Mathematical Statistician and Engineering Applications
ISSN: 2094-0343
2326-9865

Research Paper on Covid19 and Global Analysis of Online Learning in Higher Education Using Machine Learning

[1]Dr. Priti Kumari, [2]Dr. Atul Bhardwaj, [3]Dr. Akanksha

[1, 3]Assistant Professor, Faculty of Science, Kalinga University, near Mantralaya, Atal Nagar-Nava Raipur, Chhattisgarh 492101

[2]Associate Professor, Faculty of Commerce & Management, Kalinga University, near Mantralaya, Atal Nagar-Nava Raipur, Chhattisgarh 492101

[1]priti.kumari@kalingauniversitya.ac.in, [2]atulbly@gmail.com,
[3]akanksha.akanksha@kalingauniversitya.ac.in

Article Info
Page Number: 2701-2714
Publication Issue:
Vol. 71 No. 4 (2022)

Article History
Article Received: 25 March 2022
Revised: 30 April 2022
Accepted: 15 June 2022
Publication: 19 August 2022

Abstract

This study aims to evaluate student perspectives of worldwide higher education institutions using the new digital culture produced by the COVID-19 epidemic, namely online learning. Based on student state residency, the study used quantitative survey methods and a sample size of 581 worldwide students from universities, polytechnics, colleges, and different departments of higher education. According to a research, students are disappointed with virtual learning undertaken by many higher education institutions during the COVID-19 lockdown. They do not want online learning to continue after the epidemic owing to inadequate internet infrastructure and a shortage of electricity. Global higher education students have minimal acceptance of online learning technologies, preferring the traditional classroom setting, according to the diffusion innovation theory. The conservative and slow to adopt new technology group. The research suggests universities engage students more interactively through texts and video examples. It will increase their online learning so they don't fall behind academically, and they'll spend more time on it until traditional learning returns. As soon as the pandemic is finished, global higher education administrators should revert to a traditional teaching and learning structure and revamp the internet and electrical system nationwide.

1. INTRODUCTION

Modern ICT infrastructure through the internet makes education more accessible and overcomes distance and location limitations (Oriji and). 2019; Renes. Many colleges and universities use web-based learning (e-learning) to educate future workers, persons with impairments, parents with children, and military personnel. 2004; Renés. Teachers and students in different locations teach ICT in a synchronous or asynchronous situation. This sort of learning is aided by ICT technologies like video, audio, computer, CDROM, and USB-enabled storage devices (Renes, 2015). This gives pupils alternative views on e-learning. Some writers (Hawkes and Cambre, 2000; Knight, 1996) believe elearning will boost student involvement in the learning process by asking them to undertake many tasks on their own. Others, such as Kershaw (1996), Cooper (1999), and Renes (2015), note that not all kids can learn independently and hence cannot accomplish their academic goals. Higher education

institutions must build models that adapt to individual student needs and abilities to attain the essential capabilities.

Effective e-learning requires a basic infrastructure. Computers and mobile phones are pricey in many underdeveloped countries. Global data is expensive. In the, 40% of the 200 million inhabitants is poor and 74 million earn low wages (City Population, 2020; Punch, 2020). Low-income individuals struggle to grasp e-learning abilities (Olaniyi, 2006). Olaniyi (2006) contends that a university ICT center without network access is unproductive. E-learning in higher education has been explored by several scholars. According to O'Neill and SinghO'Donoghue (2004), many universities compete for e-learning compliance without considering the "promised" results. High implementation costs for staff and kids, restricted student participation, health consequences of screen time, and staff training and retraining are issues they must address. Claims enthusiasm for non-traditional form Many employees feel "restricted" and choose digital over traditional learning because it's cheaper and faster. Judgement is hard.

A survey of 266 Ugandan college students by Kituyi and Tusubira (2013) indicated that most students prefer mixing e-learning and face-to-face learning. discovered Eze et al. (2018), lectures are prepared and kept on a CD-ROM for students to play in their free time. Scholars have noted e-pros learning's and drawbacks (Hurixdigital, 2020; Nnajiofor and Achukwu, 2011). Flexibility, cross-platform accessibility, and low-cost deployment are some of the benefits. is. (Everyone can access the content.) Resistance to e-learning, electricity, bandwidth, lack of connectivity, inadequate ICT equipment for e-learning platforms, and limited computer skills and technology are challenges with online learning in the. Professors are few (Afolabi and Uhomoibhi, 2017). 72% of UK e-learning students gained weight faster than 58% of global students, according to Afolabi and Uhomoibhi (2017). Many authors have researched e-learning students' participation. Linjawi and Alfadda (2018) say online learning requires ICT knowledge and a good internet connection. Armstrong (2011) revealed that student understanding of technical tools is important, but not the instrument.

Ward et al. (2010) and Gómez Reyetal. (2018) discovered that students view online lectures as excellent, while Smart and Cappel (2006) found that electives are better than required courses. discovered. Armstrong (2011) says online learning is easier than face-to-face classes. Matsunaga (2016) found that students prefer online learning to face-to-face classes. This study didn't look at COVID 19 as a pandemic. This study examines global students' perceptions of COVID 19-era online learning. COVID19, Pandemic, Digitized Education, Online Learning (e-Learning), and Perception increase our understanding of how global students approach learning and higher education. Moreover.

