

## A Web-based Awareness System for Improving Open-source e-learning Software adoption by Nigerian Higher Institutions of learning

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### ABSTRACT

Open-source software has been widely developed and adopted for different purposes, including in the educational sector. Many institutions of learning extensively utilize open-source e-learning software to complement their in-class programs, especially during the COVID-19 pandemic. But many institutions of learning in Nigeria are still unable to utilize the opportunity due to a lack of adequate awareness and guidance on how to adopt the software. This study is aimed at educating the Nigerian public on open-source e-learning software and its benefits in education, especially in tertiary institutions amid the COVID-19 pandemic. To better have a wide coverage of respondents in Nigerian tertiary institutions, we conducted an online survey and a paper-based questionnaire. A sample of 500 responses was collected from Nigerians with different high educational levels regarding Open-Source e-learning adoption and awareness. However, only 349 responses were returned. The results of the survey were analyzed using python-based analysis libraries. The findings indicated that a greater percentage of the respondents were aware of what constitutes open-source e-learning but that most institutions in Nigeria have not fully utilized the platform for learning activities. It is implied that a reasonable number of respondents have literacy knowledge of open-source learning and agree that COVID-19 has greatly influenced the use of e-learning software in Nigerian institutions. It is therefore recommended that more work be done to improve the awareness level of various institutions to fully utilize the technology and the benefits it represents. This led to the development of a web-based solution for creating more awareness among the public. This would help close the gap found in this study and affect how open-source e-learning software is used in Nigerian schools.

**Keywords:** Open-Source Software, E-Learning Software, Covid-19 Pandemic, Awareness, Software Adoption.

### 1. INTRODUCTION

Open-source software (OSS) are community-based software that has both community- and publicly-sourced source code that are readily available for access, modification, distribution and customization by the intended users [1]. Open-source software come from different vendors and can be developed for solving various real life problems. For example [2] developed an open-source software for digital pathology image analysis, [3] developed an open-source called WannierTools for novel topological material. Similarly an online dynamic examination system was developed by [4] using a Word Press based open-source software for e-learning.

E-learning systems are platforms that can be integrated into an institution's website (portal) to deliver remote or online teaching [5](Pius, 2021). The author further stated that there are several types of e-learning portals depending on learning tools and mode of delivery. Furthermore, some e-learning portals are computer-based and require an internet connection, while some do not. The author listed some of the benefits of e-learning platforms and the need for their adoption, especially in the era of COVID-19 pandemic. These include saving time and money; capacity building and consistency; learning retention; flexibility; reducing printing costs; tracking learners' progress; among others. In another study by Ayomide Odegbesan et al. (2019) e-learning involves the utilization of all forms of electronic media and technologies to aid the educational process [6].

Due to the sudden appearance of COVID-19 and its negative impact on education [7], schools had to close without warning. This led the government to suggest using methods other than traditional learning in emergencies to make sure that students don't have to stop studying and to stop the epidemic from spreading.

E-learning is a formal learning system that makes use of electronic resources. While education can take place inside (or outside) the classroom, the essential component of e-learning is the use of computer technology and the Internet [8]. When the COVID-19

virus surfaced, traditional educational techniques were supplanted with e-learning because social gatherings at educational institutions were seen as a potential for the virus to spread. Despite the problems and analyzed numbers that indicate that students are less likely to profit from this sort of education, e-learning is the best choice available to ensure that diseases do not spread [9].

Information and communication technologies (ICTs) provide unique educational and training opportunities for people and organizations through improved teaching and learning, as well as innovation and creativity. Furthermore, the use of ICT can aid in the formulation of an educational policy that promotes the development of creative and innovative learning environments in educational institutions [10], [11]. As a result, activities and experiences related to this sort of education receive a lot of attention. Most universities in several poor nations use this technology. There are many learning-related activities in an educational setting, and educational institutions generate large amounts of potentially rich data on a regular basis to extract information from those data for a better understanding of learning-related processes [12], [13]. E-learning is a critical component of the current educational system as it transforms the entire educational system and has become one of the most popular topics among academics [14]. Gaebel et al. (2014) define it as the employment of a variety of ICT and electronic devices in the classroom [15]. Most students nowadays want to study online and graduate from universities and colleges all over the world, but they are unable to do so since they live in rural areas with limited communication options.

The purpose of this study was to look into the level of adaptation and literacy of staff and students in Nigerian institutions when it came to Open-Source E-learning. Contributions will be made as follows:

1. To find out how well staff and students in Nigerian higher education institutions can use open source e-learning software by doing a thorough survey.
2. To investigate the advantages of using e-learning software on both staff and students in Nigerian higher education institutions.
3. To investigate the influence of the COVID-19 pandemic on the use of e-learning software among staff and students of Nigerian higher institutions of learning.
4. Create a web-based system to raise awareness among Nigerian educational institutions about how to access, customize, and adopt open-source e-learning software.

