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A FRAMEWORK FOR THE DEVELOPMENT OF IN-HOUSE E-LEARNING SYSTEM FOR TERTIARY INSTITUTIONS

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ABSTRACT

Teaching and learning have been part of human lives for centuries and will continue to be a part of human society. E-learning is a learning conducted via electronic media, especially via the Internet. The aim of the paper is to explore and discuss the conceptual basis of e-Learning framework for the development of an automated in-house e-learning solution for tertiary institutions. To achieve this, the Addie model which is an instructional system design model that consist of five phases: analysis, design, development, implementation and evaluation was employed to the development of an in-house e-learning system that can be customized to the need of the tertiary institution. The proposed prototype system was developed using C-sharp on Visual Basic 2019 as the front end and SQLITE Database as back end. The automated e-learning system is user friendly, graphical user interface, portable and is recommended for the adoptability by prospective institution of higher learning because the in-house e-learning system will provide better system upgradeability, communicativeness of interface, and security.

KEY WORDS: E-learning, Framework, Development, Information Technology.

1.0 INTRODUCTION

Learning is the cognitive process of acquiring skill or knowledge, for decades learning has been part of human lives and will continue to be part of human society. The field has witnessed significant level of transformation in recent times with the introduction of electronic-learning usually referred to as e-learning. E-learning refers to the use of the convergence of information and communications technology (ICT) to enhance and/or support learning in tertiary education. According to Andrews and Haythornthwaite (2007) e-learning is the utilization of a wide variety of technologies including information technologies to facilitate educators and to create rich learning experience for learners.In many cases e-learning is delivered in the form of computer-based training or web-based learning and very often is understood as the utilization of electronic technologies for teaching and learning. Sangra et al. (2012) outline that it is very difficult to include all features of e-learning in one definition, but they express their opinion that "e-learning could be considered a natural evolution of distance learning which has always taken advantage of the latest tools to emerge in the context of technologies for structuring education".

E-learning can be used to improve distance learning and increase access to and participation in tertiary education, as part of a lifelong learning policy. It can also be used to enhance the student experience on campus. Jacobson (2016) stated that the use of e-learning in higher institutionshas increased dramatically with the development of a range of e-learning systems also known as educational technologies to support traditional teaching and learning. Institutions are now using e-learning to provide a mixture of face-to-face classroom teaching, live e-learning, self-paced e-learning and distance learning. These e-learning platforms offer many benefits to higher education institutions such as: social environments are created to support students' learning and cognitive development; student-centred learning focuses on fostering communicative and collaborative skills amongst the students making them more engaged in their learning process;e-learning technologies also have the ability to support social-interactions between students and teachers and amongst students. According to Jones (2012), e-learning has grown to complement traditional classroom-based learning. Educational technology is being used in combination with effective pedagogy and reflective teaching to transform higher education. E-learning is also being used as a resource to provide online support, online student management, and provision of formative and summative assessment feedback to the students. E-learning has emerged as a necessity to meet the challenges posed by the development of information technology and the potential for greater access to knowledge . There is much examination into the effects of communication and information technology (IT) on learning. Innovative techniques are still being explored with the aim of achieving learners' attention, and establishing active and tailored learning environments wherein learners are able to pursue continuous learning, in a motivated manner, with the use of various tools of information technology. The internet is a basic technology in the development of information technology. The use of internet technology will make it easier for people to obtain latest information quickly and effectively. The Internet has become a very important tool that is required by the knowledge-based society for the contemporary information. In this work, the appeal of the need for in-house learning solution sometimes lies in perceived inadequacies of commercial offerings, plus a desire to retain institutional autonomy over the instruction process, especially as it can represent valuable intellectual property. The aim of the paper is to explore and discuss the conceptual bases of e-learning framework for an automated in-house e-learning for tertiary institutions. The scope of this work considers that though the multiplication of software platforms for e-learning reflects the novelty, relative and dynamism of learning management system LMS, it might also represent a wasteful duplication of effort, or correspond to an over-emphasis on the technological