Digital education promotes teachers and students to use digital technology to promote remote learning and learning (Oriji and Torunarigha, 2019). Many of the younger generation in the 21st century were born as "digital natives" who knew computers, video games, and the Internet from birth. Students have grown up with cell phones, laptops, high-speed internet, social media, email, telegrams, and WhatsApp (Oriji and Torunarigha, 2019). Digitized education uses digital tools for instructional purposes. Siemens (2020) defines digital

education as teaching students of all ages utilizing computers, mobile devices, the Internet, software, and other digital technology.

E-learning is any instructional activity done synchronously or asynchronously using networks, computers, or other electronic devices (Tulasi et al., 2013). E-learning is the use of ICT for educational electronic media (the letter "e" stands for "electronic").

E-learning can be paced individually. It can be clustered and targeted simultaneously. Synchronous means all students work at the same time, as opposed to asynchronous. Online if the survey requires internet, offline if the learning resources don't, not asynchronous if learners can work at different times, and synchronous if all learners work at once. Randomizes (2006)Naidu . Whether at the undergraduate or graduate level, e-learning encourages instructor and student interaction and flexibility. This study aims to determine: (1) How widespread is e-learning in worldwide higher education? (2) Global students' e-learning engagement. (3) Online courses mutually beneficial. (4) Challenges web-based students encounter. I created four research questions based on these goals. RQ1: How much e-learning is done during COVID19? RQ2: How much e-learning do COVID19 students do? How confident were your pupils in COVID 19 online learning? COVID19 online education challenges for college students

2. LITERATURE REVIEW

According to Li and Lalani (2020), COVID19 drives over 1.2 billion pupils out of the classroom and requires study on alternate education methods. Since COVID 19, voice applications, simulated tutoring, video conferencing, and online learning tools have exploded, and education investment will reach $18.66 billion from 2019 to 2025. It could reach $ 350 billion, prompting several plans. Gratuitous lessons. BYJU, Bangalore's online tutoring platform, is the world's most valuable EdTech startup. Bansal (2020) says e-learning is cheaper than classroom learning. Since COVID19, more freshman are using BYJU's Think and Learn app. During the COVID19 epidemic, Lark, a Singapore-based teaching platform, offered unrestricted teleconferencing time, autotranslation, realtime coediting of research projects, and intelligent calendar scheduling. Song et al., EU (2020). (2004) Elearning benefits include asynchronous learning for teachers and students and staff professional development (which would not have been available otherwise).

Everett M. Rogers created the Diffusion of Innovation Theory in 1962. She says new IT breakthroughs will proliferate, become popular, and be accepted by a population or social structure (La Morte, 2019; Frank et al., 2020). Individuals in a social system recognize and embrace new ideas, activities, or products, then transmit them to other members of the same system or to a wider group of people. This process of recognizing, accepting, and disseminating ideas is typically inventive and takes time. Innovations aren't adopted simultaneously by social system members. People gradually accept new ideas. Adopter classification is when some require a shorter time and others a longer one (Dearing and Cox, 2018; Frank et al., 2020; LaMorte, 2019). Categorizing adopters helps explain why populations accept or reject innovations. Dearing and Cox (2018) and LaMorte (2019) list five adopter types: (1) innovators—these are people who are daring and willing to try an

innovation (i.e., this population will accept innovation without persuasion); (2) early adopters—these are people who occupy leadership positions and enjoy large followership and can, therefore, mold opinion of such populations quite easily (i.e., these people can embrace innovative ideas without persuasion); (3) early majority—these are people who generally do n/a. (4) late majority—these are people who are always skeptical of change and typically embrace an innovative idea that has been accepted and confirmed as effective by the larger population; and (5) laggards—these are very conservative people who are the hardest to convince of an innovative idea and can only be carried along by statistics, fear appeals, and peer pressure.

Li and Lalani (2020) said online learning has challenges (for example, lack of access to digital tools for digital learning and absenteeism or the poor internet. connection). Gutierrez (2016) discovered that e-learning students retained 25-60% of what they learnt, compared to 8-10% in the classroom. Once learned. Students spend 40-60% less time on e-learning than face-to-face classes but cover more material. Students can study at their own pace, listen to recorded lectures, and read materials, according to Li and Lalani (2020). Some scholars have internet connectivity and digital divide in computers and classrooms (Bansal, 2020; Goldstein et al., 2020; Lau et al., 2020; Srivastava, 2020). Less than half of American college students did not take online classes during COVID 19 because to persistent absenteeism and assignment failure. Srivastava (2020) has only 21.3% access to school computers in 2018. (2020) We believe the university environment is essential to understanding.

