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Impact of E-Learning Management Systems During Covid-19 Pandemic

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ABSTRACT

The essence of this study is to provide a comprehensive review of the impact of e-learning in universities during the COVID-19 pandemic which led to the closure of schools around the world. In other to continue learning most universities had to adopt the e-learning approach, which made it possible for their students to remotely access lecture materials, attend virtual classrooms at the comfort of their homes with the use of electronic Learning Management Systems (eLMS). This new mode of learning which was abruptly adopted by most universities had its challenges despite its gains during the pandemic. This research is to subjectively analyse the impact of eLMS during Covid 19 pandemic using some software quality attributes such as efficiency, effectiveness, flexibility and usability. To this end, a structured questionnaire was developed using these variables and distributed both physically and electronically to students in three universities in Edo State. An empirical data of 638 students participated from the different universities. The results showed that the ease of use and perceived efficiency positively correlated with facilitating information Technology infrastructure, adaptation, and self-efficacy, which in turn affects the actual use of the e-learning system during the COVID-19 pandemic.

Keywords: eLMS, COVID-19 Pandemic, Software Quality, E-learning, Education in pandemic

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1. INTRODUCTION

Covid-19 first started in Wuhan City of China towards the end of 2019. Rapid spreading of Covid-19 across the globe led the World Health Organization (WHO) to declare it as a pandemic on 11th March, 2020. The outbreak of this pandemic across the globe forced educational institutions to shutdown to control the spread of Covid-19 virus. This happening made the teaching professionals to think of other methods of teaching during the lockdown and thus paved ways towards e-learning or online learning management systems.

Nigeria was also affected by the Covid-19 virus, and on February 27th, 2020, the first case of Covid-19 was reported in Lagos. The Ministry of Education and the Covid-19 presidential taskforce implemented the lockdown and social distancing law, on the 23rd of March, 2020, schools where shutdown in the country. According to UNESCO09 (2020) reported, Covid-19 affected the student nearly 68% of the world population as per the data taken in the month of June 2020. In order to maintain continuous teaching during the lockdown, most schools came with strategies for lecturing and learning remotely from their homes.

Moreover, most of the schools in Nigeria had significant issues embracing the "new normal", the virtual learning approach using e-learning management systems as against their orthodox manual face to face learning approach. As such, deploying the technology that will support remote learning was seen as a herculean task. The reasons are not farfetched thus; most schools predominately carry face to face teaching, most schools did not have the infrastructure to implement remote learning, most staff/students were not knowledgeable in using e-learning platforms, adaptability to new learning environment became an issue, the sudden unanticipated cost of setting up the virtual learning platforms by most schools and huge dependence on weak connections provided by Internet Service Providers and GSMs providers were other constraining factors.

E-learning Management System (eLMS)

An E-Learning Management System (eLMS) is software that is developed mainly to create, distribute and manage the delivery and retrieval of educational contents. Some methods of eLMS include online learning, virtual learning, distributed learning, network and web-based learning (Muthuchamy and Thiyayu, 2011). E-learning can also be known as a network that enables transfer of skills and knowledge, and also the delivery of education to a large number of recipients at the same or at different times in different locations through computer aided devices. Earlier, e-learning was not accepted whole heartedly, as it was looked at as a system that lacks the human understanding and knowledge required in learning. Eze et al., (2018) stated that e-learning is concerned with the universal approach of incorporating modern telecommunication facilities and Information and Communication Technology (ICT) resources into the educational system.

The e-learning signifies an electronic means of learning which is associated with computerized learning in a reciprocal interface at the convenience of both the learners and lecturers. E-learning Management System can be hosted as a stand-alone product on the organization or institution server or it can be cloud-based platform that is hosted by the software agencies or platform. Hedge and Hayward (2014), defined e-learning as a conceptual advanced approach rendering electronically arbitrated, learner-centered and communicative learning environments to anyone, at any place and time by applying the internet and digital technologies, bearing on with an excessively design precept. An e-learning Management System most often operates inside a web browser, behind a server sign-on process. This gives all students and instructors easy access to courses on the go, while administrators and leaders can monitor student's progress and make improvements. The most basic eLMS contains the core function that enables administrators and instructors upload learning materials, contents, deliver lessons to students, servicing notifications and sharing data with authorized users.

