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Design and Implementation of Virtual Learning Environment for Flexible Skills

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Abstract

The world needs workers with more and better skills. Conventional apprenticeships and traditional methods of professional training are not providing enough skilled workers, so governments, industries and learning institutions are all using open distance learning and flexible learning to fill these gaps. Traditional methods of providing training therefore may not meet the current or projected demand for flexible skills development. The research objectives of this paper is to analyse, model and implement a real-time interactive virtual learning platform for flexible skills development. The system is developed and hosted on the web using BigBlueButton plug-in on Modular Object Oriented Dynamic Learning Environment Platform, Hyper Text Markup Language as the front end, PHP as the server side-programming tool, Apache as the middleware and MySQL database as the backend. The system provides real-time interactive learning environment with the collaboration of teacher and students in a single portal anytime and anywhere. Flexible Skills Development (FSD) strengthens capacity to harness the potential of Information and Communication Technology in flexible and blended approaches to provide effective technical and vocational education and training.

Keywords: Virtual Learning Environment, e-Learning/Teaching, Web Based Learning portal, Flexible Skills Development and Open Distance Learning.

Keywords:

1.0 Introduction

Virtual learning environments are becoming increasingly common in different contexts – in schools, colleges, polytechnics, universities and vocational training (Rudestam & Schoenholtz-Read, 2002). Therefore, Virtual Learning Environments (VLEs) offer an integrated solution to manage online learning, providing a delivery mechanism, student tracking, assessment and access to resources. Although some VLEs can be restrictive, if used effectively, they can provide a familiar, but functional environment for the user. As a unified environment, a VLE is simple and efficient to administer and therefore attractive to the provider.

A VLE can be viewed as a useful collection of e-learning tools in a package that allows a common interface and sharing of data between the tools. While the specifics of any one VLE will vary, on the whole they offer similar functionality. We can think of a VLE as having three dimensions to its functionality, each of which represents a different interface and audience (Figure 1). The three dimensions are:

i. **Institutional** – a VLE needs to integrate with other university systems, including student records, library systems, content management, etc. Being able to do this in an efficient manner is a primary concern for the IT specialists who will deploy and support a VLE.

ii. **Academic** – although one thinks of students as the end users of a VLE, it is the academic staff who will ultimately determine the success of a VLE. Therefore the methods for creating courses, setting up tools and supporting students will be the key determinants in the popularity of a VLE. Support for a range of subject areas and pedagogies will be important to these users, as well as ease of use.

iii. **Learner** – the end user of a VLE can be seen as the learner. If their experience is not a good one, for example the system is difficult to navigate or is not robust, then the feedback and use of the system will be poor, which will inhibit its uptake. For this group the system must be easy to use and consistent in its layout, but most importantly it needs to add value to the learning experience.

This is particularly the case when a VLE is deployed on campus. If the system does not add any value, then, being a strategic group, most learners will avoid it. Adding value can be in terms of additional content, more flexible study patterns, increased support and, for some users, a more appropriate environment. Viewing a VLE as having these three dimensions emphasizes that it is a system that needs to appeal to different audiences, each of whom will have different priorities and needs.

Institutional: integration with systems and processes
Learner: ease of use, reliability, added value
Academic: course creation, support for subject and pedagogy

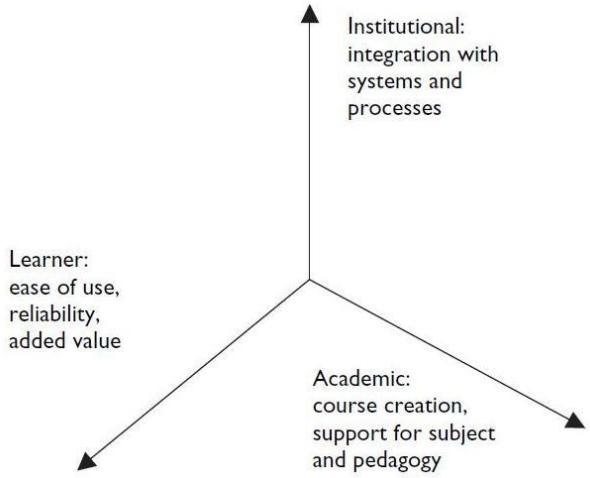

Figure 1: The dimensions of a VLE interface.

i. Administrators – scalability, value for money and integration with existing systems are important for these users.
ii. Technicians – robustness, user base, technical support and ease of maintenance will be significant.
iii. Course developers or teachers – customizability, flexibility and the integration of legacy materials will be paramount.
iv. Learners – consistency, accessibility and quality of design will be the main concerns.