Psychological theory inspired learning theories. Psychologists study how people learn. We can only employ proper teaching and learning approaches in the classroom if we know how knowledge is acquired (Learning Theories, 2004). Behaviorism, cognitivism, Gestalt theory, and constructivism are the four current learning theories. Behaviorism focuses on how pupils learn and dates to the 19th century. This idea claims that congenital or inherited variables have little effect on behavior (Western Governors University, 2020). Cognitivism is a direct reaction to behaviorism; psychologists focus on reasoning, problem-solving, language, concept development, and information processing. Started emphasizing cognition (Ertmer and Newby, 2013; Rhalmi, 2011). Cognitivism focuses on internal processes and connections that occur during learning, where learners actively participate (Rhalmi, 2011). Gestalt theory was developed in the 19th century by German psychologists Max Wertheimer, Wolfgang Koehler, and Kurt Koffka, who explored the nature of perception. Got. Humans receive stimuli in their simplest form, says theory. Gestalt theory pertains to educational problem-solving and cognition (Pappas, 2014). In Gestalt theory, psychologists think the whole is larger than the parts and that a problem might alter the organism's and its environment's equilibrium. Constructivism is rooted in the writings of Jean Piaget, Jerome Bruner, and Cecile Goodman. Constructivism interprets the mind's source of knowledge as experience, unlike cognitivism.

Gestalt and constructivist theories support the study's focus on e-learning in higher education. Gestalt theory justifies using e-learning to solve higher education's pandemic challenges. Learning is problem-solving. Because constructivist theory bases learning on the learner's

active engagement and experience, the student's e-learning perception is based on individual experience.

3. METHODOLOGY

Self-explanatory K-Means algorithm. It's a simple, widely-used clustering approach. k-means defines k clusters with the least variation (or error) in each. Cluster centers symbolize clusters. Distance squared between each point and cluster center is needed. k-means clustering finds k clusters and their cent res while reducing error.

Finally, features are resized to fit the model, ensuring they're all the same size. The scale of the features determines the magnitude of the coefficients learned in a linear model like logistic regression. Coefficients couldn't be compared between 0–1 and 0–100 features.

4. DATA SET

The magnitude of [X]. Similar to quantitative or qualitative descriptive research [X]. The descriptive quantitative technique is best for this study because it examines the current condition of online learning in higher education and the applicability of the big sample size.

5. RESULT ANALYSIS

There were 142 male students under the age of 30 in the undergraduate category. The population was 588 and the overall proportion was 24.19. In the Covid scenario, this was a population using e-learning based systems as mentioned in table.(1). The number of male students of the same age group who did not use e-learning during the Covid-19 pandemic was 132. As shown in the Table(2) ,Table(3) and figure. (1) and Figure (2), they accounted for 22.45% of the total population (2).

While 134 female students in the undergraduate category under the age of 30 were identified. Within a population of 588, the overall percentage recorded was 22.45. In the Covid scenario, this was the population of female students using e-learning. There were 132 female students of the same age group who did not use e-learning in Covid. As shown in the figure. (1) and Figure (2), which accounted for 22.45% of the total population (2).

There were 5 male students over the age of 30 in the undergraduate category. The population was 588 and the overall proportion was 0.85. In the Covid scenario, this was a population using an e-learning-based system, as shown in the table. (1). The number of male students of the same age group who did not use e-learning during the Covid19 pandemic was 5. As shown in Table (2), Table (3) and the figure. (1) and Figure (2), they accounted for 0.85% of the total population (2).

On the other hand, 5 female students were identified in the undergraduate category over 30 years old. With a population of 588, the overall percentage recorded was 0.85. In the Covid scenario, this was the population of female students using e-learning. There were 5 female students of the same age group who did not use e-learning at Covid. As shown in Table(1) and Figure (2) which make up 0.85% of the total population (2).

There were no male students under the age of 30 in the postgraduate category. The population was 588 and the overall proportion was nill. In the Covid scenario, this was a population using e-learning based systems as mentioned in table.(1). The number of male students of the same age group who did not use e-learning during the Covid-19 pandemic was 2. As shown in the Table(2) ,Table(3) and figure. (1) and Figure (2), they accounted for 0.340% of the total population (2).

While 4 female students in the postgraduate category under the age of 30 were identified. With a population of 588, the overall percentage recorded was 0.680. In the Covid scenario, this was the population of female students using e-learning. There was only one female students of the same age group who did not use e-learning in Covid. As shown in the figure. (1) and Figure (2), which accounted for 0.170% of the total population (2).

There was only one male students over the age of 30 in the postgraduate category. The population was 588, with a total of 0.170. In the Covid scenario, this was a population using an e-learning-based system, as shown in the table. (1). The number of male students of the same age group who did not use e-learning during the Covid19 pandemic was 3. As shown in Table (2), Table (3) and the figure. (1) and Figure (2), they accounted for 0.510% of the total population (2).

On the other hand, 3 female students were identified in the postgraduate category over 30 years old. With a population of 588, the overall percentage recorded was 0.51. In the Covid scenario, this was the population of female students using e-learning. There only one female students of the same age group who did not use e-learning at Covid. Like a photograph. (1) and Figure (2) make up 0.17% of the total population (2).