## **2. REVIEW OF RELATED LITERATURE**

The National Open University of Nigeria (NOUN) is one of the promising universities in Nigeria to implement e-learning [16]. This is demonstrated by the declared IT goal of "integrating ICT into the mainstream of education and training". One of the main benefits of using e-learning for maintenance management training is the flexibility it provides and the ease with which it can be tailored to individual learners [17]. Much of the adaptability of learning management solutions is based on a thorough understanding of how people learn. In such a procedure, there are two crucial principles to consider:

1. Learners who are actively involved in their studies are more likely to learn.
2. Because learners learn at different rates and in diverse ways, tailored learning is necessary. Hence, customized techniques and materials lead to efficient learning.

According to Hubackova (2015), the evolution of eLearning is linked to development, technical advancement, and improved computing affordability. The first kind of electronic education, Computer-Based Training (CBT), was created in the late 1980s and early 1990s of the previous century. The CBT system necessitates the connection of a personal computer to another kind of multimedia, such as a CD-ROM. Hubackova (2015) went on to say that the system itself was a huge step forward, even though its material was not fully developed and it lacked some subsequent aspects of eLearning, such as time or location constraints. Similarly, the development of the Computer Base Test was the technology that was developed to enable an easy evaluation process; learners are given a series of pertinent questions and answers, which led to the usage of the internet and the construction of the web system in several sectors of the Nigerian system, including the educational sector. Technology has progressed; at first, information could only be provided in text format, but in the early 1990s, browsers were developed that allowed users to add graphics to the text. The internet grew swiftly, and its cost dropped, making it more affordable and accessible to the middle class [18].

Several studies have examined the advantages and disadvantages of transitioning from traditional to e-learning. One of the leading causes of e-learning project failure is a lack of well-preparedness for this encounter. A work by Aboagye et al. (2020) presents a study that aims to examine student barriers to e-learning in the aftermath of the COVID-19 epidemic, as well as whether students are prepared to study online. According to the conclusions of the study, students need access to a hybrid method that combines

traditional and e-teaching. The purpose of another study by Sathishkumar et al. (2020) is to investigate the e-learning process among students who are familiar with web-based technologies to increase their self-study skills. [19]. During the COVID-19 pandemic lockdown, this author found that e-learning was very popular with student's at all educational institutions.

Swati and Sawai (2021) presented a comparative study of various e-learning platforms for learning management systems (LMS) and video conferencing tools. LMS studies include Moodle, TalentLMS, Chamilo, Google Classroom, and LMS365. The features considered for the tools are supported platforms, supported browsers, activities grading, courses management, learning types, security and user enrolments. The video conferencing tools studied by the research include Google Meet, Cisco Webex, Zoom, and Microsoft Team based on features such as the number of users they accommodate, free or premium version availability, screen sharing, and co-annotation, among other[20]

In recent research by [21] investigating the level of adoption of open source software among students of higher institutions in emerging countries, the authors focus on examining the factors that affect the adoption of open source software by students, particularly in Medellin. Some of the main factors identified by the authors include: the complexity of the tools, which makes it difficult for users to adjust them to their needs; the use of piracy software rather than purchasing proprietary licenses; and, most noticeably, a lack of awareness of the values that can be gained by utilizing the resources.

## **2.2 Research Questions**

This study will be carried out based on the following research questions:

1. What is the literacy level of staff and students of the Nigerian higher institutions of learning on open-source e-learning software?
2. Are the staff and students of the Nigerian institutions of learning aware of the benefits of using e-learning software?
3. Does COVID-19 pandemic influence the use of e-learning software among staff and students of the Nigerian higher intuitions of learning?
4. How can we improve the awareness level of higher institutions on how to adopt open-source e-learning software?

## **3. METHODOLOGY**

In this study, to respond to the research questions, an online survey was used to collect data from staff and students of tertiary institutions with regards to their awareness, motivation, competence, and engagement in open-source e-learning software during the COVID-19 pandemic. A total of three hundred and forty-nine (349) respondents from tertiary institutions in Nigeria filled in the survey questions.

The instrument used in this study was an online survey with the title "open-source e-learning software". Respondents include both staff and students of Nigerian higher institutions. The survey was conducted within three (3) months between February of 2022 and June 2022. The survey consists of a demography section targeting the two main genders (male and female) and age. The respondents will be asked questions on the e-learning platform's benefits and usage, the influence of COVID-19 on it, and how the open-source e-learning software awareness can be improved. The responses were analyzed using python-based data analysis libraries including pandas, matplotlib, and NumPy.

## **4. RESULT ANALYSIS**

This section analyzes the result obtained from the survey conducted. The responses are stored in the form of comma separated values (CSV) file. Python libraries were used to analyze the responses of the survey. The analysis was presented based on the sections presented during the survey to enable conducting effective exploratory data analysis based on the data.

### **4.1 Level of awareness of the respondent about open-source e-learning software.**

In this section, we explore the participant's level of awareness of the available open-source e-learning tools and facilities such as Moodle, Sakai, and so on.

