

Design and Implementation of Web Based E-Learning Management System: The case of HiLCoE School of Computer Science and Technology

Ephrem Abeselom
HiLCoE, Computer Science Programme, Ethiopia
ephabel@gmail.com

Workshet Lameneu
HiLCoE, Ethiopia
School of Information Science, Addis Ababa
University, Ethiopia
workshet@gmail.com

Abstract

Supporting the delivery of higher education with educational technologies is now becoming a common trend. As a result, many open source platforms emerged. Launching e-Learning system will be successful if prior investigation is made with issues related to need identification and environment analysis. HiLCoE was using Moodle for its e-Learning needs but the system stopped its operation when the College relocated from its Atlas campus. The objective of this paper is to assess factors leading to the failure of the e-Learning system with the view to design and develop state-of-the art e-Learning platform for the College.

To achieve the objective, interview, discussion and personal observation methods are used for data collection. A total of nineteen respondents were chosen in the process. An object oriented system development methodology and unified modeling language was used as analysis and design approach. The platform architecture was designed and the prototype was developed using HTML, PHP, and MySQL. Finally, the prototype was evaluated using user acceptance testing. Major functionalities are included in the designed e-Learning system including registration of a user as a student or instructor, approving or declining new users, posting news, notification, adding course, viewing notification and news are designed as well.

Among others, due to poor alignment to needs, poor implementation process, lack of management commitment and lack of support and technology, adoption of freely available e-Learning platforms might not be successful and systems will be much dependent while developed based on consideration of those factors and hence the system was developed with this rationale.

Keywords: E-Learning; Educational Technology; Moodle

1. Introduction

Learning is the act of acquiring new or modifying and reinforcing existing knowledge, behaviors, skills, values, or preferences which may lead to a potential change in synthesizing information, depth of the knowledge, attitude or behavior relative to the type and range of experience [1]. Exposure to learning experiences can be formal or informal. In the formal educational environment one can grasp knowledge by attending regular classes, distance learning or online learning as his/her convenience. In order to reach their students, institutions are now providing their teachings in various formats.

With the rapid increase of ICT infrastructures, every educational institution has the opportunity to make use of the Internet as a communication medium with the students [2]. For an effective and efficient access to learning materials, the concepts and methodologies of technology-based learning are increasing in importance with web based learning and becoming a crucial resource for institutions.

E-Learning is a learning that is enabled or supported by the use of digital tools and content. It is usually accessed via the Internet though other technologies are also used. It typically involves some form of interactivity, which may include online

interaction between the learner and the teacher or peers [3]. The operating environments for electronic learning can be rich, interactive, dynamic and customizable, connecting learners with an almost limitless wealth of information which in turn paves the way for new patterns of learning to emerge. Therefore, an increasing emphasis is given on information literacy, increased flexibility as to where, when and how people learn, and exploration of new ways in which learners can be empowered to structure and manage their own learning experiences.

Many e-Learning systems emerged as a result, Blackboard, Saba, Moodle, ATutor, Dokeos and Ilias to mention some. Among them Moodle is very popular and widely accepted across the globe.

Even though these systems are giants on the market, due to cultural, technological, infrastructural and environmental factors they might not be successful in all countries while adopting them. The challenge for instructors to develop and maintain an e-Learning course, security and technical issues are also additional headaches.

HiLCoE School of Computer Science & Technology is a leading institution and a center of excellence that adheres to computing technology and quality of education since August 1997 [4]. The school was using the open source platform Moodle for supporting its e-Learning offerings until it stopped working while they left Atlas campus. Since then it seems the emphasis given on supporting the delivery of learning using the fruits of e-Learning technologies are less.

Currently access to information is limited to only working hours, submit assignments and do related activities by being physically present at the school. Thus, the purpose of this paper is to analyze factors that lead to Moodle failure and based on the findings, analysis was made on how to enhance the current teaching-learning process of HiLCoE and designed state-of-the art web based e-Learning system.

2. Related Work

A case study to answer the question “why do e-Learning projects fail?” identified thirty three causes of failure [5], some of which are listed in Table 1.