Table 1.Various types of e-learning tools used by students (Population size=588) from around the world during the COVID-19 epidemic.

Type of e-learning tools	Participants	Percentage (%)
Edmodo	1	0.17
Facebook	1	0.17
Webex	12	2.04
Google Duo	17	2.89
Skype	19	3.23
Zoom	44	7.48
Google Meet	45	7.65
Learning management systems	75	12.76
E-mail	78	13.27
WhatsApp	98	16.67
Google Classroom	198	33.67
Total	588	100

Table 2. Gender of pupils who took part in the poll from around the world.

Gender	Participants	Percentage (%)
Male	291	49.5
Female	297	50.5
Total	588	100

Table 3. Academic level of pupils who took part in the poll from around the world.

Level of study	Participants	Percentage (%)
Undergraduate	573	97.5
Graduate	15	2.5
Total	588	100

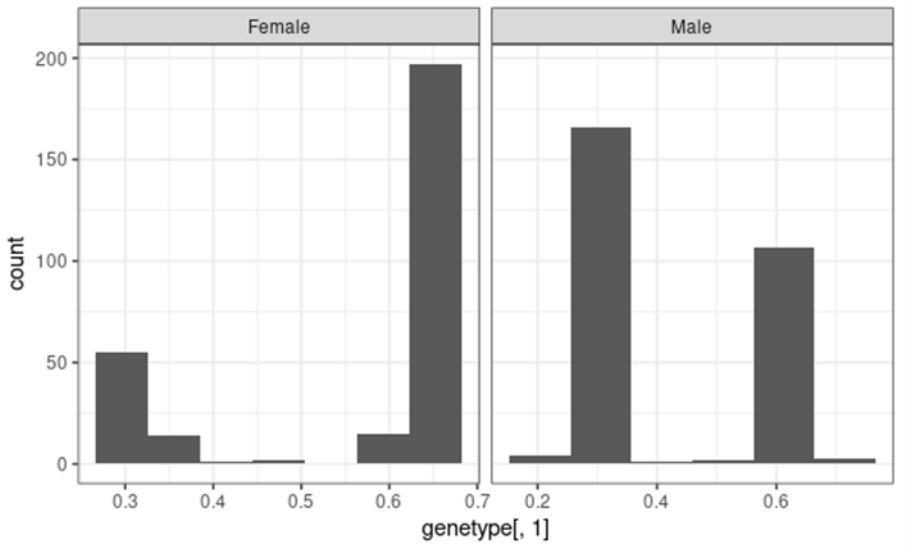

Figure1

According to the Figure 1, In the class 0.38-0.44 the number of female learners using e-learning is minimum close to zero and the count of females is not more than 5. The number of females in the class 0.63-0.68 the count reaches maxima upto about 195. In case of male learners, the count is minimum with the count as low as less than 5. The count of male learners is maximum in the class 0.27-0.34 the count shooting up to the about 160.

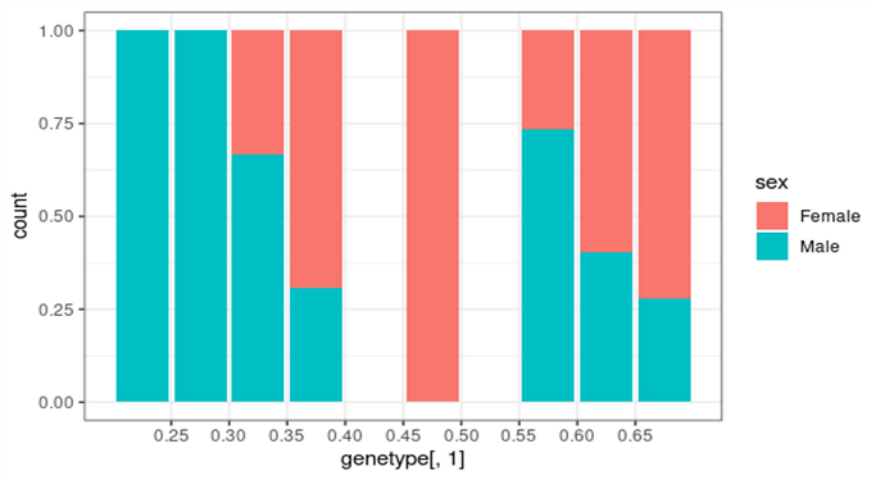

Figure 2

According to the Figure 2, in the classes 0.20-0.25 and 0.25-0.30 only male learners are involved in e-learning. The count of males in both the classes is 1.00 with no female learner prsesent in the classes. In the class 0.65-0.70 the count of male e-learners is mnimum with the number reaching only upto 0.30. It is also noticed in the figure 2 that in the class 0.45-0.50 only female e-learners are present with value shooting up to 1.00. The minima for female learners is observed in the figure 2 with the range 0.69 to 1.00 i.e., count is only 0.31.