infrastructure when the real challenge could focus in making innovative and effective use of the functionalities offered to faculty and students for reflective in-house solution. The significance of implementing the objectives of this study, is that it will erase lots of problems associated with the traditional learning system. The study will benefit the institution since it will enable users to access learning resource digitally without the inconveniences of students carrying books, journals, magazines etc. which could result in rapid wear and tear of these resources. It can provide benefits for the staffs and students involved such as: improved performance as it is interactive to the students thereby improving their productivity; improves standard of education, it will help to eliminates learning inadequacies like unfavorable time schedule for either staff or student; increased access as it enables people from any part of the world to be educated; convenience and flexibility to learners as learning process is structured in units, this makes the learner study at his own convenience without getting too bored with lectures.

The problem statement therefore, is that students suffer a lot of setbacks in external examinations due to the primitive nature of teaching system in most tertiary institutions which they receive. Lack of access to digital global information on various courses hence lacks a huge knowledge of what is obtainable in the society, some libraries are not equipped with good books, and the timetable schedule is not suitable for some of the lecturers, thereby making impartation of knowledge on students to be difficult. Students also have problems purchasing and carrying about available textbooks that are in hardcopy format. The rate of examination malpractice has increased, and attention must be given fast to it before it ruins the education system of the country. In order to curb this problem, it is relevant to implement a system of studying online where academic materials can be accessed unlimitedly to aid academic growth.

1.1 BACKGROUND

The word e-learning has been in existence since 1999 when the term was first utilized at a computer-based tutor system seminar. More words began to emerge in search of an accurate description such as “virtual learning” and “online learning”. Moreover, the principles behind e-learning have been well documented throughout history, and there is even evidence which suggests that early forms of e-learning existed as far back as the 19th century (Wang et al. 2017).

The provision of education on particular subjects or skills through distance learning has been in existence long before the launching of internet. In the 1840sIsaac Pitman taught his pupils shorthand via correspondence, this form of symbolic writing was designed to improve writing speed and was popular amongst secretaries, journalists, and other individuals who did a great deal of note taking or writing. Pitman, a qualified teacher, was sent completed assignments by mail and he would then send his students more work to be finished using the same system. In 1924, the first testing machine was invented; this device allowed students to test themselves. Then, in 1954, BF Skinner, a Harvard Professor, invented the “teaching machine”, which enabled schools to administer programmed instruction to their students (Allen and Seaman, 2017).

According to Perry (2018), the first online learning systems were really only set up to deliver information to students but in the 70s online learning started to become more interactive. In Britain, the Open University was keen to take advantage of e-learning. Their system of education has always been primarily focused on learning at a distance. In the past, course materials were delivered by post and correspondence with tutors was via mail. With the

internet, the Open University began to offer a wider range of interactive educational experiences as well as faster correspondence with students via email etc. In the 2000′s, businesses began using e-learning to train their employees. New and experienced workers alike now had the opportunity to improve upon their industry knowledge-base and expand their skill sets. At home, individuals were granted access to programs that offered them the ability to earn online degrees and enrich their lives through expanded knowledge. The enabler of information technologies is used to support any form of knowledge delivery: in fully online universities and programs, distance and blended-learning programs and courses. Therefore, with this trend it is important to localize the e-learning in tertiary institutions.

2.0 THEORETICAL FRAMEWORK FOR E-LEARNING

Theory can be defined as principles, a set of statements, or ideas that relate to a particular subject. A theory usually explains, describes, and/or predicts phenomena. The definition of theory also varies depending upon disciplines, especially when related to the term model. According to Graham et.al (2013), the two terms generally are used interchangeably and refer to the same concept. Moreover, a model is more of a visual representation of reality or a concept.

