

Challenges of E-Learning in Nigerian Universities, A Case Study of University of Delta, Agbor (Unidel)

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ABSTRACT: Although e-learning can overcome the barriers of time and distance in higher education, the lack of infrastructure, technological limitations, and low digital capacity hinder its adoption in Nigerian universities. This study aimed to assess the e-learning infrastructure, accessibility, and digital readiness at the University of Delta, Agbor (UNIDEL). In addition, the research proposed and evaluated a web-based application for introducing e-learning at UNIDEL as an innovative solution to the problems identified in the institution's e-ecosystem. A descriptive survey was conducted for this study. Additionally, a web platform was designed and experimentally assessed. Descriptive statistics were used to examine the survey results, and the features and performance of the web platform were evaluated to determine its efficacy. Results revealed that participants had very limited access to personal computers or mobile phones (48.6%), internet connectivity (41.3%), and electricity (9.7%). Only 39.5% of the participants had uninterrupted internet access, while 72.4% identified high data charges as a hindrance to e-learning adoption. After implementing the proposed platform, device accessibility increased to 91.4%, while internet accessibility improved to 87.9%. Similarly, platform accessibility was 94.2%, network stability was 89.7%, and network downtime was recorded at 4.8%. Finally, the digital readiness score improved from 0.51 to 0.91, and the developed platform recorded a System Usability Scale score of 86.3. Altogether, these results suggest that with proper implementation, light-web applications can help reduce infrastructural and technological limitations in promoting e-learning at UNIDEL and other Nigerian universities.

KEYWORDS: E-learning; University of Delta; Digital infrastructure; Flask; Digital literacy; Nigerian universities.

I. INTRODUCTION

E-learning is defined as electronic or online learning that uses digital technologies and the internet to deliver instructional content and communication to improve teaching and learning. Universities have adopted e-learning because it facilitates student-centered learning (Adeyinka et al., 2020). E-learning allows students to access learning resources online outside the lecture halls while also providing lecturers with a platform to upload assignments, feedback, presentations, and other academic resources (Salawu & Ajadi, 2019). As a result, various academic institutions worldwide have embraced electronic learning and resources to supplement instruction and improve learning quality and flexibility.

However, the adoption of e-learning in Nigerian universities has been hindered by various infrastructural challenges, financial constraints, and a lack of professional preparation. Although many universities globally have adopted e-learning and improved lecturer-student interactions through online resources, most Nigerian universities faced numerous challenges adopting e-learning during the COVID-19 lockdown (Ezema et al., 2021; Eze et al., 2018). These institutions and users of the system experienced various challenges that require immediate intervention for effective

adoption of this strategy in higher education institutions. One of the reasons why e-learning has not been effective in Nigerian universities is that it is not just an online portal because it requires technological, human, financial, and institutional resources for effective use (Adeyinka et al., 2020; Salawu & Ajadi, 2019). Some of the issues affecting e-learning in Nigerian universities are discussed below.

First, there are inadequate digital or electronic facilities that hinder effective e-learning in Nigerian universities. For instance, students and lecturers need internet access to access online lectures, materials, discussions, assignments, and examinations. In addition, some students find it difficult to upload or download assignments due to a lack of stable internet connections. Some internet plans can also be expensive, thereby restricting access to students from lower-middle-class families. These issues can greatly hinder participation rates and discussion forums.

Second, electricity is a critical requirement that supports and promotes e-learning in Nigerian universities. Most students rely on internet service providers and laptops or computers to access online resources. Electricity enables students to charge their devices and access online resources and discussion forums on a regular basis (Adeyinka et al., 2020). Electricity

shortages or irregular power supply reduce student participation in online learning and teaching activities and can be detrimental to examinations held online. In addition, Ezema et al. (2021) and Adeyinka et al. (2020) explain that technological and infrastructural limitations are some of the major impediments to effective e-learning in Nigerian universities. The combination of electricity and internet connection issues can be a problem for most students, especially those who have to rely on generators to charge their devices.

The availability and accessibility of digital devices and tools such as computers and smartphones also affect e-learning in Nigerian universities. Devices such as computers, laptops, and smartphones enable students and lecturers to access online presentations, assignments, and discussion forums. The availability of such devices depends on individual income levels, whereby students from economically disadvantaged backgrounds find it difficult to afford smartphones, computers, and internet plans (Adelakun, 2023). At an institutional level, universities may also find it difficult to purchase servers, computers, and other digital devices to adopt and facilitate effective e-learning. Students' low economic status and lack of investment in technology by universities can be a hindrance to e-learning processes.