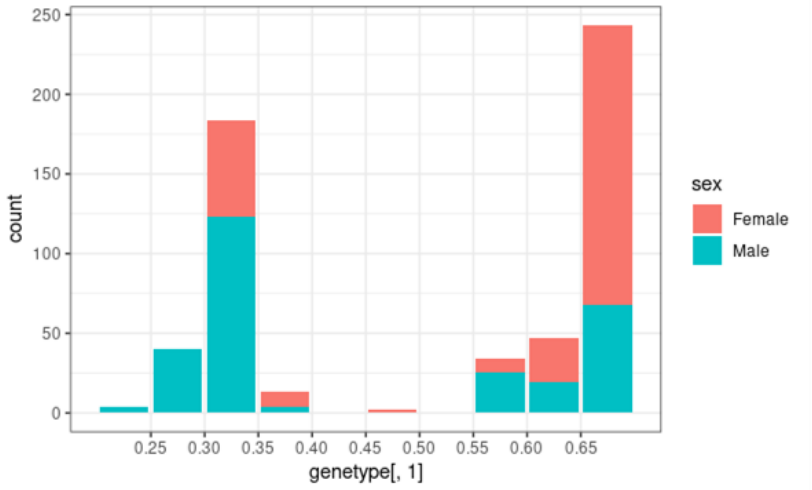

Figure 3

According to Figure 3, the local minimum count of male learners is observed in the classes in the classes 0.20-0.25 and 0.35-0.40 with the count, not exceeding the value of 5. Similarly, the minimum value more than zero for female e-learners lie in the range 0.45-0.50 with the value reaching only upto about 4. The local maxima count for male e-learners is noticed in the class 0.30-0.35 with the value soaring high upto 120. Similarly, the maximum value for the female e-learners in the Covid scenario exists in the range 0.65-0.70 with the count ranging from 70 to 240 means value settles at 170. It is to be noticed also that in the classes 0.40-0.45 and 0.50-0.55 no male or female learners exist means value of male and female e-learners is zero.

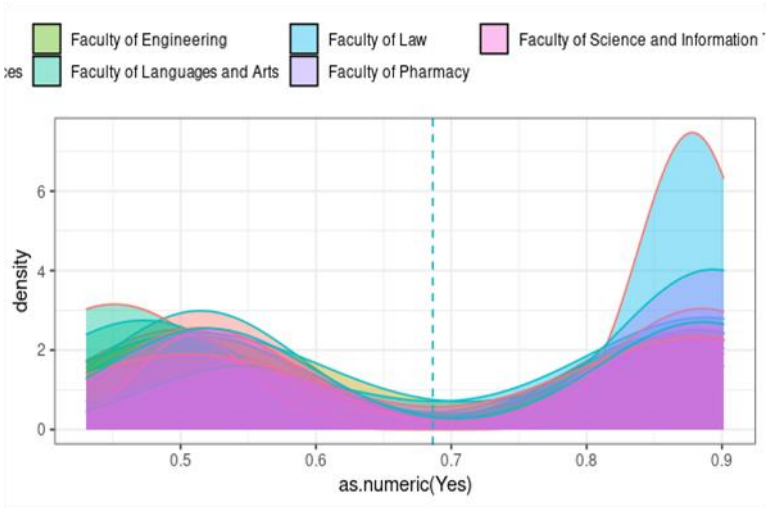

Figure 4

According to the Figure 4, density of Faculty of Law touches maxima in the range 0.8-0.9 with the density value upto 7.5. The density of Faculty of Science and Information is at minima at about value 2 but the variational range for this case is broad with the range spanning from 0 to 9, the whole range spectrum. Other faculties like Faculty of Engineering, Faculty of Language and Arts and Faculty of Pharmacy are at middle levels with the density avlue ranging from 1-3 with showing a mixed pattern of density levels. The global maxima is displayed by Faculty of Law at desity level 7.5 and Global minima is shown by Faculty of Science and Information with the value fof density ranging from 0 to 0.5.

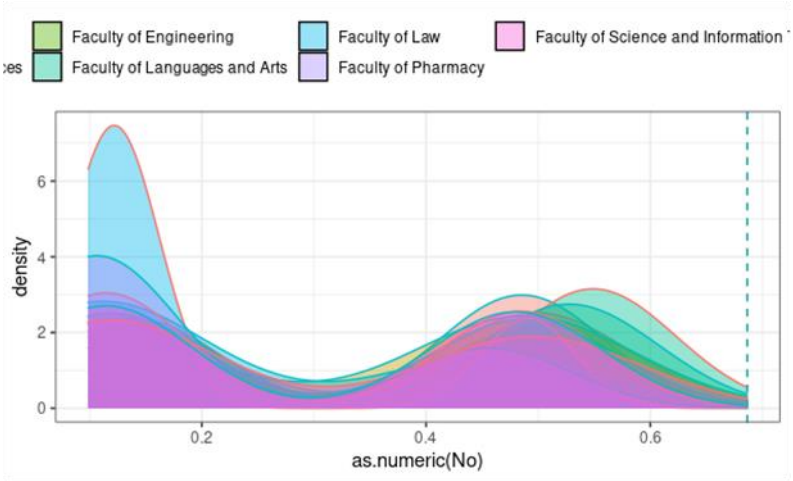

Figure 5

According to the Figure 5, with a negation of the parameters density pattern changes. In comparison with Figure 4, in this case the maxima shifts in the range 0-0.18 with the value of density 7.5 with the Faculty of Law remaining the same. In case of negation of parameter minima is also observed for the same faculty i.e., Faculty of Science and Information with the minima ranging from 0 to 0.2 at x-axis parameter at 0.3 value. Other faculties like Faculty of Engineering, Faculty of Languages and arts and Faculty of Pharmacy showing a mixed pattern in the class range 0.1 -0.7 with the density ranging from 0.2 to 4.