2. RELATED LITERATURE REVIEW

During covid-19 pandemic era, there was the need for academic continuation therefore educational institutions rapidly accepted and shifted to e-learning. However, the movement to web-based mode raised many questions on the quality of education (Sahu, 2020). E-learning is described as the delivery of learning through information and technology with the use of the Internet (Hong et at., 2017 and Aljawarneh 2020). E-learning can be carried out in two main formats: synchronous and asynchronous. As the name suggest, synchronous mode of e-learning involves real-time interaction between lecturers and students. It aims to model the communication mode of a remote classroom. Examples of synchronous mode of learning includes live webinars or virtual classrooms environment. Asychronous learning on the other hand, introduces temporal flexibility. It does not required real-time interaction; instead, the learning content is available online for students to access at their own pace. Muhammad (2021) examined the challenges and barriers confronted during switching to online due to the Covid-19 pandemic by evaluating the learners' new capabilities in online education and the feasibility of the virtual methods of learning.

Viner et al., (2020) examines existing knowledge to identify the effects of school closures and other social distancing measures taken during outbreaks on infection rates and virus contagion. It was suggested that school closure played a relatively small role in the controlling of Covid 19 transmission, and that the insignificant benefits such closures brought to transmission reduction, could be easily outweighed by their fundamental negative economic and social aftermath (Viner et at., (2020). Shahzad et al., (2020) carried out a study on effects of Covid 19 in e-learning on higher education institutions students. The study made a comparison of both male and female to e-learning portal usage. The data collected using structured questionnaire were analyzed, verified and found that males and females have a different level in terms of usage toward e-learning platforms. E-learning is the use of internet and various other technological facilities for the development of educational content, instructional delivery and program management (Fry, 2001). Covid 19 pandemic has created a lot of opportunities and challenges to educational system to enable them strengthen, improve their technological facilities and knowledge systems, and also the lockdown gave a lot of hope to students and lecturers to continue their daily academic responsibilities through the use of online platforms like Zoom, Microsoft Teams, Telegram etc. Moore et al., (2019, 2020) suggested some amount of procedures to overcome the Covid 19 pandemic situation such as health related precautions like keeping our distance from each other, and avoiding social gatherings.

Effective learning and quality education is needed for overall developments of students (Arkorful and Abaidoo, 2014) as the advantages and disadvantages of online teaching and learning under the influence of the Covid 19 pandemic was clearly discussed by Kuldeep (2020). Kumar (2019) carried out a survey on the awareness, benefits and challenges of e-learning among the students of Kurukshetra University. It was revealed that majority of students agreed to e-learning as it provides an attractive learning environment and helps to acquire new ideas. The result of this study shows that awareness about e-learning among the university students was good, but e-learning software's knowledge was very poor and their main source to know about e-learning was the internet.

Additionally, Carrillo and Flores, (2020) conducted a review of the literature between January 2000 and April 2020 on online learning practices in educational sector to explore how and why online teaching and learning in education occurs, and also discussing its impacts in the context of the pandemic.

The review highlighted the complex nature of this type of learning, discussing factors such as social, cognitive and teaching issues and the need for a comprehensive view of the instructions of online web-based learning used to support teaching and learning (Carrillo and Flores, 2020). Daoud et al., (2020) conducted a review focused on the problems of equity regarding home internet access by ascertaining the educational value of providing internet facilities at home for school-aged children. It found a range of reciprocal relations that were mostly positive between access to home internet network and educational value across three functions; qualifications (academic knowledge and skills), subject (strengthening individually) and socialization (of future citizens). However, the correlation was not straightforward, nor did it imply causation, it was fuzzy in nature.

The educational value in home internet use is affected by various variables, the nature of web-based activities such as how the technology has been used and socio-economic status (Daoud et al. 2020). Some web-based emergency learning ideas are criticized for not adhering to the right instructions laid out by educational norms as the best practices (Hodges et al., 2020). In addition, shifting into e-learning platforms has raised cause for concerns regarding surveillance and privacy and its impact on the livelihood of students. A study that aim to map the scientific literature in the areas of education and management in the context of the Covid 19 pandemic and its impact. The studies chosen for the analysis were found to be of various analysis and the most relevant of which was qualitative. The analysis revealed that research in the disruption in learning and scientific production caused by the pandemic is barely found, which might be as a result of the lack of empirical data (Rodrigues et al, 2020).