Therefore, the common educational theories applied to in e-Learning are: active learning, behaviourism, constructivism and cognitivism. As noted by Pange (2011); Picciano (2017); Hadjerrouit (2007); in active learning the learner is actively involved in the learning process through interactions and doing things. Behaviourism explains how the learner changes his behaviour during learning process according to the input stimuli and he/or she depends on the knowledge transfer from the teacher; while constructivism describes how the learner constructs his own knowledge interacting with learning materials and by experience. Then cognitivism sees the learner's changing behaviour based on development of his cognitive process of mind. There are others such as: blended learning which occurs in environment that combines e-Learning and face-to-face techniques (Gambari et al, 2017); social learning that learner changes his behaviour during the learning process based on experience or observation the behaviour of others (Quigley, 2018); adaptive learning where the learning path is constructed according to the learner's characteristics and achievements (Shelle et al., 2018);personalized learning involves the instruction is individualized for the concrete learner who directs his own learning (Redding, 2013); and collaborative learning a learning process is performed by more than one learner in virtual learning environment (Badawy, 2012); among others.

Generally, no single theory has emerged for instruction, the same is true for online education. A number of theories have evolved, most of which derive from major learning theories mentioned earlier. In this work the community of inquiry model for online learning environment developed by Garrison et.al (2000) is highlighted becauseis based on the concept of three distinct presences: cognitive, social, and teaching as shown in figure 2.1.

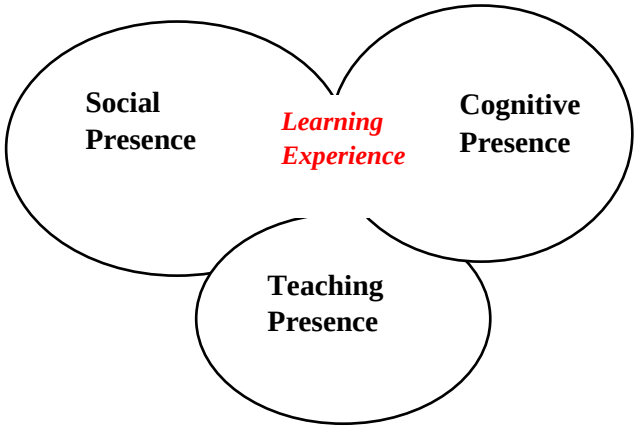


Fig. 2.1. Community of Inquiry (Garrison et.al, 2000)

Anderson, et.al (2001) while recognizing the overlap and relationship among the three components, advised further research on each component.And their model supports the design of online and blended courses as active learning environments dependent on students and instructors sharing opinions, ideas and information. Importantly, the presence is a social phenomenon that manifests itself through interactions among instructors and students. This framework has become one of the more popular models for online and blended courses that are designed to be interactive among faculty and students using blogs, wikis, video conferencing and discussion boards.

As posited by Siemens (2004), one of the proponents of connectivism, is a learning model that acknowledges major shifts in the way knowledge and information flows, grows, and changes because of vast data communications networks. Internet technology has moved learning from internal, individualistic activities to group, and even crowd activities. E-learning therefore evolves from automation of educational activities to intelligent solutions building by taking advantage of contemporary and emerging technologies.

Building a community of e-learning adopters within and across institutions and, more generally, knowledge management processes related to e-learning, are clearly crucial for further e-learning developments. In the development of platform for e-learning depends on the model that can be considered as an instructional system designsuch that, is easy to use, considered to be sequential and iterative.

3.0 METHODOLOGY

The study methodology defined here is based on the methods used to collect information on the real-world problem pertaining to lecturing pattern in tertiary institutions and to define system requirements. From the analysis of study, understanding of the frameworks, observation and analysis of interview, will lead to the initial requirements for the system. The study used the Addie model. This model is an instructional system design model that consistsof five phases: analysis, design, development, implementation and evaluation called (ADDIE) model. It is a model that can be applied to the development of an in-house e-learning system that can be customized to the need of the tertiary institution. It is applicable to any form of e-learning such as blended learning, instructor-led e-learning, self-paced e-learning. One of the features of this model is that it is understandable and can easily be adopted and use in very simple manner as each phase of the ADDIE model offers an opportunity for self-correction before moving to the next phase as shown in figure 2.2 and the phases of the model sometimes may be overlapped and interrelated.

