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Towards a Model of E-Learning in Nigerian Higher Institutions: An Evolutionary Software Modelling Approach

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Abstract

This paper presents an ongoing study on the development of an e-learning scheme in a particular higher institution in Nigeria. E-learning is an evolving technology that has become a new paradigm for delivering online and distance learning programmes to users. However, the strength of recent e-learning systems lies in the emergence of Web 2.0 tools which have influenced e-learning systems in terms of pedagogy and delivery.

We introduce an evolutionary software modelling in developing an e-learning platform. The paper argues that rather than developing a model with distinct phases and components that make it difficult to respond to changing users' requirements, the development should be broken down into increments with required users' priority for later increments. This approach further increase efficiency and flexibility of the development as well as quality and reusability of the results.

We conclude that if the scheme is fully integrated, limitations of the traditional system of learning will be eradicated in the institution of our case study and other institutions interested in adopting the scheme.

Keywords: E-learning, Evolutionary modelling, Polytechnics education, Web tools

1. Introduction

The explosion of Information and Communication Technology (ICT) as a result of advancement in Internet provides a new trend for higher institutions to introduce new teaching and learning technologies. Learning technologies have been evolving over the last two or three decades, and have gone through many phases and approaches. A specific learning approach that combines blended and hybrid learning to learning that is entirely online is referred to as e-learning. This innovative learning systems try to support learners in expanding their knowledge by providing structured learning content and intercommunication facilities to specific topics.

E-learning is evolving rapidly as a result of its importance in the educational process. It allows a communication between learners by sharing opinions on learning materials with maximum convenience and flexibility learners

are given. Hedge and Hayward (2004) defined e-learning as an innovative approach for delivering electronically mediated, well-designed, learner-centered and interactive learning environments to anyone, anyplace, anytime by utilizing the Internet and digital technologies in concern with instructional design principles. The definition is further corroborated as the use of ICT to acquire knowledge and improve skills at times and on terms defined by each learner in an interactive and engaging environment (Dutta et al., 2011).

Broadly speaking, e-learning is the delivery of educational content through electronic media, including Internet, intranet, extranet, satellite broadcast, audio and video tapes, interactive TV, interactive CDs and computer-based system. However, the strength of recent e-learning systems lies in the emergence of Web 2.0 tools which according to Awodele et al. (2009) is a concept that has developed some new initiatives in education identified as e-learning 2.0. Web 2.0 tools have influenced e-learning systems in terms of pedagogy and delivery as a result of a high degree of user involvement and social networking (Anderson, 2007). The Web has therefore been established as a major platform for applications in learning. Dalsgaard (2008) also recognized the need to move e-learning beyond learning management systems and engaged students in an active use of the web as a resource for their self-governed, problem-based and collaborative activities.

On the other hand, the increasing complexity of web applications make a disciplined approach for development and evolution mandatory (Gaedke and Graef, 2000) which necessitated the use of component-based software development in software engineering. The authors recognized the heterogeneity nature and complexity of web development as a major challenge to the adoption of this approach. Waterfall model is another approach that can be used in developing a model of e-learning, however, the two approaches do not give room for feedback.

Furthermore, there have been widespread use of web-based e-learning applications for distance and classroom learning (Vrasidas, 2004), yet little has been done to critically examine their usability (Zaharias, 2006). Usability should be thoroughly examined and used since it should be possible for users to interact and perform their tasks easily and intuitively. Evolutionary modeling is a software modeling approach that supports rapid learning and efficient use with ability for feedback from the users.

The study is significant because it provides a formal approach of developing a framework for e-learning within Nigerian context. The model can equally well be adopted by institutions seeking to implement their own e-learning initiatives. The remainder of the paper is as follows: Section 2 discusses the justification for the study, Section 3 elaborates on the literature review in the domain of study, Section 4 introduces the model development, Section 5 discusses the implementation while Section 6 concludes the study and highlights areas for further study.

