2024
September
coou African Journal of Environmental Research *Vol 5, No. 2, 2024. pp 62-85*

TURNING CRISIS INTO OPPORTUNITY: THE ROLE OF COVID-19 INDUCED ONLINE LEARNING IN PROMOTING SUSTAINABILITY AT THE UNIVERSITY OF LAGOS

Adeyemi Oginni[1], Adeniran Mofoluwake[2], Akinnubi Oluwadamisi[3]& Fabusuyi Simisola[4], Folarin Oginni[5]

[1,2,3,4]*Department of Architecture, University of Lagos.*

[5]*Gateway Polytechnic, Ogun state.*

Emails: [1]oginniadeyemi@gmail.com, 2mofoluwakeadeniran@gmail.com, [3]akinnubidamisi@gmail.com, [4]neemared18@gmail.com,[5]folarinoginni@gmail.com.

Abstract

This research looks at the transformative function of online learning in improving sustainability in higher education, with a particular focus on Masters in Environmental Design (MED) Architecture students of the University of Lagos in Nigeria. A mixed-methods approach was used to combine quantitative survey data and qualitative interviews to acquire a thorough knowledge of how online education affects sustainability efforts in higher education institutions. According to survey results, students are aware of the potential of online learning to reduce the environmental imprint of traditional education, cut prices, and improve accessibility. Students' impressions are based on observable decreases in carbon emissions, economic efficiency, and enhanced educational access. Qualitative interviews with students from several faculties indicate a range of experiences, from data prices and connectivity issues to the benefits of digitised learning materials and better time management. The study finds that online learning has the potential to play a critical role in higher education sustainability strategies. To realise this promise, focused initiatives to solve issues such as price, connection, and online course quality are required. Infrastructure investments, educator training, financial assistance, technical improvements, multidisciplinary collaboration, policy refinement, sustainability initiative growth, and a commitment to continuous development are among the recommendations. Online learning goes beyond crisis reaction to provide a chance for innovation and redesigning higher education by combining accessibility with environmental responsibility. The instance of the University of Lagos offers an example of how online education may energise sustainability efforts and alter the future of higher education.

Keywords: COVID-19, Higher Education, Learning materials, Online learning, Sustainability

INTRODUCTION

The University of Lagos, renowned as one of West Africa's prestigious academic centres, became an interesting case study for understanding the complexities of a swift transition to online learning amidst the COVID-19 pandemic. The institution's reputation, coupled with its diverse student population, offers a rich tapestry of experiences reflecting various Nigerian sociocultural and economic facets. From infrastructural challenges and pedagogical evolutions to governmental policies and local innovations, the University of Lagos's foray into online learning during this crisis unveils layers of resilience, adaptation, and innovation. Exploring the

myriad dynamics at play, this research aims to shed light on the role of online learning in promoting sustainability within higher education, particularly in environments similar to Nigeria's multifaceted context.

The COVID-19 pandemic catalysed a transformative shift in global education, propelling academic institutions into online learning platforms, a paradigm previously underexplored by many. The University of Lagos, a beacon of academic excellence in West Africa, offers a fascinating case in this grand pivot. Universally, the shift to online learning during the pandemic wasn't just an emergency response; it harboured the potential to redefine pedagogical approaches in the longer term, with sustainability at its core. Online learning, when optimally implemented, offers the promise of education that's both globally connected and locally relevant, holding potential benefits for the environment, economy, and societal inclusivity (Daniel, 2020). In Nigeria, a nation where socio-economic challenges and digital divides persist (Toquero, 2020), the movement to online platforms faces multifaceted hurdles. This study seeks to shed light on the University of Lagos's experience within this broader landscape, exploring the opportunities, challenges, and innovations that emerged amidst these challenges.

LITERATURE REVIEW

The COVID-19 pandemic, which began in early 2020, caused enormous disruptions in a variety of areas, including in the higher education sector. To ensure the safety of students, teachers, and staff, universities throughout the world were compelled to quickly adapt to remote teaching and learning techniques. This trend toward online learning has not only changed established traditional education methods but has also prompted serious concerns about the long-term implications of sustainability. The 21st century is marked by technological innovation, which is critical to maintaining excellent education to achieve the Sustainable Development Goals for Nigeria and the African continent. The relationship between technology and instructional delivery is symbiotic and intricate, with success in determining a number of factors such as instructors' digital literacy; learning context-specific technology; and institutional financial policies on technology priorities (Eaton, 2018).

Education

Education is the bedrock of any nation and is a crucial tool for the growth and development of a society, country, or community. It is the focus of sustainable development goal 4 which seeks that education should be all-inclusive, and equitable and promote opportunities for all levels of people for all of their entire lives. During the advent of COVID-19, there was a transformation from traditional face to face learning to online Teaching due to the risks involved in physical contact at the time. This shift was not without its challenges and attendant effects on the students, populace and the environment as well.

In education, innovation is doing what is best for students, classrooms, educational programmes, and the curriculum. Innovation is a process by which a domain, product, or service is renewed and brought up to date by applying new processes, introducing new techniques, or establishing successful ideas to create new value. Innovation in education is a planned activity that tries to introduce novelty into a specific setting; it is pedagogical since it aims for sustainability and enhances student or pupil preparedness through contact and interactivity (Bechard, 2007).

The shift to online learning forced educators to experiment with new educational techniques. Asynchronous learning, for example, allows students to go through course content at their leisure, possibly supporting a variety of learning styles. This adaptability may result in more effective and tailored learning experiences, aligning with the sustainability concept of satisfying the needs of the present without jeopardizing the requirements of future generations. The University of Lagos started by incorporating these novel ideas into post-pandemic teaching strategies. It should be sustained to achieve optimum and progressive impact on the learning system. University administrators should manage university education to achieve quality university education that will refine the outputs (students) and turn out to society as finished products of creativity to take over the world's society and economy now and in future generations. In agreement with Unachukwu (2014) cited in Aliwa (2016) postulated that education completely equips the individual citizen to contribute effectively to the social and economic growth of his nation.

Online learning and sustainability

Sustainable development has taken on numerous definitions over time, but for clarity, it might be defined as development that helps the present generation without jeopardizing future generations' needs. The idea of sustainability involves environmental, social, and economic components. The shift to online learning has resulted in various possible environmental benefits, including less commute, lower energy use on physical campuses, and less paper usage. These changes are consistent with the wider sustainability aims of lowering carbon emissions and preserving resources. However, there are drawbacks to online learning, such as increased technological waste and energy consumption associated with technology infrastructure.

Online classes have the potential to accelerate the realization of sustainability and the Sustainable Development Goals. The following skills are said to be integral to Environmental Sustainable Development: Envisioning, critical thinking and reflection, critical thinking skills, systemic thinking, building partnerships, and participation in decision-making (Tilbury & Wortman 2004). These skills may be easily acquired in an asynchronous situation where individuals from various cultural and educational backgrounds interact, exchange ideas, and form networks. Sun and Chen (2016) believe that online learning encourages students to improve their analytical, critical synthesis, creative expression, imagination, self-awareness, and other skills. Another new aspect of online learning is the ability to reach millions of learners who are not already enrolled in colleges or institutions. One benefit of online classes is that they have made educational information available to millions of individuals for free. Higher education is becoming more widely available and thorough.

Benefits of e-learning

Adoption of E-learning in education, particularly for higher educational institutions, offers various advantages and benefits, and e-learning is regarded as one of the finest ways of education.

Flexibility

The most significant advantage of e-learning is more flexibility in course offerings and access to course resources. E-learning programs assist students in satisfying their aspirations for

greater flexibility, a better learning experience, and a shorter time to graduation. The use of e-learning gives institutions, as well as their students or learners, much-needed flexibility in the delivery or receiving of lectures and course materials. Likewise, the ease of adaptability and customization guarantees that the learning content is ideally suited to an individual's learning style and preferences, boosting its effect and reach. Furthermore, top-tier teachers may share their expertise across borders, allowing students to attend classes across geographical, political, and economic restrictions (Adakawa et al., 2021).