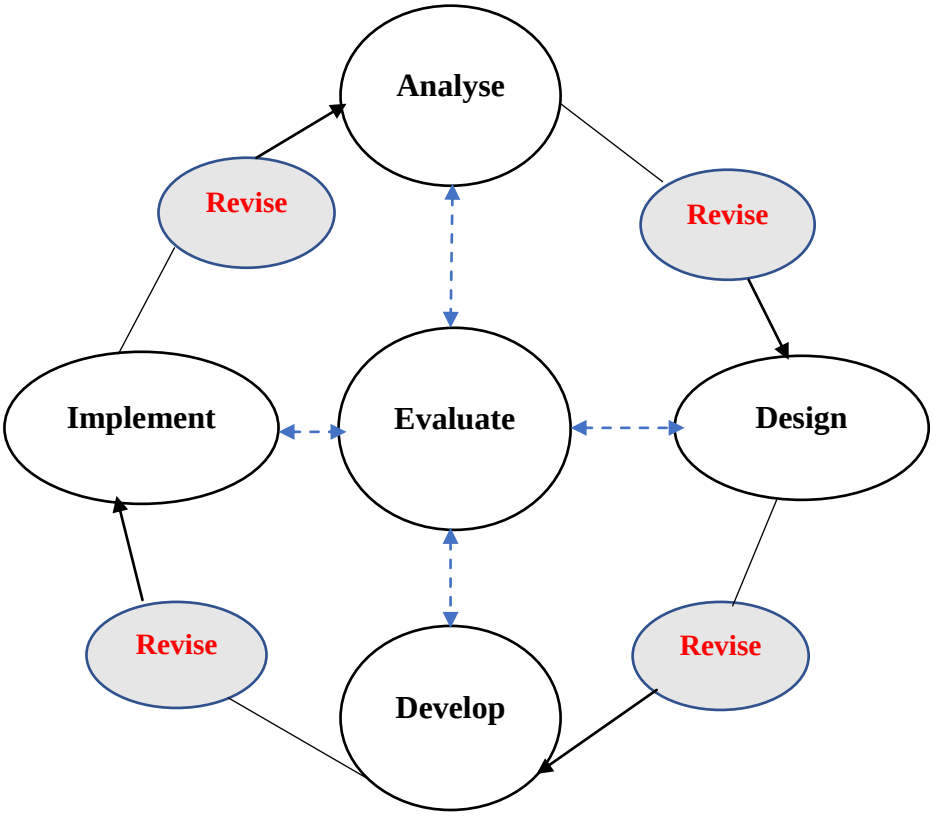


Fig.2.2. Instructional Design Model for E-learning System

Analysis: In order to understand the infrastructure of the institution, this phase required the analysis of the existing system and data related to the design-process which is collected by using questionnaires, interviews or observation. Also, the identification of the problems, opportunities, solutions, propose a system to be design with justification.

Design: After identifying the propose solution in the previous phase, it is necessary to start design and structure the system to meet and fit the learning course requirements of the in-house solution. Also, the system design helps for defining overall system requirements.

Development: The system is developed to address the performance gap existed in the analysis and design phases.

Implementation: In the phase it is the time to note the platforms the solution will run and decide how to deliver course-content to the learners that will based on peculiar situation. The delivered process of the course is based on the analysis phase performance.

Evaluation: This phase can be done for the previous phases; all of them together or individually. One of the evaluation strategies is using a combination of learner-evaluation and self-evaluation; as the quality and limitation of the system will be observedin this phase.

3.1 ANALYSIS OF THE EXISTING SYSTEM

The current system of learning material sourcing being adopted by the institutions of higher learning includes traditional classroom lectures, printed textbooks, journal, magazines, extracts on shelves and this process is often cumbersome and tedious in retrieving and filing of books from the library or even at the cost of purchase. The researcher visited the ICT section of some institutions library to investigate the way activities are carried out. It was found that most operate virtual library that are prone to connectivity issues. The library that stores learning materials does not have a software that is database-driven that stores these

electronic books, such that if a student wants to read a book, he/or she has to search for the book electronically via the computer. Some institutions still operate the conventional way of learning though some deploy existing platform of e-learning such as (Moodle, Blackboard and Edmodo e-learning applications).

