

Use of Open Source Applications in Higher Learning by Prospective Computer Science Teachers in Abubakar Tafawa Balewa University, Bauchi-Nigeria

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Abstract- This study investigated the use of open source application in higher learning by prospective computer teachers. Colleges and universities are increasingly aware of the necessity to use technology to meet both the business and academic mission of the institution. Often, open source software (OSS) and Free Source Software (FSS) are seen as viable options for meeting these challenges. Many Institutions are recognizing the importance of the interplay or overlap between FSS and OSS as an important feature for providing high quality teaching and educational experiences. Descriptive survey research design was used, which typically employs the use of questionnaire, sampling random sampling was adopted, where 79 respondents were as the sample size of the study. The finding of the research shows that the prospective teachers of computer education in ATBU are aware of the open source application, but lack of awareness about the uses and benefits of open source software, is a large factor towards less use of open source software. Factors inhibiting the optimal utilization of open source Application by prospective computer science teachers are: Unfamiliarity, Complex licensing situation, backward compatibility issues, Component and architecture incompatibilities and Migration and usage. The Findings of this study serves as the basis for making the following recommendations: Educational institutions should not spend huge money on proprietary software and Universities should replace the proprietary software by open source software for saving the money of license renewal fee, up gradation charges etc. to encourage the use, accessibility and benefits of Open Source Software by student, The school website should be linked to Datamation which highlights a list of open source software related to a particular category such as security, cloud computing, small businesses, big data, games, etc.

Keywords- Open-Source, Higher learning, Computer Science, Teachers.

I. INTRODUCTION

Open-Source Application is a form of Application in which the original source code is openly available for users to examine and modify, and to use, run or to create computer programs. One of the best-known examples of open source Application is Linux, which is widely used as an alternative to commercial operating system (OS) software. Open source Application includes a license to use, modify, and redistribute the code. Commercially sold Application products can be developed from open source Application. Open Source Application is not a brand of Application, but a philosophy of software development. Several definitions abound in relation to the concept of Open-Source Application. Open Source Application is distributed with its source code. The Open Source Definition has three essential features:

- It allows free re-distribution of the software without royalties or licensing fees to the author
- It requires that source code be distributed with the software or otherwise made available for no more than the cost of distribution

- It allows anyone to modify the software or derive other software from it, and to redistribute the modified software under the same terms.

According to Wikipedia (2010) Open-source Application (OSA) is computer Application that is available in source code form for which the source code and certain other rights normally reserved for copyright holders are provided under an application license that permits users to study, change, and improve the Application.

Perens (2000) who in February 1998 founded the Open-Source Initiative (OSI) alongside Eric S. Raymond describes open-source Application as a broad general type of Application license that makes source code available to the general public with relaxed or non-existent copyright restrictions. In the words of Engard (2011) open source usually refers to an application whose source code is made available for use or modification in line with users' needs and requirements. While Global Investment Recovery defines Open Source Application as an operating system and/or applications software for which the code is open for alteration by the public. From the forgoing, OSA's are computer Application that are

produced by Programmers and distributed under a licensing arrangement which allows the source code to be openly shared, viewed and modified by others to suit their purpose of usage.

Wheeler (2007) defines Open Source Application as an operating system and/or applications software or programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers). Open Source Application offers more flexibility and freedom than application purchased with license restrictions. Both the OSA programmers and the user community share and promote open standards and believe in sharing. Open source Application are very often developed in a public, collaborative manner.

Although certain costs are associated with OSA such as the cost of technical support, training and further development, it is argued that OSA remains less expensive than these Applications often provide greater freedom of choice and are considered by many as more cost-effective as little or nothing is usually paid for their acquisition. Many proprietary choices. However, the major reason to choose an OSA application is the freedom it confers to change the source code for individual requirements. It gives room for alteration of the program to suit your purpose. This is the reason why an Application can be utilized for varying services once it is modified to suit those purposes. Other terms that are interchangeably used with OSA include “libre Application” (where libre means free as in freedom), and “Free Application (FA). It is worthy to note that these terms are however slightly different from OSA as they connote “free Application that cannot be modified and redistributed without further limitation, but whose source code is visible”. In other words, libre and free Application are Application which even though they are distributed with their source code and without any fee attached, restricts modification and redistribution.

