An Evaluation of Open Source E-Learning Systems Incorporated with OSMM

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Abstract

This paper compares 4 LMS platforms, namely ATutor 1.4, ILIAS 3.2.4, Moodle 1.4.1 and Sakai 1.4.1 to show the selection method of LMS in which Open Source Software and Commercial software are suitable for an environment and learning Method in Data Structures and Algorithms. This selection by grouping Functionality and NonFunctionality is based on the basic data of Sabine Graf, and Beate List, ESF 02, 31.963/46-VII/0/2002.,[1] then provides the weight in each list of Functionality, NonFunctionality, OSMM and constructs the graph comparing percentile to ensure Visualization clearly which Functions and Nonfunctions which are extremely interesting along with Selection Criteria of Institute. In case DSA, it is extremely needed RLOs to support a number of the resembled contents or subjects. As the various of fields are mentioned, the selecting of LMS is found Moodle, it's outstanding management is Communication tools, Learning Objects, Management of user data, Usability, Adaptation, Architecture and implementation, Cost of ownership, Strength of the community, Licensing and Internationalisation. MOODLE, has a great management in learning management. This research aims to develop e-learning and also attend to RLOs to select Moodle in testing RLOs of DSA.

Key Words: LMS, Open Source Software (OSS), OSMM.

1. Introduction

Today's technology has developed rapidly in the world. E-learning is an important role for learning Management in Thailand and it becomes an education innovation in which the education institutions are taking an interest. E-learning is composed of 4 elements : 1) learning Management System, 2) e-learning lessons, 3) Server and Client and the storing e-learning lessons and 4) Internet as shown in Figure 1

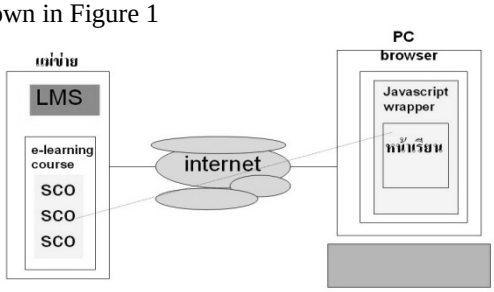

Figure 1. the structure of e-learning

E-learning can help students to keep the conceptual knowledge more durable than classroom learning. Besides, its learning management is also in the same standard it's convenient to provide the knowledge management for the organisations. In particular, checking and supporting the students' knowledge can be done automatically and they can learn everywhere at all times and it responds on demand availability each of them including they have studied based on ability of oneself and having the interaction with the lessons all the time.

This research presents a comparison of LMS systems, ATutor 1.4 [2], ILIAS 3.2.4 [3], Moodle 1.4.1 [4] and Sakai 1.0 [5], to show the selecting method of Open Source Software or selecting LMS is suitable with the environment for teaching DSA.

In fact, in accordance with Computing Curricular 2005, DSA is considered to be the foundation course Bachelor in Computer in many areas : Computer Sciences (CS), Information System (IS), Software Engineering (SE), Computer Engineering (CE), Information Technology (IT) and Business Computer (BC) [6]. DSA. It will lead the students can get through the Concept of Algorithms for writing programs. Therefore, the students must have understanding the contents deeply to be skilful and proficient for write program. This paper presents an

evaluation of Open Source e-learning platforms with the aim of finding the platform most suitable for extending to an adaptive one. The extended platform will be utilized in an operational teaching environment. Therefore, the overall functionality of the platform is as important as the adaptation capabilities.

The aim of this research is to design the lessons by using the Learning Objects (LOs) or Reusable Learning Object (RLOs) [7], based on the exploration environment of Learning Management System (LMs), and it can support the various components of the content, and it's also suitable for teaching DSA. RLOs lesson, there is the component of content, this can be divided into 5 types as follows :

1. Presentation
2. Web – based text resources
3. Source codes
4. Standalone / Client side learning tool
5. Server site learning tool

2. Literature Review

U.S Department of Defense: DOD has improved the standardization of e-learning system, and studied about Incompatibility problem and the substance was developed in different platform. DOD has complied specifications both the standardization of IMS of Global Learning Consortium [8] and the standardization of Aviation Industry CBT Committee: AICC to be the middle specifications of e-learning. Afterward, it has set up the organization to cooperate among DOD, e- Government, e-Privacy, and the educational institutions. ADL is the organization which determined the standardization of LMS. It is the system utilized for learning management to offer convenience for grouping the substance, learning activities and the interaction between instructor and students, including the designing of the test and the evaluation on the Internet Network. Last October 2001,ADL has specified regulation SCORM (Sharable Content Object Reference Model) Version 1.2 [9], it is a successful model. It was used worldwide to support the distance learning and it also passed the IEEE standardization. Therefore, the development of LMS either Commercial Software or Open Source Software, is necessary to hold the middle standardization SCORM.

