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Adapting And Domiciling Moodle Lms For Improving Learning Outcome In Digital Electronics At Colleges Of Education In North-East Nigeria

Nasiru Aminu
Department of Electrical/Electronics Education, Federal College of Education (Technical) Gombe, Nigeria
nasalamin@gmail.com, nasalamin@fcetgombe.edu.ng

Abstract

With the fast-moving waves of developments in technology in conjunction with the complex and uncertain nature of the world, education and training providers need to explore other pedagogical approaches to enhance teaching and learning process. Primarily this study investigated how Moodle learning management system can be used to improve students' achievement in digital electronics at Colleges of Education in North East Nigeria. The researcher adapted and modified the learning environment of Moodle LMS to suit the needs for teaching some abstract contents of technical education online. Four objectives, four research questions and four hypotheses guided the study. A Non-equivalent control group quasi-experimental design was used in the study. The area of the study was North-Eastern states of Nigeria. A population of 70 NCE III students of Electrical and Electronics Technology education from two schools in North-East Nigeria was used. 38 students were assigned to experimental group and 32 to control group. 30 objective test items were used for data collection. Reliability of the instrument was determined to be 0.561 using PPMC. results from mean and standard analysis with the hypotheses tested at 0.05 revealed that using Moodle LMS has significantly improved students' achievement in digital electronics. The study concluded that using Moodle LMS as complementary to face-to-face teaching-learning process has a significantly improved learning outcome of students, and therefore can be used as paradigm shift from laboratories to field.

Keywords: Moodle LMS, Learning outcome, Digital Electronics, Students achievement

1. INTRODUCTION

The use of Learning Management System (LMS) is gaining popularity among educational practitioners and giving new approach to learning and instructional delivery in all most fields of education. Learning Management System (LMS) is e-learning software for delivering, tracking and managing learning instruction [7]. "LMS in education organizes subject matter as hypertext documents on the Internet or intranet, displays not only text, but also, for example, graphics, videos, or audios, which have many pedagogical advantages. This multimedia capability permits much more flexibility in the delivery of instruction by individuals selecting hypertext links, thus allowing for nonlinear interaction with information" [23]

The application of LMS in education has given new approach to learning and curriculum delivery electronically, With LMS there is a shift from traditional Teacher-centred approach to Student-centred which allow students become active learners with access or links to simulation environment where they can perform experiments as if they are in laboratories, thereby improving the quality, efficiency and effectiveness of teaching, learning, research and educational management [16]. When compared with conventional classroom teaching, LMS resources enable the learners to study material at their own pace which easily allow repetition and revision [13]. International trends in education show a shift from class room confined or teacher-centred method of instruction to student centred. Consequently, education and training do not have to be confined to classrooms and campuses, and students and teachers do not have to be present at the same place at all times for instruction [22]. Teaching and distribution of educational materials can occur on local or global networks using an LMS. This yields several advantages, specifically: "access to a potential worldwide student body; access to better teaching materials prepared by experts; rapid update of course materials; instant access to these resources for students and teachers; and tailoring instruction for self-study, among others" [23].

The use of LMS as an e-learning tool to improve teaching and learning is so significant in Technical and Vocational Education that it cannot be overlooked, it provides an interactive learning environment in which the content to be learnt is available online ubiquitously independent of location and time [24]. Although mostly used as a repository, beyond that, Moodle LMS allows integration of simulation environment where learners can perform experiments in the form of Virtual Learning Environments (VLE) as if they are in real laboratories, thus, alleviating constraints on time and location for conducting experiments which consequently improves the performance of the students [4].

Electrical and Electronics Technology (EET) Education on the other hand is one of the major specializations in Technical and Vocational Education (TVE) in Nigerian Colleges of Education (Technical). TVE is a teacher education program aimed at producing technical teachers with the intellectual and professional background adequate for teaching technical subjects and to make them adaptable to any changing situation in technological development not only in the country but also in the world at large [18].