Open source Application is considered distinct from free Application, which is also open source but can be used for any purpose and without any costs or restrictions. Both open source Application and free Application are different from Application provided for free (freeware) by commercial Application manufacturers that do not allow access to the original source code. A central features of open source Application is that users can review the software, add features to it or hire programmers to add features, or fix errors known as bugs, rather than wait for the original software publisher or creator to release a “patch” or bring out a new version. With open source Application, programmers many of them nonprofessionals contribute to the computing community by making their improvements and bug fix available to other users.

This type of peer review is open to community input, standards, and verification, and is thought to lead to more reliable software. It is also thought to speed up the software development process. In some cases, the peer review may be uninfluenced by deadlines or other commercial concerns. However, as open source software development has evolved, companies such as the International Business Machines Corporation (IBM), Sun Microsystems, Inc., Microsoft Corporation, Apple Inc., and others have offered an increasing number of open source products. Growing segments of both government and business have adopted some open source Application such as Linux. Other commonly used open source products include the Apache open source program for Web servers and the Web browser Mozilla Firefox. OpenOffice offers open source applications similar to commercial products such as Microsoft Office. Potential drawbacks to using open source Application include incompatibility with different applications or devices run with commercial software platforms such as Microsoft’s Windows or Apple’s Mac OS. Security features included in commercial software may also block some open source Application.

Similarly, open source Application may lack security features, making it vulnerable to hacking or infection with harmful software such as computer viruses. Commercial software products usually offer rapid personal tech support for users. Finding help in solving problems that occur with open-source software may require much more effort, particularly if the user is not an expert with computer code.

1. The Problem today in the age of computer and internet most of teaching is still performed in classical way, with the new method of teaching and e-learning, which are connected with large investment. The expense for software can be reduced with use of free/open source Application. That are not used it often is because it is not known (lack Awareness), the Types are not known (inadequate knowledge of Types), the means of accessing it is not known, how to utilize it and we fear from new things where we need to put some effort (challenges). In this project the use of open source applications in higher learning will be presented. The objectives of this research, which are:

1. To determine the level of awareness of Open-Source Application by prospective computer science teachers in ATBU, Bauchi.
2. To examine the types of open source application known by prospective computer science teachers in the area under study.
3. To examine the accessibility of the open source application by prospective computer science teachers in the area under study.
4. To determine the extent of use of open source application by prospective computer science teachers in the area under study.

5. To identify factors inhibiting the optimal utilization of open-source Application by prospective computer science teachers in the area under study.

2. Research Questions

This study was provided answer to the following questions:

1. Are the prospective teachers of computer education of ATBU aware of open source applications?
2. What are the types of open source application known by prospective computer science teachers?
3. How prospective computer science teachers access open source applications?
4. In what ways do the prospective computer science teachers use the open-source application?
5. What are the factors inhibiting the optimal utilization of open source Application by prospective computer science teachers?

3. Significance of the Study

The significance of this study (use of open-source application in higher learning by the prospective computer science teachers in ATBU Bauchi) will help the university authority and the departments have an inside to know how knowledgeable and familiar, the prospective computer science teachers in the institution are with open-source application. By so doing the authority will know areas where they are lacking and areas where there is short coming like Seminars should be conducted about the use and benefits of open-source application, Universities should replace the proprietary application with open-source application for future benefits like license renewal and file up gradating.

To the prospective computer science teachers this study will help them realized that Open source application cheaper than proprietary application, Open Source Application is superior in quality to proprietary application (like less errors, more features), how to access, utilize and differentiate between pirated application, proprietary application and open source application. Finally, to the field of computer science it is an added literature and also it served as stepping stone to another research which are yet to be conducted.

II. LITERATURE REVIEW

The review of literature related and relevant to the study is an important aspect of designing and carrying out research work. Ali (1996) emphasized that "review of literature is not the mere reporting of other previous view, works and opinions such that the literature becomes a long winding essay or a litany of disconnected citations". But Review of literature can therefore be defined as a summary of information which is related, relevant and useful to the present research work being undertaken. The literature review was consisting of the following elements as the major sub-heading.

1. Awareness of Open-Source Application by Students

The open-source application or open-source software awareness level is yet to be studied that is what this research is intending to find out, but before that let take a look at Open-Source Awareness Program. In his 1997 essay *The Cathedral and the Bazaar*, open-source evangelist Eric S. Raymond suggests a model for developing OSA known as the bazaar model. Raymond likens the development of software by traditional methodologies to building a cathedral, "carefully crafted by individual wizards or small bands of mages working in splendid isolation". He suggests that all software should be developed using the bazaar style, which he described as "a great babbling bazaar of differing agendas and approaches."

