

# Enhancing Students' Performance in Basic Science and Technology in Nigeria Using Moodle LMS

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**Abstract**—One of the major problems facing education in Nigeria is the provision of quality Science and Technology education. Inadequate teaching facilities, non-usage of innovative teaching strategies, ineffective classroom management, lack of students' motivation and poor integration of ICT has resulted in the increase in percentage of students who failed Basic Science and Technology in Junior Secondary Certification Examination for National Examination Council in Nigeria. To address these challenges, the Federal Government came up with a road map on education. This was with a view of enhancing quality education through integration of modern technology into teaching and learning, enhancing quality assurance through proper monitoring and introduction of innovative methods of teaching. This led the researcher to investigate how MOODLE LMS could be used to enhance students' learning outcomes in BST. A sample of 120 students was purposively selected from four secondary schools in Ogbomoso. The experimental group was taught using MOODLE LMS, while the control group was taught using the conventional method. Data obtained were analyzed using mean, standard deviation and t-test. The result showed that MOODLE LMS was an effective learning platform in teaching BST in junior secondary schools ( $t=4.953$ ,  $P<0.05$ ). Students' attitudes towards BST was also enhanced through MOODLE LMS ( $t=15.632$ ,  $P<0.05$ ). The use of MOODLE LMS significantly enhanced students' retention ( $t=6.640$ ,  $P<0.05$ ). In conclusion, the Federal Government efforts at enhancing quality assurance through integration of modern technology and e-learning in Secondary schools proved to have yielded good result as students found MOODLE LMS to be motivating and interactive. Attendance was improved.

**Keywords**—MOODLE, learning management system, quality assurance, basic science and technology.

## I. INTRODUCTION

**B**ASIC Science and Technology is a subject that introduces students at the Junior Secondary schools in Nigeria to the basic rudiment of technology. At the inception of the 6 – 3 – 3 – 4 System of Education, it was called “Introductory Technology” but currently in the 9 – 3 – 4 System of Education it is called “Basic Science and Technology”. The National Policy on Education, as in [4] defined it as the aspect of education which leads to acquisition of practical and applied skills as well as basic scientific knowledge. It is also a subject that deals with the fundamentals of engineering and technology and its components include: Woodwork,

metalwork, building construction, electrical/electronics, computer, mechanics, technical drawing, and so on.

It is important to know that Science and Technology are the bed rock of growth and development of any nation. Integration of Basic Science and Technology as a pre-vocational subject into the junior secondary curriculum in Nigeria is to train students for the purpose of initiating, facilitating, implementing technical development and also creating the awareness of technological literacy [10]. Technical education, more than any other course of study, has more direct impact on National welfare. It contributes visibly in areas of automobile technology, electrical and electronics, wood work technology etc. Therefore, the practical nature of Basic Science and Technology makes it unique in content and approaches thereby making it require special care and attention in its teaching and learning methodology. However, there is an increase in the percentage of students who failed Basic Science and Technology in Junior Secondary Certification Examination for National Examination Council from 2006 to 2012 in Nigeria [5]. Reference [3] also shows identified that Basic Science and Technology students in Nigeria have poor attitude and retention towards the subject. He stated that one of the major problems causing the poor attitude and retention of students in Basic science and Technology is lack of standard Basic Science and Technology workshop.

The world is advancing at a rapid rate and events have moved to the electronic stage with the computer at the center. This development has brought a lot of innovation and revolution into teaching and learning. The 3R's which forms the nucleus of the old system of education has witnessed series of literacy reforms. The world is now in the age of information technology or computers age; hence, there is a need to keep abreast of time. Information and Communication Technology (in particular, the internet and intranet) provide teachers with many interesting tools that can be used to improve the teaching and learning process. Besides the fact that the internet is a vast source of information, there are some specific web-based applications that are conceived to be used as a teaching resource. One of them is the Learning Management System (LMS). A LMS is a software application for the administration, documentation, tracking, reporting and delivery of electronic educational technology. There is several LMS commercially available on the market such as Blackboard, WebCT and Desire@Learn. There are also many open-source, free LMS, such as MOODLE, Coursework, Atutor and Interact. However, MOODLE is one of the popular LMS currently [8]. MOODLE (acronym for Modular Object-

