The Application of Blended learning in Teaching Petroleum Production Engineering course in the University of Port Harcourt

Abstract:
Learning is effective when the learner can comprehend the principles taught and apply the knowledge to solve real-world problems. The terms online learning and blended learning became famous in 2020 due to the pandemic, which brought much innovation to the educational industry. Some of these innovative teaching techniques have tremendous benefits and should be sustained. This study discusses some innovative teaching techniques used in actively engaging engineering students at the University of Port Harcourt, particularly students of petroleum production engineering after the university was reopened from lockdown caused by the pandemic. The various feedback mechanisms employed to obtain students' feedback and ensure effective learning were also discussed. Some educational technologies applied include: google suite for education, zoom, google meet, Kahoot, poll EV and other applications that enhance learning in online teaching. The concerns of poor internet access were alleviated by sharing recorded live classes to ensure class inclusivity. This paper suggests viable options for implementing blended learning in teaching technical courses in developing countries with limited access to the internet and electricity.

Key words: Blended learning, Online learning, Inclusive teaching, student centred learning, educational technology

INTRODUCTION

The coronavirus has caused the death of over 5million people (5,636,236) as of January 2022, according to worldmeters.info. At the beginning of the pandemic, it was poorly understood, and several measures, including washing of hands and wearing masks, had to be enforced in most countries. In Africa, it was easy to implement the washing of hands. However, the disease continued spreading due to the difficulty enforcing wearing face masks and maintaining social distance in most African countries (Egunjobi 2020). Figure 1 shows the increase in the number of covid19 cases in Nigeria.

As the pandemic continued rapidly spreading worldwide, restricting flights from hotspot countries was implemented to mitigate the spread. The travel restrictions reduced the daily exportation rate of the coronavirus by 81.3% (Chad et al., 2020); however, most countries still had to combat the internal spread of the virus in their countries.

Other mitigative measures employed by the Nigerian government to contain the virus include the shutting down of schools on March 23 2020 (Adelowo 2020) and shutting down of markets, religious meetings, social gatherings, restaurants and recreational centres. It was projected that these measures would reduce viral spread by 67% if adequately implemented (Dandajeh 2020).

Due to the closure of many businesses, the coronavirus disease (COVID-19) shattered the means of livelihood of millions of individuals across the world and tested the strength and weaknesses of

many educational institutions of the world. The sudden closure of schools in 2020 had a drastic effect on education; both teachers and learners were helpless about how to continue learning in the face of the pandemic. While the teachers/instructors adapted to some new online teaching methods and applications, students had to adapt to online learning while getting used to the learning applications. The mental wellbeing of both teachers and learners was impacted; they were anxious and stressed from news about the pandemic, mainly when a familiar person contracted the virus.
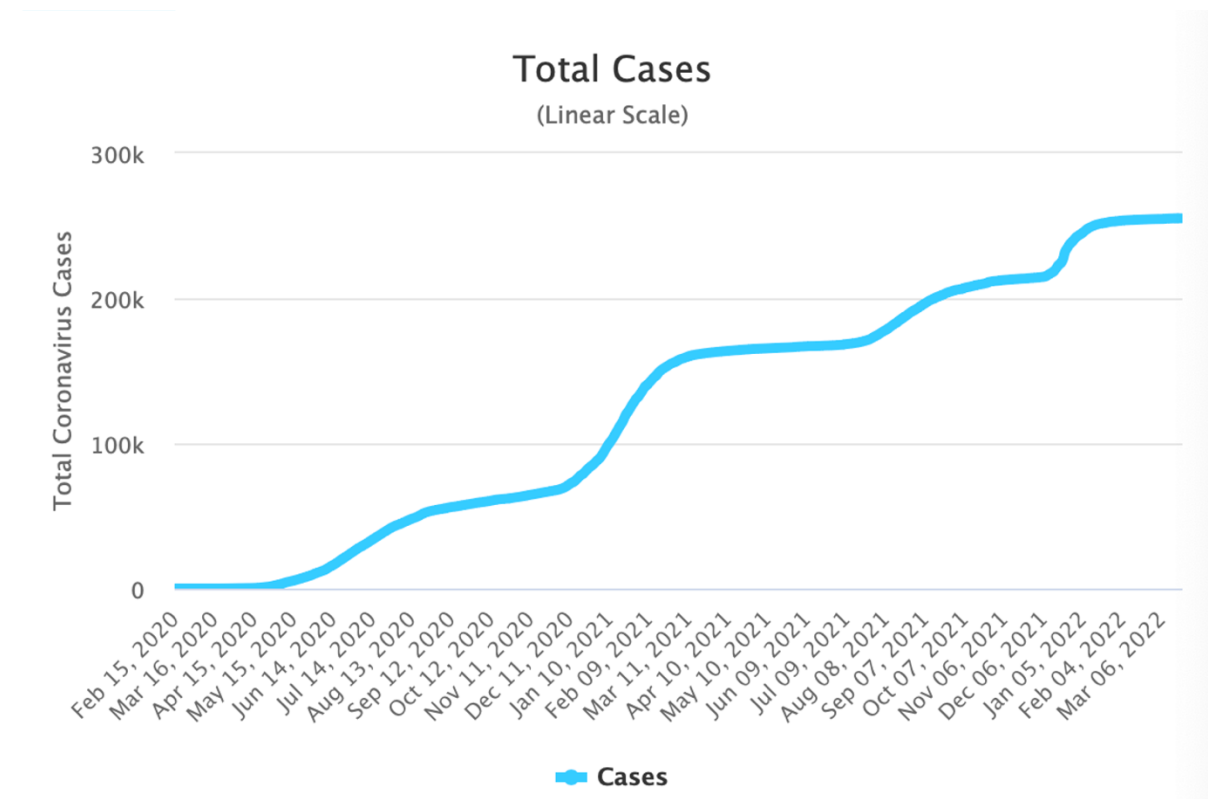