1.1 Virtual Learning Environment (VLEs)

The term "learning environment" suggests place and space – a school, a classroom, a library. And indeed, much 21st century learning takes place in physical locations like these. But in today's interconnected and technology-driven world, a learning environment can be virtual, online, remote; in other words, it doesn't have to be a place at all.

Perhaps if you are given responsibility for teaching a course or a number of sessions, it is worth finding out whether the course team makes any use of a VLE. If there is a VLE which is already widely used at your institution or in your department, you may find that your students expect you to make materials available for them in this way. Use of the Web and VLEs to make materials available to students 'anytime, anywhere' can assist in study, revision and assignment preparation.

Although VLEs have been available for several years at many schools, they are still not universally used. Many factors influence the take-up of new technology among teaching staff and, without rehearsing each of those here, it is worth saying that if you use the campus VLE in your teaching, it may provide you with an opportunity to engage the other teaching staff with new technology too. If you are part of a teaching team working on the same course, using a VLE can ensure that you are able to share resources and be aware of what your students have seen/done in other sessions. This can improve the quality of teaching by ensuring consistency and transparency, and avoiding overlap.

1.2 Flexible Learning and Skills Development for Sustainable Development

The phrase 'flexible learning' describes the delivery of higher education level qualifications where one or more of three principal factors - the way it is taught, and where and when it is delivered (as well, sometimes, as what is taught) - have all been adapted to provide choices that enable prospective students to design their study patterns to fit alongside other needs. This can include, for example, studying from home, using previous qualifications or work-based learning within study, and providing opportunities to shape the curriculum the student will follow.

The very flexibility offered by these academic courses provides learners with the opportunity to consider undertaking a higher education level course when they would not have previously seen it as an option available to them, and removing a significant number of physical and other barriers that may have been holding them back. When combined with life and work experience, flexible learning can be an immensely enjoyable and satisfying activity that extends its benefits across learners' educational, employment and personal lives.

In particular, potential flexible learners should think about the speed at which they will be able to study and achieve their qualifications *(pace)*; where they want to study *(place)* and how they want to study *(mode)* as these are the three key factors to achieving their academic goals successfully. Offering flexible learners *choices* in these areas also recognises that individuals are often juggling their study with other commitments and providing choice in the pace, place and mode of delivery can make study a real option when it might otherwise have been impossible.

Flexible learning is about providing learners with choices regarding where, when and how learning occurs. It helps to attract and meet the needs of an increasingly diverse range of students and includes making appropriate use of technology to support the learning process.

The World Commission on Environment and Development (1987) defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Since TVET is the major producer of the future workforce, it follows that the sector is responsible for aligning education and training to enable future workers to take on responsibility for responding effectively to the principles and needs of the sustainable development agenda. It is therefore incumbent upon TVET to develop knowledge, skills and competencies for green occupations, economies and societies and the innovations needed to address climate change, preserve environmental integrity and assure the continued health of nature's essential life support systems.

2.0 Related Research Works

Several frameworks have been proposed and developed for e-learning across the globe. This is with a view to developing models that integrate technology and pedagogical issues. A framework of e-learning that determined the units of study was proposed by (Koper, 2001). The framework recognized learners, staff and developers of units of study as the key actors in the learning process. Building upon this idea, Koper developed Educational Modelling Language for Open University in Netherlands. The containing framework described in Koper model has since been taken up and developed by IMS Learning Design group (IMS Global Learning Consortium,
2002), which aims to work towards establishing specifications for describing the elements and structure of any unit of learning.

Another conversational framework for e-learning is Laurillard model (Laurillard, 2002).
This model considered academic learning as learning mediated through conversations between learners and teachers, rather than situated in direct experience. The study advocated a continuing iterative dialogue between teacher and student which reveals the participants' conceptions and the variations between them. This model summarized the importance of the analysis as: places more emphasis on the interaction between teachers and learners; stresses the need for meaningful intrinsic feedback to be a central feature of e-learning; and considers how far current learning technology tools can help to meet the requirements for academic learning by analyzing each media form in terms of the conversational framework.

A new framework based upon the Laurillard conversational model and the Beer viable systems model (Beer, 1979) was Britain and Liber's framework (Britain and Liber, 2004). The framework was primarily developed in order to facilitate the take-up and use of Virtual Learning Environments (VLEs) across further education. This framework stressed on the effective management of organizational structures at different levels from the teachers through the students to the institution. This approach allows for complex networks including networks of people within an organization to be mapped in this way.