Digital Electronics is one of the major courses offered in EET education in Nigerian Colleges of Education (Technical) as part of the requirements for the award of Nigeria Certificate in Education (NCE). The course has some unique difficulties in comparison to other courses in EET whereby some abstract concepts often become difficult to understand by the students such as the concept of digital logic, where the teacher is required to clearly demonstrate to the students the presence of high signal or low signal usually represented by 1s and 0s.

The mode of teaching EET in Technical Education is by lectures, tutorials, studying theory using textbooks, and laboratory practical as may be required for each course [17]. However, [12] reported that theoretical study and tutorials are not sufficient for the students to master the concepts of digital electronics and that there are constraints on conducting laboratory experiments to compliment the theories. In a different study, [17] stated that the methods used in teaching digital electronics which involve lectures and studying textbooks alone has been linked to the persistent failure and declining performance of many students in the course, as also shown in tables 1 & 2 below.

TABLE 1: TREND OF STUDENTS' PERFORMANCE IN DIGITAL ELECTRONICS IN FCE(T) GOMBE

Academic Session	***Percentage of Grade Distribution***	
	A – C	D –F
2018/2019	32%	68%
2019/2020	26%	74%
2020/2021	19%	81%

Source: STE, FCE(T) Gombe, Senate Approved Result (2018 – 2021 Academic Sessions).

TABLE 2: TREND OF STUDENTS' PERFORMANCE IN DIGITAL ELECTRONICS IN FCE(T) POTISKUM

Academic Session	***Percentage of Grade Distribution***	
	A – C	D –F
2018/2019	37%	63%
2019/2020	24%	76%
2020/2021	14%	86%

Source: STE, FCE(T) Potiskum, Senate Approved Result (2018–2021 Academic Sessions).

Various studies have revealed quite a number of reasons to the declining performance of students in Digital Electronics in Nigerian Colleges of Education (Technical). One of which is that some concepts of digital logics are difficult for teachers to teach as well as for the students to conceptualise in a conventional classroom chalk-talk environment [17]. Also, [16] reported that lecturers in Colleges of Education find it difficult to equally satisfy the instructional needs of their students due to constraints on time and environment in lecture delivery, as well as limitation to laboratories and equipment for conducting experiments, which consequently affects their performance. Hence, it becomes imperative that solution in terms of strategies and virtual or e-learning tools be found in order to address this problem. In view of the foregoing, teaching abstract concepts of combinational logics in Digital Electronics course and limitation to time for Laboratory experiments could be simplified by using Moodle LMS where students can have access to learning materials anytime anywhere independent of location and time, more to it they can have access or links to simulation environment where they can perform many experiments as if they are in real world of work not laboratory, thus, making them adaptable to the labour market.

1.1 General concept of Learning Management System

Learning Management System (LMS) has been described in many ways, but it can generally be seen as software used to deliver, manage and track learning instruction. [5] defined LMS as "a software package that enables the management and deliverance of study materials to learners". In a broader view, [6]viewed LMS as "a software application or Web-based technology used to plan, implement, and assess a specific learning course". There are different learning management systems in existence with different prominence and applications in teaching and learning, but according to [3], all of them must have common features that include content authoring tools, calendars, syllabi, discussion boards and assessment tools. LMS can therefore be seen as an enhanced form of managing classroom activities.

Conceptually, a Learning Management System (LMS) can be seen as a central repository that if resourcefully used addresses all type of educational needs including but not limited to educational administration and planning, curriculum planning and development, instant assessment, content management and deliverance of study material for improved and more engaging teaching and learning [21]