In his 1997 essay *The Cathedral and the Bazaar*, open-source evangelist Eric S. Raymond suggests a model for developing OSA known as the bazaar model says in the traditional model of development, which he called the cathedral model; development takes place in a centralized way. Roles are clearly defined. Roles include people dedicated to designing (the architects), people responsible for managing the project, and people responsible for implementation. Traditional software engineering follows the cathedral model. Fred P. Brooks in his book *The Mythical Man-Month* advocates this model. He goes further to say that in order to preserve the architectural integrity of a system; the system design should be done by as few architects as possible.

The bazaar model, however, is different. In this model, roles are not clearly defined. Gregorio Robles suggests that software developed using the bazaar model should exhibit the following.

Patterns Users should be treated as co-developers the users are treated like co-developers and so they should have access to the source code of the software. Furthermore, users are encouraged to submit additions to the software, code fixes for the software, bug reports, documentation etc. Having more co-developers increases the rate at which the software evolves.

According to Barahona (2000) stated that Linus's law states, "Given enough eyeballs all bugs are shallow." This means that if many users view the source code, they will eventually find all bugs and suggest how to fix them. Note that some users have advanced programming skills, and furthermore, each user's machine provides an additional testing environment. This new testing environment offers that ability to find and fix a new bug.

2. Benefits of Using Open-Source Application

The benefits that motivated the use and development of open source Application are numerous and mixed. This benefit ranges from philosophical and ethical reasons to pure practical issues. For the purpose of this work, we

shall be concentrating on the practical issues which are summarized by Barahona (2000) as follow:

2.1 Quality- Which is more likely to be better: a software package created by a handful of developers, or a software package created by thousands of developers? Just as there are countless developers and users working to improve the security of open source software, so are there just as many innovating new features and enhancements to those products.

In general, open source software gets closest to what users want because those users can have a hand in making it so. It's not a matter of the vendor giving users what it thinks they want--users and developers make what they want and they make it well. At least one recent study has shown, in fact, that technical superiority is typically the primary reason enterprises choose open source software.

2.2 Reliability- Open Source Application could be said to be reliable because it does not manifest defects which can cause incorrect operation, data loss, sudden failures, or failure to meet specification or appropriate published standards which is generally termed as 'bug'. This is not to say that problems are never encountered with the use of OSA but, each problem is usually addressed with speedy fixes, a process which is undoubtedly assisted by the availability of the source code. Hence, Open Source advocates claim very rapid time-to-fix characteristics for Application. The pattern with closed-source Application is typically that a defect report needs to be filed and then there will be a delay before the vendor determines when or whether to issue an updated release. Users of the closed-source Application are much more at the mercy of the vendor's internal processes than with the Open Source arrangement.

2.3 Stability- Proprietary Application vendors can apply a number of tactics to persuade their customers to upgrade more or less willingly. Typical tactics include moving to allegedly new and improved file formats (which require the new and improved Application to read them) or to withdraw support and bug fixes for older versions after a short period. The problem for users of such Application is that they rarely have much control over that process and are left isolated if they choose to remain with the older versions. This has cost and control implications for the business whereas with OSA, the worst effects of vendor push can be mitigated. Having access to the source code can allow a business to choose to support itself on an oldVersion where necessary thereby giving more options and choice to the users.

2.4 Audit ability- A rarely-understood benefit of Open Source Application (any Application where the source code is published) is its audit ability. Closed-source Application forces its users to trust the vendor when claims are made for qualities such as security, freedom

from backdoors, adherence to standards and flexibility in the face of future changes. If the source code is not available, those claims remain simply claims. By publishing the source code, authors make it possible for users of the Application to have confidence that there is a basis for those claims. Without access to the source, third party inspection is impossible.

2.5 Cost- Most Open Source Application are provided free of royalties and fees. Administrative overhead cost is drastically minimal as there is no cost attached to number of copies in use, unlike when proprietary Application is used. There is also lower management cost as no upgrade fees are incurred. Near-zero vulnerability to viruses eliminating need for virus checking, data loss and downtime.

3. Flexibility and Freedom- This Application is flexibility as it gives users opportunity to be able to choose solutions suitable for their needs. Open Source Application offers its users greater freedom to purchase other products, avoiding lock-in to particular manufacturers. Freedom from a single vendor and freedom to modify your Application.

4. Try Before You Buy- If you're considering using open source software, it will typically cost you nothing to try it out first. This is partly due to the software's free price, and partly due to the existence of Live CDs and Live USBs for many Linux distributions, for example. No commitment required until you're sure.