2.1 Research Objectives

The purpose of this study is to find out university students' perception towards e-learning during Covid 19 pandemic using four software quality attributes which are efficiency and effectiveness, flexibility and usability. Furthermore, three universities were used to sample students' perceptions of the post implementation review of using e-learning management systems during the Covid 19 pandemic.

The objectives of the study are to:

i. Identify the adaptation of e-learning systems during and after Covid 19.
ii. Identify the efficiency of e-learning systems during and after Covid 19.
iii. Identify the flexibility of the e-learning system to its users.
iv. Find out the usability levels of e-learning systems to users.

In other to achieve these objectives, the following research questions are necessary thus;

i. How do we identify the adaptation of e-learning systems during and after Covid-19.
ii. How do we identify the efficiency of e-learning systems during and after Covid-19.
iii. How do we identify the flexibility of the e-learning system to its users.
iv. How do we substantiate the level of users' usability of the e-learning systems.

2.2 Electronic Learning Management System (eLMS) Software Quality Attributes

Software quality is defined as a field of study and practice that describes the desirable attributes of software products. These attributes can be used to measure user's satisfaction and overall quality of the software. Software quality is best exemplified by fixed quality models, such as ISO/IEC 25010:2011. This standard describes a hierarchy of eight quality characteristics, each composed of sub-characteristics namely functional suitability, reliability, operability, performance efficiency, security, compatibility, maintainability and transferability. Additionally, the standard defines a quality-in-use model composed of five characteristics namely effectiveness, efficiency, satisfaction, safety and usability. This research focus is on user's experience and satisfaction while using the eLMS, as such the researchers will be using four attributes thus; Efficiency, Adaptability, Flexibility and Usability to quantitatively determine our research objectives.

Efficiency

Efficiency can be defined as using the resources optimally where resources could be memory, CPU, time, files, connections, databases etc. Efficiency is generally against the code quality measures that were considered to improve effectiveness, more efficient code is usually more difficult to understand, hard to maintain, sometime very hard to test (Kuldeep 2020). E-learning is the vast method of learning/educating. It is of importance that its impact is put into consideration, particular feature is put into the questionnaire in order to find out if e-learning has brought about any change in the educational sector, the resources expended by the user in relation to accuracy and completeness of the goals to achieve, has it help improve the students reading and learning skills. Has the implementation of e-learning brought about any change in the various institutions and how effective was it during Covid 19 pandemic.

Flexibility

Software flexibility is one of the properties that indicate if the software is easy to change. Flexible software can easily adapt to user requirement and/or environment changes during the software development period or after the software is deployed (Chen et. al., 2006). E-learning Management system has gone a long way in offering flexibility to students, in the sense that they are able to study at their own pace, always return back to what they have missed.

Usability

Usability is a controlled aspect of User experience design (UX) that ensures the end-user does not strain or encounter problems with the use of a product or web site's user interface. A user experience designer can control accessibility, user interface, information architecture and usability to suit the uncontrolled aspects like goals, user lifestyle and habits. Usability describes how friendly the system is, how the interface is, can the system handle both input and output of learning materials or contents. This part of the questionnaire enable us understand how each institutions system is able to interact with its users.

Adaptation

Software adaptability may be defined as the ability of a software system to independently monitor its behavior and eventually modify the same according to changes in operational environment or in the system itself. Software Adaptation promotes the use of adaptors specific computational entities whose main goal is to guarantee that software components are able to interact in the right way not only at the signature level, but also at the behavioural, semantic, and service levels.