Efficiency and effectiveness

A good e-learning system allows a learner to identify and process his or her learning style, topic, goal, existing knowledge, and specific talents. Effectiveness and efficiency may also be reached in terms of prices and delivery speed at lower expenses. It is assumed that investments in travel, physical infrastructure, resource management, and the production of learning materials will be minimal. Similarly, Arkorful and Abaidoo (2014) asserted that e-learning is cost-effective since there is no need for students or learners to travel. It is also cost-effective in that it provides learning opportunities to a large number of students while not requiring a large number of facilities. Students do not have to pay for transportation or lodging since the forums built into the e-learning system provide a discussion atmosphere where problems are handled jointly in chat rooms (Adakawa et al., 2021).

Improved and Revitalized Teaching

Essential e-learning is concerned with boosting learning quality via the use of interactive computers, online interactions, and information systems in ways that conventional teaching approaches cannot match. Unsurprisingly, e-learning improves retention and results by utilizing tailored online guidance and assistance to empower learners to take greater responsibility for their learning at their own pace and level. Before teaching online courses, instructors are frequently required to take training, and enhanced pedagogy results when new approaches are introduced and a concentrated effort is made to identify learning objectives or outcomes. Because academic authorities and professors are concerned about quality, online education is frequently subjected to greater scrutiny. As a result, teachers and course designers devote more effort to creating an organized, high-quality experience for students, frequently employing Quality Matters criteria (Benton & Pallett, 2013).

Enhanced Learning Experience and Collaboration

E-learning is crucial in education because it may improve the learning experience and broaden the reach of every lecturer and teacher. Similarly, E-learning expands the potential for student cooperation. Furthermore, e-learning provides additional academic benefits such as increased access to knowledge through online resources, ease of revising course materials, the ability of students to connect with experts all over the world, a more active role for learners in setting the pace of their learning, greater flexibility for both instructors and students and scalability of courses from small to large numbers of students concurrently (Adakawa et al., 2021).

Reduction of cost

The key motivator for most e-learning selections is a decrease in overall expenditures, which includes reduced instructor charges, travel expenses, room rents, accommodation, and meals. When comparing e-learning versus classroom training, the amount of time spent away from

work for classroom training might be substantial. The greatest learning environment for the student may also be employed while attending the lessons - on a couch, going for a stroll, sitting by the ocean, etc. Furthermore, taking an online course eliminates the need to go to class, which means less time spent on the bus or other modes of transportation, which may not be sustainable or beneficial for the environment.

Challenges of Adopting e-learning in Emerging Societies

E-learning faces several problems daily, particularly in developing nations such as Nigeria, due to its dynamic, technology-driven nature, which necessitates significant investment in financial, human, infrastructure, and stakeholder support.

Electricity Power Supply and related infrastructure

The linked challenges of unreliability, unavailability, and power cost are among the most vexing obstacles impeding the successful deployment of e-learning. Power remains one of the most expensive expenditures that African manufacturing enterprises must endure, accounting for more than 50% of irregular and epileptic power supply has remained a significant barrier to the introduction of e-learning. In terms of global education and e-learning, ensuring an uninterrupted electrical power supply is a critical component of effective e-learning deployment. Furthermore, Nigeria has relied on expatriates for energy generation, which is quite expensive (Adakawa et al., 2021).

Poor Internet Connectivity

In Africa, the availability, quality, amount, and cost of bandwidth remain expensive and out of reach for many Higher Education Institutions and people. According to recent research, the typical African institution has no more bandwidth than a household connection in Europe or the United States. However, bandwidth in Africa is constantly constrained; it costs on average 50 times what a typical US institution spends per Kbps12/month; and it is of poor quality in the absence of solid policy guarantees from internet providers of guaranteed uptimes. Furthermore, a lack of bandwidth management skills and procedures at institutions does not ensure that bandwidth is used properly (Adakawa et al., 2021).

Insufficient Funds for Purchasing, Maintaining and Upgrading ICT Infrastructure

There is a scarcity of funds to support e-learning technologies and infrastructures, as these difficulties require financial assistance to adopt and sustain (Kisanga & Ireson, 2015). These studies show that there are still significant infrastructure issues that must be solved if these institutions are to attain e-learning. Meanwhile, Nigeria's lingering economic turbulence, combined with the high cost of electronic teaching facilities/devices, the cost of developing e-content, and so on, has greatly hampered the implementation of e-learning in Nigerian higher institutions of learning, as many schools, colleges, and even universities cannot and have not made conscious efforts to purchase, maintain, and upgrade ICT devices due to a lack of funds (Adakawa et al., 2021).

Technological Skills in e-learning and E-content Development

Mtebe and Raisamo (2014) identified a lack of e-learning understanding among most education stakeholders. Some professors' lack of computer expertise was alleged to be slowing down e-

learning uptake in the researched institutions since most academic staff in most public universities lack appropriate technical abilities in e-learning and e-content production. Most teachers found it difficult to convert print-based materials to electronic format. There is also evidence that users of e-learning, particularly instructors, did not want to expose their lack of ICT abilities, which contributed to another issue: resistance to change. (Adakawa et al., 2021).

Lack of Interest and Commitment among the Teaching Staff to Use e-learning

Another barrier impeding efficient e-learning deployment in most developing nations is a lack of desire and commitment among teaching professionals to employ e-learning. For example, Tarus, Gichoya, and Muumbo (2015) discovered in research done in Kenya that the majority of teaching staff's lack of enthusiasm and commitment to using e-learning in teaching at public institutions has substantially delayed efficient e-learning implementation. Meanwhile, for teaching staff to properly implement e-learning technology in their classrooms, they must have a good attitude toward technology.

Amount of Time Required to Develop E-learning Content

Perhaps the most commonly mentioned concern with e-learning was the amount of time necessary to construct and manage an e-learning course; more time is required by the teacher to contact the students via the internet, mailing system, or education course forum that pertains to the course. Students, on the other hand, require appropriate time to search for relevant material and collect data in an orderly manner; balancing time is a major issue for students. Furthermore, creating e-learning content is a time-consuming and laborious effort. The failure of academics to generate adequate e-learning curriculum content for their particular modules thus renders university endeavours to embrace e-learning worthless, since students cannot profit from non-interactive curriculum content (Adakawa et al., 2021).

Lack of Operational E-learning Policies

It has also been said that most African nations have conservative and restrictive regulations that, most of the time, act as a barrier to the use of e-learning or the adoption of technology that encourages e-learning. The lack of explicit policy instruction has an impact on the proper implementation of e-learning. It has been stated that for any institution to successfully adopt an e-learning program, the university must have well-defined strategic plans that outline e-learning policies and implementation methodologies. Lack of ICT learning policy is a frequent issue in many African colleges, including Nigeria (Tarus, Gichoya & Muumbo, 2015). The absence of a functioning e-learning policy in Nigeria reveals a big gap in the country's educational environment. As technology quickly affects the way education is given and accessible throughout the world, Nigeria's education system is challenged owing to a lack of a clear and comprehensive e-learning policy. This gap impedes the successful integration of digital platforms into education, limiting fair access to high-quality learning materials and opportunities. The lack of such rules also limits the potential benefits of e-learning, such as increased educational reach, flexibility, and innovation. To solve this problem, educational authorities must commit strategically to developing and implementing specific e-learning policies.

METHODOLOGY

Study Area

The University of Lagos, Nigeria (UNILAG), is a home for University students, or higher education candidates, and it is located in Akoka, Lagos, in the South-West of Nigeria (see figure 1). According to UNILAG's 2019/2020 statistics, of the entire student population, 15% are postgraduate students.