1.2 Moodle as a Learning Management System

"Learning Management Systems (LMS) are software systems that synthesize the functionality of computer-mediated communications software and online methods of delivering course activities and materials" [5]. On the same rail, Modular Object-Oriented Dynamic Learning Environment (Moodle) is a Learning Management System (LMS) - a free, Open-Source Software package founded and designed by Martin Dougiamas in 2000 using sound pedagogical values, to help educators create effective quality courses and also help students learn with ease at their pace [6]. The main advantage of the open-source format is that it enables users to download a variety of learning modules that fit their needs. Educators can add email, discussion boards, live chats,

online quizzes, and a variety of other modules that differentiate their system from commercially available LMS. An advantage of open-source systems is that users can add new features and enhancements that are available to all users at no additional cost (Moodle, 2023). Moodle complements face-to-face teaching method; it is available in more than 50 languages and present in more than 239 countries with over 154,043 registered sites from the 239 countries that are currently up and running (Moodle, 2023). The platform has become established as an online tool that allows the use of graphics, forums, chat, databases, quizzes, survey, wikis, web links, virtual laboratories, video transmissions, and Java and Active X technologies to reinforce lessons. Moodle is an LMS that uses a LAMP (Linux, Apache, MySQL, PhP) and WAMP (Windows, Apache, MySQL, PhP) based protocols. In Moodle, documentation and help is provided at every stage. Documentation and installation for Moodle are enormously superior to their counterparts, and Moodle works on any system as cited and suggested by [2] that this as a good reason to choose Moodle for large scale deployments.

2.0. LITERATURE REVIEW

[8] on Studying the Effectiveness of Learning Management System on Student Engagement, Motivation and Performance in Higher Education in Mumbai, India. The study found out that not only do the students who utilize Moodle LMS in their learning tend to score higher than those who were taught using only face-to-face, they are also more likely to make use of deep approaches of learning like higher order thinking, reflective learning, and integrative learning in their study as they reported higher gains in general education, practical competence, and personal and social development.

Similarly, another study by [12] was conducted on study of students' performance in learning management system. Moodle LMS was used in the study and uploaded on the Local Area Network (LAN) of Banaras Hindu University. One of the purposes of the study was to investigate the relationship between Moodle LMS and academic performance of students in electrical engineering. Non-equivalent control group quasi experimental design was used in the study where a random sampling was used to draw 33 students for both the experimental and control groups. The study reveals that engaging students on Moodle LMS has significantly improved their performance compared with that of the control group. Based on the findings, the study recommended adoption of the system by the university. [9] conducted a study on Moodle-LMS at Goa University, India. The study was to identify the effect of Moodle LMS on students' engagement, motivation and performance in a software engineering course. A 'Post-test only' experimental design was used in the study with 27 students in both experimental and control groups and no sampling was done. The participants ware engaged in the experiment for around two months (approximately 25 lectures) in a semester of 60 lectures with each lecture being of 45 minutes duration. Two modules were selected from the syllabus, weighing about 40% of the syllabus. Findings from the study reveal that students who used Moodle-LMS have significantly higher degree of academic performance vis-à-vis the control group students. The study therefore concluded that "Moodle-LMS have a positive effect in teaching and learning process". The study recommended that further studies be carried out in different areas, particularly with abstract contents.

Another research was also conducted by [20] on Blended e-Learning Activities for the Information and Innovation Management Course: Its Outcomes of Graduate Students at Bangkok-Thonburi University. The main objective of the research was to investigate how blended e-learning activities for Information and Innovation Management Course using Moodle LMS would affect learning outcomes of graduate students of Bangkok-Thonburi University. An experimental research design was used in the study where 90 students were recruited using simple sampling technique. Findings from the research revealed that students had learning outcome at a high grade and shows very good level satisfaction using blended Moodle e-Learning activities. A survey from the study on the students' satisfaction on blended e-Learning teaching approach by using Moodle LMS revealed that most of the students strongly agreed that blended learning be organized in all of their courses. Finally, the researcher draws conclusion, that Moodle LMS is an appropriate tool in blended e-Learning management approach for higher education students and recommended that blended e-Learning module using Moodle LMS should be developed for different areas of study, which will help enhance students' learning. The findings from this study are parallel with a study conducted by Theprasan, Thienthong & Sanrach (2010) on synthesizing blended learning and teaching with use of collaborative learning techniques using Moodle LMS, the study avails a better learning outcome with the use of Moodle LMS. Also, in a tangential study conducted by [26], on effectiveness of learning from video clips using Moodle Learning Management System in a fundamental psychology course at Christian university in Thailand, reveals that the students have satisfaction by using Moodle LMS program and their performance was at a very good level.