(Dutta et al. 2011) proposed a six step model for e-learning adoption in higher education.

They are: learning management system; integrated content capture system; synchronous collaboration tool; content development tool; online testing and assessments; and multimedia software. These tools and technologies constituted the model for the development of an elearning centre in Hashemite University, Jordan. The university has adopted and used Blackboard, an integrated collaborative learning system, for teaching and learning.

In Nigeria, attempt at introducing models for e-learning in higher institutions largely focus on theoretical framework for collaborative learning. (Ajadi et al. 2008) discussed the theoretical basis and the relevance of e-learning in the position of distance education in Open University. The study highlighted the prospects and challenges of e-learning in the institution of concern. (Awodele *et al.* 2009) proposed a framework of e-learning that incorporate active and open collaboration, and integrate other services that aid in learning process.

The study aimed at having an extended and enhanced learning environment that is tied or connected to other systems within the immediate environment based on theoretical analysis.

The model of e-learning developed in University of Jos ICT initiatives became a novel model in the country that was adopted and integrated in the institution over a period of time from now (Liverpool et al., 2009).

Locally, the institution adopted Knowledge Environment for Web-based Learning

(KEWL) system which is a course management system developed by a consortium of African

Universities led by the University of Western Cape with the University of Jos as a member of the consortium. Moodle was adopted as a course management system in 2007. This is a popular learning tool with functionalities supporting scientific notation and collaborative learning across the globe for creating online dynamic web sites for students.

E-Learning System involves a systematic process of planning, design, development, evaluation, and implementation to create an online environment where learning is actively fostered and supported. The process of e-Learning can be represented by e-learning process model depicted in Figure 2.

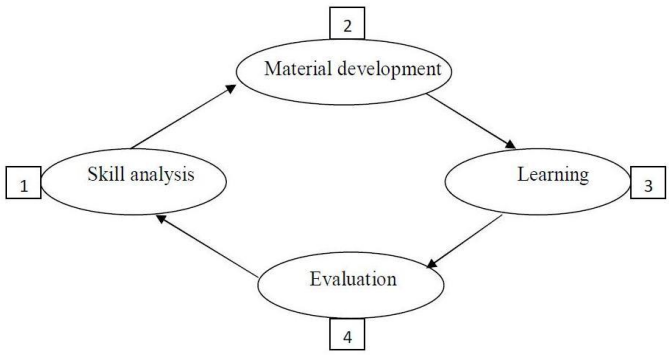

Figure 2: e-Learning cycle model

i. **Skill analysis**:- The learning manager analyses the learner's present skill and skill that is set as a learning goal, and obtains the necessary material information. The manager then searches for the related material (registered for the search).

ii. **Material development**:- The developer creates exercise questions and the material structure (table of contents) linked with explanatory pages.

iii. **Learning**:- The learner engages in learning that is suited to the need, that is, individual learning for knowledge acquisition, or collaborative learning for workshop-type learning.

iv. **Evaluation**:- The learner carries out exercises and takes examinations using questions designed according to the learning goal. The learning manager makes the evaluation of each learner, using results of exercises and examinations.

Classes take place online through the use of software packages that have special classroom features such as discussion forums, calendars, "chat rooms" where participants can communicate in real time with one another, with quiz and polling capabilities. Files, such as word processing documents, sound files, pictures, and videos can be uploaded to the virtual classroom for viewing by students. Thus, the "platform" is essentially a place that looks like a private website and is intended to work like an electronic classroom. The classes taught on these platforms are accessible via the Internet, and are usually private, meaning that only individuals who are registered for the class can see the password protected website. A platform for online courses may also be called an LMS (Learning Management System) or LCMS (Learning Content Management System) (Kameron & Saskia, 2010).

Modular Object-Oriented Dynamic Learning Environment (MOODLE) is a software application for the administration, documentation, tracking and reporting of training programmes, class room and on line events, e-learning programmes, and training content. It is designed to teach how e-learning can be implemented and made effective using popular LMS, Moodle. Moodle is a free and open source e-learning software platform; that means, there is no cost or license fee for deployment. Moodle is designed to help educators create online courses with a focus on interaction and collaborative construction of content.