2. Justification

The establishment of polytechnic education in Nigeria was as a result of the need to expand technical and vocational education to ameliorate acute shortage of technical manpower. According to National Policy on Education (Federal Republic of Nigeria, 1998), polytechnic education is expected to be the main vehicle for technical education in Nigeria at the tertiary level of education. It is on this background we carried out an empirical study coupled with our classroom experience to investigate the usage of Internet for academic purpose in The Polytechhnic, Ile-Ife (Amassoma *et al.*, 2010). The study revealed a negative impact as to the usage of Internet on the students' overall academic performances due to inadequate knowledge of the basics of Internet operation and how to operate computers.

The question now is how can the Internet be brought to the doorsteps of the students in order to enhance their educational development? We therefore embark on this project to develop an interactive learning environment that will aid students' learning and provide for their independent studies. The relevance of Information and Communication Technology (ICT) as a form of an emerging technology in higher learning cannot be over-emphasized because it has become a tool that revolutionize teaching and learning across the globe (Aminu, 2003; Sheyin, 2009).

In an effort to introduce technology to teaching and learning, we adopted a model of e-learning in which its framework mimicked that of University of Jos ICT initiative (Liverpool *et al.*, 2009). We adapted the framework to this study because of its peculiary within the Nigeria context and as a result of being the first framework available in the literature that has been fully integrated into higher learning in Nigeria. However, the interface design of the e-learning framework in University of Jos was not elaborated. This study seeks to introduce the software approach towards the development of a model that can be adopted especially in other polytechnics and higher institutions in Nigeria. Our goal is tailored towards developing a model that provides students with valuable resources for using the web as a tool to enhance their independent and collaborative study.

On the other hand, a number of factors should be considered in the adoption and integration of a model for e-learning in higher institutions. In developing a framework for e-learning, Khan (2001) recognized eight dimensions as depicted in Figure 1. These factors are institutional, pedagogical, technological, interface design, evaluation, management, resource support and ethical. Each of these dimensions posessed sub-dimensions that focus on particular aspects of an e-learning environment. Our contribution in this research is to design an interface using a modelling approach that gives room for users' verification and validation. This in essence would be needed for the creation of a successful experience for diverse learners.

3. Related 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; syncronous collaboration tool; content development tool; online testing and assessments; and multimedia software. These tools and technologies consitituted the model for the development of an e-learning 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.

4. Software Modelling

We briefly discuss the three generic process models that are used in current software engineering practice

(Pressman, 2005). These are:

i. Waterfall model: This takes the activities involved in a software design process into distinct phases such as requirement, specification, software design, implementation, testing and so on. After each stage is defined , development goes on to the next stages. The main drawback of the waterfall model is the difficulty of accommodating change after the process is underway. One phase has to be completed before moving onto the next phase.

ii. Evolutionary or iterative model: This approach interleaves the activities of specification, development and validation. An initial system is rapidly developed from very abstract specifications. This is then refined with customers' input to produce a system that satisfies the customers' need. The system may then be delivered. Alternatively, it may be re-implementated using a more structured approach to produce a more robust and maintainable system.

iii. Component-based model: This technique assumes that parts of the system already exist. The system development process focuses on integrating these parts rather than development from the scratch.

In this study, we adopt an evolutionary model which is based on the idea of developing an initial implementation, exposing this to user comment and refining it through many versions until an adequate system has been developed. The objective is to work with users and evolve a final system from an initial outline specification. We therefore opt to start with well-understood requirements and add new features as proposed by the users. This is with a view to producing a more complete version of software with each iteration as illustrated in Figure 2.

Functional requirements of the model should be identified in order to know the services that can be provided and the operational constraints that reflect the needs of users to solve specific problems which include: the model should be able to attach a unique identifier to every forum post made by the user; be able to attach a unique identifier to every forum reply made by the user to help identify which user made any particular contribution; be able to fetch the record of every intended member when prompted; and be able to update each student activity appropriately. All these features are taken into consideration in the design of the model.

5. Software Modelling

We present modules that make up the model of e-learning scheme. These are the units within the framework of the scheme which include: Login page, User Home page, Personal details page, Forum page, Chat room page, New user page, Edit user page and Search page. These components are depicted in a flowchart in Figure 3.

The proposed model allows members to login and view their details, create new forum topics and contribute to already existing forum topics and access various virtual study groups via chatrooms and share their opinion.