5. Utilization of Open-source Application

According Barahona (2000) says many people may have preconceived ideas about potential uses of open-source application. With the variety of products available, however, there are many ways projects might consider using open source (including but not limited to the following):

- Deploy onto *off-the-shelf* open source server software (such as Linux, Apache, or MySQL).
- Reuse open source architectural frameworks (such as Struts, spring, or Zope).
- Make use of open source development tools (such as Ant, Eclipse, or CVS [Concurrent Versions System]).
- Leverage reusable libraries (such as Xalan, OpenSSL, or GTK+).

Open-Source development is often performed "live and in public", using services provided for free on the Internet, such as the Launchpad and GitHub web sites.

Factually, many of the leading social media applications and large service providers incorporate open source as the foundation of their applications. Without open source, many of these organizations and companies would not exist. Although many people are not aware, the Internet

runson open source application and we use it every day when we surf, communicate, purchase, and research on the net.

Webbink (2003) says Companies such as Google, YouTube, Facebook, Twitter, LinkedIn, Amazon, eBay all have open source as the foundation for their infrastructure and cloud-based services. Many of them have contributed significantly to open source projects such as Linux, Eclipse, and Apache while others have spawned important projects, such as Google's Android operating system and Facebook's Open Compute project. There are many more examples relating to how important open source application is to business today. When we really consider the implications of this, students who have been exposed to open source technologies will have the greatest advantage when they go through post-secondary education and apply for jobs (Webbink, 2003).

6. Types of Open-Source Application

According to Weber (2008) classified the types of open-source application into the following categories:

Operating Systems, Internet and Programming Tools

6.1 Open-source software sites

- Free Software Foundation www.fsf.org
- Open Source Initiative www.opensource.org
- Freshmeat.net
- SourceForge.net
- OSDir.com
- developer.BerliOS.de
- Bioinformatics.org
- Individual project sites; e.g., www.apache.org;
www.cpan.org; etc.

7. Some dates from the history of open source

- 1970s: UNIX operating system developed at Bell Labs and by a diverse group of contributors outside of Bell Labs; later AT&T enforces intellectual property rights and “closes” the code
- 1983: Richard Stallman founds the Free Software Foundation
- 1993: Linus Torvalds releases first version of Linux built
- 1997: Debian Free Software Guidelines released
- 1998: Netscape releases Navigator in source

According to Mackie (2007) Every month, Datamation highlights a list of open source software related to a particular category such as security, cloud computing, small businesses, big data, games, etc. on their website e.g. Firefox, Openoffice, Moodle, Blender, Scribus, ClamAV, Thunderbird, Audacity, Celestia, VLC, LibreOffice, CoolPlayer, DeaDBeeF, EasyTAG, Rhythmbox, SoX, WaveShop, BackupPC, Win32DiskImager, XSIbackup, Zookeeper, Blender, DSpace, EPrints, The GIMP, GNOME, KDE, LORLS, Mailman, Thunderbird, MySQL, PHP, Perl, Plone, PostgreSQL, Python, Sakai, Samba, TeX, Zope, Freshmeat, SourceForge, osalt, GIMP [GNU (Gnu's Not

Unix) Image Manipulation Program], etc. these are the names of just few of the open source Application tools that are currently used by millions of people around the world. While most of the users neglect or ignore the fact that these tools are open, these applications surely owe part of their success to the fact that people have been able to freely work, adapt, and improve them thanks to the open source distribution philosophy. In this chapter i want to highlight the benefits of open solutions in education and promote the active use of open source Application in computer science classes.

Mackie (2007) further stated that Students benefit from open source Application and open learning techniques because of the additional amount of information that is made available to them. The ability to share information amongst students, retrieve existing information from multiple sources, achieve a better understanding of the topics being discussed in the class by digging into real world examples, represent an opportunity that should not be underestimated.

8. Challenges of Open-source Application

Using OSA has been reported to have many benefits, but there are also challenges involved. Understanding the potential challenges of using OSA in developing a product is important for practitioners, so they become aware of them and can anticipate them and take appropriate measures to address these challenges by (Mackie, 2007).

9. Unfamiliarity- Open-Source Application generally do not focus on making user interface design intuitive which makes it difficult for average computer user to learn and use it due to which they prefer proprietary Application.

10. Complex licensing situation- Not surprisingly, several studies reported the complex OSA licensing situation to be an issue lack of consistency between licensing agreements and little guidance on interpreting the open source licenses. Legal issues with licensing remain a major concern. There are multiple licenses available for open source Application which makes licensing of this Application a complex process.