Moodle is a free and open-source e-learning software platform, also known as a Course Management System, Learning Management System, or Virtual Learning Environment. Moodle is a course management system designed to help educators who want to create quality online courses. Moodle has many resources and activities to aid in flexibility and diversification of learning.

Moodle run on the widest variety of platforms**.** The web application platform that runs on most platforms is PHP combined with MySQL, and this is the environment that Moodle has been developed in (on Linux, Windows, and Mac OS X). Moodle also uses the ADOdb library for database abstraction, which means Moodle can use more than ten different brands of database

(Oracle, IBM DB2, Microsoft SQL Server, Borland Interbase, Informix, Visual Foxpro, SAPDB, SQLite, Sybase, Microsoft Access etc.). Moodle should be easy to install, learn and modify.

Code reuse is instead achieved by libraries of clearly-named functions and consistent layout of script files. PHP is also easy to install (binaries are available for every platform) and is widely available to the point that most web hosting services provide it as standard. Moodle knows what version it is (as well as the versions of all plug-in modules) and a mechanism has been built in so that Moodle can properly upgrade itself to new versions. It should be modular to allow for growth. Moodle has a number of features that are modular, including themes, activities, interface languages, database schemas and course formats. This allows anyone to add features to the main code base or to even distribute them separately. It should be able to be used in conjunction with other systems.

One thing Moodle does is keep all files for one course within a single, normal directory on the server. This would allow a system administrator to provide seamless forms of file-level access for each teacher, such as Appletalk, SMB, NFS, FTP, WebDAV and

so on. The authentication modules allow Moodle to use LDAP, IMAP, POP3, NNTP and other databases as sources for user information. The objectives of this research are to:

i. shape up e-learning presentation to a more attractive and interactive one;

ii. gain an in-depth and effectiveness of e-Learning implementation, especially to answer the issue of collaboration without neglecting the issue of education.

There are now many commercial Virtual Learning Environments, all of which offer a similar set of features. These VLEs typically place the learning material at the centre of the system and provide a set of tools which are of use as the learner progresses though that material.

An ideal-typical VLE architecture encompasses an administrative database, a content database as well as an administrative, analytical, communicational, authoring and learning process management component (Bodendorf, 1993; Strohmeier, 2008).

3.0 Methodology

It is critical to create an environment for online learning that is simple to use and easy to access. Various software packages have been developed to manage the different elements of online learning. These are often referred to as Virtual Learning Environments (though various alternative terms are used interchangeably - for instance: learning management tools, online learning frameworks, collaborative learning environments, web course design tools, online learning environments etc).

3.1 System Design

The researcher uses a lecture material, OTM 313 – Office Application I, as the sample lecture in order to help researcher develops e-learning system to be more applicable. The entire lecture materials are maintained through a back-end web based application as the Content Management System (CMS) enabling the lecturer to update his/ her lecture material at any time.

a. **Login Screen**:- The login screen is the main screen before user access the virtual classroom. User authorization is made through username and password validation, where username can be student ID or lecturer ID.

b. **Class Login Screen**:- The class login screen will display available e-learning classes.

The user may select from various class(es) if available.

c. **Loading Screen**:- After the user is accepted or authorized to log in to specified class, he/she will download the virtual world objects from the server and will be presented in the learning outcome.

d. **Main Screen**:- Having finished the download process, the users enter the main screen interface of the virtual classroom. The user will be allowed to move around and interact in the virtual classroom as his/ her e-learning class along with other users (students and lecturers) currently logged in the same class.

e. **Lecture Content Screen**:- The contents delivered are maintained by lecturers through the backend Content Management System. Contents are accessed from the virtual realm to the web server; the web server will handle the delivery of each content from the database server, determine which content to display and send it back to the virtual realm to be displayed in this screen. Figure 2 shows the design flow diagram.

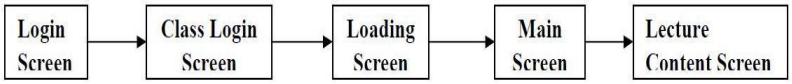

Figure 3: Design flow diagram

3.2 System Requirement Specification

Table 1 and 2 show the minimum hardware and software specifications for e-learning system development and implementation.