Figure 1: Total COVID19 Cases in Nigeria (worldometers.info)

Most developed countries smoothly transited from in-class learning to online learning because some of the technologies required for the transition were already being implemented in their distance learning programmes prior to the pandemic. However, public institutions in developing countries stayed shut down for months primarily due to insufficient knowledge in implementing online/blended learning with the limited facilities at their disposal.

The COVID-19 pandemic had a devastating impact on the educational sector in Nigeria. Before the pandemic, the Nigerian education system adopted a purely face-to-face approach to teaching and learning and public tertiary institutions in Nigeria did not use any online learning.
Some of the challenges in Nigerian tertiary education during the COVID-19 pandemic include; poor learning facilities, unequal access to education opportunities, poor skills, inequality in education, poor knowledge on transiting to online learning, poor health facilities in school (Eze et al.,2021), and the passing of several Nigerian professors (Bature-Akpakpan, 2021)

The intervention provided by the Nigerian government during schools' closure was majorly for primary and secondary schools, and it includes educational radio programmes and educational TV programmes. These educational programmes were aired at specific times, and students without access to electricity, TV or Radio at the time of airing did not benefit from the broadcast. Although these interventions were ineffective, they are commendable because they kept the students abreast with what they had learnt before the pandemic. The primary issue with this approach was the lack of inclusivity. Only the privileged few with access to electricity, TV and radio at the time of airing benefited from the broadcast. Another snag was that there was no opportunity for students' feedback in these programmes, making it difficult to measure if the student learned during the broadcasts.

In the public tertiary institutions, the school closure caused students to lose an academic year. At resumption, lecturers were put under pressure to clear the backlog of students. This adversely affected the physical and mental health of lecturers and students. Oyegoke et al. (2021) studied the impact of the COVID-19 lockdown policy on engineering students' anxiety in Ahmadu Bello University Zaria, Nigeria. The study confirmed that the students had an increase in the anxiety level, in which the female student had a higher level of anxiety than the male students. The highest contributing factors to the anxiety include "worries about academic delays/extension of the academic calendar and worries about running out of supplies.

Morrissey & Reser (2007) studied the effects of a global pandemic on mental health for engineering students in Australia. They noted that regional pandemics and other natural disasters negatively impact the populace's mental health and stress levels, especially for engineering students.

Danowitz and Beddoes (2020) studied the effect of COVID-19 on engineering students' baseline stress. The data was analysed to determine the average increase in stress levels for students in the United States of America. They studied the pandemic's effects on quality of life, such as sleep habits and financial security. They discovered that the mental wellness of the engineering students was negatively impacted disproportionally by COVID-19.