11. Backward compatibility issues- An OSA product is continuously evolving, depending on the liveliness of a community. Changes to products include new features, bug fixes and architectural changes. After an Organization starts using an actively evolving product, new versions are released. As a product's development continues, at some point newer versions are no longer backward compatible, which can become a problem if the product in which the OSA is integrated depends on certain features.

12. Component and architecture incompatibilities- OSAs may not be compatible with each other, or with existing architectures. This phenomenon is called

architectural mismatch, which may have serious consequences for the development schedule and costs. Another compatibility issue that may arise is that components may have dependencies on conflicting libraries.

13. Migration and usage- Complexity of configuring or setting up a user-environment can be an issue. One study reported that significant effort was required to set up an installation. Two studies reported additional cost involved in migration to an OSA alternative and staff training to be a challenge.

III. METHODOLOGY

The research methodology explains how the research will be accomplished, that is what the data consist and data will be collected, organized and analyzed.

1. Research Design

The design of the study is the plan for how the study will be conducted. It is concerned with what types of information or data will be gathered and through what forms of data-collection technique (Berg, 1995). According to Jen (2007) defines survey design studies documents the nature, scope, dimensions and directions of events, behaviours, attitudes and so on about persons or things. The researchers used a descriptive survey research design which input was gotten from a sample population which typically employs the use of questionnaires and interviews to determine the options, attitudes, preferences and perceptions of persons of interest to the researcher.

2. Area of Study

The area which the study covered was the undergraduate of computer science education of Science Education Department ATBU Bauchi.

3. Population of the Study

According to Jen (2007) Population of the study is the people or objects that the researcher is studying or has studied. It includes all members of the target of the study as defined by the purpose of the study and reflected in the research questions. Population therefore must be well defined by stating clearly the subject from whom data is to be collected. The general populations were the undergraduate student of ATUB Bauchi while target population consisted of all computer science education students of ATBU, Bauchi in 2018/2019 academic session.

Table 1 Computer Science Education Students of ATBU 2014/2015 academic session

Level	100 level	200 level	300 level	400 level	500 level
Number of Students in each level	13	62	56	5	23

Source: Field work, 2018/2019.

4. Sampling Techniques and Sample Size

According to Jen (2007) a simple random sample is a subset of individuals (a sample) chosen from a larger set (a population). Each individual is chosen randomly and entirely by chance, such that each individual has the same probability of being chosen at any stage during the sampling process, and each subset of k individuals has the same probability of being chosen for the sample as any other subset of k individuals. This process and technique are known as simple random sampling. This process involves composition of samples from identified population by ensuring that each member of the population has the sample.

According to Jen (2007) if the population is large, say in thousands, the percentage population to sample should be a minimum of about 10% while for small population, about 20% will do for a descriptive research study. The sample of the study comprises of all 300 level and 500 level computer science education student of Science Education ATBU Bauchi that is $56 + 23 = 79$. The researchers picked two level of students because 100 and 200 level are still beginners in the field of computer science, there is a possibility that they are not conversant with open-source application at their present level while 400 level will be left out because they are on Industrial attachment (IT). Since the population is not larger the whole population will be considered which means census sample was used to carry out the research.

5. Instrument for Data Collection

According to Jen (2007) a research instrument is a measurement device or tool used to collect record or measure data, which are required to provide answer to research questions or test hypotheses. In that regard the instrument that was used for this research was a structural Questionnaire. A Questionnaire is an instrument for eliciting descriptive factual information from the respondents. (Ali, 1996).

6. Validity of the Instrument

The instrument was validated by two specialists in the field of computer science education department of Science Education ATBU Bauchi. Whose ensured on face and content validity of the instrument.

7. Method of Data Collection

The method of data collection that was used to gather data in this research was personally and through the involvement of a research assistant. The questionnaire was administered face to face to the respondents by either the researchers or research assistants. The questionnaire was both completed on the spot and collected back immediately or the researchers/research assistants comes back after some time to collect them.

8. Method of Data Analysis

Descriptive Statistics is the discipline of quantitatively describing the main feature of a collection of information, or the quantitative description itself. Descriptive statistics are distinguished from inferential statistics (or inductive statistics), in that descriptive statistics aim to summarize a sample, rather than use the data to learn about the population that the sample of data is thought to represent. To achieve the purpose of this study, the researchers analysed the data using simple percentage.

IV. DISCUSSION AND PRESENTATION OF DATA

The discussion of data was presented based on the research questions raised, which guided the study.