The above studies are related to the current study which are intended to determine the effect Moodle LMS on students' achievement but not in the area of Digital Logic. It is therefore in view of this that the current study works on Moodle LMS in the area. The study specifically works on teaching students some areas of digital electronics using Moodle LMS. The review of literature and related researches indicated that most of the studies compare student engagement and motivation to their performance in their learning environments, i.e. traditional vis-à-vis LMS. However, the current study concentrated on the students' achievement and satisfaction in relation to the new learning environments (Moodle LMS).

3.0 METHODOLOGY

Non-equivalent control group quasi experimental design was adopted for the study, which used intact classes without randomization. Two groups were used in the study, Experimental group and control group. The experimental group was used to test the effect of the treatment (Moodle LMS), while the control group was used to provide some control over threats to internal validity as explained by [20]. The experimental group was taught concept of Digital Electronics using Moodle LMS hosted at

https://www.myedumedia.com/ where the course materials were uploaded. The participants were exposed to the experiment for a period of six teaching weeks that covered "Logic gates, Flip-Flop and Counters" as contained the NCCE Minimum Standard for teaching Vocational and Technical Education. A regular semester consists of approximately 18 lectures with each lecture being of 2 hours duration, [17]. The treatment was administered for six teaching weeks. The three topics selected from the syllabus covered 40% of the course syllabus. The study was guided by 4 research questions, and 4 hypotheses as thus:

3.1. Research Questions

i. What is the difference between the pre-test mean scores of students taught Digital Electronics in the experimental group and those taught in control group?
ii. What is the difference between the mean achievement in pre-test and post-test scores of students taught Digital Electronics in the experimental group?
iii. What is the difference in the post-test mean scores of students taught Digital Electronics in experimental group and control group?
iv. What is the difference between the gain score of students taught Digital Electronics in experimental group and control group?

3.2. Research Hypothesis

H01: There is no significant difference between the pre-test mean scores of students taught Digital Electronics in experimental group and control group.
H02: There is no significant difference between the pre-test and post-test mean scores of students taught Digital Electronics in experimental group
H03: There is no significant difference between the post-test mean scores of students taught Digital Electronics in experimental group and that of control group.
H04: There is no significant difference between the gain score of students taught Digital Electronics in experimental group and that of the control group.

The population for the study comprised of all NCE III students of Electrical and Electronics Technology education in Colleges of Education (Technical) in North-Eastern Nigeria. A total of 70 students were involved in the study, out of which 38 constituted the experimental group and 32 constituted the control group.
An achievement test instrument tagged DEAT (Digital Electronics Achievement Test), which consists of 30 objective test items developed by the researchers covering the selected content area was used for data collection. The instrument was subjected to face and content validation. The test-retest method was used to determine the reliability of the instrument using the Pearson Product Moment Correlation Coefficient (PPMC).

4.0.Results and Discussion

4.1 Research Question 1

Table 3 shows the result of research question 1 obtained through pre-test. The table shows mean scores of the experimental group and that of the control group. It is statistically indicated that the initial performance of the students in both groups is the same with mean of 4.71 and 5.09 respectively; this is done prior to the treatment of the experimental group. Thus, any change in their achievement could be as a result of the treatment.