LMS program can be arranged depending on the 2 copyrights available. They are Open Source Software in General Public License (GPL), for example ATutor, Claroline, DoceboLMS, Moodle, OpenLMS and Vclass. Another is LMS Commercial Software, developed by EducationShpere and sponsors from Ramkhamhaeng University. The Educational institutions in Thailand have begun developing LMS by adapting the Open Source Software such as the continuing education of Chulalongkorn University, Online learning project of the Educational institutions in Thailand have begun developing LMS by adapting the Open Source Software. A Driving Force for National Science and Technology Capability : NSTDA or Thai2Learn, Kasetsart University, Chiang Mai University and Asian Institute of Technology : AIT etc. The selection and development of LMS in Open Source Software in Thailand was admired and there are main 4 platforms: ATutor, ILIAS, Moodle and Sakai.

The main problem in the development of e-learning in Thailand [10] is that instructors are not interested to designing teaching materials and they also lack in time to do this. Furthermore, we found some of them might not have a basic computer skill enough to utilize e-learning effectively. Thai Cyber University(TCU) has surveyed their basic computer skills and has held a workshop on using e-learning so that the instructors can produce e-learning media and can be effectively used.

Following the policy indicates that instructor should have at least 1 to 2 online courses per semester. Another problem is Human resources such as the lack of instructional designers and programmers to handle the specific system, including Hardware, software resources-server, and equipments to connect the Computer Network. TCU has considered the cost of the copyright of Software using for development e-learning exists. To solve these problems, we should choose Open Source Software to develop e-learning continuously. Especially in developing countries, they should select Open Source Software as a strategy in developing the 3 aspects as the following:

1. e- Government
2. e- Healthcare
3. e- Education

3. Applied Approach

This paper informs the result of an evaluation and comparison function, non function and environment. As table 1 is the result of platform and a subcategory and figure 2 is the result of table 1. All 4 platforms via the

Table 1. Selection Criteria Matrix

Selection Criteria Matrix

	Functionality																		Non Functionality												OSSMM							
	Communicaion tools							Learning object					Administra			Course Manageme			Management o user data				Usability				Adaptation				Technical aspects							
Subcategories	Forum	Chat	MailMessages	Announcements	Conferences	Collaboration	Synchrounous & asynch. Tools	Tests	Learning material	Exercises	Other creatable Los	Importable Los	User management	Authorization management	Installation of the platform	Administration of courses	Assessment of tests	Organiztion of course objects	Tracking	Statistics	Identification of online users	Personal user profile	User-friendliness	Support	Documentation	Assistance	Adaptability	Personalization	Extensibility	Adaptivity	Standards	System requirements	Security	Scalability	Architecture and implementation	Interoperability	Cost of ownership	Strength of the community	Licensing	Internationalisation	Accessibility	Document transformation
Max/Val	4	4	1	2	2	2	4	4	4	3	2	4	3	4	1	2	3	3	4	2	2	3	3	3	2	2	4	3	4	4	3	2	4	2	3	3	3	3	3	5	3
Atutor	1	3	1	1	0	0	4	1	4	0	2	4	0	1	1	1	1	3	4	2	1	1	2	1	2	2	1	3	3	1	2	2	0	0	1	0	2	0	2	0	5	0
ILIAS	2	4	1	0	0	0	4	4	1	0	2	4	3	4	1	2	2	2	1	1	2	2	1	1	2	0	2	3	4	0	3	2	4	0	2	4	0	2	2	2	0	2
Moodle	4	4	0	2	0	2	4	4	4	3	2	4	1	1	1	1	1	1	4	1	2	2	3	3	2	2	3	2	4	1	3	2	2	2	3	2	3	3	2	3	2	0
Sakai	3	4	0	1	0	0	4	0	4	3	1	4	0	2	1	2	0	0	4	0	1	1	3	1	1	0	0	0	4	0	0	2	2	2								

content analysis process, for example, try out the test, an example for instructor including the course designers, managing user and simulating course activities. LMS of Moodle showed a great result in evaluation by holding criterion of standardization of (The qualitative weight and sum : QWS). There are 8 main types of an evaluation: they are

1. Communication tools
2. Learning Objects
3. Management of user data
4. Usability
5. Adaptation
6. Technical aspects
7. Administration
8. Course Management

This paper has extended environment evaluation with QWS. OSMM (Open Source Maturity Model) [11] is applied from an Software Evaluation by CMM :Capability Maturity Model [12], is a model to measure the reliability and quality of the software development process of an organization. The CMM has specified a gread procedure to extend the reliability and quality of these processes.