Online Teaching and Learning

Due to the technological revolutions in education during the pandemic, many universities/schools worldwide have changed from traditional undergraduate classrooms into virtual online education and blended learning environments. Some courses can be taught easily online using live classes, while other courses require a blend of online and physical classes.

Balachandra et al. (2021) discussed using online teaching applications like Zoom, Google Meet, Kahoot, and Google Classroom in teaching languages. They opined that it's best to have live language classes, and blended language classes may not be practical for teaching languages.

Bhavana et al. (2021) discussed the learning environment developed by teachers for students' e-learning tasks. They surveyed different learning environments in the pandemic situation, the learning behaviour of the engineering students, how they spend their time in self-learning and with instruction, their self-evaluation before and during covid-19. The instructors use diverse digital learning resources and adopt new learning approaches in Engineering Education to sustain students' interests.

Sobia et al. (2021) examined the impact of the online learning climate on Pakistani students' engagement. It also hypothesises the mediating role of basic psychological needs on the nexus between online learning and students' engagement. The study was conducted to inform policymakers in academia to reflect on the students' psychological needs within a virtual teaching environment.

Agricultural education is practical-oriented; hence, a blended learning model is preferred to fully virtual classes. Muthuprasad et al. (2021) studied Indian Agricultural Student's perception and preference towards online learning through an online survey. They explored the student's preferences for various attributes of online classes. The results indicated that most of the respondents (70%) were ready to opt for online classes to manage the curriculum during this pandemic. The students preferred recorded classes with quizzes at the end of each class to improve learning effectiveness. The students opined that the flexibility and convenience of online classes make it an attractive option. However, broadband connectivity issues in rural areas make it challenging for students to use online learning initiatives.

However, public universities in Nigeria are still implementing only face to face learning even though most undergraduate students have access to smartphones where some educational applications can be installed for eLearning. There are so many benefits from e-learning that can benefit public institutions. These include:

1. **No crowded classes:**
One of the major problems in most public institutions in Africa is the lack of proper facilities for learning. Lecture halls are usually crowded, and there is usually no public address system in these lecture halls, making it extremely difficult for students seated far from the lecturer to hear and see all that is being taught and written on the board. Blended learning is a viable solution to the poor educational facilities in developing countries. With online learning applications like zoom, the students can see what is displayed as they log in using their devices. The lecturer will not need any public address system as he teaches online because the students will hear clearly from their devices. The students will not be seated in crowded, poorly ventilated classrooms during online learning. They can log in from the comfort of their homes to learn. This will make learning very palatable, and the students will be very attentive to the lecture since the learning environment is friendly and comfortable.

2. **Recorded Lectures**
Lectures given online can be recorded. The recorded lecture material can be used as reference materials for students. Recording in-class lectures require using unique video cameras and other media devices. However, recording online lectures is very easy and inexpensive. Recorded online lectures can be stored in the cloud and shared, and the file link can be easily shared with students through their emails or using social media platforms like WhatsApp or telegram, which most classes have.

3. **Easy access to online resources**
Several websites can be included in online learning materials. Videos can also be embedded in the teaching materials. This can demonstrate to the students how they can learn from these online resources.

4. **Ease of transition to online learning**
Epidemics' occurrence creates or accentuates new stressors, including panic and fears for loved ones or oneself, constraints on social activities and physical movement due to

quarantine, and unforeseen and radical lifestyle changes (Oyegoke et al., 2021). Being suddenly made to learn online in an already stressful pandemic can make learning even more stressful and ineffective. If blended learning (online and in-class learning) is adopted as the new learning technique, future transitioning to fully online classes will be seamless and stress-free.

5. Containing Epidemics/Pandemics

Experts have noted that the frequency of new pandemics has increased in recent years (Chin et al., 2020). With the concerns on climate change, global warming and possible future pandemics, developing countries like Nigeria should start implementing blended learning so that the education sector will not be negatively impacted if there is reason to shut down schools in future. Also, during outbreaks of epidemics like Ebola and Lassa fever, online learning can help curtail the spread of the disease in the communities. This is because students will be made to learn from their homes and not mandated to come to a physical school. This will reduce the transmission of the disease among students.