The actual implementation of the model starts from login page for existing users while new users are expected to sign up and fill the personal details before proceeding to the home page where all the activities carried out can be seen as shown in Figure 4. The students and others engaged in the web interation can then select the specific activities to be carried out. Forum pages are illustrated in Figure 5 and Figure 6 which contain all topics posted by the participants in collaborative learning community with a click button that directs one to see the comments on every topics.

6. Conclusion and Future Works

In this paper, we presented an ongoing model-based approach to software development. The approach of evolutionary software development was adopted as a result of the need to further increase efficiency and flexibility of the development as well as quality and reusability of the model.

We argued that the capability of Nigeria to adequately empower its citizenry, institution and sustain democratic ideals and principles, diversity and strengthen the national economic and ensure peace and security depends largely on the quality, functionality, responsiveness and global competitiveness of its technical education which polytechnics education offer. It is therefore imperative that the quality of education in this category of higher learning is enhanced through e-learning scheme since there are established reasons to believe that models of collaborative learning are very effective as means of learning.

Our future work will incorporate a more interactive user interface based on the horizontal communication structure and the feedback from the active participation of the people involved in the learning community in order to take into consideration the social aspects of learning and support a feeling of commitment and affiliation to the group. A prototype of the model when fully completed can be integrated into other private and public polytechnics as well as other higher learning in the country.

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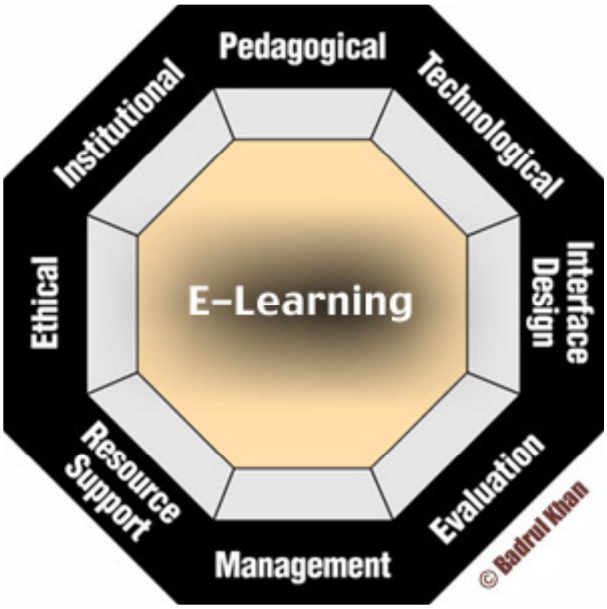

Figure 1. E-learning framework (Khan 2001)

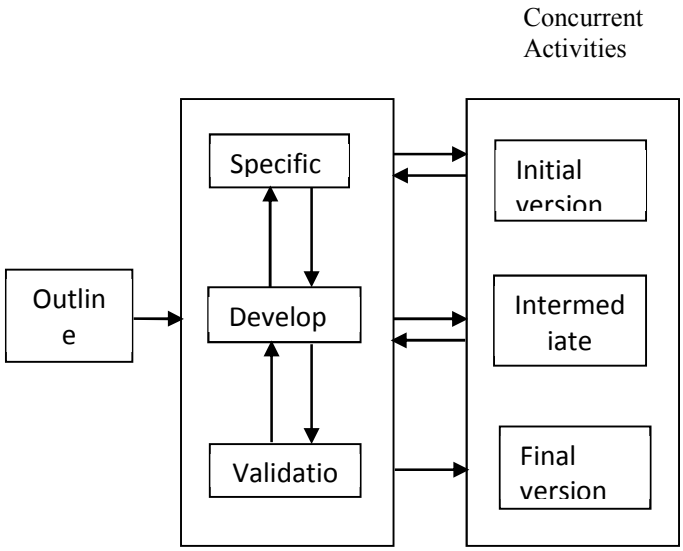

Figure 2. Evolutionary Software Model (Pressman, 2005:51)