1. Data Analysis and Presentation

Table 2 Response Rates

Respondents	No. of Questionnaire	Returned	Unreturned
500 level	23	23	0
300 level	56	56	0
Total	79	79	0

Source: Field work, 2020

Q1. Are you Familiar with the following open source Application?

Table 3 Types of open source Application

Items	Open source application	Familiar		Unfamiliar		Undecided		Total	
		N	%	N	%	N	%	N	%
a.	Linux (Operating system)	40	50.63	39	49.37	-	-	79	100
b.	Apache (HTTP web browser)	40	50.63	39	49.37	-	-	79	100
c.	Mozilla Firefox (Web Browser)	60	75.95	19	24.05	-	-	79	100
d.	Open Office (Office Suit)	42	53.16	37	46.84	-	-	79	100
e.	Word Press (blogging)	34	43.04	45	56.96	-	-	79	100

	platform								
f.	VLC (Media Player)	50	63.29	29	36.71	-	-	79	100
g.	Notepad++ (CSS editor)	58	73.42	21	26.58	-	-	79	100
h.	7-zip (to unzip folders)	34	43.04	45	56.96	-	-	79	100
i.	PDF Creator (Create PDF files)	58	73.42	21	26.58	-	-	79	100
j.	True Crypt (Encryption Program)	36	45.57	43	54.43	-	-	79	100

Source: Field work, 2018/2019

In the table 4.2 above, the respondents shows that Mozilla Firefox (Web Browser) has the highest percentage of familiarity the respondents 60 (75.95%) while word press has the lowest percentage of familiarity only 34(43.0%) been familiar with it.

Q2 Are you aware of the following features of open source software.

Table 4. Features of open source software

Items	features of open source application	Aware		Not aware		Undecided		Total	
		N	%	N	%	N	%	N	%
a.	Available with source code	46	58.23	33	41.77	-	-	79	100
b.	Freedom to Use	34	43.04	45	56.96	-	-	79	100
c.	Freedom to Modify	24	30.38	55	69.62	-	-	79	100
d.	Freedom to Redistribute	16	20.25	63	79.75	-	-	79	100
e.	More Secure	28	35.44	51	64.56	-	-	79	100

f.	Cheaper Software	28	35.44	51	64.56	-	-	79	100
g.	Reliable	38	48.10	41	51.90	-	-	79	100
h.	Secure Future	16	20.25	63	79.75	-	-	79	100

Source: Field work, 2018/2019

In the table 4.3 above, the responses shows that Available with source code has the highest percentage of awareness with 46(58.23%) respondents while secure future has the lowest percentage of awareness with only 16(20.25%) been aware with it.

Q3 Are you familiar with the following Software?

Table 5 Familiarity of system software.

Items	Systems Software	N	%	N	%	N	%	N	%
a.	License Software	40	50.63	39	49.37	-	-	79	100
b.	Proprietary Software	34	43.04	45	56.96	-	-	79	100
c.	Open Source Software	52	65.82	27	34.18	-	-	79	100
d.	Pirated Software	26	32.91	53	67.09	-	-	79	100

Source: Field work, 2018/2019

In the table 4 above, the respondents shows that Open Source Software has the highest percentage of familiarity the respondents 60 (75.95%) while Pirated Software has the lowest percentage of familiarity only 26(32.91%) been familiar with it. Q5 Are you familiar with the following open source licenses?

Table 6 Open source licenses

Items	open source licenses	Familiar		Unfamiliar		Undecided		Total	
		N	%	N	%	N	%	N	%
a.	MIT License	10	12.66	69	87.34	-	-	79	100
b.	BSD License	4	5.06	75	94.94	-	-	79	100
c.	GNU GPL (General Public License)	20	25.32	59	74.68	-	-	79	100
d.	GNU LGPL (Lesser General Public License)	10	12.66	69	87.34	-	-	79	100
e.	Mozilla Public License	40	50.63	39	49.37	-	-	79	100
f.	Copy left	14	17.72	65	82.28	-	-	79	100

Source: Field work, 2018/2019

In the table 4.5 above, the responses shows that Mozilla Public License has the highest percentage of familiarity with 40(50.63%) respondents while Copyleft has the lowest percentage of familiarity with only 14(17.72%) been familiar. Q6 Do you access the following software movements?

Table 7 Software movements

Items	Software movements	Yes		NO		Total	
		N	%	N	%	N	%
a.	Open Source Software Movement	42	53.16	37	46.84	79	100
b.	Free Software Movement	37	46.84	42	53.16	79	100

Source: Field work, 2018/2019

In the table 4.6 above, the responses shows that Open Source Software Movement has the highest percentage of access to software movements 42(53.16%) opted yes while Free Software Movement has the lowest percentage of access with only 37(46.84%) opted yes to it.