6. Reducing exposure to environmental pollution/ insecurity

There has recently been much concern about the environmental pollution in Rivers State, Nigeria, due to the illegal refining activities. Environmentalists and health workers have complained about how this will negatively impact the health of students exposed to soot (Odutola 2019). The air quality in River state Nigeria is usually unhealthy in the early hours of the day, and residents are advised to stay indoors during the early hours in Port Harcourt. If blended learning is implemented, this will reduce student exposure to unhealthy air in the early hours of the day when they usually rush out for lectures. Blended learning can also help reduce students' exposure to insecurity. Students can attend evening lectures online from the comfort of their homes and do not have to move around in the dark after the evening classes as would have been obtainable in fully physical classes. In some parts of Nigeria, the insurgency has kidnapped students from school(secondary and tertiary schools). This can be curbed if students are allowed to learn online from their secure homes.

CONCERNS ABOUT ONLINE LEARNING

Online learning has so many advantages but has not been fully implemented in Nigerian public institutions due to several concerns as outlined here:

1. Students may not be attentive during the online classes

There is a valid concern of sustaining students' interest and keeping students active during online classes. Instructors can sustain students' interest by having periodic feedback from the class during the class session. For instance, the instructor can verbally ask for feedback, create discussion opportunities, or have virtual breakout sessions in small classes.

In large classes, the instructor can launch polls periodically during the class or have periodic online quizzes during the class session to measure the students' learning. Other applications that can be used in receiving real-time feedback include Kahoot, PollEv, ahaslides and others. Balachandra et al. (2021) discussed different teaching technologies, meticulously explaining the limitations in the existing applications and the necessary features in the yet-to-be-developed ones.

2. Demonstration facilities:

Most educators are concerned about demonstrating several principles in online learning, especially when teaching courses that require drawing or calculation. The whiteboard application can be used in drawing any figure for illustration during the online class session. It functions in the same way as a physical while board functions.

3. eLearning is Exclusive.

There are several concerns about how eLearning is only assessable for privileged few who have access to electricity, internet facilities, and devices. Live classes may not be inclusive because students lacking devices, internet, or electricity at the live class time may be disadvantaged. For inclusivity, eLearning can still be effectively implemented in a blended form. This will involve the instructor prerecording the lecture and sharing it with students. The students will be able to view the videos at their convivence and complete the class activities from the lecture. This approach of blended classes will also accommodate students in different time zones.

4. Mindset towards eLearning

A negative attitude is a significant challenge to online learning. Many teachers, parents, and students in Nigeria doubt online learning and assessment adequacy and effectiveness. They may accept it as support but not replace face-to-face teacher-student relationships. This poses a challenge in getting them to participate. They see eLearning as a coping measure and not as an actual means of learning. Students should be made to change their mindset towards online learning. Virtual classrooms are as effective as physical classes.

Case Study: Application of blended learning in the university of Port Harcourt, Nigeria
This segment addresses some of the concerns of online learning from the author's successful implementation of blended learning in teaching petroleum production engineering course at the University of Port Harcourt, Nigeria.

It is opined that subjects that require little or no computation can be easily taught online. However, courses like engineering that require a lot of technical drawing, illustration and computation will be challenging to teach using online platforms. The author effectively taught the petroleum production engineering course using various innovative teaching technologies such as zoom for live classes; google slides, docs and sheets for classwork collaboration, the whiteboard in zoom for illustrations and calculations; and google classroom for uploading course materials and links for surveys.

As the University of Port Harcourt reopened after the lockdown, online training was conducted by the Information and Communication Technology (ICT) centre to instruct lecturers on using google suite for education. Some lecturers were willing to use these tools until the university fully opens to face to face learning. Other lecturers preferred using Telegram and WhatsApp for classes because the students were not comfortable with live classes due to the unavailability of an internet-enabled device to join a live class.

The Petroleum Production course is a graduate course for postgraduate diploma students. Before deciding on the blended approach to teaching this course that semester, the students sent several surveys to obtain their feedback on their fears and concerns about learning online. Some of the surveys were also to assess the students' data usage and their use of social media. These surveys made the students know their opinion about learning was important to the instructor and made the students feel welcomed. The surveys were a way of creating a friendly learning environment for the students. The outcome of the surveys is as shown in Figure 2.