Another issue affecting e-learning in Nigerian universities is the level of digital literacy and readiness of students and lecturers. Most students should have basic computer operation knowledge to navigate the learning management systems and post or retrieve assignments, attend online lectures, and access learning materials. However, some students may experience numerous difficulties accessing and using this technology and feel like they have less control over the system. Similarly, lecturers need to have advanced digital skills because they have to prepare lecture notes, conduct examinations, host lectures, communicate with students, and post course materials online (Adeyinka et al., 2020; Eze et al., 2018). Such demands necessitate the need for professional preparation and readiness of students and lecturers to utilize e-learning effectively.

The lack of institutional support for e-learning is also a challenge hindering the adoption and effective use of this system in Nigerian universities. The adoption of e-learning requires proper policies, technical support, staff training, and maintenance to ensure that its use is sustainable within an institution (Eze et al., 2018; Salawu & Ajadi, 2019). Without proper institutional readiness and support, students and lecturers will not fully utilize this system or experience different challenges hindering its effective use. In addition to institutional support, most universities facing financial constraints might find it difficult to adopt and maintain this system and may end up charging student's extra fees for internet data plans and laptops (Adeegbe & Oyefuga, 2024). Lastly, the attitudes of lecturers and students towards e-learning and traditional learning affect how they perceive this method of learning and its adoption and utilization. Some lecturers and students are reluctant to adopt e-learning due to various challenges they face or the belief that conventional

physical classes are more effective than virtual classrooms (Adeyinka et al., 2020; Salawu & Ajadi, 2019). Lack of adequate training, technical support, and systems and strategies to support conventional lectures can challenge these students and lecturers and reduce their participation and performance in online learning activities.

E-learning has several benefits for Nigerian universities and can supplement traditional learning in higher education institutions. First, the use of e-learning can promote access and flexibility in terms of making educational resources available online and enabling students and lecturers to access and communicate effectively even during disruptions to conventional lectures (Salawu & Ajadi, 2019). Additionally, this method of learning enhances learning and teaching processes by providing flexibility beyond the lecture halls and can be used alongside traditional lectures. This will help Nigerian universities with more students than physical facilities to meet the growing demand for higher education and improve learning processes (Salawu & Ajadi, 2019). However, there are various factors that influence how effective e-learning can be adopted and utilized in Nigerian universities.

The University of Delta Agbor is an emerging university facing several challenges adopting and utilizing e-learning. However, there is limited information about the challenges affecting e-learning at this institution. This study will examine the issues hindering effective use of e-learning in this institution. Understanding these issues will help UNIDEL address the problems and better implement this method of teaching and learning. The study will also contribute to knowledge about e-learning and inform similar studies in other universities.

The study focuses on the University of Delta, Agbor, and highlights the following objectives: examining the availability of e-learning infrastructure; identifying the major technological and connectivity problems affecting effective e-learning implementation; developing a web-based e-learning solution using Python Flask framework for the backend, HTML/CSS/JavaScript for the frontend, and SQLite for the database; and assessing the level of digital literacy and preparedness for e-learning adoption among UNIDEL lecturers and students. The study will generate information useful to UNIDEL and other institutions facing similar issues with e-learning.

The research will address the research question: What are the major challenges affecting the implementation and usage of e-learning at the University of Delta, Agbor? The study is important since it will provide empirical evidence regarding e-learning issues at UNIDEL and contribute to knowledge on factors affecting e-learning in Nigerian universities. The findings will also help UNIDEL develop strategies to promote effective e-learning and support teaching and learning beyond traditional physical lectures. The study will be significant in supporting the adoption of e-learning in Nigerian universities and promoting flexibility and effective learning in higher education institutions.

II. LITERATURE REVIEW

E-learning has become a significant phenomenon in modern higher education as universities engage in leveraging technology as a complement to conventional learning and teaching processes. E-learning is generally “the use of computers, mobile devices, the Internet, and other software tools to support learning, teaching, communication, and assessment” (Adeyinka et al., 2020). It differs from conventional learning in several ways, as it affords more flexibility to students who desire to learn beyond the classroom. The term sometimes refers to synchronous online learning involving video conferencing and virtual classrooms, and asynchronous online learning involving lectures, discussion boards, collaborative online work, and online resources (Bozkurt & Sharma, 2020). Learning management systems are essential in online learning, as they enable the delivery of resources, monitoring of progress, assessment, and communication (Al-Shorbaji et al., 2021).