Table 1.1 Respondents knowledge about open-source software

Do you know what open-source software is?		
Total Response =349		
Response	Number	Percentage (%)
Very well	168	48
Somehow	128	37
Maybe	29	8
Not at all	24	7

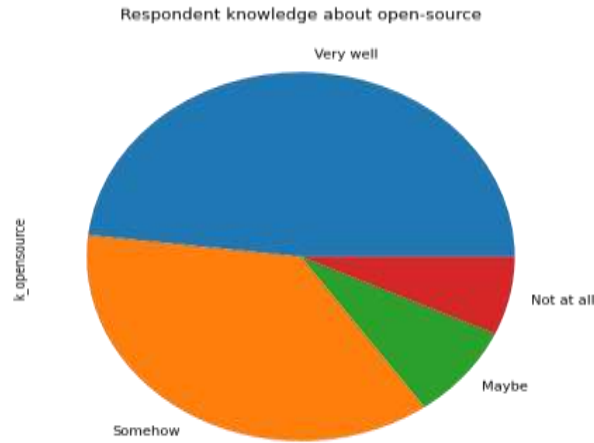


Figure 1.1 Distribution of respondent knowledge about open-source learning software

Open-source software are popular software that are largely used for various applications. From the responses recorded, it has shown that a greater percentage (48% and 37%) of the respondents know what open-source software are. There are a few that don't know or are not sure about what open software. Similarly, a greater percentage of the respondents are also aware of the most used open-source e-learning software used in the educational sector. Though the majority are aware of open-source software, the majority have not used any of the platforms for teaching or learning.

To delve more deeply into the level of awareness of open-source e-learning software, we can determine the number of PhD and masters' holders among the respondents that know and use tools for teaching and learning.

Table 1.2 PhD and Masters Holders from respondent knowledge about open-source e-learning

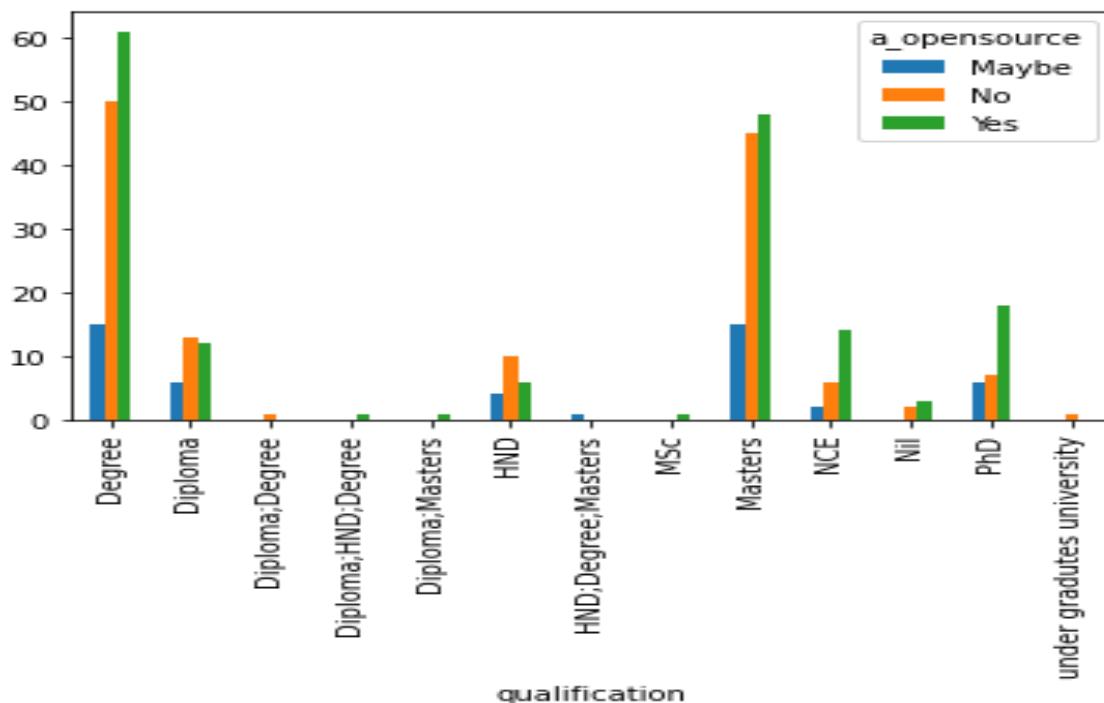
Do you know what is open-source software very well?		
Total Response : 349		
Type	Yes	No
PhD	18	331
Head of Department	19	330
Experience 21-30 tears	12	337
Age 41-50	22	327

Some of the famous open-source e-learning software that is widely adapted and used by most institutions that use e-learning include: Moodle, Chamilo, Sakai, among others. A considerable number of respondents (39%) responded that they didn't know about their existence and usage. 47% responded that they knew of the software's existence.

**Table 1.3 Knowledge of the respondent about popular open-source software**

Are you aware of open-source e-learning software such as Moodle, Chamilo, Sakai, Open Edx, Atutor etc.		
Response	Number	Percent (%)
Yes	165	47
No	135	39
Maybe	49	14

The figure 1 below shows the distribution of the respondents based on their qualifications on their prior knowledge about open-source e-learning software.



**Figure 1.2 Distribution of respondents based on their qualification**

Based on the views of the respondents, it is also important that more awareness is needed to educate institutions and individuals on the adaptation and use of open-source e-learning software. About 90% of the respondents recommended more awareness.