In order to ensure inclusivity and fairness to all learners, a google form was prepared to decide if the course will be fully online or blended. (Figure 2) 43.5% of the class preferred a mixture of in-class and online learning. Therefore, the hybrid model of learning was used in

to deliver this course that semester. When asked what concerns they have about online learning, 52.2% of the student had no concern, while 26.1% felt it is complex, and 21.7% had no data to join the online classes (Figure 3). However, the survey conducted to evaluate the students' use of social media showed that about 70% of the students were active users of WhatsApp (Figure 4). They were all active users of one form of social media; they were only unwilling to use their data for learning but could use it in social media. A further survey assessing the time spent online (Figure 5) showed that all the students spent about two hours daily online. About 47% of the students spent about 5hours online daily.

With the information obtained from the survey, an orientation was conducted to address the concerns of the students. Students without data were advised to pair up with students with data or limit their use of social media so they could preserve data for their weekly virtual classes. Other concerns expressed in the surveys include difficulty in learning the mathematical aspect of the course and concerns about the effectiveness of knowledge transfer in an online class with poor internet connections. The concern about learning mathematical concepts in an online class was addressed by showing the students the use of the whiteboard app in zoom and how it can function as a physical whiteboard. The concerns about knowledge transfer were addressed by encouraging the students to change their mindset towards online learning and assuring them that there would be several feedback mechanisms to ensure they were learning. The students' concern about poor internet connection was addressed by assuring the students that the recording of each class session would be mailed to them immediately after the class.

The students and instructor unanimously agreed that 70% of the class would hold online and 30% in class. The in-class sessions were organised for the laboratory session of the course where the students had to perform some experiments in the petroleum production laboratory. A google form was sent out to collect students' information such as matriculation and email address that was used in adding them to the google classroom learning management system.

They were also graded on google classroom, and the student had feedback on their performance and could monitor their grade as the semester progressed. There were biweekly assignments given to the students through google classroom to enforce their learning on taught concepts. Announcements and links to the various surveys were posted on google Classroom. The google classroom also served as a discussion platform for some challenging assignments. Some of the assignments in the course required group collaboration and virtual presentation from the group members. This was easily done through google docs and google slides. Midway into the semester, a survey was taken on how the course has been for the students. All the students responded that the course content and delivery was effective (Figure 6).
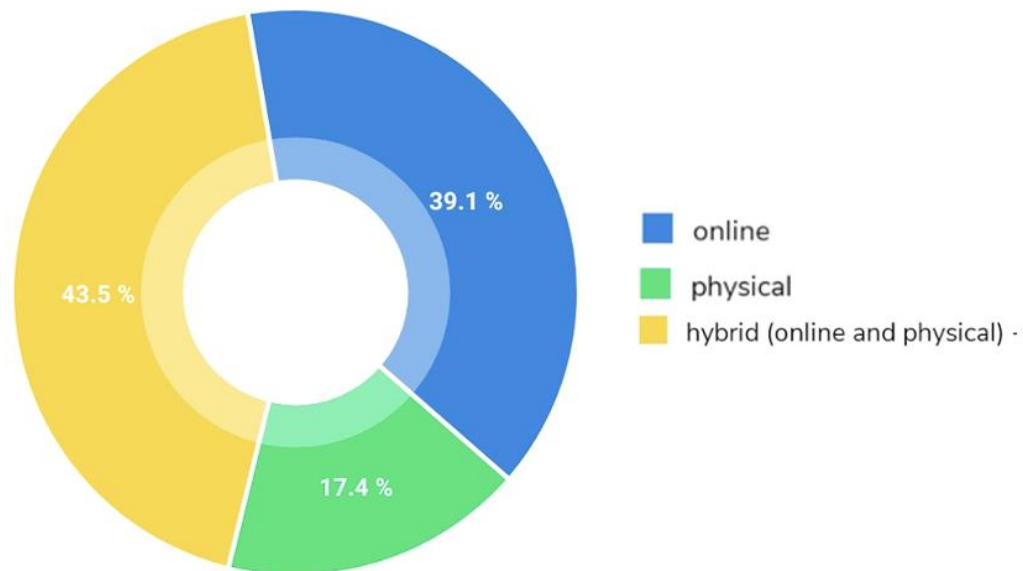
Figure 2: Survey on the preferred mode of learning
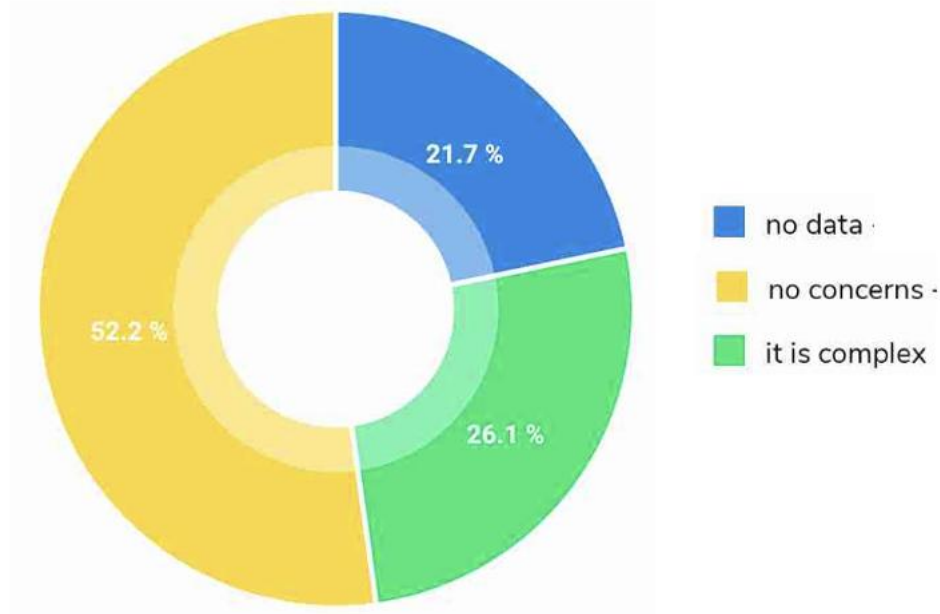