Figure 1: Map of The University of Lagos

Source: University of Lagos (2023)

The School of Postgraduate Studies (SPGS) of the University has an approximate population of 9,046 students, with the majority being Masters students. Our research focus is on Masters of Science in Environmental Design (MED) students of the Department of Architecture, who were enrolled in An Architectural Sustainability class at the University during the COVID-19 pandemic. For the two-year master's program, the average class size is 70, making the target population 140 across the two levels.

Methods

To ensure a robust understanding of the experiences and perceptions of those most affected by the transition to online learning, a questionnaire, structured through Google Forms, was administered to a target group of Masters of Science in Environmental Design (MED) students who were enrolled in the university during the COVID-19 pandemic period in 2020. A total of 168 responses were obtained. In addition, interviews were conducted with several students from

across the two classes (First year and second year), to gain a more in-depth insight on the perspectives of the students.

Questionnaires

The Google Forms platform was chosen for its ease of accessibility, widespread familiarity, and capabilities for organizing responses efficiently. By focusing on both current and past students who experienced the shift, the study aims to capture a broad spectrum of experiences, from immediate adaptations to reflections on long-term impacts. The questionnaires were divided into five sections. The first section was focused on informing the recipients about the purpose of the survey as well as helping them understand that their data will be protected. The second section aimed at getting the respondent's demographic information and understanding the impact of COVID-19 on the adoption of online classes. The third section focused on assessing the environmental, economic and social implications of online learning. The fourth section focused on Assessing challenges, opportunities, perceptions and attitudes towards online learning for sustainability. And the final section getting student's opinions and recommendations on how sustainability through online classes can further be promoted.

Interviews

The qualitative interviews conducted in this study provide a vital complement to the quantitative data gathered through questionnaires, offering a deeper understanding of the challenges and opportunities encountered during the University of Lagos' transition to online learning in response to the COVID-19 pandemic. These interviews were conducted with a diverse group of students, representing different individual backgrounds, and were chosen strategically to capture a broad range of experiences. The insights gathered from these interviews offer a nuanced perspective on the relevance of online learning and its implications for sustainability in higher education. The choice to conduct interviews stemmed from the need to delve into the intricacies of students' experiences and perceptions. As we explore the findings in the following section, we will gain valuable insights into how students from different academic backgrounds navigated the transition, their perspectives on the sustainability implications, and the opportunities and challenges they encountered along the way.

PRESENTATION OF RESULTS

Pie charts and bar charts were used in the statistical analysis of the responses to the questionnaires that were sent to the students via Google Forms. The findings of the investigation into the contribution of COVID-19-induced online learning to university sustainability initiatives have been divided into five sections. These include:

a) Adoption of online classes at the University
b) Transitioning from physical classes to online classes.
c) Assessment of the environmental, economic, and social implications of online learning
d) Assessment of challenges, opportunities, perceptions, and attitudes towards online learning for sustainability
e) Recommendations on how online classes can be improved, sustainable and promoted

Adoption of online classes at the University

The data gathered from the responses revealed the frequency with which university students were exposed to and treated to online courses. Approximately 65% of the pupils who participated in the survey were exposed to online learning during the Covid-19 epidemic. About 21% of people were exposed following the Covid-19 epidemic, whereas 14% were exposed before it. See figure 2

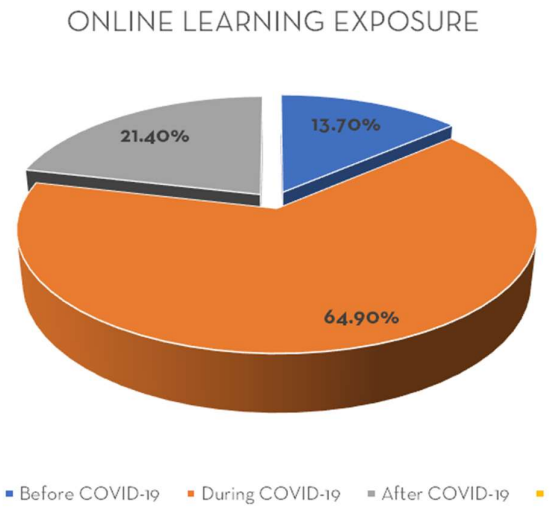

Figure 2: Pie chart showing students' exposure to online classes

Transitioning from physical classes to online classes

Making the switch from something familiar to the unfamiliar may occasionally pose substantial challenges for people. This is the situation with the university's online learning system. According to the results, 39.3% of respondents found it to be somewhat tough, 20.8% thought it was neutral, 21.4% thought the transitioning was fairly fluid, 14.9% thought it was extremely challenging, and 3.6% thought it was very smooth (as shown in figure 3). It was evident from the response analysis that most students had a very hard time attempting to adjust to the change.

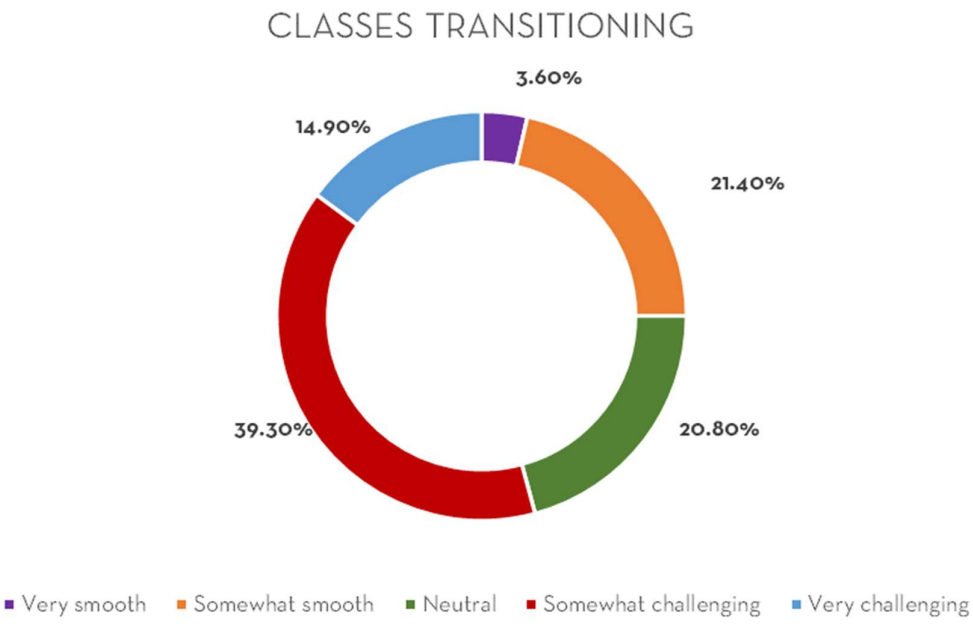

Figure 3: Pie chart showing how students found the transitioning

The difficulties the students experienced while transitioning to online classes can be assigned to the following:

Lack of Motivation:

Certain students find it challenging to concentrate in online classes since there is less in-person interaction. Students lose the sense of urgency and drive they require to arrive to class on time, fulfil deadlines, and advance when their teachers or other students are physically absent. Deteriorating grades and procrastination may result from this.

Lack of Equipment:

To be successful in remote learning and take classes online, students must possess a device that can be used for typing assignments and has a good internet connection, such as a laptop, desktop computer, or tablet with a keyboard. These gadgets are pricey, particularly for students from lower-income families. The statistics in Figure 4 show how the students felt due to the lack of equipment.