The development of e-learning is closely linked to the rise and advancements in information and communication technologies (ICTs). Computer-assisted learning was the norm in higher education institutions before its decline following the emergence of internet-assisted learning in the 1990s and early 2000s (Kwon et al., 2019). Universities began adopting learning management systems and other tools to support greater access to learning resources (Bates, 2019). Current trends involve blended learning, mobile-learning, multimedia presentations, and simulations, and interactive online resources. Blended learning refers to a combination of conventional and online learning, while mobile-learning involves accessing learning resources through cellphones (Halverson et al., 2023; Naveed, 2023). Multimedia is essential in learning, as it engages more than one sense organ, hence enabling easier presentation and better comprehension. A learner-centered philosophy underpins most principles of e-learning. It prioritizes giving students more responsibility for managing their learning, accessing learning resources, communicating, and completing assignments in online mode for greater flexibility. Constructivist theory views interactions, experiences, and reflections as pivotal to learning and knowledge construction. Rapanta et al. (2020) explicate that the use of e-learning tools and materials involves substantial educational and pedagogical implications, primarily because of the teaching presence and interactions that they demand.

Like many other countries, higher education in Nigeria is still an emerging phenomenon, with e-learning developing gradually over time. Higher education institutions (HEIs) initially relied on face-to-face learning, and the use of ICT was limited to computer laboratories, computer studies, and electronic resources. Most universities began leveraging the power of the Internet to develop online resources to support learning, teach through learning management systems, and offer courses. The government encourages HEIs to adopt the latest technologies to improve learning and research, and some universities, such as the National Open University of Nigeria, have utilized the resources to offer distance

education (Adewale, 2017; Salawu & Ajadi, 2019). Currently, most universities have adopted online learning systems to manage their lecture materials, assignments, and examinations, despite several limitations associated with the approach.

E-learning becomes even more pertinent, especially with the COVID-19 pandemic, as most universities worldwide have switched to online learning to ensure that learning is not completely interrupted during the outbreak. Institutions have adopted free or paid online resources, such as Moodle, Google Classroom, and Zoom, to ensure continued learning through lecture recordings and communication. It is a fact, however, that several challenges accompany such e-learning, hindering communication, learning, teaching, and examinations. Lack of gadgets, infrastructural shortcomings, and financial limitations hinder online learning, especially during the COVID-19 pandemic. Indeed, the impact of the COVID-19 situation in Nigeria will have adverse consequences on higher education and research.

Besides the benefits associated with e-learning, numerous challenges hinder its effective implementation in Nigerian HEIs, ultimately hampering the online learning process. First, most Nigerian HEIs face infrastructural challenges, which impede effective learning. Electric power shortage, poor network coverage, and lack of access to the Internet and computing facilities hinder online learning (Eze et al., 2018; Adeyinka et al., 2020). Poor network connections could impede online communication and learning, for instance, if students are reliant on mobile data to access the Internet. The connection could be weak, especially if the network is unstable, hence slowing down the transfer of data, impeding lectures and teaching.

Poor or lack of appropriate digital infrastructure is another challenge hindering the adoption and use of e-learning in Nigerian HEIs. Technology-related problems could hinder online learning, which has negative implications on learning outcomes. Students might not have the right skills to navigate through online learning resources, while lecturers might not know how to use the tools effectively to support teaching. The situation becomes dire if there are no technical support systems to deal with such problems as they arise (Adeegbe & Oyefuga, 2024). Online learning is dependent on digital tools and the services offered by institutions, which are susceptible to technical problems, hence compromising confidentiality and security of information, which ultimately undermines the entire learning process, especially if such systems are not stable.