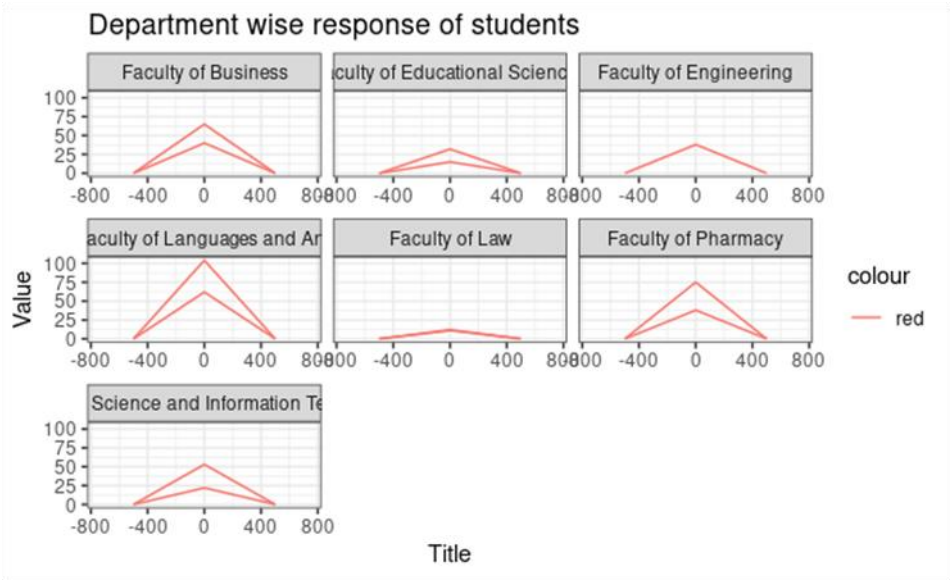

Figure 6

Figure 6 which shows department-wise response of students and minimum value of students response involved in e-learning in Covid scenario is displayed by Faculty of law students and value reaches only upto 12. The Faculty of Languages and Arts is showing maximum number os students involved in e-learning during Covid with the value soaring high upto 100. Other faculties like like Faculty of Engineering, Faculty of Languages, Faculty of Business, Faculty of Educational Science and arts and Faculty of Pharmacy show midium variational pattern with the values ranging from 25 to 75.

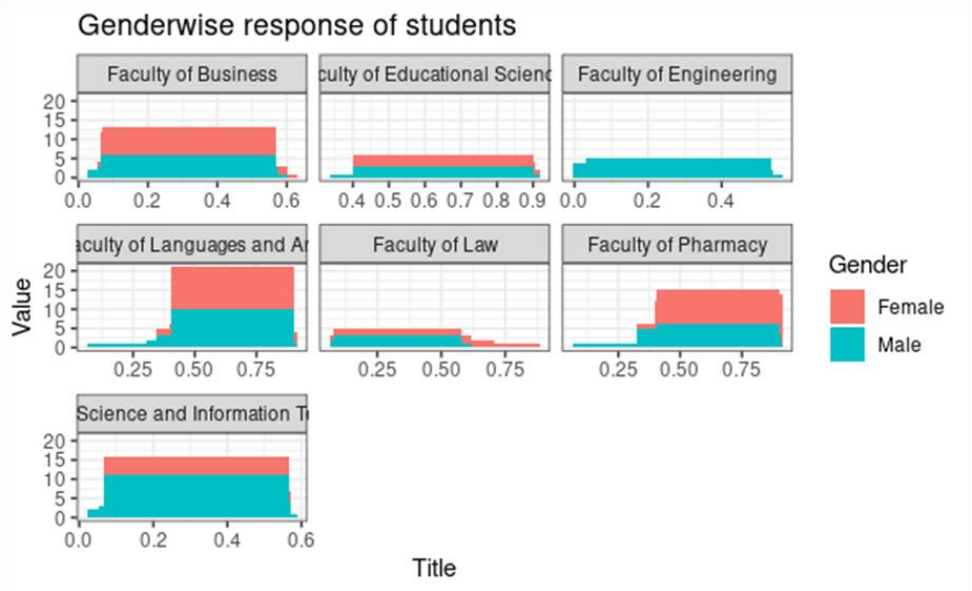

Figure 7

Figure 7 shows Gender-wise respones of students involved in e-learning during Covid. According to the graphs in the Figure 7, Faculty of Law is displaying minimum response of students with the value not exceeding 5 and gender-wise females are at still more minima with value only upto 3. Maximum response of both male and female e-learners is observed

in case of Faculty of Languages and Arts with females at value 10 and males at value 20, the maximum value. In all the faculties under obseravation female e-learners response exceeds the response by male e-learners during Covid. In case of faculty of Engineering, female response is nil and male e-learner response reaching the value only upto 5. Othe faculties show mixed patterns with the female response always more than male e-learners during Covid.