Table 1: Factors Leading to Failures for e-Learning Projects

<i>Factor</i>	<i>Reason</i>
Poor Alignment to Needs	Previous poor experiences of e-Learning that is boring or not relevant to individual and business needs.
Communication	e-Learning project teams don't manage the expectations of business managers.
Lack of Implementation Skill	- Weak or ineffective ICT competence in the e-Learning project management. - Content creation by teams who lack an understanding of learning processes and design issues. Content creation by teams who lack an understanding of the potential of IT and web resources. - Errors in key administrative tasks which give a bad impression to learners, insufficient or inadequately trained staff or badly executed systems. - Resistance from Trainers: Existing trainers do not integrate ICT into their educational practice and have difficulties adapting to new requirements of technology. - Course content and delivery is too rigid, fails to give individual learners choice and flexibility and fails to respond to sudden business change; the syllabus is too rigid and too difficult to change. - Not learning from others' experience (no benchmark comparison of success

Factor	Reason
	taken against other organizations elsewhere).
Poor Implementation Process	- Over reliance on synchronous events after the early stages of introduction. - No pilot process for step-by-step development leading to large scale rollout. - There is no in-built e-assessment, usage measurement, record keeping, evaluation recording, and links to competency measurement or business evaluation. - Development and deployment too slow for the business who finds other solutions perceived to be faster.
Management Commitment	- Senior management do not sponsor projects and fail to encourage and lead adoption. - Users of social networks and collaborative learning tools run out of enthusiasm and there is lack of senior organizational sponsorship. - Changes in personnel at key stage of project development leading to lack of continuity/vision of the original goals. - IT departments who fail to understand and manage the issues of web use, IT policy, location and support leading to access and firewall problems.
Scalability	Early content implementations are heavily customized and insufficient attention paid to the future amendment and updating leading to rigid course content that is expensive to change.
Support	- Introduction can result in unplanned increases in workload of existing training staff; i.e., e-tutoring, content development, lesson preparation (virtual classrooms), learning to use learning technology tools or providing a help desk. - There is no plan for the substantial human support services that are needed to blend e-learning into the mix of delivery options. Too much reliance is placed on e-learning as a stand-alone solution.
Technology	Over reliance on technology tools alone with insufficient attention paid to getting the right blend of learning methods and learning tools.

Even though there are many e-Learning systems available in the market, content available for learning on the web is variable and thus the needs of content developers, educators and students can't be addressed that leads to a gap [6]. In order to bridge the gap, the authors developed an e-Learning system.

For identifying the gap between actual behaviors and desired outcomes they used surveys, direct and indirect observation, interviews and focus group discussions as tools.

They designed the system with available tools and tested the prototype and found that the systematic use of e-Learning as part of the instructional design process will improve the learning process.

3. The Proposed Solution

In this section, overview of the proposed system with its functional and non-functional requirements, analysis model using use case diagram, use case descriptions and sequence diagrams are presented. Requirement gathering and analysis is done through interview, discussion and personal observation. In the process of requirement elicitation, we interviewed two previous and current system administrators, discussed with five undergraduates, five each from postgraduate Computer Science and Software Engineering students and personal experiences on how the teaching learning process is directed. Various documents are revised as secondary data

source such as documents related to why e-Learning projects fail, advantages and limitations of e-Learning systems, preconditions in web based e-Learning development for best design and implementation of the system. As an analysis and design approach, object oriented methodology was chosen and UML was used because it makes it easier for adding new functionalities and modifications.

According to personal experience and the discussions made with school colleagues, HiLCoE is currently using

- E-mail for contacting instructors and submitting assignments.
- Physical presence at the Registrar to view course grades.
- Notice boards to post notifications, class schedules, call for papers, vacancies and announcements.

The use case diagram shown in Figure 1 was drawn from the functional requirements.