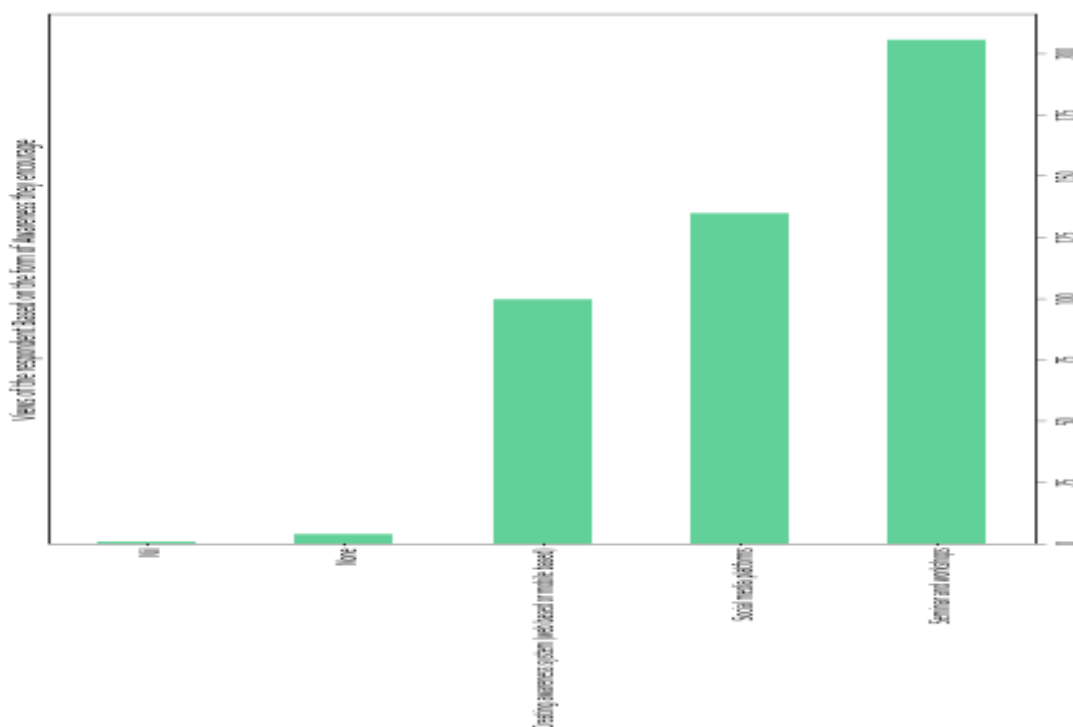
**Table 1.4 Respondents view on the need to create more awareness**

Do you think it is necessary to create more awareness on open-source e-learning software?		
Total Response: 349		
Response	Number	Percent (%)
Extremely important	191	54.7
Very important	131	37.5
Moderately important	20	5.7
Somewhat important	5	1.4
Not important	2	0.57

The table below shows that about a greater proportion of the respondents recommended seminars and workshops be conducted at various institutions of higher learning to introduce and train staff on the ways of adopting open-source e-learning facilities to leverage their advantages. Some of the respondents recommend enlightening people through social media platforms or by developing a web-based application for creating proper awareness and linking people to the appropriate software. Even though a greater percentage of them are of the view that a workshop or seminar should be organized, due to the tight schedules of administrative staff, their time to attend seminars is very limited. So, the respondents think that the problem can be solved by making a web-based system that anyone can use at their own pace.

**Table 1.5 respondents view on the mode awareness to create**

In your opinion, what form of awareness do you recommend?		
<b>Total Response: 349</b>		
<b>Response</b>	<b>Number</b>	<b>Percent (%)</b>
Seminar and workshops	144	41.3
Social media platforms	78	22.3
Creating awareness system (web based or mobile based)	55	15.7
Seminar and workshops;Social media platforms;Creating awareness system (web based or mobile based)	30	8.5
Seminar and workshops;Social media platforms	22	6.3
Seminar and workshops;Creating awareness system (web based or mobile based)	10	2.8
Social media platforms;Creating awareness system (web based or mobile based)	5	1.43
None	4	1.15
Nil	1	0.28



**Figure 1.3 distribution of the views of the respondent on the mode of awareness**

From the respondents' point of view, most of the institutions in Nigeria are partially knowledgeable about e-learning facilities. About 50% of the respondents are of the view that high institutions of learning are somewhat aware of the existence and how open-source software can be utilized to support teaching and learning. Only 36% are of the view that tertiary institutions in Nigeria are fully knowledgeable about e-learning facilities.

**Table 1.6 respondent view about Nigerian institution knowledge about Open-source e-learning software**

Do you think Nigerian institutions are fully knowledgeable about e-learning facilities?		
<b>Total Response: 349</b>		
<b>Response</b>	<b>Number</b>	<b>Percent (%)</b>
Somewhat aware	173	49.6
Fully aware	126	36.1
Not sure	28	8.0
Not aware	22	6.3

**Motivation on the need to improve the use of e-learning in Nigerian institutions**

Individuals must be motivated to improve their adoption and use of e-learning resources. About 86% recommended that institutions in Nigeria need to be motivated to increase the use of e-learning resources. While 9% of the respondents believed there was no need for any motivation for the use of e-learning, the table below shows the details.