CONCLUSION

Only one in four higher education students had online learning activities, compared to polytechnics and universities. These results support ADewoledeshi (2014), Bali and Liu (2018), and Opeyemi et al. (2019), who found that students were interested in worldwide ELearning universities. Two of the four unhappy pupils were university students. After the pandemic, three of four Higher Education Organization students were unsuitable for mixed online/classroom courses. This study's results support online learning research and the innovation diffusion theory. While earlier studies have focused on online learning at specific schools or student perceptions in COVID-19-specific settings, this study surveys students from across the country. Since it was, it should be regarded global pilot studies and learn during COVID-19.

References

1. Adewole-Odeshi E (2014) Attitude of students towards e-learning in south-west Nigerian universities: an application of technology acceptance model. Available at: http://digitalcommons.unl.edu/cgi/ viewcontent.cgi?article=2504andcontext=libphilprac (accessed on 11 May 2021).
2. AECT (2001) What is descriptive research? The Association for Educational Communications and Tech-nology. Available at: http://members.aect.org/edtech/ed1/41/41-01.html (accessed on 11 May 2021).
3. Afolabi OO and Uhomoibhi J (2017) E-learning implementation in higher education: aspects of infrastructure development challenges and students learning approaches. Available at: https://pure.ulster.ac.uk/en/ publications/e-learning-implementation-in-highereducation-aspects-of-infrastru-3 (accessed on 11 May 2021).
4. Apuke OD (2017) Quantitative research methods: a synopsis approach. Arabian Journal of Business and Management Review 6(10): 40–47.
5. Armstrong DA (2011) Students' perceptions of online learning and instructional tools: a qualitative study of undergraduate students' use of online tools. The Turkish Online Journal of Educational Technology 10(3): 222–226.
6. Bali S and Liu MC (2018) Students' perceptions toward online learning and face-to-face learning courses.
7. Journal of Physics 11(8): 1–8.
8. Bansal N (2020) Importance of online education during coronavirus crisis. Available at: http://bweducation. businessworld.in/article/Importance-Of-Online-Education-During-Coronavirus-Crisis-/30-04-2020-190816/ (accessed on 11 May 2021).

9. City Population (2020) Nigeria: states and cities. Available at: https://www.citypopulation.de/Nigeria-Cities.
10. html (accessed on 11 May 2021).
11. Cooper T (1999) Whose academy is it? New Statesman 128(4460).
12. Dearing JW and Cox JG (2018) Diffusion of innovations theory, principles, and practice. Health Affairs 37(2):183–190.
13. Ertmer PA and Newby TJ (2013) Behaviorism, cognitivism, constructivism: comparing critical features from an instructional design perspective. Performance Improvement Quarterly 26(2): 43–71.
14. European Commission (2020) Coronavirus: online learning resources. Available at: https://ec.europa.eu/ education/resources-and-tools/coronavirus-online-learning-resources_en (accessed on 11 May 2021).
15. Eze SC, Chinedu-Eze VC and Bello AO (2018) The utilisation of e-learning facilities in the educational delivery system of Nigeria: a study of M-University. International Journal of Educational Technology in Higher Education 15(34): 1–20.
16. Frank M, Jadick MJ, Minnick C, et al. (2020) Diffusion of innovation theory. Available at: https://www.ou.edu/ deptcomm/dodjcc/groups/99A2/theories.htm#home (accessed on 11 May 2021).
17. GfK Polonia (2013) Analysis of sample size in consumer surveys. Available at: https://ec.europa.eu/economy_ finance/db_indicators/surveys/documents/workshops/2013/pl-gfk_k._pusczak_-_sample_size_in_customer_ surveys_v2_2.pdf (accessed on 11 May 2021).
18. Goldstein D, Popescu A and Hannah-Jones N (2020) As school moves online, many students stay logged out. The New York Times. April 6. Available at: https://www.nytimes.com/2020/04/06/us/coronavirus-schools-attendance-absent.html (accessed on 11 May 2021).
19. Gutierrez K (2016) Facts and stats that reveal the power of eLearning. Available at: https://www.shiftelearning.
20. com/blog/bid/301248/15-facts-and-stats-that-reveal-the-power-of-elearning (accessed on 11 May 2021).
21. Gómez-Rey P, Barbera E and Fernandez´-Navarro F (2018) Students' perceptions about online teaching ef-fectiveness: a bottom-up approach for identifying online instructors' roles. Australasian Journal of Ed-ucational Technology 34(1): 116–130.
22. Hawkes M and Cambre M (2000) The cost factor. Technological Horizons in Education 28(1): 26.
23. Hurixdigital (2020) 10 Advantages of e-Learning in higher education over traditional methods. Available at:
24. https://hurix.com/e-learning-in-higher-education/ (accessed on 11 May 2021).
25. Kershaw A (1996 September/October). People, planning, and process: the acceptance of technological in-novation in post-secondary organizations. Educational Technology 36: 44–48.
26. Kituyi G and Tusubira I (2013) A framework for the integration of e-learning in higher education institutions in developing countries. International Journal of Education and Development using Information and Communication Technology 9(2): 19–36.