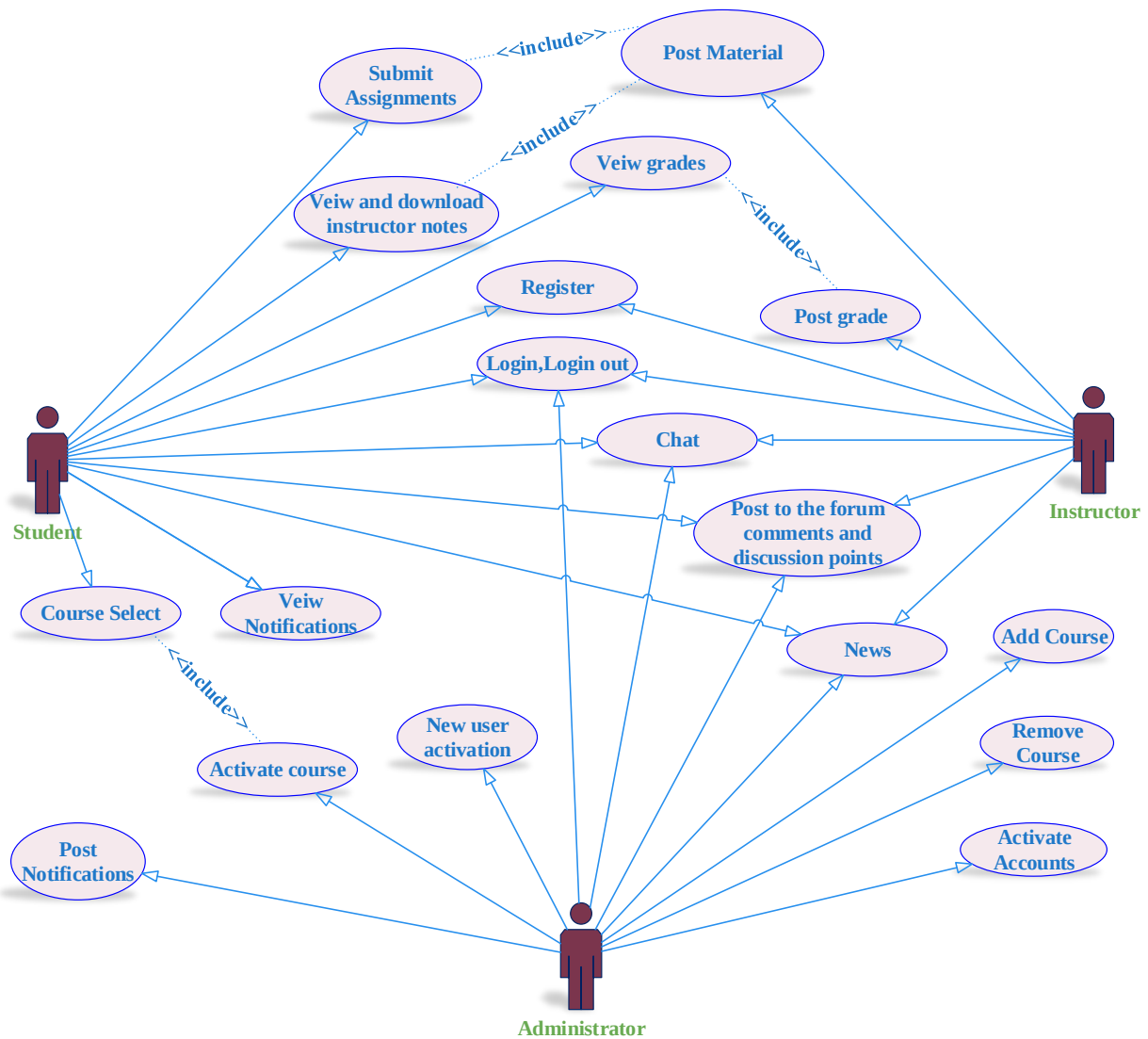


Figure 1: Use Case Diagram for the Proposed E-learning System

As shown in Figure 2, the architecture used in the e-Learning system is three tiered: presentation tier, logic/application tier and data tier. This type of architectural style is characterized by the functional

decomposition of applications, service components and their distributed deployment which provides improved scalability, availability, manageability and resource utilization.