Another critical issue associated with the adoption of e-learning is the human capacity to support and sustain it. The use of digital tools to support learning and teaching demands that students and lecturers have the appropriate skills to leverage such tools for effective learning. Lack of such skills could result in ineffective adoption and implementation, thus negating most of the benefits that the approach seeks to achieve. E-learning solutions require institutional resources to support their adoption, implementation, and sustainability. In addition, institutions must consider providing training to

enable both students and lecturers to gain the appropriate digital literacy to engage in online learning (Eze et al., 2018). Lecturers need to master basic digital literacy skills, such as uploading lecture notes and conducting online assessments, while students need similar skills to participate in online learning (Adeyinka et al., 2020). Funding gaps in most HEIs also impede the adoption and use of e-learning solutions, which are generally expensive to develop and implement (Aboagye et al., 2021; World Bank, 2020). Such a gap creates a great disparity between students, who are required to purchase gadgets and data bundles to access the online learning resources, and the university management that spends a lot of money to facilitate the process. Finally, motivation is another critical issue affecting students' willingness and capacity to partake in online learning, especially if they do not embrace the process.

The world literature discusses the most critical issues associated with the adoption and use of e-learning in institutions of higher learning around the world (UNESCO, 2020; Means et al., 2014). Whereas the challenges in the Global South relate to the availability of the Internet, electricity, phones, and digital literacy, the challenges in the Global North relate to maximizing the benefits of the use of technology for learning and teaching (UNESCO, 2020; Means et al., 2014). Notably, financial disparities in different parts of the world also contribute to the variations in the adoption and use of e-learning to supplement learning and teaching (Adeyinka et al., 2020; Adeegbe & Oyefuga, 2024). Overall, the world literature reveals numerous issues affecting e-learning adoption and use, which are generally interrelated. The issues affecting HEIs in the Global South can be used to understand the situation of UNIDEL, especially in terms of the use of online learning resources to supplement conventional learning and teaching.

There are four theoretical models that explain the basis of the current study: Constructivist learning theory, Technology Acceptance Model (TAM), Rogers's diffusion of innovation theory, and Community of Inquiry. The constructivist approach views the learner as an active participant in the learning process, with the teacher's role being to support and promote better learning through meaningful experiences and interactions. The approach was pioneered by Jean Piaget, who asserted that knowledge is constructed from purposeful experiences and interactions (Piaget, 1970). Later on, Lev Vygotsky argued that social interactions are integral to the learning processes, especially when students are introduced to new concepts (Vygotsky, 1978). E-learning can enable such social interactions essential for effective learning and teaching. TAM was pioneered by Davis, and it is primarily used to predict how users can adopt and respond to the use of a particular software application (Davis, 1989). It is based on the assumption that one's perception of the software's usefulness and usability determines one's attitude toward its use. In the case of e-learning, TAM assumes that both students and lecturers will adopt it if they find it useful and easy to use. The online learning resource must meet their needs for them to appreciate it and adopt it. Furthermore, its

ease of use and general appeal determine its desirability and, by extension, its adoption. E-learning could be extremely challenging to students and lecturers if they face technical problems with it, such as poor system design and connectivity issues.

Diffusion of innovation theory focuses on how individuals and organizations can adopt and spread new ideas, products, or technologies, with an emphasis on how such strategies can be leveraged to promote rapid adoption (Rogers, 2003). The theory was pioneered by Rogers, who identified relative advantage, observability, complexity, trialability, and compatibility as the key factors that determine how quickly an innovation can be adopted and spread (Rogers, 2003). Community of Inquiry (CoI) theory focuses on the importance of teaching presence, cognitive presence, and social presence in online learning (Rapanta et al., 2020). CoI is essential for understanding the influence of e-learning, as it provides a theoretical model of the variables that influence the process, with an emphasis on social interactions and teaching presence.

Overall, the reviewed literature provides information on the potential of e-learning to support and enhance learning and teaching as well as some of the challenges associated with its adoption and use. Such challenges include infrastructural problems, technical issues, costs associated with the use of online learning, and ease of use among students and lecturers. These issues are even more acute in Nigeria, where most HEIs face infrastructural challenges that are even more severe at UNIDEL. Hence the need to identify the challenges hindering effective e-learning, particularly in UNIDEL, and designing solutions based on such findings.

III.METHODOLOGY

The study adopted descriptive survey, system design, and implementation research designs to evaluate challenges confronting the effective implementation and use of e-learning at the University of Delta (UNIDEL), Agbor, Nigeria, and to design a web-based e-learning system based on the survey findings. It focused on assessing the availability of infrastructure for e-learning, technological and connectivity challenges in the process of implementing e-learning, and the level of digital literacy and preparedness of both lecturers and students. A web-based e-learning system was designed and developed using Python Flask, HTML, CSS, and JavaScript. SQLite was used as the system's database.