**Table 1.7 Respondents view on the increase use of e-learning tools**

In your opinion, do you recommend increase in the use of e-learning?		
<b>Total Response: 349</b>		
<b>Response</b>	<b>Number</b>	<b>Percent (%)</b>
Yes	300	86
No	32	9.2
Maybe	15	4.3

The respondents also express their views on how the e-learning facilities can affect the confidence of learners and instructors towards learning. A greater percentage (86%) are of the view that e-learning can increase the confidence of both learners and instructors; only a few (8.3%) do not agree. Table 1.8 below shows the distributions

**Table 1.8 e-learning increase learners and instructors confidence toward learning**

Do you think availability of e-learning resources can increase confidence of learners/instructor?		
<b>Total Response: 349</b>		
<b>Response</b>	<b>Number</b>	<b>Percent (%)</b>
Yes	299	86
No	29	8.3
Maybe	19	5.4

Due to the lack of technical know-how on how to access, customize, and distribute open-source software, some of the respondents are of the opinion that a repository should be created with possible e-learning software or a link that can guide the user on how to access and utilize open-source tools. About 55% believed that it was very necessary, 38% necessary, and only 10% said it was not necessary.

**Table 1.9 respondent on the need to create open-source software repository**

in your opinion, do you think creating a repository for easy access to the link of open source software website or link to download a copy, can help users?
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<b>Total Response: 349</b>		
<b>Response</b>	<b>Number</b>	<b>Percent (%)</b>
Very necessary	193	55
Necessary	134	38
No response	12	3.6
Not necessary	10	2.8

## 5. DISCUSSION OF FINDING

This study found that a greater percentage of higher institutions in Nigeria have prior knowledge of e-learning tools for teaching and learning, but very few are aware of open source e-learning platforms and how to utilize them efficiently. The study confirmed that the open source awareness system proposed in this research will assist individuals and institutions of learning in having the technical knowledge and the necessary level of guidance to access, download, and utilize the available open-source software to support online teaching and learning activities. It was observed that due to the influence of the COVID-19 pandemic, institutions of learning are henceforth willing to adopt an e-learning platform as a complement to classroom learning to avoid a total shutdown of academic activities in case of any unforeseen circumstances. As a result, developing a solution to increase people's awareness of open-source platforms is required.

Based on the analysis of the participant responses, the following finding was made from the research:

1. Most of the people who answered the survey knew that there were e-learning options, but only a small number knew about open-source software.
2. Most schools and colleges in Nigeria don't use e-learning software as an alternative to traditional ways to help students learn.
3. Although open source software is free and distributed, it is bound by some policies, security requirements, and compatibility issues that require technical knowledge to manage.
4. A greater percent of the respondents, up to 90%, are of the view that institutions lack complete knowledge and awareness of open-source software. Hence, more awareness is necessary.
5. Creating a simple easy to use web portal that can guide institution on how to access, download, customize and utilize an open-source software will go a long way in assisting the Nigerian higher institution in utilizing the full potentials of open-source e-learning in support education.

### 5.1 Recommendations

Based on the findings in this study and the responses from the participants, it was recommended that a web-based system should be developed that will provide more awareness and easy access to the sources of open-source e-learning software available for use by institutions of learning. More guides on how to select, download, and customize software should be provided on the website of the system.

The section that follows discusses the proposed system that is being developed to aid in raising awareness.

## 6. WEB-BASED SYSTEM DEVELOPMENT

### 6.1 System Design

By making the system accessible to users, the system architect demonstrates how the system functions. Users have the option to sign up, log in, see and download open source, view news and updates on open source, and be taken to the open source's main website for direct downloads. By registering new open source, uploading new versions, posting news, and responding to inquiries and comments, the admin site is used to govern the website.



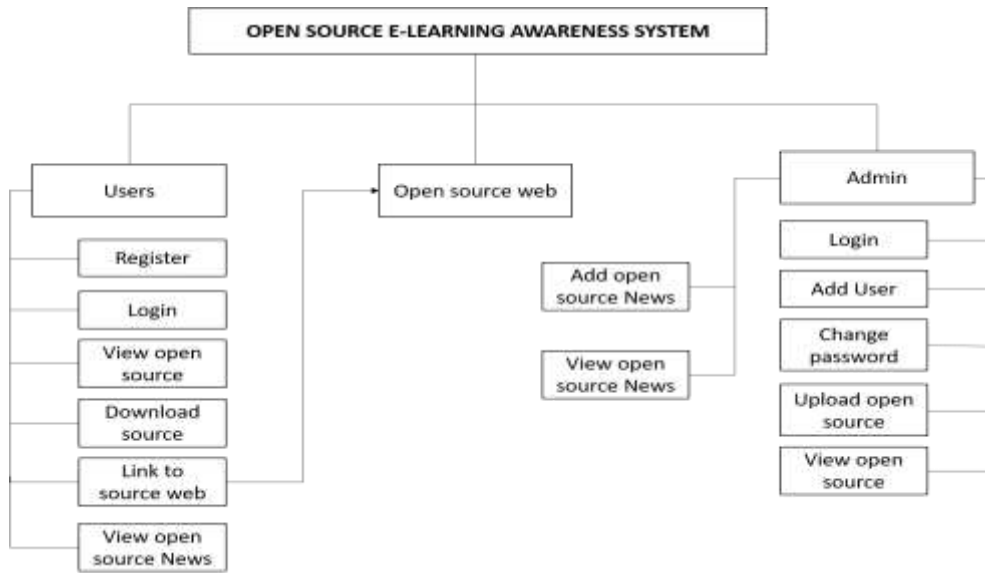


Figure 1.4 system architecture

The use case diagram in figure 1.5 below illustrates the users that interact with the system with their use cases. Users could be any individual or an IT coordinator for a particular institution willing to have more light on recent advancements in open-source software shared on the portal. The admin is responsible for updating the portal with recent updates on open-source software as well as responding to users' requests on the portal.