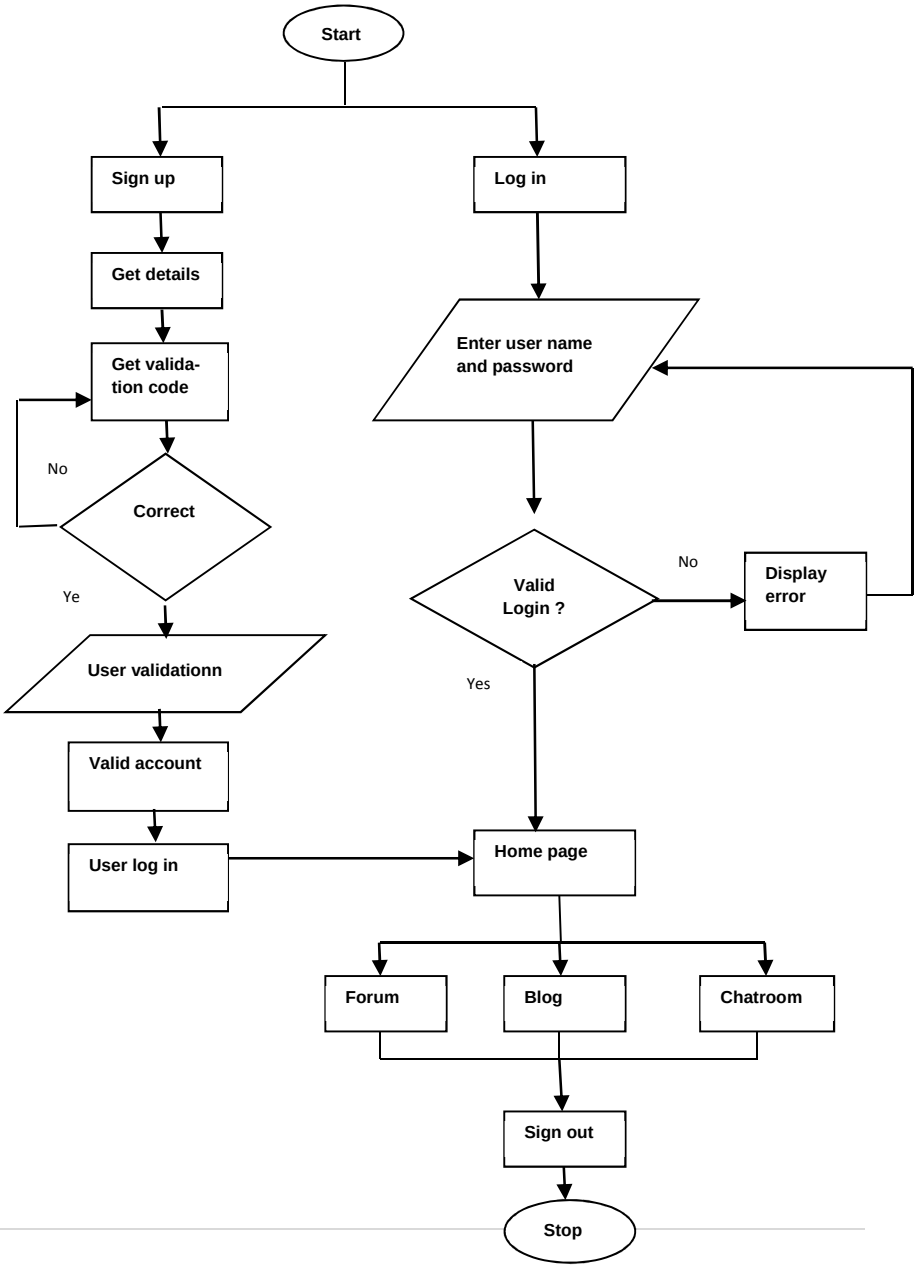

Figure 3. Model flowchart

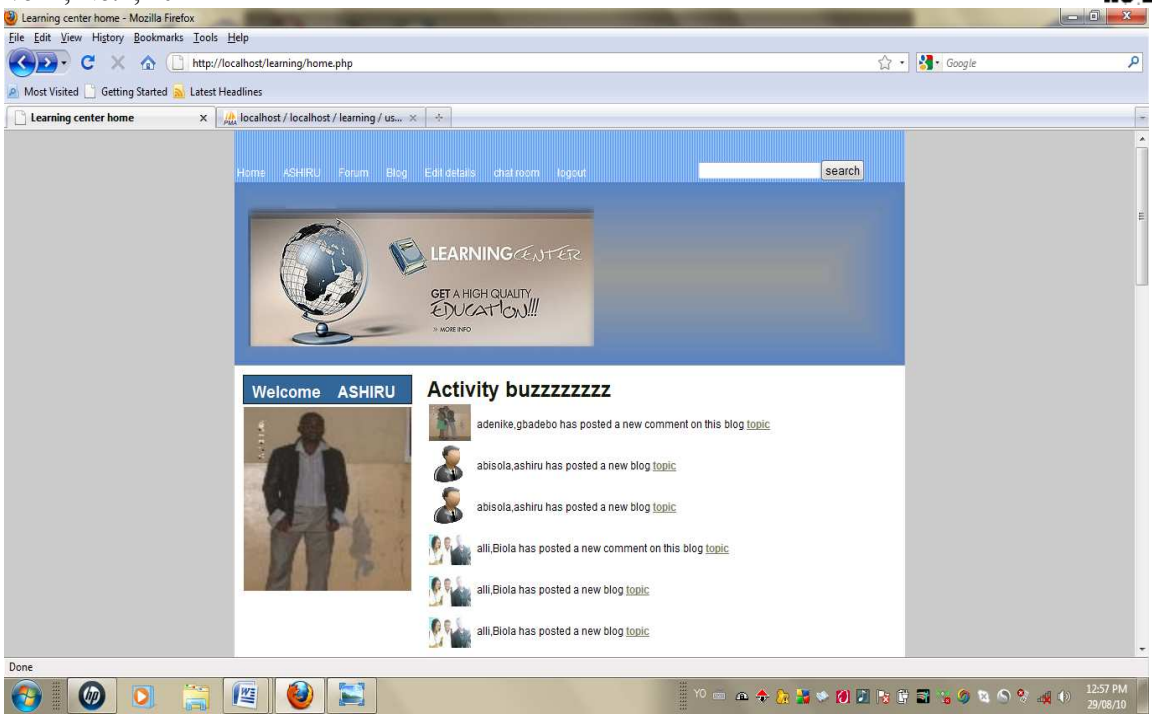