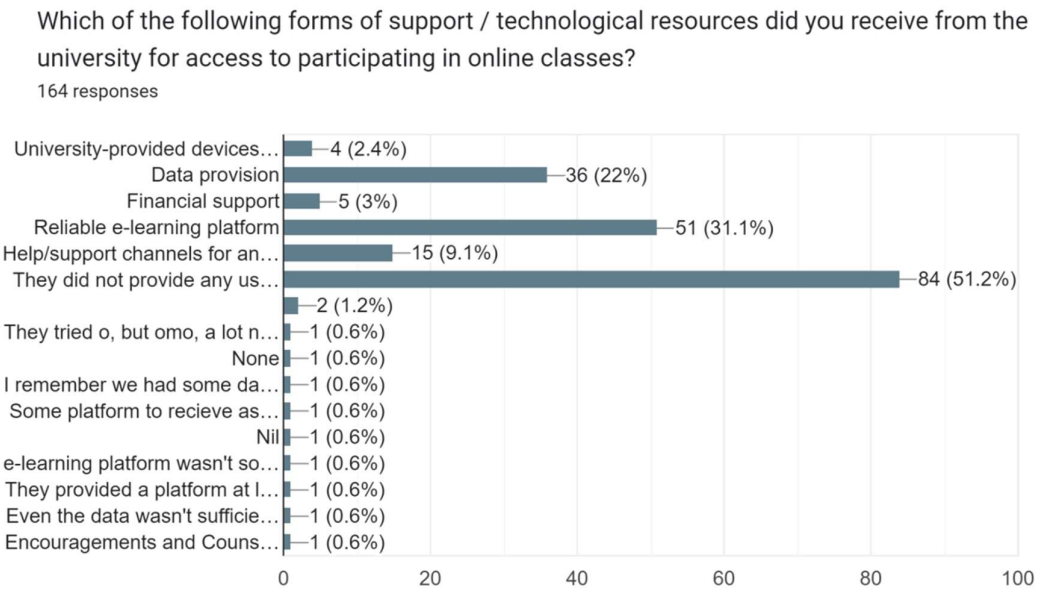

Figure 4: Bar chart showing how students found the transitioning

Assessment of the environmental, economic, and social implications of online learning

Environmental impacts of online classes:

There is a predicted response to every action. In the instance of online classes, there were consequences in different aspects of life. Since fewer cars were travelling through and through the university, the online classes had a good environmental impact in a society where sustainability is a top priority. According to the study as presented in Figure 5, 64.7% of respondents thought that as there were fewer events on campus, this translation helped lessen the consequences of carbon gases. A little over 23.4 percent of respondents were unsure if the change had an impact on the university's environmental footprint, while 12 percent were adamant that the online courses had no beneficial effects.

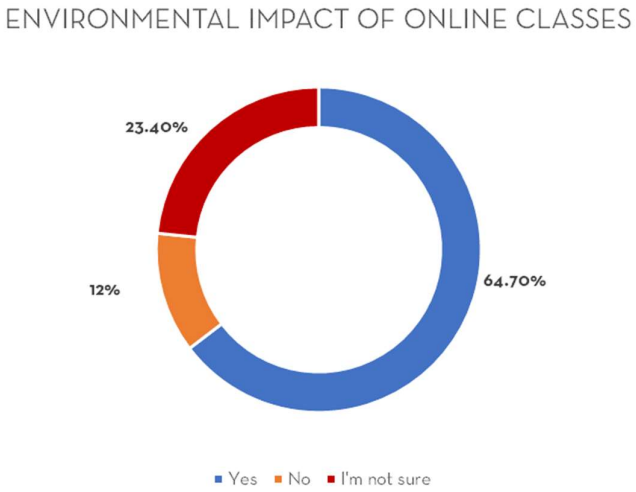

Figure 5: Pie chart showing environmental impacts of online classes

Economic impacts of online classes:

Online classes frequently turn out to be less expensive than physical classes when comparing the costs of learning with physical learning. The overall cost is typically less than that of classrooms, even though the classes themselves may not necessarily be less expensive (figure 6). It will be less expensive because students won't have to worry about paying for accommodations or transportation.

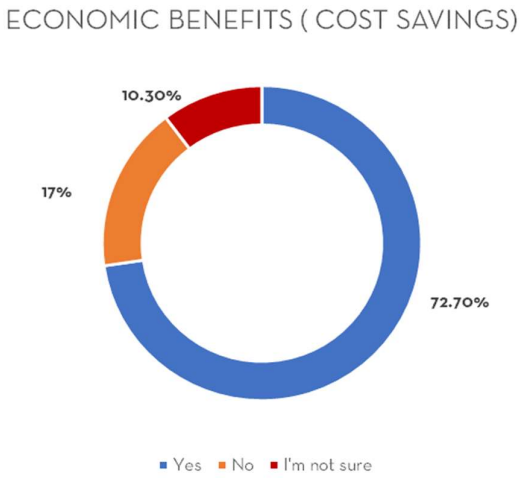

Figure 6: Pie chart showing the economic benefits of online classes

Reducing Transportation Costs:

Eliminating the need to travel to and from school is one of the main ways that online education can save costs. Avoiding lengthy journeys and attending classes from home not only saves money on transportation expenses but also saves time.

Reducing the cost of materials:

The ability to save money on supplies is another advantage of online learning. The cost of buying printed materials can be considerably decreased by taking advantage of the many courses that offer digital textbooks and other resources. Many courses include electronic versions of course notes, slideshows, and other crucial materials that are required during class, which not only saves money on textbooks but also makes learning easier.

Social impacts of online classes:

Online courses are renowned for their ease and adaptability, enabling learners to finish their assignments at their own pace. But that independence also comes with a cost. While online learners are not required to physically attend classes, they are also not afforded the chance to connect with professors and other students in person. From the survey carried out, students had various opinions on this. 50.6% were in between the transition being positive or negative, 20% felt it affected them negatively socially, and 29.20% felt it affected them positively as presented in Figure 7.

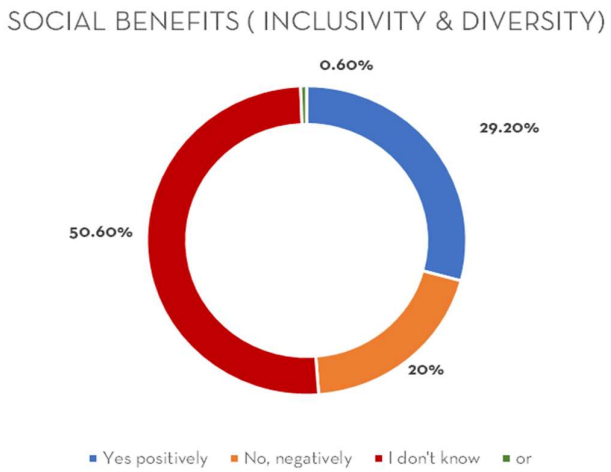

Figure 7: Pie chart showing the social impacts of online classes

Assessment of challenges, opportunities, perceptions, and attitudes towards online learning for sustainability

The year 2020 brought about a global digital revolution as the COVID-19 pandemic struck. The boisterous classes abruptly became silent. The classroom was a never-ending source of mischief, unending laughter, arguments, and silence. Everyone was compelled to stay at home and carry on with their daily routines. The education department was in for a completely new experience. They pushed the full system online. While seated at home, every student has complete and simple access to their studies. The students were pleased about the move from offline to online learning, while the earlier findings revealed the exact reverse. Despite everyone's expectations, there were several difficulties with online learning. Some difficulties experienced include:

Technical and Internet issues

Everybody in the population is spread among both urban and rural places. Not always is strong connectivity available. This puts obstacles in the way of the online learning process. Additionally, there is a good risk that a website will crash occasionally as a result of overloading on one particular site. Due to the class delays, students rarely understand what is being covered in the lectures and do not have enough time to go over the entire curriculum. This is one of the most frequent issues with online learning that students run into during online lectures, which makes them miss class.