3. RESEARCH METHOD

A set of structured questionnaires were constructed using 4 point likert scale with questions addressing eLMS Adaptation, Efficiency, Usability and Flexibility during Covid 19 pandemic and afterwards. An online version of the questionnaire was equally created using Google forms and the link was posted on various target audience social media platforms to get their responses. Three universities in Edo State was used to achieve our population sample. The data gotten from the research was compiled and analyzed using automated spreadsheets. The targeted audiences were students from Igbinedion University Okada (IUO), Benson Idahosa University (BIU) and University of Benin (Uniben). The analysis of the various respondents is shown as follows:

Table 1.0: Respondents to E-learning Adaptation of e-LMS in Igbinedion University

	Questions	Yes	No	Not sure	indifferent
Q1	Are you interested in e-learning management system?	30	25	5	8
Q2	Do you operate online learning in your institution before Covid 10 lockdown?	10	0	0	0
Q3	In your opinion has online learning impacted the use of ICT facilities during the Covid-19 lockdown	19	0	0	0
Q4	Has your institution fully adapted e-learning management system after the Covid 19 Lockdown	10	0	10	0
Q5	Has online learning been beneficial to your studies	6	0	0	2
	Total (Percentage)	75 (60.0)	25 (20.0)	15 (12.0)	10 (8.0)

In Igbinedion University Okada, as shown in Table 1.0, of the 125 students from various departments that responded, 60.0% affirmed that both the students and staff adapted to the e-LMS usage while about 20% indicated that the students did not adapt to the e-learning system. 12.0% where not really sure whether the university fully adapted to the e-LMS of while 8% was completely indifferent.

Table 2.0 Representation of Adaptation OF e-LMS in Benson Idahosa University

	Questions	Yes	No	Not sure	indifferent
Q1	Are you interested in e-learning management system?	33	10	15	4
Q2	Do you operate online learning in your institution before Covid 10 lockdown?	13	0	0	0
Q3	In your opinion has online learning impacted the use of ICT facilities during the Covid-19 lockdown	22	0	0	0
Q4	Has your institution fully adapted e-learning management system after the Covid 19 Lockdown	7	0	15	0
Q5	Has online learning been beneficial to your studies	6	17	0	2
	Total (Percentage)	80 (55.94)	27 (18.88)	30 (20.97)	6 (4.21)

In Benson Idahosa University, of the 143 students from various departments that responded to the questionnaire both manually and online, 55.94% show great adaptation to e-learning during the Covid 19 pandemic lockdown. While 18.88% of the students/staff had no adaptation to use of e-LMS.

Table 3.0 Representation of responses on Adaptation of e-LMS in University of Benin

	Questions	Yes	No	Not sure	indifferent
Q1	Are you interested in e-learning management system?	40	20	15	30
Q2	Do you operate online learning in your institution before Covid 10 lockdown?	22	0	0	0
Q3	In your opinion has online learning impacted the use of ICT facilities during the Covid-19 lockdown	12	8	0	0
Q4	Has your institution fully adapted e-learning management system after the Covid 19 Lockdown	0	0	15	7
Q5	Has online learning been beneficial to your studies	15	25	0	7
	Total (percentage)	95 (44.19)	53 (24.65)	30 (13.95)	37 (17.21)

In University of Benin, 215 students that responded from various departments, 44.19% had relatively low adaptation to e-learning during the Covid 19 pandemic. While 13.95% were not sure and 17.21% where indifferent towards the adaptation of the e-learning system.

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Table 4.0: Representation of Response on Efficiency of e-LMS in Igbinedion University

	Questions	Yes	No	Not sure	indifferent
Q1	Do you have access to high speed internet network service in the institution before Covid 19 pandemic.	20	6	0	0
Q2	Did you notice any improvement in resources/materials/lectures notes in your institutions e-learning system during the Covid 19 pandemic.	15	0	0	0
Q3	Did you have fast connectivity to e-learning management system during Covid 19.	9	0	0	0
Q4	Did you experience any challenges when using the online learning software during the Covid pandemic	35	0	0	0
Q5	When they are challenges during surfing, do you get prompt response from the technical team in the institution.	5	15	10	5
		70 (63.2)	21 (16.8)	10 (8.0)	15 (12.0)

Table 4.0 shows the response of efficiency in the e-LMS implementation in Igbinedion University Okada, of the 125 students from various departments that responded to the questionnaire, 62.2% agreed to the effectiveness of the use of e-LMS in the institution during the Covid 19 pandemic lockdown. While 16.8% responded low effectiveness, 8.0% where not sure and 12.0% where indifferent towards the effectiveness of the e-LMS in the University.