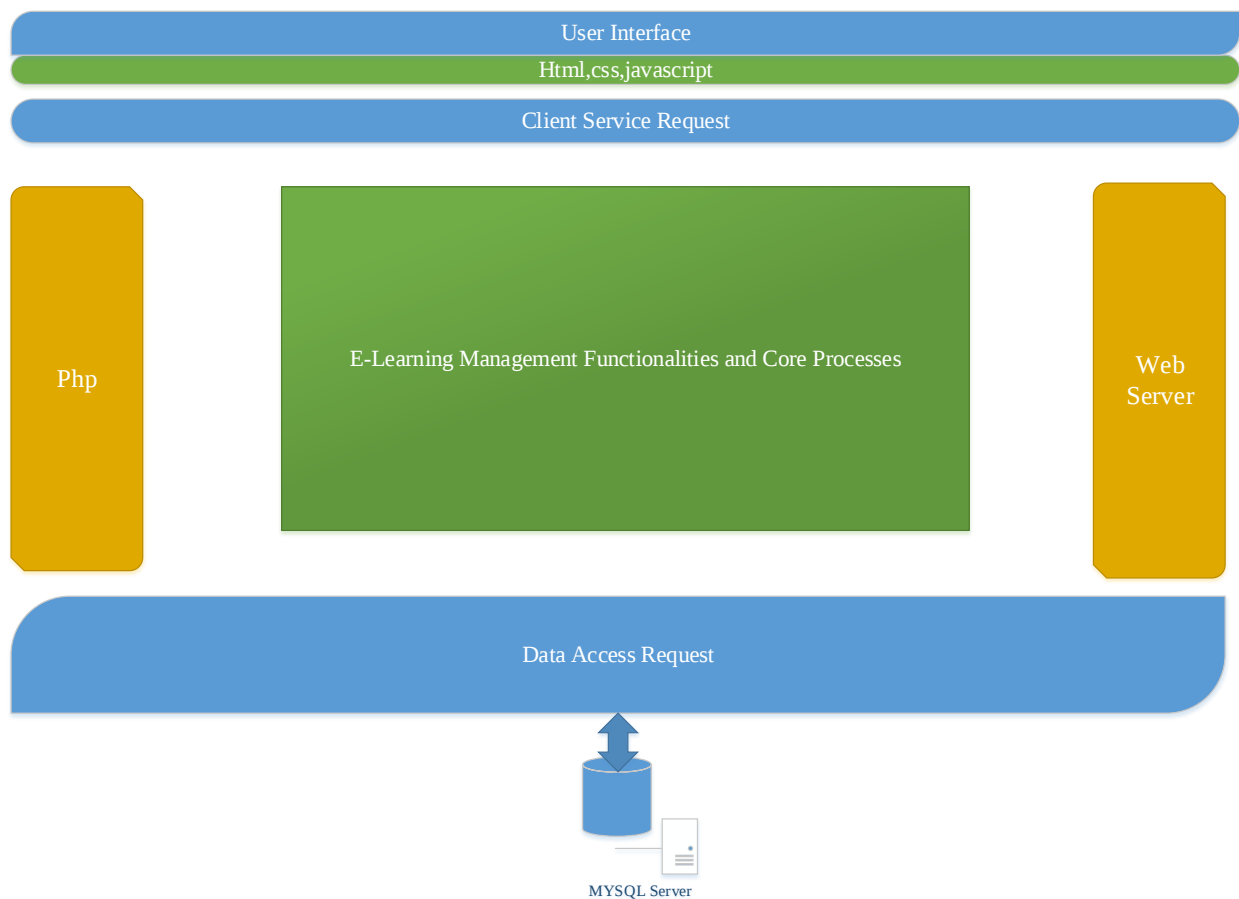


Figure 2: System Architecture

For the realization of the proposed solution, the use cases and sequence diagrams are converted to a source code and integrated in such a way that they

work together for common purpose and to fill the gap between the analysis model and its realization. The home page of the prototype is shown in Figure 3.

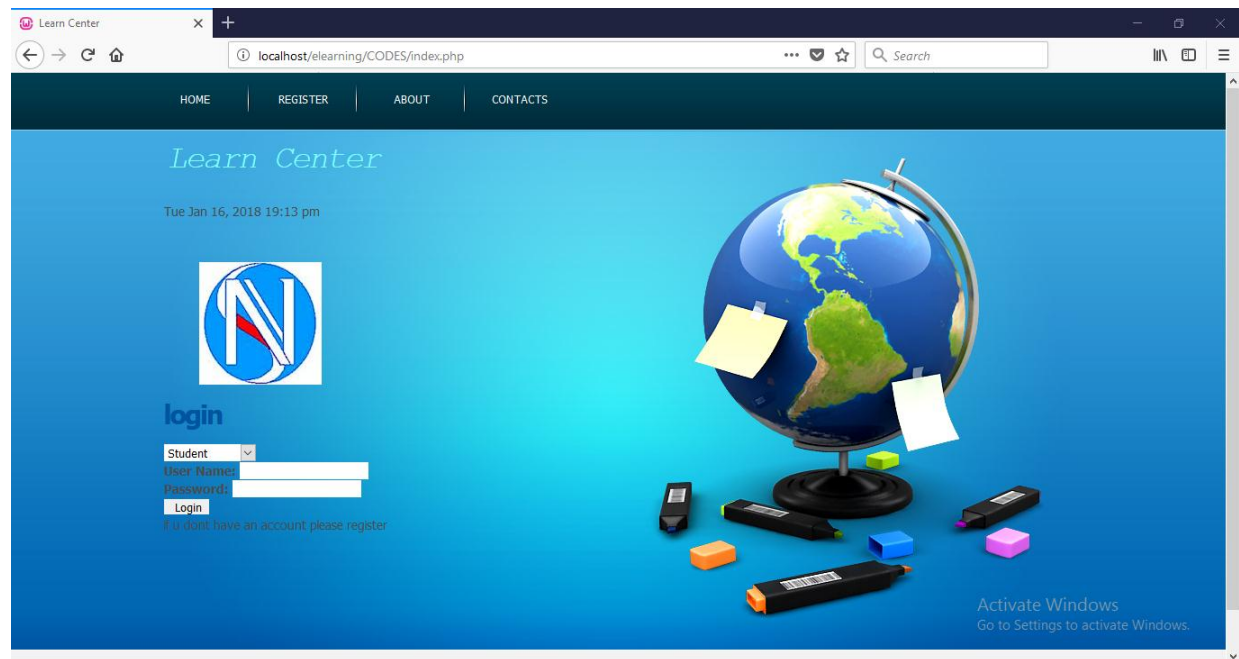


Figure 3: Home Page

The evaluation of usability is an important aspect of software design and development. In order to

measure the success of the design, designers must evaluate the system. The evaluation of the e-Learning

platform used a method of questionnaires with 9 major usability criteria to evaluate different aspects of the prototype developed. The result is summarized in Table 2.