Figure 4. Home Page

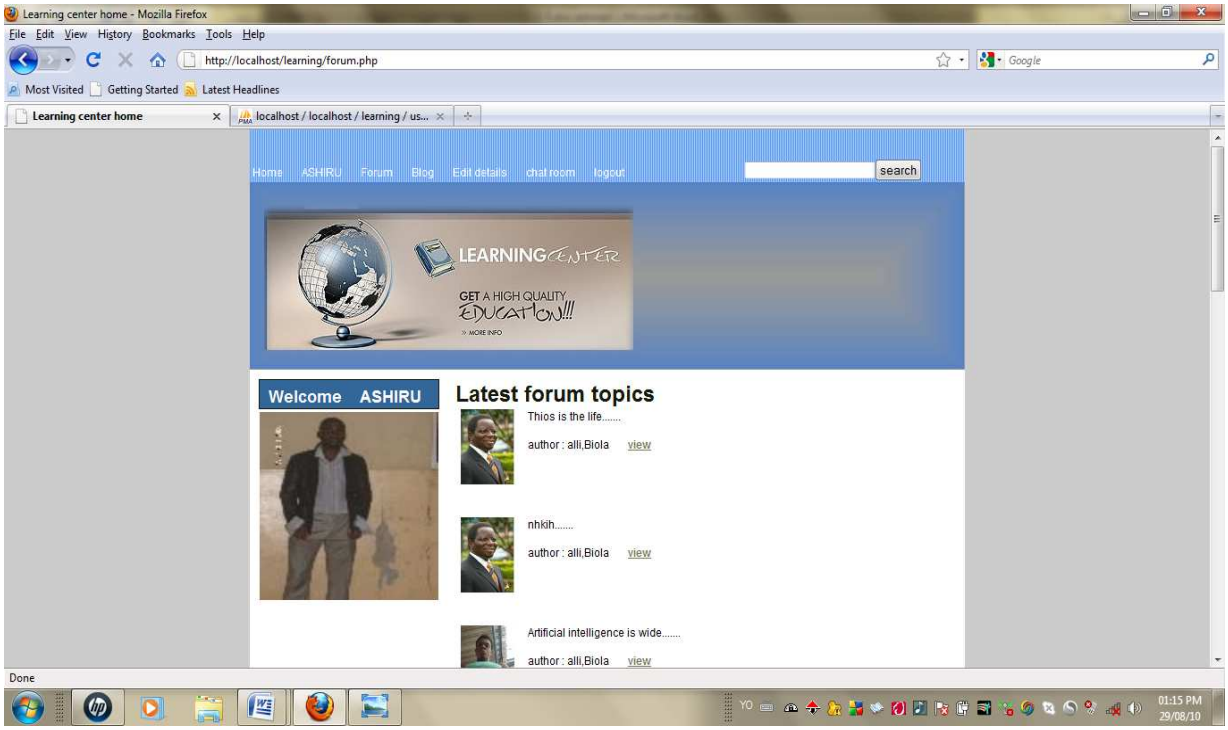

Figure 5. Forum Page

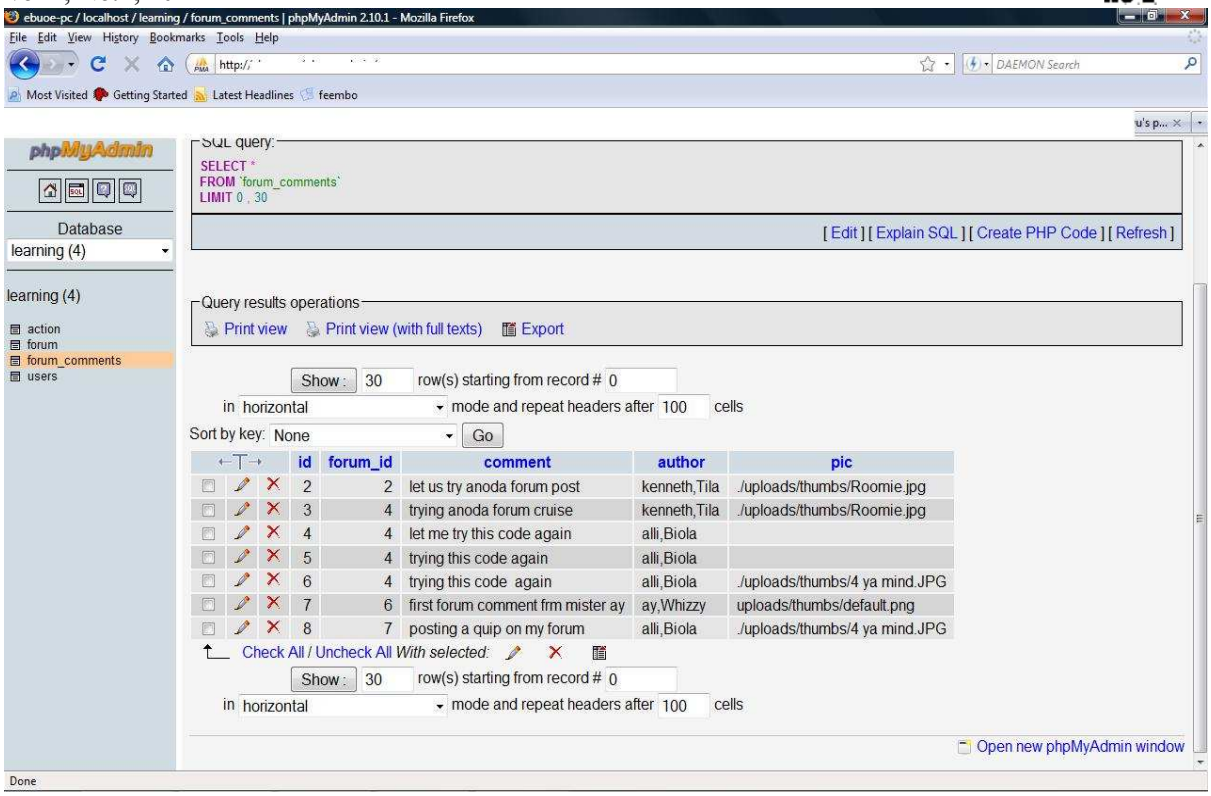

Figure 6. Forum comment environment

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