The major problem of the existing system is that it lacks an efficient and effective way of allowing students access to electronic materials/resources. Also, the system appears tedious for students to retrieve hardcopies of materials while others even go to the extent of tearing out pages of materials from the library to personalize them. In the case of existing e-learning platforms mentioned earlierhave limitations in areas such as communicativeness of interface, system upgrade, and security.

3.1.1 Solution to the Problem of the Existing System:

In order to curb the challenges of the existing system, a customized computerized system where students can learn, having their classes online will be very helpful as lecture notes can be easily shared and downloaded into students' computer system easily and as such, all students of a class can have access to same material. An in-house web-based learning system is proposed that will be relevant to the institution. The proposed system is centered at making learning materials available in an institution library that is on-line and to aid effective learning material and electronic teaching management. The proposed system is often called learning repository and it allows for making available learning materials in electronic format on the internet to enhance the ease of study among students and staff of an institution.

This system is highly justified in design to allow for its implementation in the institution. It is justified through its potential ability of making ready the materials needed for learning at any point in time in any location. The system will aid students learning and relief library staff of the stress of filing and cataloguing library learning materials.

The advantages are enormous as: it has the ability of making a single material available to thousands of users at same time anywhere; it will reduce the cost of hardcopy maintenance of materials in the library; the proposed system allows lecturers and students to schedule lecture time effectively; and it allows interaction between lecturers and students.

However, one perceived disadvantage to indigent users is that the system requires internet connection and thus data must be available on the device before materials can be accessed.

4.0 DESIGN

In order to meet the system requirement, the system design could be seen as the application of conceptual framework to product development. System design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirement. There is some overlap with the disciplines of system analysis, framework and solution engineering. The objective of the system design is the abstract representation of a system that integrates the function of the existing system into an automated process. As a result of the huge resources expected to be invested into the system, this system has the primary objective of developing a prototype solution for enhancing effective lecture delivery over the internet as medium for e-learning, through effective communication, uploading, download and studying course materials. The control center for the new system is highlighted as: create an account; sign in; register new course(s); visit the class dashboard.

4.1 INPUT AND OUTPUT (DATABASE SPECIFICATION)

The input generally referred to how the system will be able to collect data from its users, the input table for this system is given Table 4.1.

Table 4.1: User Login Table

Field	*Type*	*Size*	*Null*	*Default*	*Extra*
Username	varchar	45	Yes	Null	Null
Password	Varchar	100	Yes	Null	Null

The user login password is entered in Table 4.1 to authenticate the validity of the user.

Table 4.2: Create Account (Student) Table

Field	**Type**	**Size**	**Null**	**Default**	**Extra**
MAT. NO	Varchar	40	Yes	Null	Null
Names (full)	Varchar	50	Yes	Null	Null
Level	Varchar	20	No		Auto select
Department	Varchar	40	No		Auto select
Password	Varchar	100	Yes	Null	Null
Confirm Password	Varchar	100	Yes	Null	Null

All students' registration details are stored in table 4.2.

Table 4.3: Create Account (Staff) Table.

Field	**Type**	**Size**	**Null**	**Default**	**Extra**
ID. NO	Varchar	35	Yes	Null	Null
Names (full)	Varchar	40	Yes	Null	Null
Password	Varchar	100	Yes	Null	Null
Confirm Password	Varchar	100	Yes	Null	Null
Course Offer	Varchar	80	Yes	Null	Null
Staff Key	Const	80	No	MOS	Null

All staff registration details are stored in this table 4.3.

The output analysis is how the data that is captured in the inputs can be displayed back to the user after it has been processed. The output table for this system is given in table 4.4

Table 4.4: User account table

Field	**Type**	**Size**	**Null**	**Default**	**Extra**
ID_MAT_NO	Varchar	35	No	Yes	Null
NAMES	Varchar	40	Yes	Null	Null
LEVEL	Varchar	100	No		Auto select
DEPARTMENT	Varchar	100	No		Auto select
PASSWORD	Varchar	80	Yes	Null	Null
ACCOUNTTYPE	Const	80	No		Staff/student

The details information of all users of the system is display in table 4.4.