TABLE 3: PRE-TEST MEAN SCORE OF EXPERIMENTAL AND CONTROL GROUP

VARIABLE	N	σ	S D	SD ERROR
Exp.	38	4. 71	2. 117	0.343
Control	32	5.09	2.022	0. 357

v. Where N= Number of students, σ= Mean score, and SD= Standard deviation

4.2. Research Question 2

Table 4 shows the result of question 2 obtained through pre-test and post-test. The results show mean scores of the experimental group. The mean score of pre-tests is 4.71 which is lower than the post-test mean score of 60.18 of the same group. The results show that there is a difference between the two mean scores, but the significance will be tested as a null hypothesis later.

TABLE 4: PRE-TEST AND POST- TEST MEAN SCORE OF EXPERIMENTAL GROUP.

VARIABLE	N	μ	σ	SD ERROR
Pre-test	38	4. 71	2. 117	0.343
Post-test	38	60.18	13.201	2.141

4.3. Research Question 3

Table 5 presents the results of research question 3. The result shows the mean and standard deviation of post-test for the experimental group and control group. The result in the table discloses that the experimental group obtained higher mean scores of 60.18 with standard deviation of 13.201 while the control group has a mean score of 46.59 and standard deviation 8.167. The result also shows that student in the experimental had higher post-test mean score than those control group. This indicated that, the use of Moodle LMS has a high and positive effect in comparison with those taught Digital Electronics without the use of Moodle LMS.

TABLE 5: DIFFERENCE IN POST-TEST MEANS SCORE OF EXPERIMENTAL AND CONTROL GROUPS

VARIABLE	N	μ	σ	SD ERROR
Exp. Group	38	60.18	13.201	2.141
Control	32	46.59	8.167	1.444

4.4. Research Question 4

Table 6 presents the results of research question 4. The result shows that there is a difference between the mean gain scores of the experimental and control groups with means of 55.47 and standard deviation of 11.645 and 41.50 and 7.012 respectively. This shows the effect of the treatment on the experimental group, but the significance of the effect will be statistically tested as a null hypothesis H04.

TABLE 6: DIFFERENCE BETWEEN THE MEAN GAIN SCORE OF EXPERIMENTAL GROUP AND CONTROL GROUP

VARIABLE	N	μ	σ	SD ERROR
Exp.	38	55.47	11.645	1.889
Control	32	41.50	7.012	1.239

4.5.Hypothesis One H_{01}

Table 7 shows the t-test result that tested hypothesis between the experimental and control group at pre-test. The table shows the number of students per group, their mean scores, standard deviation, degree of freedom, t-calculated, p-value and the decision. From the table it can be seen that the p-value is greater than confidence level ($p<0.05$). The result revealed that at pre-test, there is no significant difference between the pre-test mean scores of students taught Digital Electronics in experimental group and control. Thus, H01 was accepted.

TABLE 7: DIFFERENCE BETWEEN EXPERIMENTAL AND CONTROL GROUPS PRE-TEST MEAN SCORES

Var.	N	μ	σ	Df	t-cal	P	Decision
Exp	38	4.71	2.11	68	.77	.769	Accept
Control	32	5.09	2.02				

4.6.Hypothesis Two: H_{02}:

Table 8 shows the result obtained through a paired sample t- test between pre-test and post-test score of experimental groups. The table shows the number of students, means and standard deviations in the pre-test and post-test as 38, 4.71, 2.117 and 38, 60.18 & 13.201 respectively. The result indicates a degree of freedom 37, t-cal value of 29.365, and P-value of 0.00. Based on the foregoing, p-value is less than the confidence level ($p< 0.05$). This indicates that the difference between the post-test and pre-test mean achievement is significant, therefore, the null hypothesis H02 was rejected.

TABLE 8: DIFFERENCE BETWEEN EXPERIMENTAL GROUP'S PRE-TEST AND POST-TES MEAN SCORES

Var.	N	μ	σ	Df	t-cal	P	Decision
Pre-test	38	4.71	2.11	37	29.36	0.0	Rejected
Post-test	38	60.18	13.20				

4.7. Hypothesis Three: (H03)

Table 9 shows the result obtained through an independent sample t- test between the post-test scores of the experimental group and control group. From the result experimental group has a mean score of 60.18 and standard deviation 13.201 while the control group has a mean score of 46.59 and Standard deviation of 8.167. It is also indicated that the degree of Freedom is 68, t-cal is 5.062 while the p-value is 0.000 which is less than level of significance ($p<0.05$). This shows that that there is significant difference between the post-test mean scores of students taught Digital Electronics in experimental group and that of the control group. Therefore, the null hypothesis H_{03} is thus rejected.