Table 1: Hardware Specification

Hardware	System Development	Implementation
Processor	*Intel*® or *compatible Pentium* 4 1.8GHz	*Intel*® or *compatible Pentium* 600 MHz
Memory	512 MB	128 MB
Hard disk space	20 GB	5GB
Graphic Card	64 MB	64 MB

Table 2: Software Specification

Software	System Development	Implementation
Operating System	Window XP Professional, Window 7	Windows XP, Window 7, Window 8.
Database Server	MySQL 4.1 NT	-
ODBC Driver	MySQL ODBC Driver 3.51	-
Web Server	IIS 5, Apachee	-
CMS Development	PHP 4	-
Graphic Library	-	OpenGL32 For Windows
Internet Browser	-	MSIE 5.5 or other compatibles

3.3 Content Management System

In computing, a content management system (CMS) is a document centric collaborative application for managing documents and other content. A CMS is often a web application and often it is used as a method of managing web sites and web content. At the back-end side of the e-learning system, a Content Management System (CMS) is needed to administrate user information as well as managing the lecture content delivered in the e-learning system.

a. **Login Screen**:- The main login screen is where authorization process for the Content Management System takes place. Valid username (lecturer ID or student ID) and password is required to access the CMS.

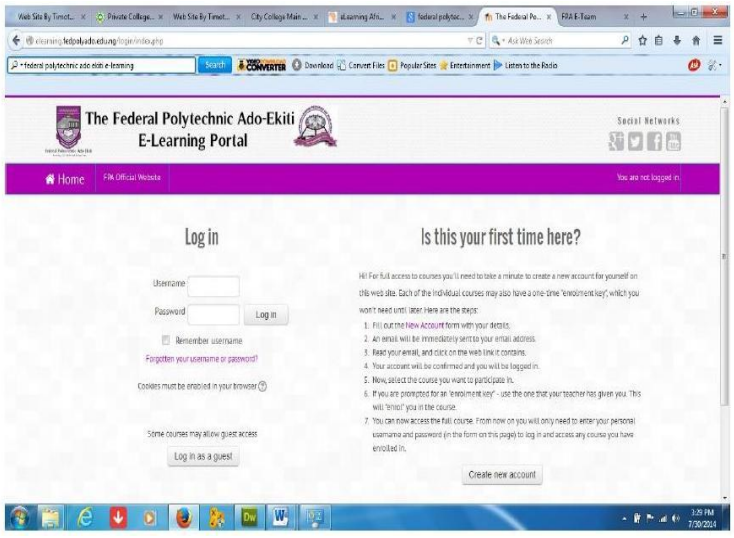

Figure 4: Login Screen

b. **Lecture Creation:-** This section of Moodle CMS is where the administrator can add new lecture. This master lectures will be the main

controller for the lecture materials in the specified lecture. As displayed in the screen, the lecture, Office Application I (OTM 313) was used as a sample lecture in the Federal Polytechnic, Ado e-Learning web portal.

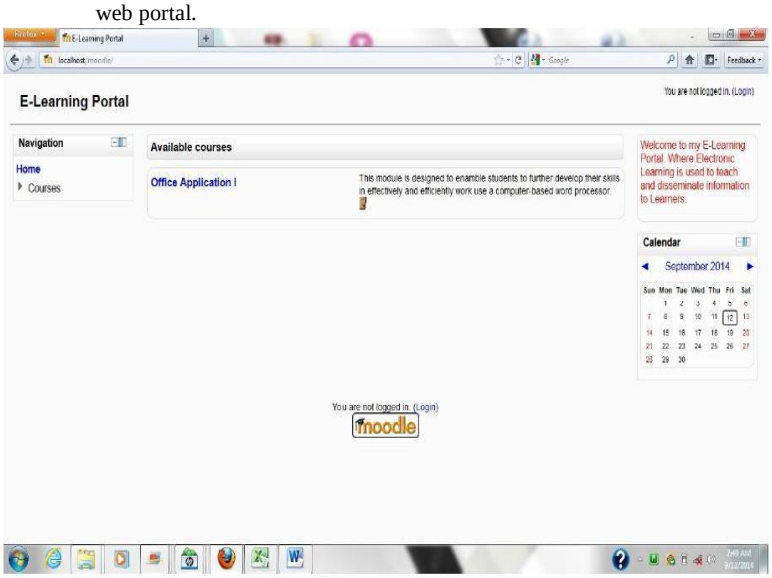

Figure 5: The screen shot of creation of courses

c. **Adding New Content**:- This section of Moodle CMS is used when adding lecture material/ content to specified lecture.

d**. Adding Quiz Question**:- This section of Moodle CMS is used when the lecturer wants to add questions for the quiz conducted in the virtual realm. The quizzes are used to determine student achievement in learning the lecture content using this e-learning platform.

e. **Add new user**:- This section of Moodle CMS is used by the administrator when adding a new user to access the e-learning platform. User ID, password and user role (Lecturer, Student and Admin) information are entered in this section.