The database in this prototype solution is a warehouse of data and a repository for data and information in an organized way to prevent redundancy and to preserve data integrity amongst others. Microsoft SQL Server Management was used as the database backend for this web-based system. The database comprises of tables which are: tblLogin, tblCategory, tblCourseLectureAllocation, among others. Six database tables were used for this system. A table in the database comprises of the field name, data type, size and allow null when viewed in the design view.

4.2 PROGRAM MODULE SPECIFICATION

The proposed system can have a structure as preferred in an in-house customized e-learning solution. This prototype solution is structured as:

*Splash screen***:** The system home page is a page where any user lands after typing the address of the site on a web browser or open the stand-alone application. The home page contains general information such as the heading, welcome messages, core values, the mission of the system and a few images of students. Moreover, there are links to other pages such as login, course lecture allocation, time scheduling of lectures, forum for students, administrators, help section, course materials.

Registration/Login Page: This is the page where staff and student register as new user or login with their details.

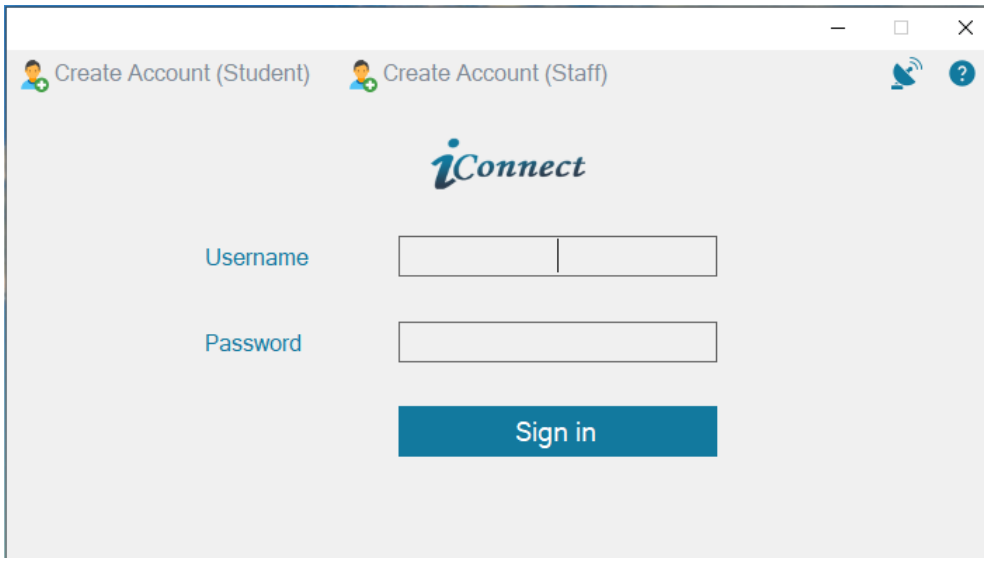


Fig 4. Staffs and Students registration/login page

Dashboard: In this section of the application, the students, staff and other users can get access to scheduled lectures, courses offered, materials, assignments etc.