Table 3: Analysis of the post-test mean scores of Experimental and Control groups.

Var.	N	μ	σ	Df	t-cal	P	Decision
Exp.	38	60.18	13.20	68	5.062	0.00	Rejected
Control	32	46.59	8.167				

4.8. Hypothesis Four: (H04)

Table 10 shows the result obtained through an independent sample t-test between the gain scores of the experimental group and the control group. The outcome shows that the experimental group a mean gain of 55.47 and a standard deviation of 11.645, while the control group had a mean gain of 41.50 with a standard deviation of 7.012. The t-cal is 5.938 with a degree of freedom 68 while the p-value is 0.000 which is less than level of significance ($p<0.05$). This indicated that the difference between the gain scores of the experimental group and the control group is significant. Therefore, the null hypothesis H04 is thus rejected.

TABLE 40: T-TEST ANALYSIS BETWEEN THE GAIN SCORES OF THE EXPERIMENTAL AND CONTROL GROUPS

Var.	N	μ	σ	Df	t-cal	P	Decision
Gain							
Exp.	38	55.47	11.65	68	5.94	0.00	Rejected
Control	32	41.50	7.012				

5. Conclusion

There are many advantages and positive effects of Moodle-LMS in teaching and learning process, among which are: (1) verse contents and engagement; (2) interactive and transparent assessment with instant feedback and (3) students' motivation [9]. However, many studies have revealed that effective use of it in these areas can contribute to an improvement in academic achievement.

Based on the analysis of the collected data, this current study also reveals that using Moodle LMS has a direct effect in improving the learning outcome of students. All the hypotheses tested show a significant difference in the mean achievement between the experimental group and control group. Finally, the high scores, higher mean, higher standard deviation and higher gain in the experimental group can be attributed to the treatment (Moodle LMS) applied to the group as also found by [10] and [11]. Therefore, based on findings of the study, it can be concluded that using Moodle as complementary to face-to-face teaching-learning process and not a replacement to it, as also opined by [1] has significantly increased the learning outcome and achievement of students.

References

[1] Cafino, M. S.,& Capadosa, R. N., (2015). Achievement in College Algebra Using Moodle Learning Management System with Blended Instruction; Unpublished Doctoral dissertation: Dilliman College of Education, Philippines

[2] Calipayan, J. P., & Buniel, J. M. C. (2021). Effectiveness of Enhanced Module in Teaching Electrical Installation and Maintenance Concepts for National Competency II. Journal of Humanities and Social Studies, 9(4). https://doi.org/10.24940/theijhss/2021/v9/i4/hs2104-034

[3] Chapman, E. (2002). Alternative approaches to assessing student engagement rates. Practical Assessment, Research, and Evaluation, 8(1), 13.

[4] Chen, P., Lambert, A. D., & Guidry, K. R. (2010). Engaging Online Learners: The impact of Web-based Learning Technology on College Student Engagement. *Computers & Education*, *54*(4), 1222-1232.