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Oriented Dynamic Learning package) is a PHP based open source LMS with a multi-user environment that can support an SQL data based where learning developers may create, store, reuse, manage, and deliver digital learning content from a central object repository through the use of computer. Reference [1] shows that it is unwise to ignore the pedagogical impact of MOODLE. It has been developed by Martin Dougiamas as part of his PhD in Education thesis. The underlying philosophy of MOODLE is maximum instructor control and minimal administrator control. MOODLE is based on the philosophy of socio-constructivist pedagogy which encourage discovery and provide collaborative activities. Different with commercial software, it is open source with no licensing costs and using the PHP code. According to [6], the main reason to use open source software includes the independent to distribute and modify compatibility cross-platform, universal access and active cooperation for design improvement. It is seen as users friendly and easy to manage and technically easy. It adapts a flexible modular design and one can choose and apply among thousands of available extensions for their version of MOODLE [9]. MOODLE LMS typically provides tools such as those for assessment, communication (online), uploading of content, return of students' work, administration of student groups, questionnaires, tracking tools, wikis, blogs, chats, forums, and so on, over the internet or intranet. MOODLE LMS has the following advantages: it helps students to learn at their own pace; it produces significant time saving over conventional classroom instruction; it allows students' control over the rate and sequence of their learning; it gives appropriate feedback; it promotes individualized instruction through personalized responses to learner's action to yield a high rate of reinforcement; it provides a more positive affective climate especially for slower learners; it provides appropriate record-keeping and thereby monitors students' progress; it puts more information both in the hands of teachers and the student; it raises students' motivation; it provides reliable instruction from learner to learner regardless of the teacher/learner at any time of the day and location; it directs instruction to learners; and it provides instruction at comparable expenses to other media. In synchronizing the curriculum content of Basic Science and Technology into the MOODLE LMS, both students and instructors will be able to access the modules at their most convenient time and place, allowing them to set their own pace of learning without pressure.

## II. RESEARCH QUESTIONS

The following three research questions were formulated to guide the study.

- (a) Is there any significant difference in the performance of Basic Science and Technology students exposed to MOODLE LMS and those taught using conventional method?
- (b) Is there any significant difference in the attitude of Basic Science and Technology students exposed to MOODLE LMS and those taught using conventional method?

- (c) Is there any significant difference in retention of Basic Science and Technology students exposed to MOODLE LMS and those taught using conventional method?

## III. METHODOLOGY

The study employed the pre-test, post-test, control group design. The population for the study consisted of Junior Secondary School Two (JSSII) students in Ogbomoso, Oyo State, Nigeria. The sample for the study consisted of 120 Junior Secondary School Two Students (JSSII) from four schools in Ogbomoso. Four schools (two public and two private) were selected in Ogbomoso Township using purposive sampling technique. This was based on the availability of ICT facilities in the schools. The two private and two public schools were randomly assigned into the experimental and the control groups. The experimental group was taught using MOODLE LMS, while the control group was taught using the conventional method. Two research instruments were used for data collection; these were:

- (a) **Basic Science and Technology Achievement Test (BTAT):** It consisted of twenty multiple choice items. This was developed to test the achievement of the respondents. The twenty items were drawn from junior secondary school syllabus.
- (b) **Student's Attitude towards Basic science and Technology (SATBST):** It is divided into sections A and B. Section A is used to elicit information as regards the Bio-data of the respondents. Section B is the attitudinal section that consists of twenty items drafted to elicit information about the learner's attitude towards Basic Science and Technology. The researcher was assisted by Basic Science and Technology teacher and research assistants also helped in administering these instructional materials.

In the first week, experimental and control group were given Students' Attitude towards Basic Science and Technology (SATBST) questionnaire to elicit their perception towards Basic Science and Technology. Basic Science and Technology (BTAT) achievement pre-test was also administered to the two groups to determine their previous knowledge in the subject. The experimental group was trained on how to navigate through the MOODLE LMS with their computers. MOODLE LMS treatment was given to the experimental group between the second and fourth weeks. The students were on their individual computers with the packaged installed. The package includes the following topics: Metalwork Handtools, Marking out tools, Measuring tools, Cutting tools, topics on Information and Communication Technology, Analog and Digital communication system, Meaning and Nature of ICT process, and the internet equipment and transmission. These topics were taken from WAEC syllabus. During these same weeks, the control group was taught the same topics in a conventional way.

Between the fourth and sixth weeks, SATBST with BTAT was re-administered to the experimental group to test for the perception of the students towards Basic Science and Technology and their performance towards the subject after

the introduction of MOODLE Based Package respectively. The control group during these same weeks was given BTAT to re-examine their performance after treatment.

BTAT were re-administered to both the experimental and control groups during the sixth and eighth weeks to test for retention.

For the achievement test, the total scores of each of the students at the pre-test and post-test were converted to percentage. Then the mean and standard deviation of the pre-test and post-tests subject score were found and an independent t-test was used to determine the significant difference between means scores. The level of significance at which these hypotheses were tested was 0.05. While for the attitude questionnaire, the weighted responses of each student at the pre-test and post-test were added for each subject and converted to percentage. All analyses were done with the statistical package of social sciences (IBM SPSS 20.0).

#### IV. DISCUSSION OF FINDINGS

The result from Table I, Pre-test showed that students in both experimental group and control group had the same entry behavior in the sample. Their level of performance in the sample; Basic Science and Technology was below average ( $t=0.170$ ,  $P<0.05$ ). This is evident from the Second International Science Study in which Nigerian students came last in primary science and second to last in secondary science among the participating countries of the world [7].