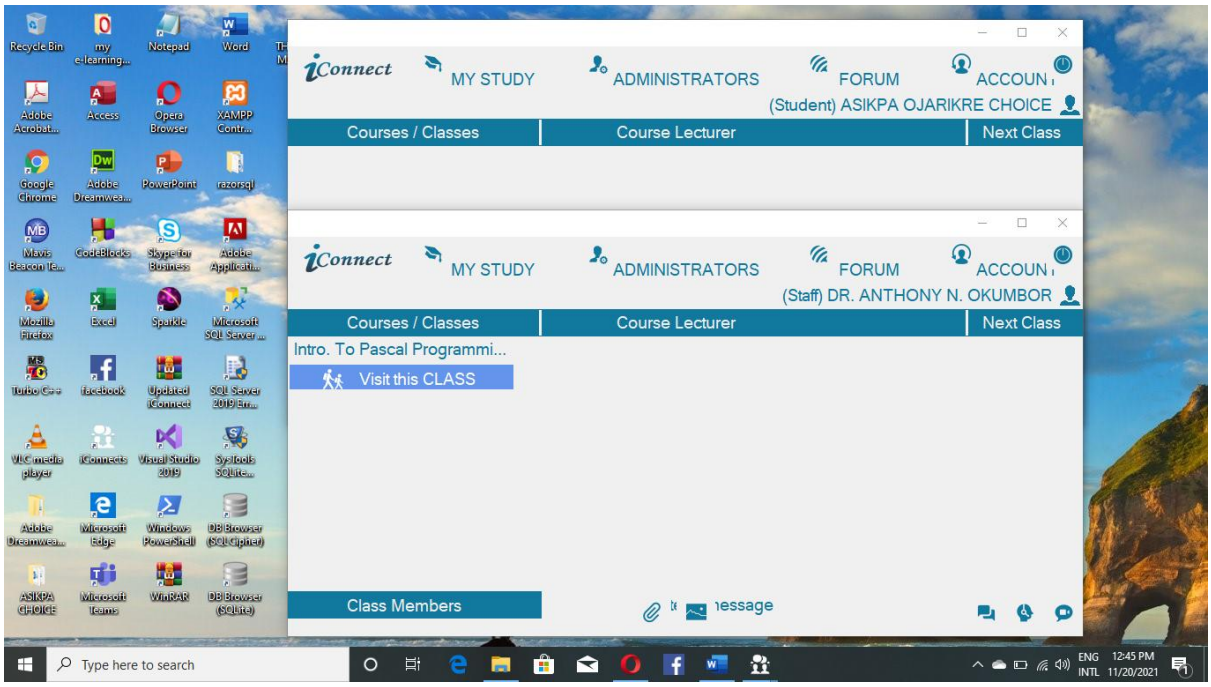


Fig 4.2. iConnect dashboard.

4.3 THE FLOW DIAGRAM OF SYSTEM

The various processes that take place include user registration and login using matriculation number (matno.) for students, identity (id) for staff and password and if authenticated, the user (students) is directed to his dashboard where they can register a course or view ongoing classes. Same happens to the lecturers as he logs in, fix a class and then commences his lecture and share materials where necessary.

The various processes for the proposed system have been summarized in a Data flow diagram as shown in figure 4.3.