[5[Coates, H. (2005). Leveraging LMSs to Enhance Campus-Based Student Engagement. Educause Quarterly, vol. 28, no. 1, pp 66-68. Retrieved May 3rd, 2023 from https://www.educause.edu/ir/library/pdf/eqm05110.pdf

[6] Dougiamas, M. & Taylor, P. (2003) Moodle: Using Learning Communities to Create an Open-Source Course Management System. Proceedings of the EDMEDIA 2003 Conference, Retrieved May 3rd, 2023, from: https://dougiamas.com/archives/edmedia2003/

[7] Ebardo, R. A., & Valderama, A.M (2010). The Effect of Web-Based Learning Management System on knowledge Acquisition of Information Technology Students at Jose Rizal University: Special Issue of the International Journal of the Computer, the Internet and Management, Vol. 17 No. SP3, December, 2010

[8] Enemali, J.D (2010). Education and Training for Industrialisation. Ibadan: Sterling-Hordon Publishers

[9] Falleiro, S. (2013). Moodle-LMS as an Innovative and Cost-Effective e-Learning Tool for Open and Distance Learning: Commonwealth of Learning conference proceedings: Retrieved on 17th July, 2023 from: http://hdl.handle.net/11599/1950

[10] Garth, A. (2008). Analysing data using spss; Sheffield Hallam University

[11] Kulshrestha, T.& Kant, A, R (2013) Benefits of Learning Management System (LMS) in Indian Education; International Journal of Computer Science & Engineering Technology. Vol. 4 No. ISSN: 2229-3345

[12] Komori, G., Takahashi, S., Aikawa, N., & Nishida, Y. (2013). Electric circuit e-learning system using LMS in Moodle. IEEJ Transactions on Fundamentals and Materials, 133(1), 1-6. https://doi.org/10.1541/ieejfms.133.1

[13] Mahmud, M (2015). Strategies for Improvement of e-Learning of Agricultural Education in North Eastern Nigeria, Unpublished Doctoral Dissertation: MAUTECH, Yola: Nigeria

[14] Moodle. (2023). Moodle statistics. https://stats.moodle.org/

[15] Moodle. (2023). Online Learning with The World's Most Popular LMS. Moodle. https://moodle.com/

[16] Muhammad, D (2015). Influence of Computer Assisted Instruction on Academic Performance of Students in Federal College of Education Technical Gombe, Unpublished Master's Thesis: Islamic University in Uganda, Kampala: Uganda

[17] Mustapha, B. A., & Taale, K. D. (2014). Effects of Teacher-Constructed Electrical Models on Students' Academic Achievement in Basic Electricity in Technical Colleges of Borno State, Nigeria. International Journal of Innovative Social & Science Education Research, 2(1) 16-25.

[18] National Commission for Colleges of Education (2012). Nigeria Certificate in Education Minimum Standards for Vocational and Technical Education; NCCE, Abuja.

[19] Ogodulunwa, C. A. (2008). Fundamentals of Educational Measurement and Evaluation; Jos: Fab Educational Books.

[20] Sambo, A. A. (2005). Research Methods in Education. Lagos: Stirling-Horden publication.

[21] Schar, S.G., & Krueger, H. (2010). Using New Learning Technologies with Multimedia, IEEE Multimedia, Vol, No. 3, 40-51.

[22] Schreurs, J & Dumbraveanu, R. (2014). A Shift from Teacher Centred to Learner Centred Approach; International Journal of Engineering Pedagogy: DOI: http://dx.doi.org/10.3991/ijep.v4i3.3395

[23] Sengel, E (2005). Effect of a Web-based Learning Tool on Student Learning in Science Education: A Case Study. Unpublished Doctoral Dissertation: Middle East Technical University, Turkey

[24] Shu'aibu, B. (2014). Conceptual Model for Integrating ICT In Nigeria Higher Education Institutions Offering Technical and Vocational Education *Unpublished doctoral dissertation,* Universiti Teknologi Malaysia, Malaysia

First Author Nasiru Aminu holds a Bachelor degree in Electrical and Electronics Engineering and Masters in Electrical Technology Education from Abubakar Tafawa Balewa University, Bauchi, Nigeria. He is currently a PhD student conducting research on Development of an android application for teaching Electrical Installation practice. He is a lecturer at FCE (T) Gombe, Nigeria, Nasiru Aminu holds the award of best constructed practical project in Electronics Engineering during his bachelor studies and now has more 15 publications in journals and conference papers.