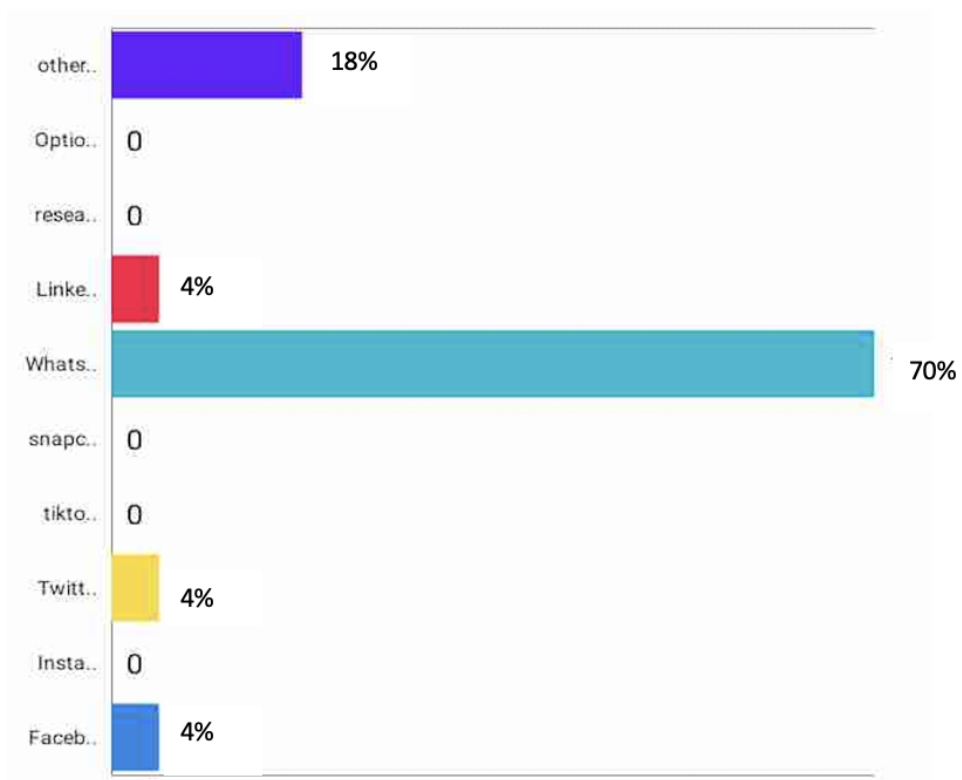Figure 3: Students' Concern about online learning