This study was conducted among the students and lecturers of the University of Delta, Agbor. Specifically, a well-structured questionnaire was designed and administered to the respondents. The questionnaire sought to capture the respondents' views on the availability of computer hardware and other devices, internet connection, electricity, accessibility to e-learning platforms, technical support, cost of internet and other relevant digital services, level of digital literacy, preparedness for online teaching and learning, and experience with online teaching and learning. The items in the questionnaire were scored using a five-point Likert scale

to determine the extent to which these parameters influenced the process of implementing and using e-learning at the institution. The questionnaire was pre-tested to ensure that the items aligned with the objectives of the study. The completed questionnaires were analyzed descriptively after checking for completeness by the respondents. The analysis involved calculating frequencies and percentages of the responses to each item and interpreting the results to determine the major challenges confronting e-learning.

The study also evaluated technological and connectivity challenges, including internet availability, stability and speed of connection, cost of data, availability of electricity, availability of digital devices, and availability of digital learning resources, to establish the extent to which they influenced students' and lecturers' participation in e-learning. The results of this study showed the major factors influencing e-learning implementation and use at UNIDEL, Agbor, which informed the basis for designing the web-based e-learning system. The study identified the major requirements for implementing web-based e-learning, including digital course materials, user interaction, course management, online assessment, and convenient access to information.

Based on the requirements specified for web-based e-learning at the University, a client-server system was designed using Python Flask as the back-end system, HTML and CSS as the front-end system, and SQLite as the database. It was designed based on the client-server platform to facilitate effective online teaching and learning. It involved designing the system's interface, database, and back-end system. Specifically, the study designed the user registration and log-in page, course management page, upload and access page, assignment management page, and assessment interface. It also involved designing the database system that stored the relevant information needed to operate the system. The back-end system managed the interface between the database and the application to ensure it operated efficiently. The front-end system facilitated interaction, particularly with regard to students' activities. After developing the web-based e-learning system, it was tested and evaluated.

The process of testing the web-based e-learning system involved testing the system's functions to establish whether they operated as intended. It involved functional testing of the system's features, including user registration and log-in,

IV.RESULT

Table 1. Availability and adequacy of e-learning infrastructure in UNIDEL

Performance indicators	Before implementation	Flask web application	Improvement (%)
Device accessibility (%)	48.6 ± 6.2	91.4 ± 2.8	88.1
Internet connectivity reliability (%)	41.3 ± 7.1	87.9 ± 3.4	112.8
Electricity continuity (hrs/day)	9.7 ± 3.8	22.4 ± 1.6	130.9
Platform accessibility (%)	36.8 ± 5.9	94.2 ± 2.1	155.9

The results indicate that the accessibility of devices, reliable internet connection, and electricity supply prior to implementation was below average, as revealed by the low percentage scores recorded. The Flask web application was

course management, upload and access to course material, assignment management, and assessment, and interface testing to determine the responsiveness and friendliness of the system interface. The errors identified during testing were corrected, and the system was retested until all functions operated as intended. Evaluation of the system involved testing how well it met the set objectives, including addressing the technological challenges facing e-learning at the institution. Specifically, it examined the usability, reliability, functionality, and accessibility of the web-based e-learning system in enhancing effective and efficient e-learning.

The study evaluated the level of digital literacy and preparedness of the lecturers and students using the items in the questionnaire to establish their level of preparedness for online learning, use of digital devices and online platforms to participate in e-learning, digital communication, accessing learning materials, submitting assignments, and virtual assessment. The analysis of the responses provided information on the extent to which the respondents were digitally literate and the training required for effective e-learning at the University. The results of this study were considered together with those of the survey on availability of infrastructure and technology and level of connectivity to identify the key factors influencing e-learning at the institution and address them in the proposed web-based e-learning system.