Reduced capacity for focus

In most cases, students' focus quickly deteriorates in online classes. Students find it extremely challenging to focus and understand what is being taught. The main cause of this is a lack of communication between the instructors and the students. When observed, students pay full attention for the first few minutes of class and comprehend everything that is given, but after a while, they lose interest in what they are being taught. Students find it more challenging to focus and comprehend due to their decreasing attention span. As a result, students frequently struggle with independent study and exam preparations. One of the main issues with online

learning is that students have to cope for a long amount of time with such situations as seen in, figure 8.

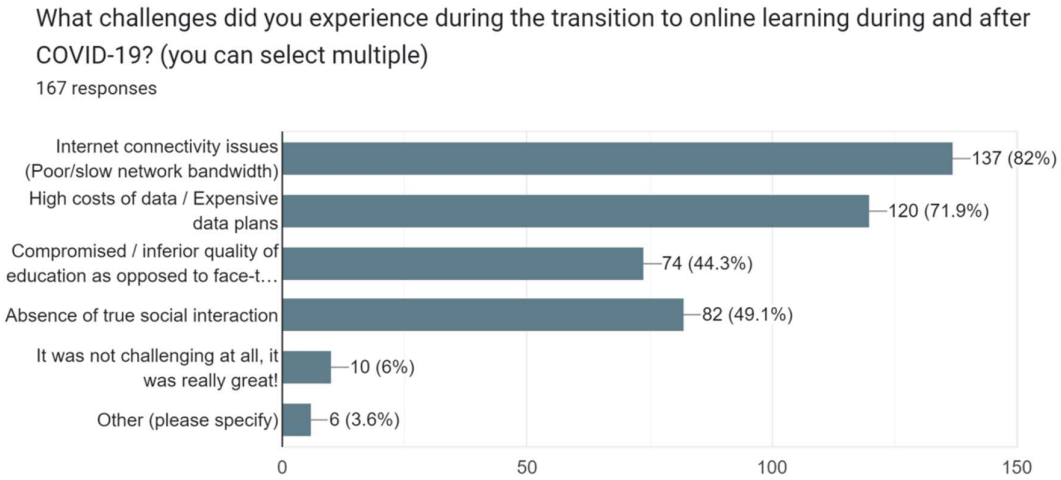

Figure 8: Bar chart showing challenges of online classes

Table 1 shows the responses to the interviews taken with the respondents. (Interview questions can be found in the Appendix). The analysis of the data is;

Table 1. Interview Results and Data Analysis

	INTERVIEWEE 1	INTERVIEWEE 2	INTERVIEWEE 3	INTERVIEWEE 4	INTERVIEWEE 5
Question 1	Found the transition abrupt and highlighted its potential negative impact on student motivation and social interaction.	Mentioned struggles with the online platform and testing but found online tests easier.	Described the transition as abrupt and faced challenges with testing platforms.	Termed the transition as sudden and experienced difficulties with online platforms	Found the school unprepared for online learning, leading to difficulties and internet issues.
Question 2	Observed no faculty-specific measures and the experience was similar to other faculties	There were no faculty-specific measures. The faculty of law performed moderately (6/10).	There were no notable faculty-specific measures; engineering's experience was similar to other departments.	The faculty of social science adopted similar measures to other departments, using Zoom and the LMS platform.	Rated the faculty's performance at 5/10 and mentioned the use of WhatsApp and Zoom.
Question 3	Highlighted reduced transport, fewer emissions, and environmental benefits of online learning, especially fewer campus events.	Emphasized the environmental benefits of reduced carbon emissions and less littering during the pandemic.	Mentioned reduced electricity usage and transport costs during the pandemic.	Emphasized the environmental benefits, such as reduced carbon emissions and littering.	Emphasized the environmental benefits and cost savings during the pandemic.
Question 4	Experienced cost savings in terms of transport and food expenses.	Saved money on transport but spent considerably on data. However, her food expenses decreased.	Saved on transport and school materials costs. However, data expenses increased.	Saved on transport and food expenses. However, data costs increased.	Saved on transport and school materials costs. However, data costs increased.
Question 5	Speculated that the school saved	The school may have saved on	Speculated that the school may	Speculated that the school may	Speculated that the school may

	on electricity costs and maintenance due to reduced campus activities.	electricity and maintenance costs due to reduced campus activities.	have saved on electricity and maintenance costs.	have saved on electricity and maintenance costs.	have saved on electricity, and maintenance costs, but lost money from trader rents.
Question 6	Saw online learning as an opportunity to make education accessible to many, irrespective of their location.	Saw the online repository of course materials as valuable. She highlighted the need for lecturer training and improving the learning platform.	Appreciated the availability of course materials online but noted challenges related to network connectivity.	Appreciate the accessibility of course materials online.	Appreciated the accessibility of course materials online but highlighted challenges related to network connectivity.
Question 7	Did not observe significant changes in social inclusivity or diversity.	Mentioned the growth of a digital community but did not observe significant changes in social inclusivity.	Did not observe significant changes in social inclusivity.	Highlighted the growth of a digital community but did not observe significant changes in social inclusivity.	Noted that online learning made education wider and richer but did not observe significant changes in social inclusivity.
Question 8	Challenges included high data costs, poor networks, and the unpreparedness of lecturers to handle online platforms.	Challenges included data costs, network connectivity, and difficulties being attentive in online classes.	Challenges included network issues, low motivation, and difficulties being attentive in online classes.	Challenges included network issues, low morale, and difficulties being attentive in online classes.	Challenges included network issues, glitches, and difficulties being attentive in online classes.
Question 9	Received no support personally.	Received no personal support but heard about some students receiving iPads.	Received no personal support.	Received no personal support except for instructions on using the LMS site.	Received no personal support except for instructions on using the LMS site.
Question 10	Believed that online learning presented opportunities for students to engage in other ventures and for the university to cater to its students more effectively.	Felt that online learning could have enabled her to work part-time as a content writer.	Saw opportunities in online learning for part-time work, cost savings, and time management.	Felt neutral about the shift to online learning and did not see significant personal benefits.	Felt neutral about the shift to online learning and did not see significant personal benefits.
Question 11	Rated online learning as highly effective (5) for promoting sustainability due to its reduced environmental impact.	Rated online learning as highly effective (5) for promoting sustainability.	Rated online learning as effective (4), emphasizing the importance of improving the online learning system.	Rated online learning as effective (5) for promoting sustainability and emphasized its flexibility.	Rated online learning as effective (5) for promoting sustainability
Question 12	Believed online learning contributed to sustainability, especially in terms of reduced carbon emissions.	Believed that online learning contributed to sustainability and aligned with sustainable development goals.	Believed that online learning contributed to sustainability.	Believed that online learning contributed to sustainability.	Believed that online learning contributed to sustainability, particularly in terms of environmental benefits and cost savings.
Question 13	A recommendation was for the school to conduct hindsight analyses	Suggested that the school should invest in better online learning platforms	Recommended investing in better online learning platforms and improving the	Recommended that the school invest in online learning platforms	The recommendation for the institution is to acknowledge the value of

	and identify areas for improvement.	and prioritize sustainability.	school's organization.	and allocate funds appropriately.	modernizing education.
Question 14	No additional suggestions or comments were provided.	Recommendations included revising testing software and resolving issues with the academic calendar.	Suggested revising the testing software and investing in quality coders.	Emphasized the need for the institution to prioritize and invest in online learning for the benefit of students and sustainability.	Suggested the survey could be extended to lecturers and university faculty to get their unique perspectives as well

To identify the assessment of the environmental, economic, and social implications of online learning

To achieve the third objective of the study, Regression Analysis was adopted. The analyses were carried out at a 0.05 level of significance. This was achieved with the use of Statistical Package for Social Scientists (SPSS 27.0 VERSION). The results are shown in Table 2.