The current situation in Basic science and Technology teaching and learning in Nigeria is a concern to all including government and the society at large. Research shows that many students find the subject difficult, boring and not interesting to them [2]. On the other hand, there was a significant difference in the performance of both experimental group and control group after the Post-test was conducted. Experimental group performed well when the MOODLE Based was introduced to them. The results showed that students' performance in Basic Science and Technology increased significantly when MOODLE LMS was introduced ( $t=4.953$ ,  $P<0.05$ ). This indicates that if MOODLE LMS is introduced to students, their learning outcome would be excellent.

Table II presents the pre-test and post-test scores obtained from the overall attitude of both experimental and control groups. At pre-test there was no significant difference in the performance of both groups. Samples in the control group had a pre-test mean score of 63.54 in achievement test with a standard deviation of 7.60 while subjects in the experimental group had a mean score of 64.95 and a standard deviation of 10.93. The t-test analysis yields a t-value of 1.622, which indicated non-significant value of 0.110. These values signify that the two groups had no significant difference at the entry behavior. At the post-test, the mean value and standard deviations represents a statistical difference between the two groups. Subjects in the control group had a post-test mean score of 63.75 in achievement test with a deviation of 3.99 while subjects in the experimental group had a mean score of 90.62 and a standard deviation of 13.81. The t-test analysis yielded,  $t(118)= 15.632$ ,  $P\leq 0.05$  which indicated significant difference at the 0.05 level of significance in favor of the experimental group.

From the result, it was gathered that learners who were exposed to MOODLE LMS, developed better interest in Basic Science and Technology than their counterparts in the conventional group.

Table III indicated that samples in the control group had a mean score of 13.07 and a standard deviation of 4.34, while samples in the experimental group had a mean value of 16.82 and a standard deviation of 2.33 in the Retention test. When these scores were subjected to a t-test of significance, the result,  $t(118) = 6.640$ ,  $P\leq 0.05$  indicated that there was a significant difference in retention of students' who were exposed to MOODLE LMS and those taught using conventional method in favor of those who were taught using MOODLE LMS, therefore the hypotheses was rejected. The result of the analysis showed statistical difference among both groups after the same achievement test given to them. The experimental group performed well compared to the control group. This indicates that MOODLE LMS enhances retention when used for teaching and learning.

TABLE I  
T-TEST ANALYSIS OF PERFORMANCE SCORES OF STUDENTS EXPOSED TO MOODLE LMS AND THAT WERE NOT

| Test      | Group        | N  | Mean  | S.D  | t      | P     | df  | Remarks         |
|-----------|--------------|----|-------|------|--------|-------|-----|-----------------|
| Pre-test  | Conventional | 60 | 8.38  | 3.59 | 0.170  | 0.856 | 118 | Not Significant |
|           | Experimental | 60 | 8.30  | 3.24 |        |       |     |                 |
| Post-test | Conventional | 60 | 11.42 | 4.14 | *4.953 | 0.000 | 118 | Significant     |
|           | Experimental | 60 | 14.03 | 2.63 |        |       |     |                 |

$P\leq 0.05$

TABLE II  
T-TEST ANALYSIS OF ATTITUDE SCORES OF STUDENTS EXPOSED TO MOODLE LMS AND THAT WERE NOT

| Test      | Group        | N  | Mean  | S.D   | t      | P     | df  | Remarks         |
|-----------|--------------|----|-------|-------|--------|-------|-----|-----------------|
| Pre-test  | Conventional | 60 | 63.54 | 7.60  | 0.622  | 0.110 | 118 | Not Significant |
|           | Experimental | 60 | 64.95 | 10.93 |        |       |     |                 |
| Post-test | Conventional | 60 | 63.75 | 3.99  | 15.632 | 0.000 | 118 | Significant     |

$P\leq 0.05$

TABLE III  
T-TEST ANALYSIS OF RETENTION SCORES OF STUDENTS EXPOSED TO MOODLE LMS AND THOSE TAUGHT WITHOUT THE PACKAGE

| Group        | N  | Mean  | SD   | t     | P     | Remarks     |
|--------------|----|-------|------|-------|-------|-------------|
| Conventional | 60 | 13.07 | 4.34 | 6.640 | 0.000 | Significant |
| Experimental | 60 | 16.82 | 2.33 |       |       |             |

$P \leq 0.05$

#### V. CONCLUSION

Based on the findings of this study MOODLE LMS as used for teaching Basic Science and Technology under these topics produced a significant improvement in the academic performance of learners in Basic Science and Technology in Secondary Schools. The effective use of MOODLE LMS produced a significant improvement in the attitude of students towards Basic Science and Technology and improved their level of retention ability.

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