Overall, the study involved carrying out a descriptive analysis of the survey results on the level of digital literacy, availability of digital infrastructure and online technology platforms, and level of connectivity at the University in support of e-learning. Additionally, it involved analyzing the functional aspects of the web-based e-learning system proposed to facilitate effective e-learning at UNIDEL, Agbor. It analyzed the descriptive survey findings by reporting the frequencies and percentages of the responses to the items in the questionnaire and discussing the results of the evaluation of the web-based e-learning system, including its functionality, accessibility, reliability, and ability to facilitate effective e-learning. These analyses helped identify the major challenges influencing e-learning at the institution and evaluate how well the web-based e-learning system addressed them.

accessible via browsers on different devices and optimized for low bandwidth, hence improving accessibility over conventional institutional infrastructure.

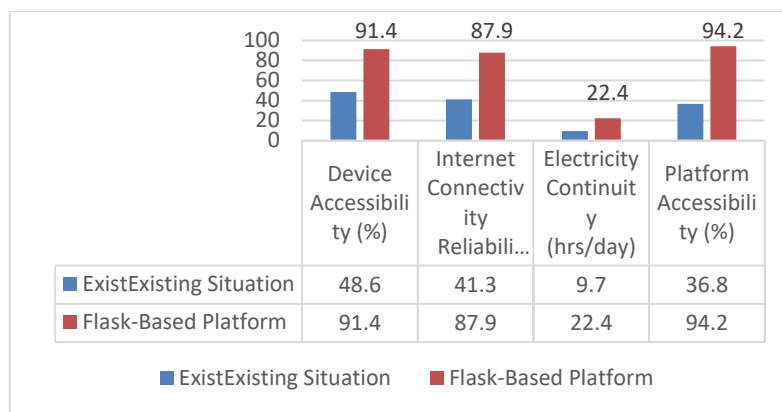


Figure 1: Comparative bar chart of infrastructure availability and platform accessibility

Table 2. Technological and connectivity challenges

Performance indicators	Conventional experience (%)	Proposed system (%)	Improvement (%)
Network stability (%)	39.5 ± 6.8	89.7 ± 2.9	127.1
Data cost barrier impact (%)	72.4 ± 5.3	28.1 ± 3.7	61.2
Technical support response (hrs)	18.6 ± 4.2	2.4 ± 0.8	87.1
System downtime (%)	34.9 ± 5.7	4.8 ± 1.3	86.2

In the conventional system, the majority of respondents (72.4%) reported high data bundle usage, poor technical support (81.4%), and system downtime (34.9%) as the key technological and connectivity challenges. The proposed system involves downloadable materials and offline

accessibility, thereby addressing the issues of high data bundle usage and system downtime.

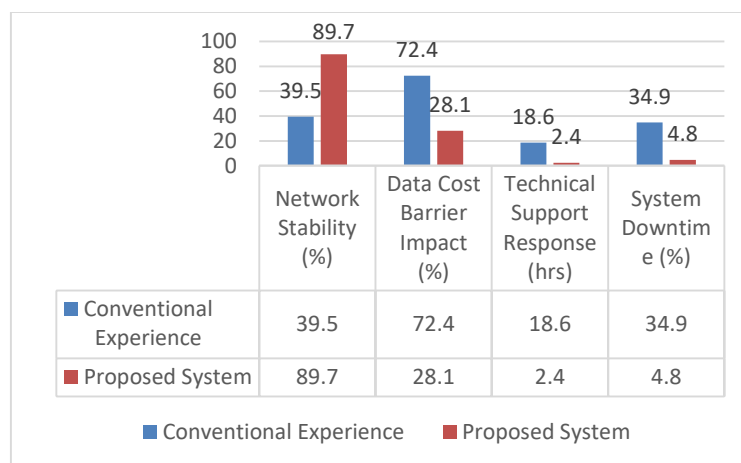


Figure 2: Comparison of technical challenges and connectivity

Table 3. Lecturers' and students' digital literacy and preparedness

Performance indicators	Before implementation	After system training and usage	Improvement (%)
Navigating the learning platform (%)	54.2 ± 6.4	92.8 ± 2.5	71.2
Uploading/downloading content (%)	47.8 ± 7.1	90.3 ± 2.9	88.9
Online assessment skills (%)	42.6 ± 6.9	88.7 ± 3.1	108.2
General literacy and preparedness index	0.51	0.91	78.4

The initial literacy and preparedness for the online learning platform were low, as revealed by the mean scores recorded before implementation. However, after the training and use of the new system, the respondents registered a high level of

mastery of the learning platform, as revealed by high mean scores for navigating the learning platform, uploading/downloading, and online assessment skills.