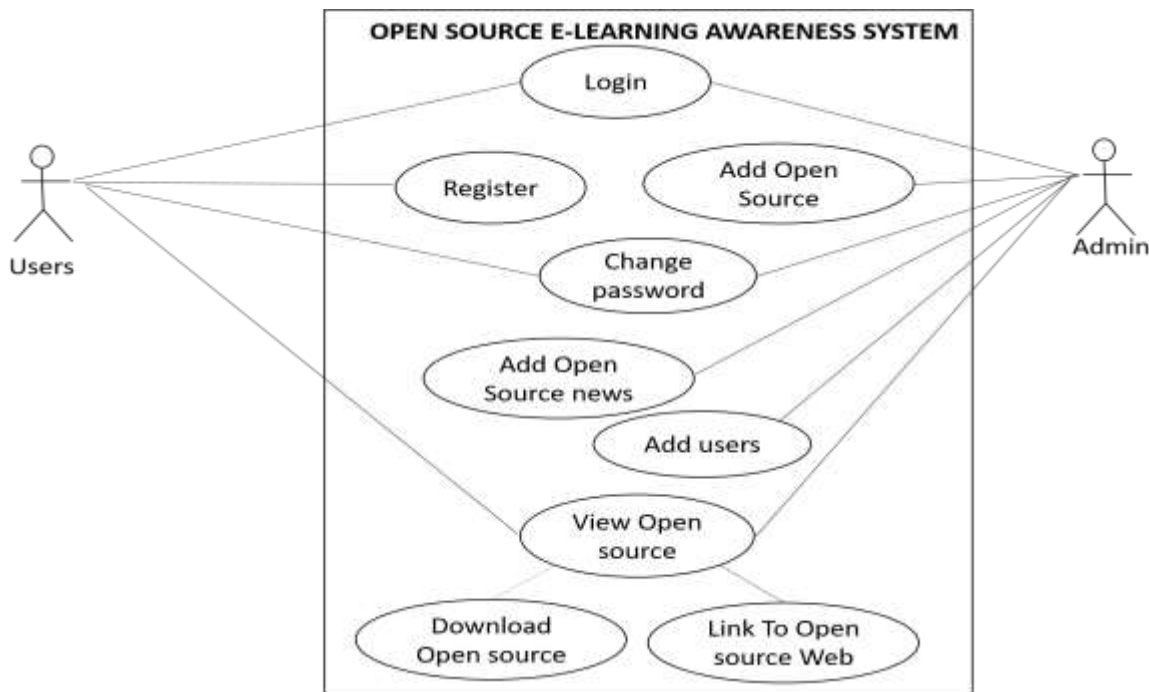


Figure 1.5 Use case diagram

The activity diagram in figure 1.6 below, illustrates the sequence of activities users need to perform with the system in order to accomplish a particular use case scenario.