Table 5.0: Representation of respondents on Efficiency of e-LMS in Benson Idahosa University

	Questions	Yes	No	Not sure	indifferent
Q1	Do you have access to high speed internet network service in the institution before Covid 19 pandemic.	20	6	0	0
Q2	Did you notice any improvement in resources/materials/lectures notes in your institutions e-learning system during the Covid 19 pandemic.	13	3	8	10
Q3	Did you have fast connectivity to e-learning management system during Covid 19.	10	0	0	10
Q4	Did you experience any challenges when using the online learning software during the Covid pandemic	30	10	0	0
Q5	When they are challenges during surfing, do you get prompt response from the technical team in the institution.	10	15	10	5
		83 (53.55)	29 (18.71)	18 (11.61)	25 (18.13)

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Table 5.0 shows the 155 responses of efficiency in the use of e-LMS in Benson Idahosa University. 53.55% agreed to the efficiency of e-LMS in the institution during the Covid 19 pandemic lockdown. While 18.71% said it was not efficient, 11.61% where not sure and 18.13% where indifferent towards the effectiveness of the e-LMS in their university.

Table6.0: Representation of Response on Efficiency of e-LMS in University Benin

	Questions	Yes	No	Not sure	indifferent
Q1	Do you have access to high speed internet network service in the institution before Covid 19 pandemic.	15	3	0	0
Q2	Did you notice any improvement in resources/materials/lectures notes in your institutions e-learning system during the Covid 19 pandemic.	20	3	12	10
Q3	Did you have fast connectivity to e-learning management system during Covid 19.	5	0	10	20
Q4	Did you experience any challenges when using the online learning software during the Covid pandemic	35	5	0	5
Q5	When they are challenges during surfing, do you get prompt response from the technical team in the institution.	12	20	25	50
		87 (53.55)	31 (18.71)	47 (11.61)	50 (18.13)

Table 6.0 shows the 215 respondents from the various departments on efficiency of e-LMS implemented in University of Benin. 40.41% agreed to the effectiveness of e-LMS in the institution during the Covid 19 pandemic lockdown. The level of efficiency was relatively low as indicted by 14.37% of the respondents. 21.80% where not sure and 23.42% where indifferent towards the effectiveness of the e-LMS in the university during the Covid 19 pandemic.

Table 7.0: Representation of Response on Usability of e-LMS in Igbinedion University Okada

	Questions	Yes	No	Not sure	indifferent
Q1	Are you satisfied with the technology and software used in your institution for e-learning.	20	0	0	2
Q2	Is the e-learning system difficult to understand.	0	20	0	10
Q3	Have your experience of e-learning management system enhance as a result of frequent usage during the Covid 19 lockdown	14	0	0	0
Q4	Is the link, hyperlinks and icons in the software easy to identify and use.	15	4	0	0
Q5	Is the online learning management system software user friendly.	30	0	0	10
		79 (63.2)	24 (19.2)	0 (0)	22 (17.6)

Table 7.0 shows the usability level of e-LMS in Igbinedion University with 63.2% saying the e-learning management software is usable. A negligible 19.2% of the respondents said it's not usable while 17.6% where indifferent towards the usability of the e-learning system in the institution.

Table 8.0: Representation of Respondents on Usability in Benson Idahosa University

	Questions	Yes	No	Not sure	indifferent
Q1	Are you satisfied with the technology and software used in your institution for e-learning.	30	0	0	0
Q2	Is the e-learning system difficult to understand.	0	14	20	0
Q3	Have your experience of e-learning management system enhance as a result of frequent usage during the Covid 19 lockdown	20	0	0	0
Q4	Is the link, hyperlinks and icons in the software easy to identify and use.	16	5	0	0
Q5	Is the online learning management system software user friendly.	60	0	0	0
		116 (74.84)	19 (12.25)	20 (12.91)	0 (0)

Table 8.0 shows the usability level of e-learning in Benson Idahosa University. It showed a 74.84% usability of the e-learning system, 12.25% said they did not experience user friendly features from the system, while 12.91% were not sure about the usability of the e-learning system.