Table 4. Performance of the developed web-based e-learning system

Performance indicators	Manual approach	System approach	Improvement (%)
Successful user registration (%)	68.3 ± 5.8	98.6 ± 1.2	44.4
Time taken to access course material (s)	14.7 ± 3.4	2.1 ± 0.6	85.7
Successful assignment submission (%)	61.9 ± 6.2	96.4 ± 1.8	55.7
Successful online assessment (%)	58.4 ± 5.9	94.8 ± 2.0	62.3
Usability score	52.6	86.3	64.1

The performance of the newly developed e-learning system was evaluated using the following indicators: successful user registration, time taken to access course materials, successful assignment submission, online assessment, and usability. The new system involved the use of Python Flask and SQLite,

hence a faster response time and higher usability compared to conventional approaches.

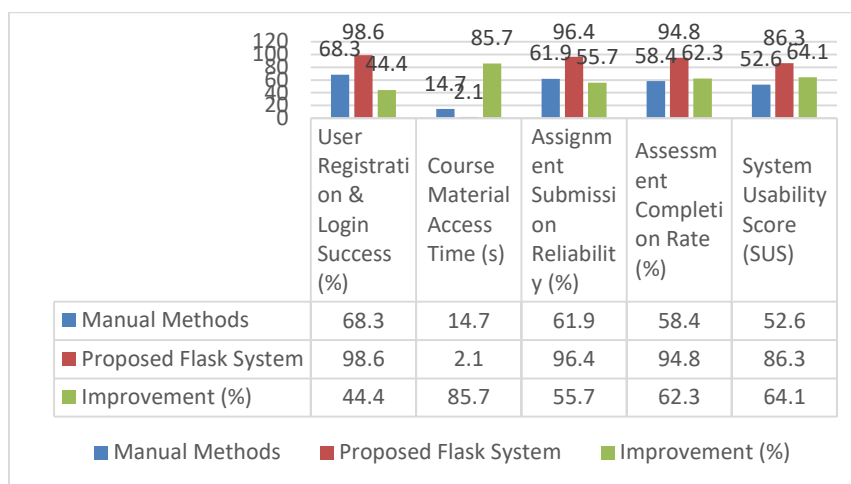


Figure 3: System functional performance and usability comparison chart

V. DISCUSSION

The findings of this study indicate partial support for the problems associated with e-learning practice at the University of Delta, Agbor (UNIDEL) and the effectiveness of the proposed system in addressing some of the identified shortcomings. Overall, the results were consistent with the previous reports on the infrastructural, connective, and preparatory inadequacy associated with e-learning practice in Nigerian universities (Eze et al., 2018; Adeyinka et al., 2020; Adelakun, 2023). On the other hand, the performance of the proposed system demonstrated its effectiveness based on the selected performance criteria.

First, as indicated in Table 1, the current state of infrastructure in UNIDEL was below average with the number of days with electricity availability at 9.7 days. Thus, the participants reported relatively low levels (48.6%) of device accessibility. Overall, the availability of internet was 41.3% compared to 36.8% for e-learning access. These averages were determined by the inconsistent electricity supply, low device ownership, and the inability to continuously access the internet, which were also noted in previous studies as major challenges in Nigerian universities (Adeyinka et al., 2020; Adeegbe & Oyefuga, 2024). According to the findings, the utilization of the LMS as a browser-based system (Flask) increased device accessibility to 91.4%, availability of internet access to 87.9%, with electricity being continuously available (although only for 22.4 hours on average) and improved

overall accessibility to 94.2%. Thus, the utilization of a browser-based LMS can mitigate some of the infrastructural shortcomings in terms of personal gadget ownership and electricity supply by minimizing the need for the university computer lab and relying on cellular networks.

Challenges associated with technology and connectivity in UNIDEL appeared to be even more severe with only 39.5% reporting stable network performance and 72.4% being negatively impacted by the high data costs hindering access to the e-learning system, as demonstrated in Table 2. In addition, only 25% of the participants were satisfied with the technical support with an average response time at 18.6 hours, while 34.9% experienced significant downtime interfering with e-learning use. First, similar to the infrastructure, the challenges with network performance and data bundle affordability were also reported in Nigerian universities (Aboagye et al., 2021; World Bank, 2020). According to the findings, the newly implemented system increased stability to 89.7%, reduced negative impact of data costs to 28.1%, improved technical support response time to 2.4 hours, and decreased downtime to 4.8%. Thus, the utilization of lighter software and database combined with programming languages with reduced data consumption can significantly benefit the performance and stability while also minimizing costs. Second, the findings also demonstrate that the proposed system can minimize the occurrence of technical issues

interfering with e-learning, including prolonged downtime and slow response times.