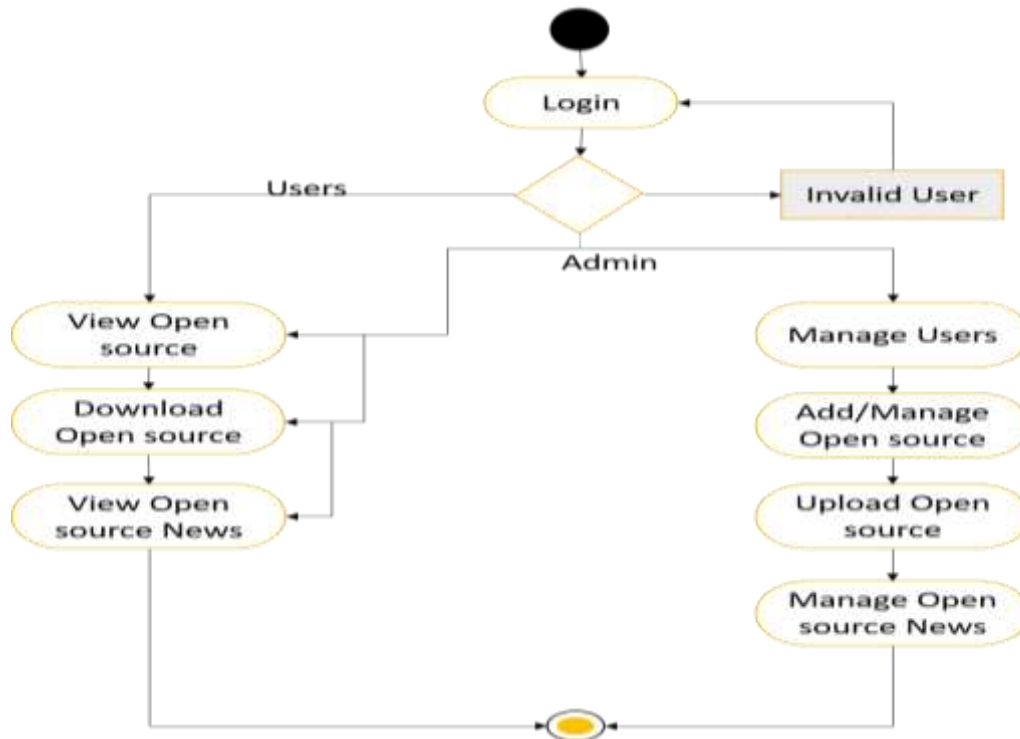


Figure 1.6 Activity diagram

## 6.2 User interface Design

The home page of the open-source website includes mission and vision statements, as well as news and updates about open source (see figure below for home page). The portal can be accessed via the link: [www.oseawareness.org](http://www.oseawareness.org)



Figure 1.7 Home Page

The selected and uploaded open sources to this site are displayed at the bottom of the home page; users can view the related version by clicking on each open source or download it by using the download link; and the number of views per open source is displayed on the right side of the open source. The new comment session is displayed below the open-source list.



Figure 1.8 open source update

A user can register with the site if they have never registered before or login if they have already registered to make him/her able to download or visit a link to open source, ask questions, and make a comment.

The admin user can register a new open source project if he or she logs in as admin by clicking on "open source". A list of registered open sources will be displayed as in Figure 1.8 Source list page. To add a new source, click on "add new source" at the top of the open source list. Figure 1.9 depicts the dialogue home. Add the new source. Sometimes open source comes up in a version. Just click on "view" under "action. It will take you to the open source details and version as in the figure 6.2.3 below. This page will show upload the version of the source link and set the status of the version.