Q7 Do you access the following open source projects?

Table 8 Open source projects

Items	open source projects	Yes		NO		Total	
		N	%	N	%	N	%
a.	FSF (Free Software Foundation)	35	32.91	44	67.09	79	100
b.	GNU (Gnu's Not Unix)	21	15.19	58	84.81	79	100
c.	BSD (Berkeley Software Distribution)	23	17.72	56	70.88	79	100

Source: Field work, 2018/2019

In the table 4.7 above, the responses shows that FSF (Free Software Foundation) has the highest percentage of access to open source projects 35(32.91%) opted yes while GNU (Gnu's Not Unix) has the lowest percentage of access with only 21(15.19%) opted yes to it. Q8 which of the following open-source product you are already using?

Table 9 use of open source products

Items	Open source application	Used		Never Used		Undecided		Total	
		N	%	N	%	N	%	N	%
a.	Linux (Operating system)	40	50.63	39	49.37	-	-	79	100
b.	Apache (HTTP web browser)	40	50.63	39	49.37	-	-	79	100
c.	Mozilla Firefox (Web Browser)	60	75.95	19	24.05	-	-	79	100
d.	Open Office (Office Suit)	42	53.16	37	46.84	-	-	79	100
e.	WordPress (blogging platform)	34	43.04	45	56.96	-	-	79	100
f.	VLC (Media)	50	63.29	29	36.71	-	-	79	100

	Player)								
g.	Notepad ++ (CSS editor)	58	73.42	21	26.58	-	-	79	100
h.	7-zip (to unzip folders)	34	43.04	45	56.96	-	-	79	100
i.	PDFCreator (Create PDF files)	58	73.42	21	26.58	-	-	79	100
j.	TrueCrypt (Encryption Program)	36	45.57	43	54.43	-	-	79	100

Source: Field work,2018/2019

In the table 4.8 above, the respondent's shows that Mozilla Firefox (Web Browser) has the highest percentage of usage the respondents 60 (75.95%) while word press has the lowest percentage of usage only 34(43.0%) uses it. Q9 which of the following do you use to access the applications?

Table 10 access of open source software

Items	access to open source Software	Used		Never Used		Undecided		Total	
		N	%	N	%	N	%	N	%
a.	www.fsf.org	22	27.85	57	72.15	-	-	79	100
b.	www.opensource.org	22	27.85	57	72.15	-	-	79	100
c.	www.sourceforge.net	15	10.13	64	89.87	-	-	79	100

Source: Field work,2018/2019

In the table 4.9 above, the respondent's shows that www.fsf.organdwww.opensource.org has the highest percentage of usage the respondents 22(27.85%) each while www.sourceforge.net has the lowest percentage of usage only 15(10.13%) uses it. Q10 What challenges do you encounter when using open source application?

Table 11 Challenges of open source application.

Items	open source challenges	Yes		NO		Total	
		N	%	N	%	N	%
a.	Unfamiliarity	40	50.63	39	49.37	79	100
b.	Complex licensing situation	52	65.82	27	34.18	79	100
c.	Backward compatibility issues	39	49.37	40	50.63	79	100
d.	Component and architecture incompatibilities	51	64.56	28	35.44	79	100
e.	Migration and usage	42	53.16	37	46.84	79	100

Source: Field work,2018/2019

In the table 4.10 above, shows the Responses to Challenges of open-source application with complex licensing situation has the highest percentage of responses with 52(65.82%) respondents opted yes, while backward compatibility issues have the lowest percentage of responses with only 39(49.37%) opted yes itas one of the challenges of open-source application.

V. CONCLUSION

The prospective teachers of computer education in ATBU are aware of the open-source application which is the emerging concept towards the less budget and legal software. The lack of awareness about the uses and benefits of open source software is a large factor towards less use of open source software. The types of open-source application known by prospective computer science teachers are Linux (Operating system based on UNIX), Apache (HTTP web browser), Mozilla Firefox (Web Browser) Mozilla Thunderbird, Open Solaries, WordPress VLC (Media Player) etc.Open Source Software products are being increasingly used as an alternative to Commercial Off-The-Shelf components and the types of open source application known by prospective computer science teachers in the area under study is quiet encouraging.

