Effect and Preferred Test Mode

Chi-test was used to compare the preferred test mode of male and female respondents. The null  $H_0$ : “There is no significant relationship between students gender and preferred test mode”. Table 2 shows the contingency table of preferred test mode and gender. Table 3 shows the *G*-tests results. The likelihood ratio at  $p = 0.280$  is insignificant. Therefore, the null hypothesis is accepted, there is no significant relationship between gender and preferred test mode. This is corroborated by the works of Alavudeen et al. [3] and Zolfaghari et al. [20] whose studies found no relationship between gender and online learning satisfaction.

## Conclusions

Herein, the attitude of engineering students in a Nigerian university to *e*-learning was presented. Students majorly use handheld devices and laptops to engage with *e*-learning. Students positively perceive having the required skills to transition to online learning. Most of the students had at least a somewhat good internet connection to engage in *e*-learning. However, most of the students do not find *e*-learning to be an effective learning method, found internet data to be costly, found it difficult to transition to *e*-learning, and have low interactions with lecturers and fellow students. Finally, 61% of the students prefer a mixed learning method, and the preferred learning method has no relationship with students’ gender. Students used in this study mostly had a negative perception about taking *e*-learning. Despite all the challenges students faced while engaging in *e*-learning, they were still interested in using it alongside traditional learning methods. This is a positive development, since *e*-learning usage in Nigerian universities will likely transcend the pandemic period. Therefore, using both traditional learning and *e*-learning methods can allow users to optimize learning by harnessing the advantages of both learning methods. A major limitation of the study is that the sample was drawn from a single faculty of a private university in Nigeria. Therefore, respondents in this study are primarily from an affluent background with access to technological devices and supporting digital facilities. Consequently, the study results cannot be generalized to the populace from a less affluent background. Future studies should consider doing qualitative studies on the attitude and experience of students and lecturers of diverse backgrounds using *e*-learning.

**Funding** The authors received no funding for this research.

### Declarations

**Conflict of interest** The authors declare no conflict of interest.

## References

1. Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding *e*-learning during covid-19 at a private medical college. *Pak J Med Sci*. 2020;36(COVID19-S4):S57–61. <https://doi.org/10.12669/pjms.36.COVID19-S4.2766>.
2. Adeleke R, Iyanda AE, Osayomi T, Alabede O. Tackling female digital exclusion: drivers and constraints of female Internet use in Nigeria. *Afr Geogr Rev*. 2021;00(00):1–14. <https://doi.org/10.1080/19376812.2021.1963296>.
3. Alavudeen SS, Easwaran V, Mir JI, Shahrani SM, Aseeri AA, Khan NA, Almodeer AM, Asiri AA. The influence of COVID-19 related psychological and demographic variables on the effectiveness of *e*-learning among health care students in the southern

- region of Saudi Arabia. *Saudi Pharm J.* 2021;29(7):775–80. <https://doi.org/10.1016/j.jsps.2021.05.009>.
4. Ani OE, Uchendu C, Atseye EU. Bridging the digital divide in Nigeria: a study of internet use in Calabar Metropolis, Nigeria. *Libr Manag.* 2007;28(6–7):355–65. <https://doi.org/10.1108/01435120710774495>.
  5. Chisadza C, Clance M, Mthembu T, Nicholls N, Yitbarek E. Online and face-to-face learning: evidence from students' performance during the Covid-19 pandemic. *Afr Dev Rev.* 2021;33(S1):S114–25. <https://doi.org/10.1111/1467-8268.12520>.
  6. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Bio Med Atenei Parmensis.* 2020;91(1):157–60. <https://doi.org/10.23750/abm.v91i1.9397>.
  7. Deji O. Education minister directs Nigerian tertiary institutions to consider e-learning options. FrankTalknow. 2020. <https://franktalknow.com/education-minister-directs-nigerian-tertiary-institutions-to-consider-e-learning-options/>
  8. Hussein E, Daoud S, Alrabaiah H, Badawi R. Exploring undergraduate students' attitudes towards emergency online learning during COVID-19: a case from the UAE. *Child Youth Serv Rev.* 2020;119(November): 105699. <https://doi.org/10.1016/j.childyouth.2020.105699>.
  9. Kapasia N, Paul P, Roy A, Saha J, Zaveri A, Mallick R, Barman B, Das P, Chouhan P. Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Child Youth Serv Rev.* 2020;116(June): 105194. <https://doi.org/10.1016/j.childyouth.2020.105194>.
  10. Leadership Ng. 2.1m successful candidates to miss varsity admission. *Leadership-Newspaper.* 2019. <https://leadership.ng/2-1m-successful-candidates-to-miss-varsity-admission/>
  11. Michał B, Michalina Z-B, Monika S, Andrzej J, Beata W-K. Student's perception of online learning during COVID pandemic. *Indian J Pediatr.* 2020;87(7):554. <https://doi.org/10.1007/s12098-020-03327-7>.
  12. Milicevic V, Denić N, Milićević Z, Arsić L, Spasić-Stojković M, Petković D, Stojanović J, Krkić M, Milovančević NS, Jovanović A. E-learning perspectives in higher education institutions. *Technol Forecast Soc Change.* 2021. <https://doi.org/10.1016/j.techfore.2021.120618>.
  13. Nicholas-Omoregbe OS, Azeta AA, Chiazor IA, Omoregbe N. E-learning management system: a case of selected private universities in Nigeria. *Turk Online J Dist Educ.* 2017;18(2):106–21.
  14. Nlebem A. FG orders closure of all schools in Nigeria as Coronavirus spreads. *Business Day.* Business Day. 2020. <https://businessday.ng/coronavirus/article/%0Afg-orders-closure-of-all-schools-in-nigeria-as%02coronavirus-spreads/>
  15. Nwagwu WE. E-learning readiness of universities in Nigeria—what are the opinions of the academic staff of Nigeria's premier university? *Educ Inf Technol.* 2020;25(2):1343–70. <https://doi.org/10.1007/s10639-019-10026-0>.
  16. Olayemi OM, Adamu H, Olayemi KJ. Perception and readiness of students' towards online learning in Nigeria during covid-19 pandemic. *Libr Philos Pract.* 2021;2021:1–22.
  17. Olorok F. E-learning can't work in Nigeria, says ASUU. *Punch News Paper.* 2020. <https://punchng.com/e-learning-cant-work-in-nigeria-says-asuu/>
  18. Udegbunam O. Nigeria's electricity grid collapses again. *Premium Times Nigeria.* 2021. <https://www.premiumtimesng.com/news/headlines/461195-nigerias-electricity-grid-collapses-again.html>
  19. WHO. Pandemic characterization. 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#!>
  20. Zolfaghari M, Sarmadi MR, Negarandeh R, Zandi B, Ahmadi F. Attitudes of nursing and midwifery school's faculty toward blended e-learning at Tehran University of Medical Sciences. *Hayat J.* 2009;15(1). <http://hayat.tums.ac.ir/article-1-127-en.html>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.