27. Knight P (1996) Assessment for Learning in Higher Education. SEDA Series. London: Kogan Page.
28. Learning theories (2004) Insight into the move towards outcomes based education. Available at: http://dl.icdst.
29. org/pdfs (accessed on 11 May 2021).
30. LaMorte WW (2019) Diffusion of innovation theory. Available at: https://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories4.html (accessed on 11 May 2021).
31. Lau J, Yang B and Dasgupta R (2020) Will the coronavirus make online education go viral? Available at: https:// www.timeshighereducation.com/features/will-coronavirus-make-online-education-go-viral (accessed on 11 May 2021).
32. Li C and Lalani F (2020) The COVID-19 pandemic has changed education forever. This is how. Available at: https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/ (accessed on 11 May 2021).
33. Linjawi AI and Alfadda LS (2018) Students' perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: a cohort study. Advances in Medical Education and Practice 9: 855–863. Matsunaga S (2016) College students' perceptions of online learning: knowledge gain and course effectiveness.
34. The Online Journal of Distance Education and e-Learning 4(2): 20–30.
35. Naidu S (2006) E-Learning: A Guidebook of Principles, Procedures and Practices. 2nd edition. New Delhi:Commonwealth Educational Media Center for Asia.
36. NUC. (2020). National Universities Commission statistical digest 2017. Available at: https://www.nuc.edu.ng/ nuc-statistical-digest-2017/ (accessed on 11 May 2021).
37. Nnajiofor FN and Achukwu BC (2011) Benefits, challenges and implication of implementing e-learning Nigeria higher institutions. UNIZIK Orient Journal of Education 6(1): 221–229.
38. O'Neill K and SinghO'Donoghue GJ (2004) Implementing eLearning programmes for higher education: a review of the literature. Journal of Information Technology Education 3: 313–323.
39. Olaniyi SS (2006) E-learning technology: the Nigeria experience. Available at: https://www.fig.net/resources/proceedings/fig_proceedings/fig2006/papers/ts84/ts84_03_salawudeen_0593.pdf (accessed on 11 May 2021).
40. Opeyemi OZ, Adeyemi AA, Olajuwon TD, et al. (2019) Perception of nursing students towards online learning: a case study of Lautech open and distance learning centre, Ogbomoso, Oyo State, Nigeria. Galore International Journal of Health Sciences and Research 4(4): 23–30.
41. Oriji A and Torunarigha YD (2019) Digitized education: examining the challenges of digital immigrant
42. educators in the face of net generation learners. KIU Journal of Social Sciences 5(4): 337–347.
43. Pappas C (2014) Instructional design models and theories: gestalt theory. Available at: https://elearningindustry.com/gestalt-theory (accessed on 11 May 2021).

44. Punch (2020) 87% Nigeria's poverty rate in North–World bank. Available at: https://punchng.com/87-nigerias-poverty-rate-in-north-world-bank/ (accessed on 11 May 2021).
45. Renes SL (2015) Increasing access to higher education through e-learning. In: Gradinarova B (ed) Instructional design, organizational strategy and management.
46. Rhalmi M (2011) Description of cognitivism. Available at: https://www.myenglishpages.com/blog/description-of-cognitivism/ (accessed on 11 May 2021).
47. Siemens (2020) Digitalization in education. Available at: https://www.plm.automation.siemens.com/global/en/ our-story/glossary/digitalization-in-education/25307 (accessed on 11 May 2021).
48. Smart KL and Cappel JJ (2006) Students' perceptions of online learning: a comparative study. Journal of
49. Information Technology Education 5: 201–219.
50. Smith C, Hoderi M and Mcdermott W (2019) A preliminary study of students' perception and learning from different delivery methods. Academy of Educational Leadership Journal 23(2): 1–10.
51. Song L, Singleton ES, Hill JR, et al. (2004) Improving online learning: student perceptions of useful and
52. challenging characteristics. The Internet and Higher Education 7(1): 59–70.
53. Srivastava S (2020) Online learning in times of coronavirus: net-based learning can't be temporary measure, must be part of education policy. Available at: https://www.firstpost.com/learning/online-learning-in-times-of-coronavirus-net-based-learning-cant-be-temporary-measure-must-be-part-of-education-policy-8277281.html (accessed on 11 May 2021).
54. State University (2020) Nigeria higher education. Available at: https://education.stateuniversity.com/pages/ 1105/Nigeria-HIGHER-EDUCATION.html (accessed on 11 May 2021).