Table 2: Presenting the Coefficients of the Model

Coefficients								
Model		**Unstandardized Coefficients**		**Standardized Coefficients**			**95.0% Confidence Interval for B**	
		B	**Std. Error**	**Beta**	**t**	**Sig.**	**Lower Bound**	**Upper Bound**
1	(Constant)	0.992	0.067		14.772	0.000	0.860	1.125
	Do you believe that the shift to online learning reduced the university's environmental footprint?	0.122	0.082	0.166	1.495	0.137	-0.039	0.284
	Can you identify any specific environmental benefits associated with online learning? (you can select multiple)	0.053	0.051	0.107	1.035	0.302	-0.048	0.154
	Did you experience any cost savings (e.g., travel, accommodation, materials) as a result of shifting to online classes during COVID-19?	0.181	0.083	0.228	2.186	0.030	0.018	0.345
	How do you perceive the financial impact of the shift to online classes on the University of Lagos?	0.191	0.064	0.336	2.972	0.003	0.064	0.317
	Has the shift to online classes influenced the accessibility of education at the University of Lagos for you or others?	0.008	0.084	0.010	0.096	0.924	-0.158	0.174
	Have online classes affected social inclusivity and diversity in student enrolment at the University of Lagos during the COVID-19 period?	0.075	0.056	0.114	1.320	0.189	-0.037	0.186

a. Dependent Variable: When did you first begin participating in online classes at the University of Lagos?

The table "Coefficients" provides information effect of individual variables (the "Estimated Coefficients" or "beta" --see column "B") on the dependent variable. While the confidence intervals provide a range of values within which we can assert with a 95% level of confidence that the estimated coefficient in "B" lies. For example, "The coefficient for PFM lies in the range 0.181 and 0.191 with a 95% level of confidence.

Model Specification

Dependent Variable: When did they first begin participating in online classes at the University of Lagos? (WUL)

Independent Variable: Do you believe that the shift to online learning reduced the university's environmental footprint? (X1), Can you identify any specific environmental benefits associated with online learning? (X2), Did you experience any cost savings as a result of shifting to online classes during COVID-19? (X3), How do you perceive the financial impact of the shift to online classes on the University of Lagos? (X4), Has the shift to online classes influenced the accessibility of education at the University of Lagos for you or others? (X5), and Have online classes affected social inclusivity and diversity in student enrolment at the University of Lagos during the COVID-19 period? (X6)

WUL = function (DEF, CEB, DCD, HSE, HUL, HCP) + A OR Y = f (X1, X2, X3, X4, X5, X6) + A

Where A = Constant, DEF = X1, CEB = X2, DCD = X3, HSE= X4, HUL = X5, HCP = X6 and f = beta (B) values.

Hence, the Model or linear equation

=Y= A + f(X1, X2, X3, X4, X5, X6)

=Y= (0.992) + (0.122*X1¬) + (0.53*X2) + (0.181* X3) + (0.191*X4) + (0.008*X5) + (0.075*X6)

=Y= 0.992 + 0.122X1¬ + 0.53X2 + 0.181 X3 + 0.191X4 + 0.008X5 + 0.075X6

DISCUSSION OF THE FINDING (COEFFICIENT OF THE MODEL)

This is summarized as follows:

During the period under review (11th February 2024), the below holds:

i. X3 and X4 had the greatest influence on “The role of COVID-19 induced online learning in promoting sustainability at the University of Lagos” respectively.
ii. X5 and X2 influence on the “The role of COVID-19 induced online learning in promoting sustainability at the University of Lagos” were one of the least influences.

Interpretation (Model Summary)

Table 3 shows a summary of the model generated to show the functional or empirical relationship between the variables measured; Regressors or independent variables (Have online classes affected social inclusivity and diversity in student enrolment at the University of Lagos

during the COVID-19 period? Did you experience any cost savings (e.g., travel, accommodation, materials) as a result of shifting to online classes during COVID-19? Do you believe that the shift to online learning reduced the university's environmental footprint? Can you identify any specific environmental benefits associated with online learning? (You can select multiple), has the shift to online classes influenced the accessibility of education at the University of Lagos for you or others? How do you perceive the financial impact of the shift to online classes on the University of Lagos?) And the Regress or dependent variable (When they first begin participating in online classes at the University of Lagos?).

Based on the summary, it can therefore be concluded that there exists a significant linear relationship between "When they first begin participating in online classes at the University of Lagos" and the predictors (listed above).

Table 3: Coefficient of the Model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.920[a]	0.846	0.841	0.311	0.198

a. Predictors: (Constant), Have online classes affected social inclusivity and diversity in student enrolment at the University of Lagos during the COVID-19 period?, Did you experience any cost savings (e.g., travel, accommodation, materials) as a result of shifting to online classes during COVID-19? Do you believe that the shift to online learning reduced the university's environmental footprint? Can you identify any specific environmental benefits associated with online learning? (You can select multiple), Has the shift to online classes influenced the accessibility of education at the University of Lagos for you or others? How do you perceive the financial impact of the shift to online classes on the University of Lagos?
b. Dependent Variable: When did they first begin participating in online classes at the University of Lagos?

Figures 9, 10 and 11 describe the Residual Histogram, Scatterplot and P-P plot. The Normal P-P Plot may be used to test the normality assumption in simple linear regression. This assumption is met if the dots on your P-P Plot are on, or close to, the diagonal line, as in our example below.

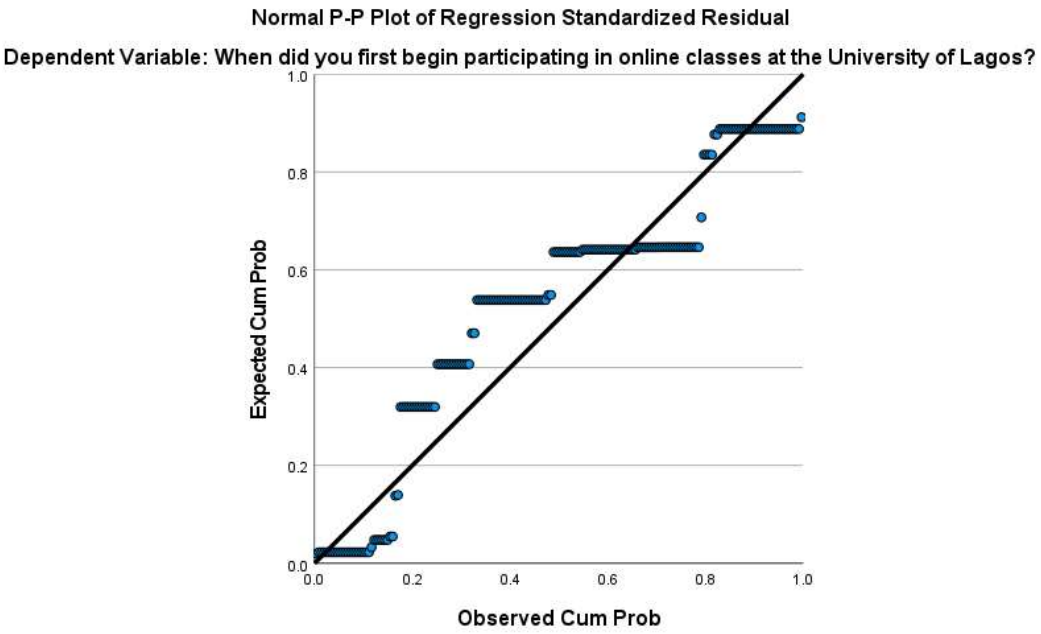

Figure 9: Normal P-P Plot of Regression Standardized Residual

We can also test this assumption by reviewing the histogram of standardized residuals for the dependent variable. If these residuals are approximately normally distributed, as they are in our example below, then the assumption is met.