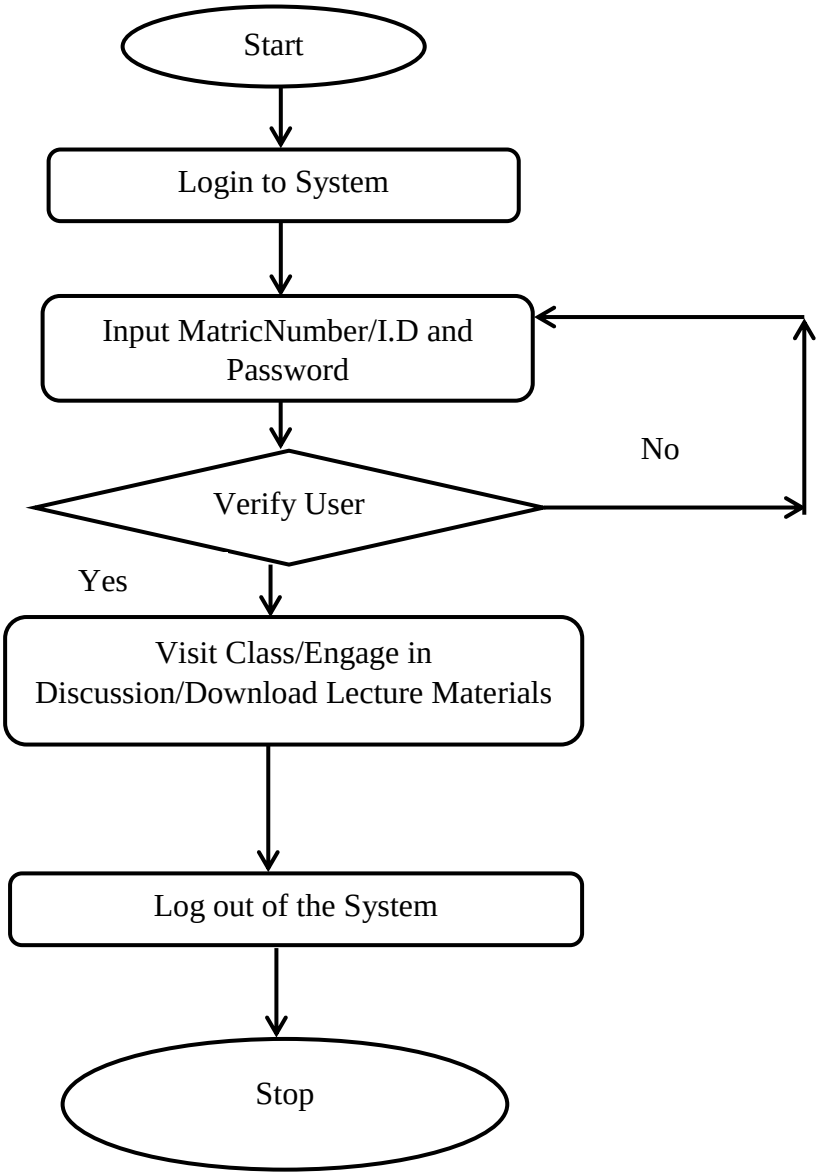


Fig 4.3. Program Flowchart

The figure 4.3 is flow diagram describing the login processes that captures what a user does when searching and navigating the website.

5.0 THE DEVELOPMENT AND IMPLEMENTATION

The study utilized the C-sharp (C#) on Visual Studio 2019 in developing the program at the front-end interface and the SQLite for the development of the backend. C# is a general-purpose, multi-paradigm programming language that encompasses static and strong typing, lexically scoped, imperative and declarative, functional and generic, object-oriented and component-oriented programming disciplines. SQLite is a relational database management system contained in a C library. In contrast to many other database management systems, SQLite is not a client–server database engine, rather is embedded into the end program and incorporated into web-based solution.

Web-based learning material repository system in the design stage helps minimize error during the time of testing and running. It is a good practice to test each component of a program as it is produced as well as testing the complete program. It is also important to understand the required platform where the solution will run. In this work the minimum hardware requirements for the system are as follows: a minimum of 512MB of memory (RAM); minimum of 5GB hard disk drive (HDD); a minimum processor of Pentium IV and the common peripherals of a system. The minimum software requirement platform for the system to work are: operating system such as: Microsoft Windows 98/2000/XP/VISTA/7 or 8 and above and Web browsers as: Internet Explorer, Opera, Google chrome, Mozilla, Firefox. The e-learning application prototype software for this study passed through the unit and system test procedure, a standard testing procedure for software development.

6.0 CONCLUSION AND RECOMMENDATION

In this paper, learning that has been part of human society had witnessed transformation to the electronic learning was presented. The e-learning was referred to as the use and convergence of information and communication technology to enhance learning and teaching in tertiary institutions. One critical question, considered whether an in-house e-learning system for tertiary institutions could be developed. The frameworks of the common educational theories that applied to e-learning were highlighted. The work proposed a system of teaching and studying online where academic materials can be accessed to aid e-learning. The study further noted that though there could be existing e-learning solutions but their limitations such as communication of interface and system upgrade necessitates the development of customize computerized systems where students can learn online. In the development of this solution, the Addie model was employed. Key to this model, is an instructional system design model that consist five phases: the analysis, design, development, implementation and evaluation. It offered an opportunity for self-correction before moving to the next phase. The objective of the system design was an abstract representation of a system that integrated the function of the existing system into automated process where a prototype e-learning was developed using C-sharp (C#) on visual studio 2019 for the frontend and SQlite for the backend. The automated e-learning system is portable and user friendly.

We recommend that, better knowledge management has become crucial for e-learning; therefore, government could help by encouraging the dissemination of good practices to avoid wasteful duplication of efforts. In designing policies, governments should consider the importance of academic autonomy and avoid micro-managing change. The concept presented in this paper for the development of e-learning solution could be adopted by tertiary institutions for further growth of e-learning.

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