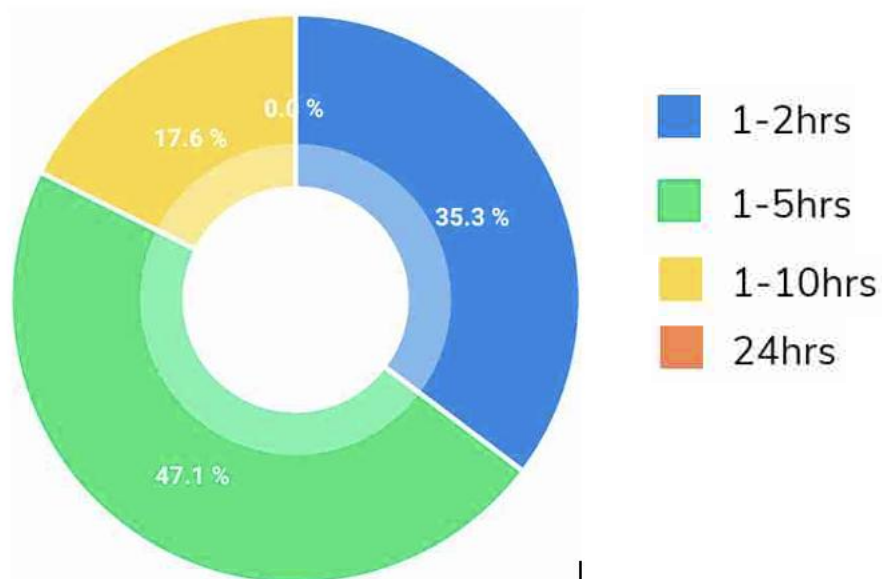Figure 4: Survey on Social media usage of students
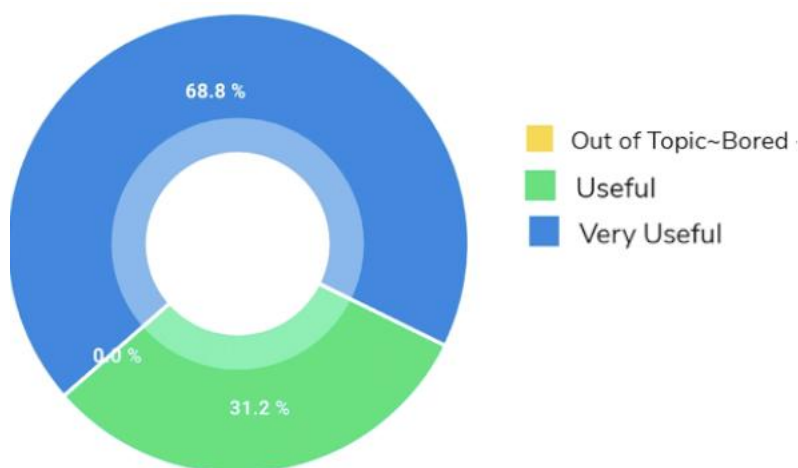

Figure 5: Survey on time students spend online daily

Figure 6: Mid-semester survey on class effectiveness.

Conclusion:
There is the need to re-think education in what, where, how and when learners should learn. In addition, information and communication technology is gradually revolutionalising learning and teaching at all levels. COVID 19 showed that it is possible to have efficient, entirely virtual learning. Although institutions have opened to in-class learning, it is essential to retain the online teaching and learning skills by imbibing hybrid learning, especially in our higher institutions in Nigeria. This will help overcome access and poor learning during emergencies in the future and ensure that distance barriers do not hinder education and academic sessions will not be threatened. The petroleum production engineering course was taught effectively using a hybrid of online classes for the theory aspect and in-class learning for the practical aspect. With access to smartphones and data for regular social media activities, weekly online classes were held. The students were very excited at the end of the course and attested they learnt a lot, and it was a lot convenient to have the hybrid classes. The online classes were easily recorded and served as reference materials they could always refer to. This also made studying for exams easy. Implementing blended learning is more effective in a friendly and inclusive learning environment where the students' opinions are sought, and proper orientation is provided. Government should put up policies that encourage eLearning in public institutions. Also, internet providers should provide subsidised data to the university community to encourage teaching and learning online.

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