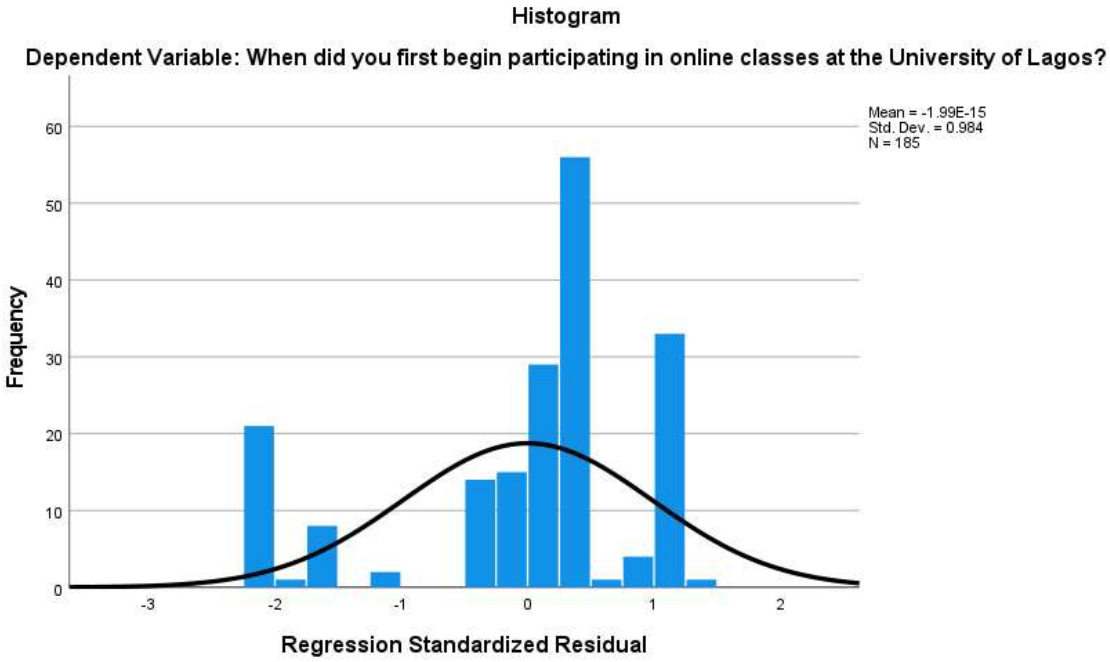

Figure 10: Histogram of standardized residuals for the dependent variable

We can check the assumption of homoscedasticity using the scatterplot of standardized residuals versus standardized predicted values. What we want to see is an absence of any pattern. Our fictitious data set satisfies this assumption.

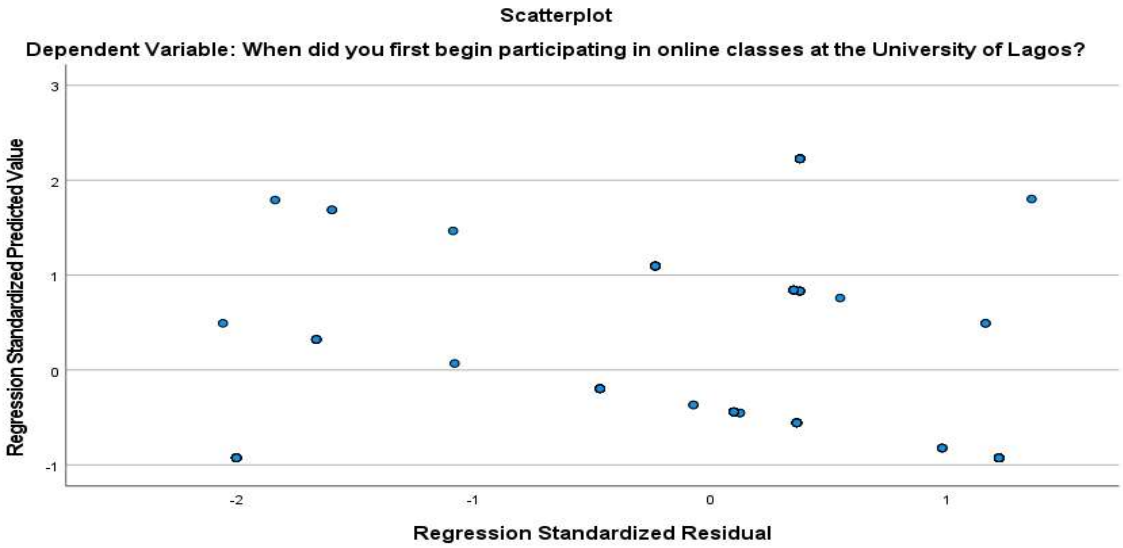

Figure 11: Scatterplot of standardized residuals versus standardized predicted values

To identify the challenges, opportunities, perceptions and attitudes towards online learning for sustainability at the University of Lagos.

To achieve this fourth objective of the study, ANOVA was adopted using One-Way ANOVA (Inferential Statistic), F-distribution, mean square, the sum of squares, degree of freedom, level of significance and returned p-value. The result of the analysis using the mean is shown in Table 3.

Hypothesis Interpretation:

If the p-value for each challenge, opportunity, perception and attitude towards online learning for sustainability in the University of Lagos is <0.05, we will reject the null hypothesis (H_0). And if the p-value is >0.05, we will accept the alternative hypothesis (H_1). Therefore:

H_0: There is no significant difference between the challenges, opportunities, perceptions and attitudes towards online learning for sustainability University of Lagos and When they first begin participating in online classes at the University of Lagos.

H_1: There is a significant difference between the challenges, opportunities, perceptions and attitudes towards online learning for sustainability University of Lagos and When they first begin participating in online classes at the University of Lagos.

Interpretation of ANOVA Table

The ANOVA statistics (as shown in Table 4) were calculated as 497.888, at a 5 percent level of significance, the returned p-value of 0.000 was found lower than the level of significance (0.05); $p < 0.05$. Thus, the null hypothesis is rejected. Therefore, there is no significant difference between the challenges, opportunities, perceptions and attitudes towards online learning for sustainability at the University of Lagos and when they first begin participating in online classes at the University of Lagos.

The University of Lagos students' experiences attitudes and perceptions of online learning for sustainability vary greatly over time according to the study. Upon first enrolling in online classes students' attitudes, opportunities and challenges differ significantly from those later in the online learning process.

This finding suggests that students' relationships with online learning evolve as they become more familiar with it. It could be valuable for educators and administrators to understand these prospects for adaptation to better support students at every stage throughout their online learning journey.

Table 4: Examine the challenges, opportunities, perceptions and attitudes towards online learning for sustainability at the University of Lagos

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
What challenges did you experience during the transition to online learning during and after COVID-19? (you can select multiple)	Between Groups	345.177	3	115.059	497.888	0.000
	Within Groups	41.828	181	0.231		
	Total	387.005	184			
Which of the following forms of support / technological resources did you receive from the university for access to participating in online classes?	Between Groups	306.960	3	102.320	116.314	0.000
	Within Groups	159.224	181	0.880		
	Total	466.184	184			
What opportunities would you say the shift to online learning presented for you and the university? (you can select multiple).	Between Groups	583.695	3	194.565	270.979	0.000
	Within Groups	129.959	181	0.718		
	Total	713.654	184			
On a scale of 1 to 5, how strongly do you agree that online learning is an effective method to promote sustainability in higher education (1 being strongly disagree and 5 being strongly agree)?	Between Groups	291.005	3	97.002	191.989	0.000
	Within Groups	91.450	181	0.505		
	Total	382.454	184			
Do you think the experience of online learning during COVID-19 has changed your perspective on the potential for online education to contribute to sustainability?	Between Groups	150.873	3	50.291	353.153	0.000
	Within Groups	25.775	181	0.142		
	Total	176.649	184			

Source: Field Survey (2024)

F-test Calculated (Statistic) = 497.888; Level of significance = 0.05; Returned p-value = .000

CONCLUSION

In conclusion, this study has shed light on the multifaceted role of online learning in promoting sustainability within higher education, with a specific focus on the University of Lagos.