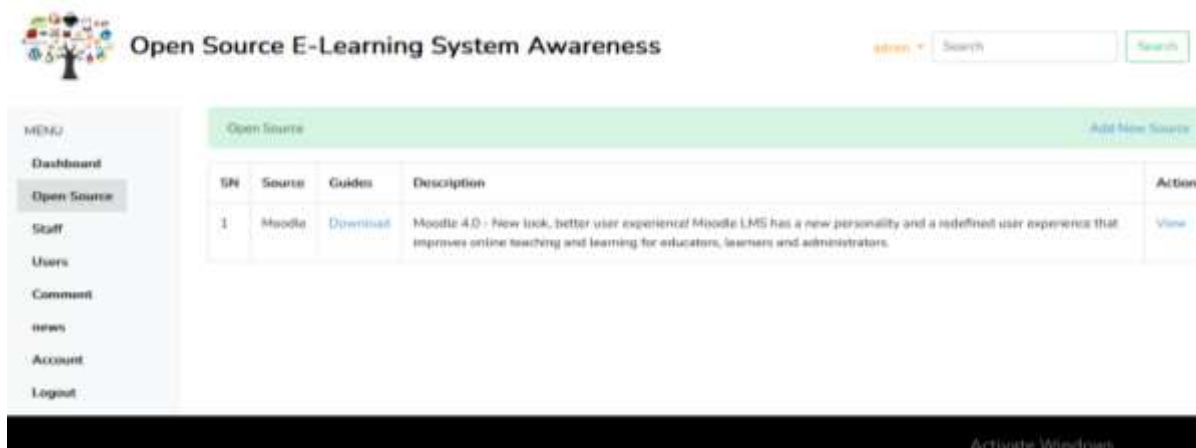


Figure 1.9 Source list page

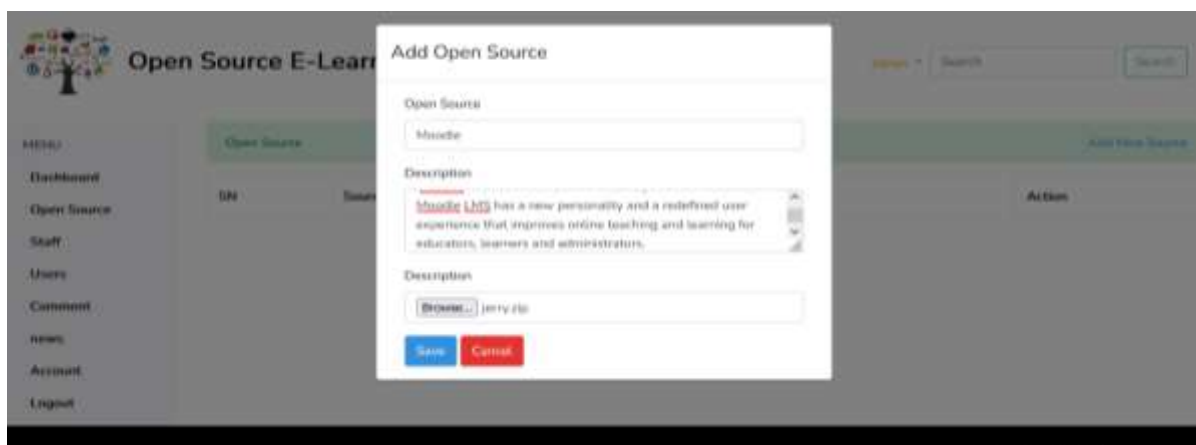


Figure 1.10 add new source

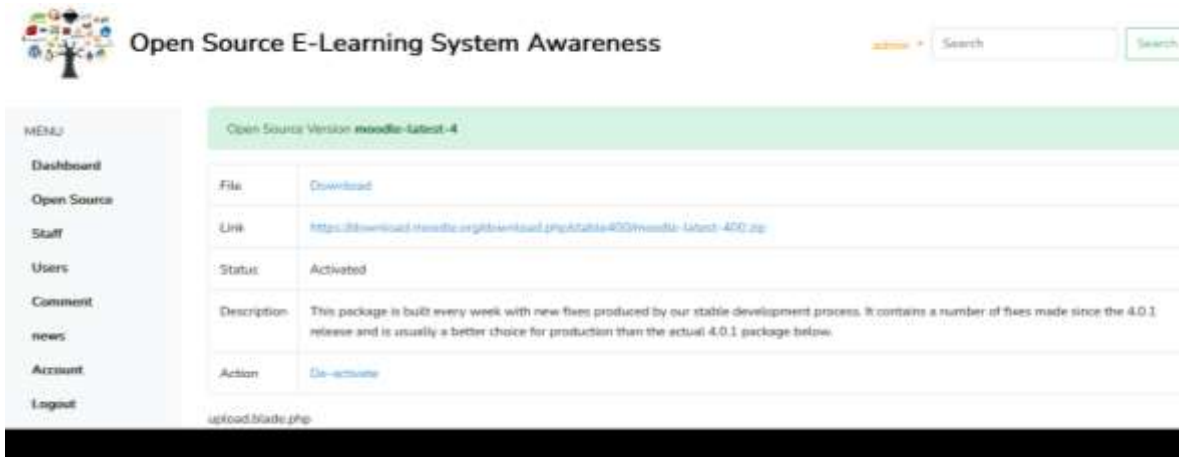


Figure 1.11 upload source files home page

The comments and the news session can be viewed and updated on the admin side. The news is displayed in a list. To add news, click on the button at the top of the news list called "News". This will give you a dialogue box to enter the news and updates about open sources.

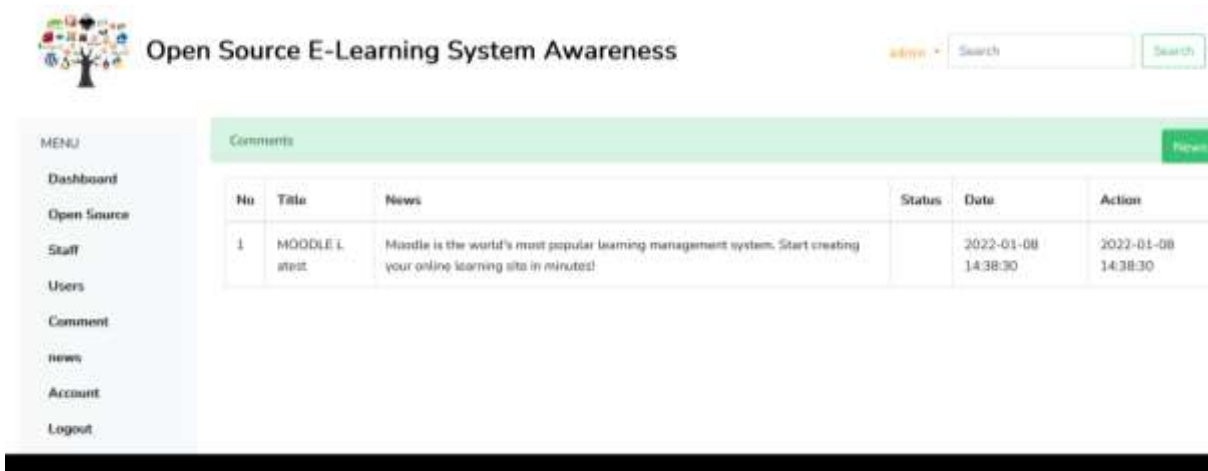


Figure 1.12 New software uploaded

## 6. CONCLUSION

Open-source e-learning software has received rapid adoption, especially during the COVID-19 pandemic in most countries, as an alternative to in-class learning to avoid the wide spread of the virus. The pandemic has a greater influence on learning outcomes and necessitates the improved use of e-learning facilities to complement physical learning. The findings in this research demonstrated that, although a greater percentage of individuals are aware of e-learning tools, most Nigerian institutions of learning are yet to adapt and fully utilize the benefits open-source software represents in supporting online learning. Based on the recommendations from the respondents, collected using an online survey conducted over various social media platforms as well as an individual paper-based questionnaire distributed. In this study, we proposed a web-based solution for improving people's awareness and providing guidance on how to adopt the open-source e-learning software by higher institutions of learning in Nigeria. The proposed system is readily available online for easy access. It is highly recommended that individuals and officials of institutions that require more awareness and guidance should visit the web portal. In the future, the web portal will be expanded to collaborate with open-source software vendors to improve accessibility.

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