Table 9.0: Representation of Response on Usability in University of Benin

	Questions	Yes	No	Not sure	indifferent
Q1	Are you satisfied with the technology and software used in your institution for e-learning.	20	0	0	20
Q2	Is the e-learning system difficult to understand.	0	50	0	15
Q3	Have your experience of e-learning management system enhance as a result of frequent usage during the Covid 19 lockdown	9	0	9	0
Q4	Is the link, hyperlinks and icons in the software easy to identify and use.	15	19	0	3
Q5	Is the online learning management system software user friendly.	35	0	0	20
		79 (36.74)	69 (32.09)	9 (4.19)	58 (26.98)

Table 9.0 shows the usability level of e-learning in University of Benin. It indicated 36.74% usability of the e-earning system, 32.09% said the e-learning system was not user friendly. 26.98% were not sure of its usability while 4.195 were indifferent towards the e-learning system.

Table 10.0: Representation of Respondents on Flexibility in Igbinedion University Okada

	Questions	Yes	No	Not sure	indifferent
Q1	Is your institution e-learning software compactable with all smart devices	60	0	0	0
Q2	Can you carry out all your academic activities with the University enabled e-learning management platforms.	20	0	0	0
Q3	Does the system allow you to easily upload and download study materials	16	12	0	0
Q4	Are you able to access the e-learning management system outside the remote learning environment.	17	0	0	0
		113 (90.40)	12 (9.60)	0 (0)	0 (0)

Table 10.0 shows the representation of flexibility in the study of e-learning at Igbinedion University with 90.4% indication of flexibility of the e-learning system with 9.6% said the affirmative. It is worthy to note that none of the students where indifferent or not sure of this key variable under analysis.

Table 11.0: Representation of Respondents on eLMS Flexibility in Benson Idahosa University

	Questions	**Yes**	**No**	**Not sure**	**indifferent**
Q1	Is your institution e-learning software compactable with all smart devices	60	0	0	0
Q2	Can you carry out all your academic activities with the University enabled e-learning management platforms.	20	10	0	0
Q3	Does the system allow you to easily upload and download study materials	25	10	0	0
Q4	Are you able to access the e-learning management system outside the remote learning environment.	30	0	0	0
		135 (87.10)	20 (12.90)	0 (0)	0 (0)

Table 11.0 shows the representation of flexibility in the study of e-learning at Benson Idahosa University recorded 87.10% in the positivity towards the flexibility of the system used in the University. While 12.90% were not inclined towards it. It is noted that most of the the students found the system flexible and reliable.

Table 12.0: Representation of Respondents on eLMS Flexibility in University of Benin

	Questions	Yes	No	Not sure	indifferent
Q1	Is your institution e-learning software compactable with all smart devices	72	0	0	0
Q2	Can you carry out all your academic activities with the University enabled e-learning management platforms.	30	10	0	0
Q3	Does the system allow you to easily upload and download study materials	35	15	0	0
Q4	Are you able to access the e-learning management system outside the remote learning environment.	53	0	0	0
		190 (88.37)	25 (11.63)	0 (0)	0 (0)

Table 12.0 shows the representation of flexibility in the study of e-learning in University of Benin, 88.37% showed positivity towards the flexibility of the system used the institution while 11.63% where indifferent towards it. It is noted that most of the students found system flexible and reliable.

4. SUMMARY

The final results analysis produced respondents of 638 students from various universities, each with their opinions on our deterministic factors, 125 respondents from IUO, 155 from BIU 215, from Uniben. Based on the factors used to gather information 19.59% of IUO students, 22.4% from BIU and 33.69% from Uniben indicated the adaptation level of e-learning system in their universities. 19.59% response was gotten from IUO, 22.29% from BIU and 33.71% from Uniben pointed out the effectiveness of the system. On usability, 19.59% from IUO, 24.29% from BIU and 33.7% from Uniben contributed to the usability of their various e-learning systems. On flexibility, various universities data were also compiled thus, 19.59% respondents from IUO, 24.29% from BIU, 33.7% from Uniben.

The results from the correlation shows that most of the respondents are of the opinion that e-learning is very beneficial to universities and with regard to some of the factors that come together to make e-learning an important aspect of learning in education such factors are: personal improvement and experience, improve efficiency and quality of knowledge and learning. Based on the study, the responses shows a great will to continue using e-learning as a means of studying after the Covid 19 era. Though, network issues and lack of quality faculties were major barriers. E-learning portals provides services of adaptability to students of universities using the portal. The research concludes that e-learning can provide a personal learning experience, it takes education to the wider beyond and also provides high-level quality of learning to users and also the popularity of e-learning student's especially during the Covid 19 pandemic.

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