The prospective computer science teachers access open-source applications through FSF (Free Software Foundation), GNU (Gnu's Not Unix) and BSD (Berkeley Software Distribution).Accessibility of the open source application by prospective computer science teachers is quiet encouraging and Using OSS has been reported to have many benefits, but also has various challenges.

The prospective computer science teacher uses open source application for Encryption Program, 3D content creation, Create PDF files, Media Player, Image Editor, to Unzip folders, FTP Client, e-Commerce platform, Web Browser, Office Suit etc. The factors inhibiting the optimal utilization of open source Application by prospective computer science teachers are:Unfamiliarity, Complex licensingsituation, backward compatibility issues, Component and architecture incompatibilities and Migration and usage.

VI. RECOMMENDATIONS

The Findings of this study serves as the basis for making the following recommendations:

- Every student should be aware about the uses and benefits of Open Source Software that is by incorporating Open Source Software as a general course in tertiary institutions.
- The school should be linked to Datamation which highlights a list of open source software related to a particular category such as security, cloud computing, small businesses, big data, games, etc. on their website that will improve on the types of open source application known by prospective computer science teachers.
- Free Source Software programs should be conducted in every college and university to enhance the accessibility of the open source application by prospective computer science teachers in the area under study.
- Educational institutions should not spend huge money on proprietary software and Universities should replace the proprietary software by open source software for saving the money of license renewal fee, up gradation charges etc. to encourage the use of open source application by prospective computer science teachers in the area under study.
- Understanding the potential challenges of using Open Source Software in developing a product is important for practitioners, so they become aware of them and can anticipate them and take appropriate measures to address these challenges.

Furthermore, the references to the literature on Open-Source Software challenges can benefit researchers interested in doing future research in this area.

Acknowledgements

We would like to show our gratitude to Nigerian Army University (NAUB), Bui and Abubakar Tafawa Balewa University (ATBU), Bauchi for supporting this research.

REFERENCES

- [1]. Ali, A. (1996). Fundamentals of research in education. Awka: NuelCenti (Nig) Publishers.
- [2]. Berg, B.L. (1998). Qualitative research methods for social sciences. U.S.A. Allyn and Bacon.
- [3]. Eric S. R. (1997). The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary. O'Reilly & Associates, Inc., Sebastopol, CA, USA.
- [4]. Engard, N.C (2011) Book review on "Practical open source software for libraries" by ARIADNE. issue 66. <http://www.ariadne.ac.uk/issue66/rafiq-rvw/>. Accessed on 16/07/18
- [5]. Gay, L.R. (1981) Educational research competence for analysis and application (2nd ed). Columbus-Ohio: Charle E. Merrill.
- [6]. Gbdirect, G.(2011). Benefits of using open source software. <http://opensource.gbdirect.co.uk/migration/benefit.html>. Accessed on 23/01/18
- [7]. Glance D.G, Kerr J, Reid A (2004). Factors affecting the use of open source software in tertiary education institutions. www.myresearchspace.grs.uwa.edu.au/files/folders/20/download.aspx. Accessed on 19/1/2018
- [8]. Gonzalez, J.M(2000). Advantages of open source software. <http://eu.conecta.it/paper/advantages.html>. Accessed on 14/06/18
- [9]. Jen, S.U. (2007). Fundamentals of research methodology (3rd ed) Yola: paraclete publishers, Yola-Nigeria.
- [10]. Lakhan, S. E. & Jhunjunwala, K. (2008). Open source softwares in education. EDUCAUSE Quarterly. 31(2) (April-June 2008).
- [11]. Leo, B. (2004). The 1991 census adjustment: undercount or bad data, statistical science
- [12]. Microsoft ® Encarta ® 2009. © 1993-2008 Microsoft Corporation. All rights reserved
- [13]. Ndomi, B.M. & Yallams, S.M. (2000). Research project writing and supervision. Bauchi: League of Researchers in Nigeria.
- [14]. Ogbazi, N.J. & Okpala, J. (1994). Writing research report: guide for researchers in education and social sciences and humanities. Enugu Nigeria: Prime Time Ltd.
- [15]. Perens, B. (2000). Open sources: voices from the open source revolution. .
- [16]. Weber, S. (2008). The political economy of open source software, BRIE working paper 140,
- [17]. Webbink, M. (2003). Understanding open source software. Retrieved on March 28, 2018 from <http://www.groklaw.net/article.php?story=20031231092027900>
- [18]. Wheeler, D.A (2007). Why open source software / free software (OSS/FS, LOSS, or FOSS) look at the Numbers! <http://www.dwheeler.com/contactme.html>