Table 2: Usability Testing Summaries for the Developed E-learning Management System

No.	Question	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1.	The steps required to install and run the e-Learning system on the web server are simple and easy	17	1		1	
2.	The e-learning system's user interface is attractive	19				
3.	Registration is facilitated easily	14	4		1	
4.	The e-Learning system provides easy navigation	18	1			
5.	Logging into the system is facilitated easily	18	1			
6.	If an error occurs, the application provides appropriate support to manage the error	15	2		2	
7.	The system is sufficient to fulfil the College's e-Learning need	13	4		2	
8.	The application is easy to use	17	2			
9.	The security of users is maintained properly	19				
Average Result		16.7	2.14		1.5	
Result in Percentage		87.72	8.78		3.5	

A questionnaire was distributed for a total of 19 respondents. The values of the responses were taken based on the Likert scale. According to the result of user interface evaluation as shown in Table 2, most of the respondents (87.72%) strongly agree that the system prototype has an interface that is easy to use, attractive and the security is maintained properly.

For the question regarding whether the developed system satisfies their need or not, 13 out of 19 respondents (68.43%) strongly agreed while 2 out of 19 respondents (10.53%) are not satisfied. This shows that still there are unseen needs which are not accessed with the requirement elicitation process. Regarding easiness of steps required to install, configure and run it on web servers, 17 out of 19 respondents (89.47 %) strongly agreed.

4. Conclusion and Future Work

Due to poor alignment to needs, poor implementation process, lack of management

commitment and lack of support and technology, adoption of freely available e-Learning platforms might not be successful and leads to frustration on system users. Analysis of business requirements and operating environments must be done to launch systems. Moodle was adopted as an e-Learning platform for supporting the e-Learning needs of HiLCoE, but was not successfully implemented.

In this paper, we identified the failure factors for Moodle at HiLCoE and according to the analysis made, poor alignment to needs while choosing contents because of lack of prior need assessment and requirement elicitation, changes in system administrators and location of the College from Atlas campus led to its failure. Therefore, based on consideration of the failure factors, designing and developing a web based e-Learning management system can solve the problem so that the continual of the system which supports the delivery of education can be benchmarked.

The e-Learning management system was developed using PHP and runs on a broad variety of browsers. The usability test for the system was performed and the evaluation has shown the success of the web application.

Finally, the following recommendations are drawn:

- Additional need assessment using requirement elicitation and validation techniques must be done because 10.53% of the respondents are not satisfied with the developed system.
- We developed the system using a standard web service with the implementation of authentication and authorization only. Other security requirements like confidentiality, integrity, auditing and availability must be implemented in order to minimize risks on the school.
- We will identify additional gaps and factors that are prevalent in the area of e-Learning management system.
- Ease of use and other parameters are also research areas for further exploration.

References

- [1] Learning-Wikipedia, “Learning”, <http://en.wikipedia.org/wiki/Learning>, Last accessed on July 18, 2017.
- [2] Waterhouse, S, “The Power of E-learning: The Essential Guide for Teaching in the Digital Age”, Pearson Education Inc., Upper Saddle River, 2005.
- [3] Waikato Research, “Introduction to e-Learning”, White Paper, <http://www.waikato.ac.nz/tdu/pdf/booklets/17eLearningIntro.pdf>, Last accessed on April 04, 2017.
- [4] HiLCoE School of Computer Science & Technology, Graduate Program Research Office, “M. Sc. Thesis/Project Guideline”, Version TPG HiL11/2011, 2011.
- [5] Towards Maturity Briefing, “Why Do E-Learning Projects Fail?”, White Paper, 2010, https://www.aoc.co.uk/sites/default/files/Why_Elearning_Projects_Fail.pdf, Last accessed on August 10, 2017.
- [6] Noesgaard S. S. and Ørngreen R., “The Effectiveness of E-Learning: An Explorative and Integrative Review of the Definitions, Methodologies and Factors that Promote e-Learning Effectiveness”, The Electronic Journal of e- Learning, Vol. 13, Issue 4, 2015, pp. 278-290.