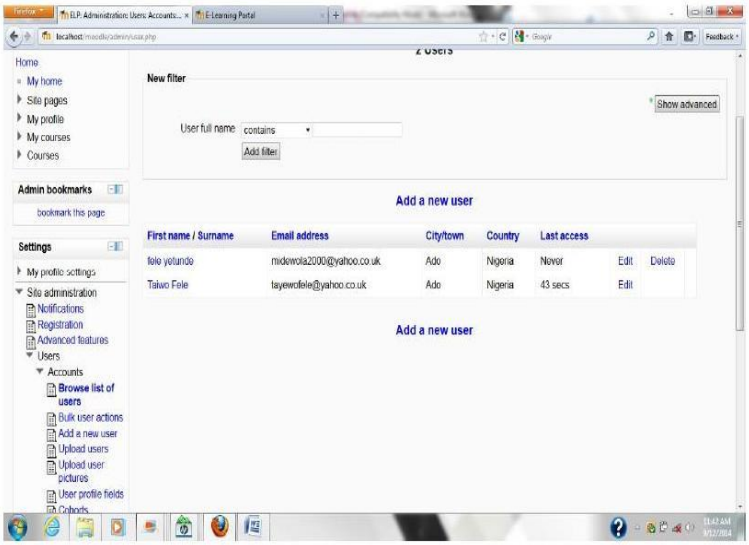

Figure 6: The screen shot of adding new user

d. **Content Screen**:- When user entering particular area in the virtual world where it has been previously set with content trigger, the content of the specified area is popping up to the screen. This content can be any of lecture materials or other tips given by the lecturer.

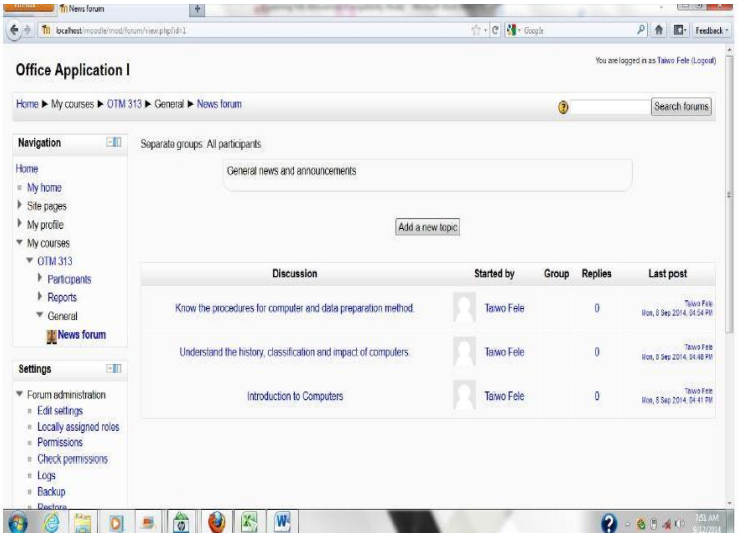

Figure 7: The screen shot of creation of lecture materials

e. **Quiz Screen**:- One way to assess students' study progress in this Moodle e-learning system is by using students' progress level that is stored along with other student information in the database. The status information contains Student ID, name, progress level, number of login to the class, last login date allowing the student to know his/her study progress.

4.0 Result and Discussion

The architecture of Moodle is compatible with the hardware and software of The Federal Polytechnic, Ado-Ekiti. The incorporation of LMS are done during the building and use in Internet network. Lessons were created according to the minimum requirements of NBTE curriculum and IMS, according to the recommendation of the administrator of Moodle. The teacher has the freedom to change the courses, something the other users do not have.

There are three different formats for the class (course) – Weekly, Topic, and Social. The weekly format organizes the class into weeks, with assignments, discussion boards, tests, etc, all residing in a week-by-week block. The Social format is built around a forum (bulletin board), which is good for announcements and discussions. The Topic format organizes everything by topics (or units), regardless of how long they take and they are used for e-learning by our students, who use the resources of their home PCs by logging into Federal Polytechnic, Ado portal.

5.0 Conclusion

In conclusion, the design and implementation of virtual learning environment allows better cooperation among the learners, the lecturers and the students. The accessibility, usability and student collaborative learning are also improved.

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