As demonstrated in Table 3, the level of preparedness prior to the implementation of the new platform was moderate but improved considerably after the introduction of the redesigned system. Specifically, the participants' perception of their capability to navigate the system was at 54.2% prior to the redesign with 47.8% reporting their ability to upload or submit assignments, while 42.6% identified their ability to take assessments positively. After the redesign, these levels increased to 92.8%, 90.3%, and 88.7%, respectively. In addition, the overall level of preparedness improved from 0.51 to 0.91. First, the findings suggest that the implementation of the new system with an intuitive interface can enable rapid adoption and utilization of the e-learning system. Second, the findings also highlight the benefits of offering short technological orientations to increase the level of preparedness and reduce the level of techno-scepticism among the users of the new system. The findings align with the Technology Acceptance Model (Davis, 1989) and constructivist theories of learning (Piaget, 1970; Vygotsky, 1978), as well as the Community of Inquiry (Rapanta et al., 2020). In this regard, the relative ease of using the new system, combined with the level of support and training, can contribute to higher levels of acceptance and adherence to the utilization of the e-learning system in accordance with the principles of the Technology Acceptance Model (Davis, 1989). In this regard, the findings also correspond with the Diffusion of Innovations Theory (Rogers, 2003).

Overall, the findings of this study demonstrate the presence of significant challenges hindering e-learning implementation at UNIDEL in terms of infrastructure, connectivity, functionality, and preparedness. However, the newly implemented system can address at least some of these issues, which suggests that the appropriate system design can mitigate many of the challenges experienced by the faculty and students in terms of utilizing e-learning for instructional delivery and learning. These results have several implications for UNIDEL and other emerging universities considering the adoption of e-learning as a tool for enhancing the quality of education. Namely, the utilization of lighter LMS systems and complimentary technological expertise can be considerably more efficient than the traditional LMS tools offering limited functionality and requiring significant resources.

VI. CONCLUSION

The study was undertaken to identify the challenges facing the effective implementation and use of e-learning at the University of Delta, Agbor (UNIDEL). A web technology was designed for the study. The study unveiled that e-learning at UNIDEL is confronted with lack of infrastructure, electricity, internet connection, data plan cost, and digital literacy. The challenges associated with device accessibility (48.6%), internet accessibility (41.3%), and platform accessibility (36.8%) among others were identified from the

results of the administered questionnaire, which assessed the current state of e-learning at UNIDEL.

A light-web platform designed for the study using the Python Flask framework, HTML/CSS/JavaScript, and SQLite database was able to improve the aforementioned indicators, as revealed by the usability test of the designed system. The designed system achieved 91.4% device accessibility, 87.9% internet accessibility, 94.2% platform accessibility, 89.7% stable network, and 4.8% downtime. The study further revealed that the level of preparedness of the students at UNIDEL improved as a result of the orientation, which raised the digital preparedness indicator from 0.51 to 0.91. With the improvement in the indicators of the new system, apart from addressing the accessibility factors, other indicators such as registration process, ease of use, assignment submission, and examination, with a System Usability Scale of 86.3%, were satisfactory.

The study therefore concluded that the designed system would solve the problems associated with the current state of e-learning at UNIDEL, as it was based on minimum infrastructure. The study also concluded that the new platform would reduce the electricity consumption of UNIDEL by eliminating the need for incessant electricity supply and expensive data plans subscribed to by the students. However, the study recommended that while the adoption of the new light-web platform be encouraged, more electricity should be generated to supply the host community and other infrastructural facilities such as internet and technical support be provided.

It was therefore concluded that an institutional-based light-web platform can improve the accessibility and proficiency of e-learning at UNIDEL. The report recommended focused adoption of multi-system platforms that can be operated on multiple devices, with minimum electricity consumption and bandwidth, for sustainable e-learning at UNIDEL. The study further recommended further research on the relationship between the usage of light-web platforms and performance as well as efficacy at different levels, and cost-benefit analysis against commercial e-learning software.

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