Through a combination of quantitative questionnaire data and qualitative interviews, a comprehensive view of student's experiences and perceptions during the transition to online learning has emerged. The quantitative data revealed that students generally recognize the potential for online education to contribute to sustainability. It is seen as a viable approach to reduce the environmental impact of higher education, driven by reduced carbon emissions, cost savings, and increased accessibility.

The qualitative interviews enriched our understanding of the challenges and opportunities encountered by students during this transition. Common challenges included high data costs, poor network connectivity, and decreased motivation. However, students also highlighted the benefits of online repositories, time management improvements, and cost savings. Moving forward, it is evident that online learning can play a pivotal role in higher education sustainability efforts. To harness this potential fully, a concerted effort is needed to address the challenges faced by students, including affordability and connectivity issues, and to improve the quality and delivery of online courses.

RECOMMENDATIONS

Proper network and adaptive technologies for learning: Make use of adaptive learning technologies, which allow you to tailor assignments and content to each student's requirements and performance. The majority of students experienced network and technical issues most time and were sometimes kicked out of the online classes due to network instabilities.

Instructors' Professional Development: To improve their abilities as online instructors, educators should make investments in professional development and training, exchange best practices, and promote ongoing development.

Regular Feedback: The students suggested that they be given assignments and exams with prompt, helpful feedback to measure their comprehension during the course. To make improvements, ask students for their opinions on the course, the resources, and the teaching strategies.

User-friendly learning platform: Learning must be done in an orderly and adaptable way. The previous platform wasn't dependable and occasionally didn't work. Additionally, lecturers should be given instructional tools because they are unable to articulate themselves while explaining things to the pupils.

Means of proper communication: Create unambiguous lines of communication between teachers and students. To make communication simple, use chat applications, email, or discussion boards. Teachers should also be encouraged to answer questions from students.

Furthermore, the University of Lagos can;

Invest in Infrastructure: To ensure the success of online learning, institutions must invest in reliable infrastructure, including affordable and high-speed internet access for all students. This will reduce data costs and connectivity issues.

Enhance Training: Educators should receive comprehensive training in online teaching methods and the use of learning management systems. This will enhance the quality of online courses and support student engagement.

Financial Support: Institutions should explore options for providing financial support to students for data costs. Scholarships or subsidies can make online learning more accessible.

Improved Testing Platforms: Develop and implement robust online testing platforms that reduce technical glitches and ensure a fair assessment of student knowledge and skills.

Interdisciplinary Collaboration: Encourage interdisciplinary collaboration between faculties to develop and share best practices for online learning, thereby ensuring consistency in the quality of education across the university.

Review and Update Policies: Regularly review institutional policies to adapt to evolving educational needs. Policies should support sustainability initiatives and provide flexibility in curriculum delivery.

Expand Sustainability Initiatives: Collaborate with students and faculty to expand sustainability initiatives within the university. Online learning can be a catalyst for exploring new ways to reduce the university's carbon footprint and environmental impact.

Feedback Loops: Establish feedback mechanisms for students to express their concerns and ideas about online learning. This can inform continuous improvement efforts.

In a rapidly changing educational landscape, the adoption of online learning is not just a response to crises but an opportunity to innovate and contribute to sustainability in higher education. With the right strategies and investments, institutions like the University of Lagos can lead the way in achieving a harmonious balance between accessible education and environmental responsibility, ultimately shaping the future of higher education.

REFERENCES

Adakawa, M. I., Musa, A. U., Umar, & Muhammad, J. (2021). Adoption and use of e-learning in Nigerian higher institutions for sustainable socio-economic development. *ResearchGate*. https://www.researchgate.net/publication/368918387_Adoption_and_Use_of_E-learning_in_Nigerian_Higher_Institutions_for_Sustainable_Socio-_Economic_Development.

Aliwa, J. (2016). Women Education: A Prelude to Women Empowerment and Sustainable Development in Nigeria G.C. Unachukwu and B.C Ijioma. *Nigerian Academic of Education*.

Arkorful, V., & Abaidoo, N. (2014). The role of e-learning, the advantages and disadvantages of its adoption in Higher Education. *International Journal of Education and Research*, *2*(12). https://ijern.com/journal/2014/December-2014/34.pdf.

Bechard, J. P. (2007). Higher Education and Pedagogical Innovations: A Literature Review. *New Sciences*, *27*(2).

Benton, S. L., & Pallett, W. H. (2013). Class Size Matters. *Inside Higher Ed*. https://www.researchgate.net/publication/308904932_Class_size_matters.

Daniel, J. (2020). Education and the COVID-19 pandemic. *PROSPECTS*, *49*(1–2), 91–96. https://doi.org/10.1007/s11125-020-09464-3.

Eaton, S. E. (2018, February 1). *The impact of technology on how instructors teach and how students learn*. http://hdl.handle.net/1880/106424.

Ebuara, V. O., Okon, J. E., & Akpan, C. P. (2015). *Fundamentals of Educational Management: Managing Schools for Sustainable Development*. University of Calabar Press.

Federal Republic of Nigeria (2014). National Policy on Education. Abuja: NERDC

Kisanga, D., & Ireson, G. (2015). Barriers and strategies on adoption of e-learning in Tanzanian higher learning institutions: Lessons for adopters. *International Journal of Education and Development Using Information and Communication Technology*, *11*(2), 126–137. http://files.eric.ed.gov/fulltext/EJ1074165.pdf.

Mtebe, J. S., & Raisamo, R. (2014). Investigating perceived barriers to the use of open educational resources in higher education in Tanzania. *The International Review of Research in Open and Distributed Learning*, *15*(2). https://doi.org/10.19173/irrodl.v15i2.1803

National Policy on Education (6th Ed.). (2014). Nigerian Educational Research and Development Council (NERDC). https://www.scribd.com/document/549495834/National-Policy-on-Education (Original work published 1977)

Ofor-Douglas, S. (2020). Quality Assurance in Managing University Education in Nigeria. *International Journal of Educational Management (IJEM)*, *18*(2), 185–202.

Osuji, C. U., Koko, M. N., Maureen, & Koko, N. (2018). Managing Secondary Education In Nigeria For Global Citizenship And Economic Emancipation Managing. *ResearchGate*. https://www.researchgate.net/publication/329268117_MANAGING_SECONDARY_EDUCATION_IN_NIGERIA_FOR_GLOBAL_CITIZENSHIP_AND_ECONOMIC_EMANCIPATION_Managing_Secondary_Education_in_Nigeria_for_Global_Citizenship_and_Economic_Emancipation.

Sun, A., & Chen, X. (2016). Online Education and its Effective Practice: A research review. *Journal of Information Technology Education*, *15*, 157–190. https://doi.org/10.28945/3502

Tarus, J. K., Gichoya, D., & Muumbo, A. M. (2015). Challenges of implementing e-learning in Kenya: A case of Kenyan public universities. *The International Review of Research in Open and Distributed Learning*, *16*(1). https://doi.org/10.19173/irrodl.v16i1.1816

Tilbury, D., & Wortman, D. (2004). *Engaging people in sustainability*. http://ci.nii.ac.jp/ncid/BB09969493

Toquero, C. M. D. (2020). Challenges and Opportunities for Higher Education amid the COVID-19 Pandemic: The Philippine Context. *Pedagogical Research*, *5*(4), em0063. https://doi.org/10.29333/pr/7947

Uyanga, U. D., & Emana, I. E. (2016). Education is an instrument for achieving social justice and good governance. *Journal of Educational and Social Research*. https://doi.org/10.5901/jesr.2016.v6n2p205

APPENDIX

Link to Questionnaire and interview questions:
https://drive.google.com/drive/folders/1ZL6W4hssKTfbbh_nfTq7wVykLy2yt_u8?usp=sharing