In order to utilize OSMM effectively, one must have the knowledge and skills to use it. In particular, the selecting e-learning for the organization, we realize OSMM to be considered because it's reliability and quality measurement of the software development process in the organization, it is an instrument creates in comparing and making decision in select an open source product, which we have taken in testing composed of the following:

1. Architecture and implementation
2. Interoperability
3. Cost of ownership
4. Strength of the community
5. Licensing
6. Internationalisation
7. Accessibility
8. Document transformation

The OSMM describes which steps should Capgemini need to take to determine these indicators, how to score these indicators and how the selection of a product is achieved. These indicators are called application indicators. Product indicators are grouped into 4 different groups:

- Product
  - Age
  - Licensing
  - Human hierarchies
  - Selling Points
  - Developer community
- Integration
  - Modularity
  - Collaboration with other products
  - Standards
- Use
  - Support
  - Ease of Deployment
- Acceptance
  - User community
  - Market penetration

The survey by Shirley Alexander and Tanja Golja [13] indicated the needs of instructors from LMS found instructors' needs should have the 5 main factors such as making subject announcements, providing access to materials, providing links to web resources, sending emails and using discussion board. The students' needs are accessing to course/subject materials, reading announcements, checking grades, reading community messagesed, graded quizzes, submiting assignments electronically, participating in assessable discussions and access external links & resources.

Therefore, before selection Open Source Software will be appropriate with an organization of the instructors and the students' needs, we have to compare Function, Non Function and Environment in Selection Criteria Matrix to get accurate data respond with their needs.

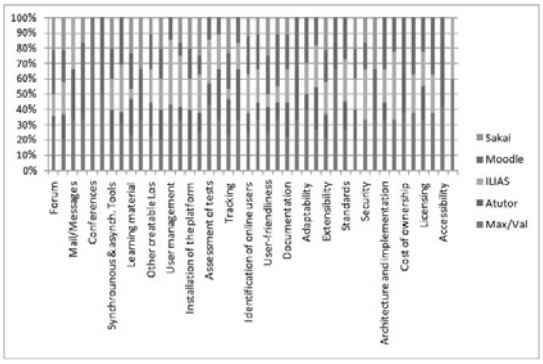

Figure 2. Graph shown the result of Selection Criteria Matrix.

Table 2. Comparison Function, Non Function and OSMM.

Selection Criteria Matrix

	Functionality				Non Functionality				OSMM							
Subcategories	Communication tools	LO	Administration	Course Management	Management of User data	Usability	Adaptation	Technical aspects	Architecture and implementation	Interoperability	Cost of ownership	Strength of the community	Licensing	Internationalisation	Accessibility	Document transformation
Atutor	10	11	2	5	8	7	8	4	1	0	2	0	2	0	5	0
ILIAS	11	11	8	6	6	4	9	9	2	4	0	2	2	2	0	2
Moodle	16	17	3	3	9	10	10	9	3	2	3	3	2	3	2	0
Sakai	12	12	3	2	6	5	4	6								

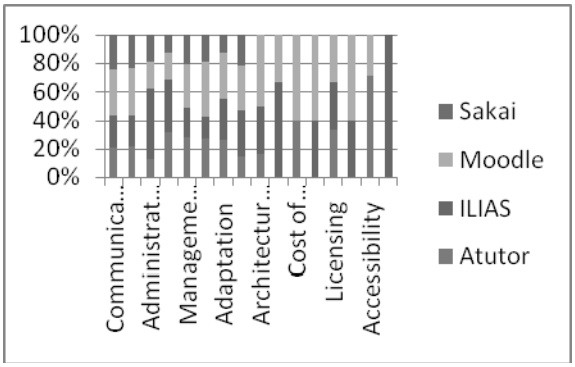

Figure 3. Graph for Function, Non Function and OSMM.

Table 2, shows in detail the comparison between Functionality, Non Functionality and OSMM using qualitative weight and sum (QWS) combined with OSMM. Figure 3 indicates LMS MOODLE has the highest area of graph in Communication tools, Learning Objects, Management of user data, Usability, Adaptation, Architecture and implementation, Cost of ownership, Strength of the community, Licensing and Internationalisation occupied the highest areas of the graph.

LMS ILIAS, the highest area of graph in Administration, Course Management, Interoperability and Document transformation LMS of MOODLE and ILIAS, the highest area of graph is equal as in Technical aspects.

4. Recommendation

The result of the assessment and comparison of LMS in section 3 showed the selection Software LMS in Open Source Software to be appropriate with the environment for a great learning management. MOODLE has the highest rank of score by having a great management in learning management (Non Functionality Requirement) and ILIAS has a great management in capability of e-learning (Non Functionality Requirement). Getting an appropriate selection of LMS for universities and organizations, is valuable to be used, so the selection of LMS depends on the requirements for usability in many areas. The user must really know about what kind the work is. Each organization may not use as highly capable in Functionality Requirement and Non Functionality Requirement for work. In addition, educational institutions needing an expert instructors in using the LMS and developing technically may choose LMS ILIAS because ILIAS is suitable for Functionality Requirement. Otherwise they should select LMS MOODLE because it has a great Functionality Requirement.

5. Future work

We choose LMS as a tool in the experimental research for designing development in RLOs, based on the environment of LMS, to support the variety of an element of all substance for DSA by using Ontology [14]. Besides, we need to assess and compare LMS in Selection Criteria Matrix form continually because LMS Version is updated all the time.

6. Acknowledgement

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