DESIGN OF HIGHER EDUCATION LEARNING MANAGEMENT SYSTEM INTEROPERABILITY

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Abstract - **LMS (Learning Management System) is a learning support application provides learning administration, learning materials, evaluation, and grade. Nowadays, most of higher educations (HEs) has an LMS. There is incompleteness of learning materials in an HE LMS. Taking learning materials from other HEs can complete this incompleteness. Nevertheless, until now there is no LMS HEs interoperability so that students and teachers can join some courses in other HEs by single sign on. This paper proposes a design system for HE LMS interoperability including teachers, students, and courses. Only through single sign on, a student can access other HE LMSs, join offered courses, interact with teacher and other students by chatting or forum, and get grade reports.**

Keywords - **higher education, interoperability, LMS**

I. INTRODUCTION

In recent years e-learning systems have become very popular in all fields of higher education. The Internet and web technology do offer great solutions for presenting, publishing and sharing learning content and information, as is the case in many other areas. Special software called Learning Management System (LMS) is generally used in most institutions providing web-based learning [1]. Essentially, LMS is a high level strategic solution for planning, sharing, and managing all learning processes within an organization, including online, virtual classroom, and distance learning. All of these can be met through web-based learning, CD-ROM and video content, that stand alone with each other information that can be downloaded [2]. The focus point of LMS is to manage and to organize students to know their ability improvement during joining the course.

LMS became an important thing for the instructional courses delivery because it has a major role in developing user's knowledge autonomy. LMS provides opportunities for users to connect to the world outside the classroom and the opportunities to make new research topics. It is recommended to implement in higher educations (HEs) to improve the quality of management and education to become modern, and as a leading education provider, including lifelong education [3]. Therefore, each college trying to make the LMS as good as possible, especially in terms of completeness of the contents.

LMS quality is determined by the learning objectives, lecturers, audiences, learning environments, and learning resources. One factor of learning resources quality measurement is learning materials completeness [4]. In addition, the completeness of an LMS is one of the determinants of its maturity level. If LMS goals are aligned with university academic regulations, LMS maturity level will increase [5]. Accessing learning materials should be effective and efficient [6] so that user satisfaction level increases [7,8].

Although each HE has an LMS but its learning material contents are different and not complete. These incompleteness or lack of learning materials in an HE may be supplemented by materials from other HEs [9]. However, each HE stands on its own LMS and there is no interoperability among HE LMSs, the completeness of materials can not be met from other HE. Therefore, through the HE LMS interoperability, it is expected to enrich the course materials which are obtained by a student.

LMS interoperability needs resources and supporting infrastructure such as LMS interoperability tools for course design, communication between users, feedback, and supporting target achievement. Meanwhile, users need shareable material tools [9].

Some researches have been conducted as efforts to meet the completeness of LMS course in HE. Previous research used the concept of synchronization between learning materials [10,11]. The weakness of that research is students are unable to follow courses in HE from which they are obtained. Only the administrator can perform the synchronization. Whereas a lifelong learning networks must be able to make connections between college LMS without any access restrictions for users [9].

This research will propose a design for HE LMSs interoperability including administrators, lecturers, students, and courses. A student can join courses at other colleges even though through cyberspace. Only by registering and following the prescribed requirements, a student can be part of other university and is entitled to receive course materials, quiz, and gets transcripts of the courses followed. Management information on the LMS will be managed centrally, while the service will be arranged at each LMS.

To make HE LMS interoperability, a standardization that allows the exchange of learning objects is needed. One of the standardization that provides this service is SCORM (Shareable Content Object Reference Model).

One of open source application LMS that provides SCORM is Moodle. By comparing several open source LMSs, Moodle is better than others [12]. Therefore, this research will be applied to Moodle.

The purpose of this research is to design interoperability among HE LMSs starting from the cash payments, rights of access, course activities, until grade report. Designing this interoperability refers to the Moodle LMS 1.9.8. The contribution can be given is the design of interoperability among HE LMSs including lecturers, students, and courses interoperability.

A. Learning Management System (LMS)

There are several LMS definitions given by the experts [1,2,6,8,9]. Essentially, LMS is learning support application by providing learning materials, evaluation and grading. LMS core components are provision of tools for synchronization and asynchronization communication, content storage and delivery, quizzes and surveys online, book value, and email communication [13]. A good LMS does not only set the course and registration of HE members, but also regulates the payment, scheduling classes, and assessment results of courses that followed [14],[15],[16].

LMS establishes academic system which is equivalent with enterprise resource planning (ERP) [17] in terms of pedagogical and institutional resources [18] so it requires a standardization [19]. Some organizations [20] issued standardization, such as Advanced Distributed Learning LMS (ADL), Aviation Industry CBT Committee (AICC), IEEE Learning Technology Standards Committee (IEEE LTSC), and IMS Global Consortium (IMS). ADL issued a standardization called SCORM [21, 22, 23]. SCORM enables the exchange of packets between the learning object.

B. Moodle

Moodle which stands for Modular Object-Oriented Dynamic Learning Environment is a software package that is used for web-based learning activities [19]. Moodle is open source and the source code can be downloaded from http://moodle.org/downloads There are several versions of Moodle that can be downloaded. The latest version of Moodle is 2.0. The application package obtained after download Moodle 2.0 are Moodle and Xampp (Apache + My SQL + PHP). Moodle provides SCORM issued by ADL. SCORM integrates specific elements of the IEEE, AICC, and IMS became a joint document. In order that LMS can perform a mutual exchange, we need standardization, and one of them is SCORM. Through the SCORM then exchange between the LMS lecture materials can be done easily.

II. METHODOLOGY

The research methodology is (a) study literature about LMS (standardization of LMS, Moodle, and online payment system) (b) design LMS, (c) design database; (d) design LMS interoperability, and (e) design interface.

III. RESULTS

A. LMS Design

There are four actors who can operate this LMS. They are portal and local administrators, lecturers, and students. Portal administrator is responsible for managing a central server that regulates the overall LMS metadata. Local administrator has a duty to manage the LMS for each college. Students can enroll in HE LMS where they came but they could find and join the course from other colleges after paying tuition fees. The lecturers will be part of the LMS after they have been enrolled in HE LMS where they came to the account as a lecturer. They can teach students from other universities. Lecturers can create new course materials.

LMS is divided into three components namely users, administrative, and academics. Specific design is shown in Fig. 1. This design refers to Moodle context design which consists of three main components namely users, frontpage, and course category.

B. Database Design

The Moodle tables relationships is depicted in Fig.2. Tables are grouped according to their functions. Group A is an association of tables used to store user information (administrator, lecturers, and students). Group B is an association of tables used to store payment data. Group C serves as a course table group. User log data is stored in group D. Group E is responsible for managing the students grade data, the group F is used to classify users and courses and the group G is used for managing the student assignments. Table H is a table to store information of HE local-LMS.

Furthermore, a group of tables relates each others in activities conducted storing user's data. Interoperability among LMS HE requires additional tables, ie `mdl_higher_education` table. It has `he_id`, `he_name`, `he_mdl_ip`, `he_city` `he_location`, and `he_grade` `fields`. It also requires additional fields in some tables. `credits` and `follower` fields is added into the `mdl_course`. `degree` field is added into `mdl_user`.

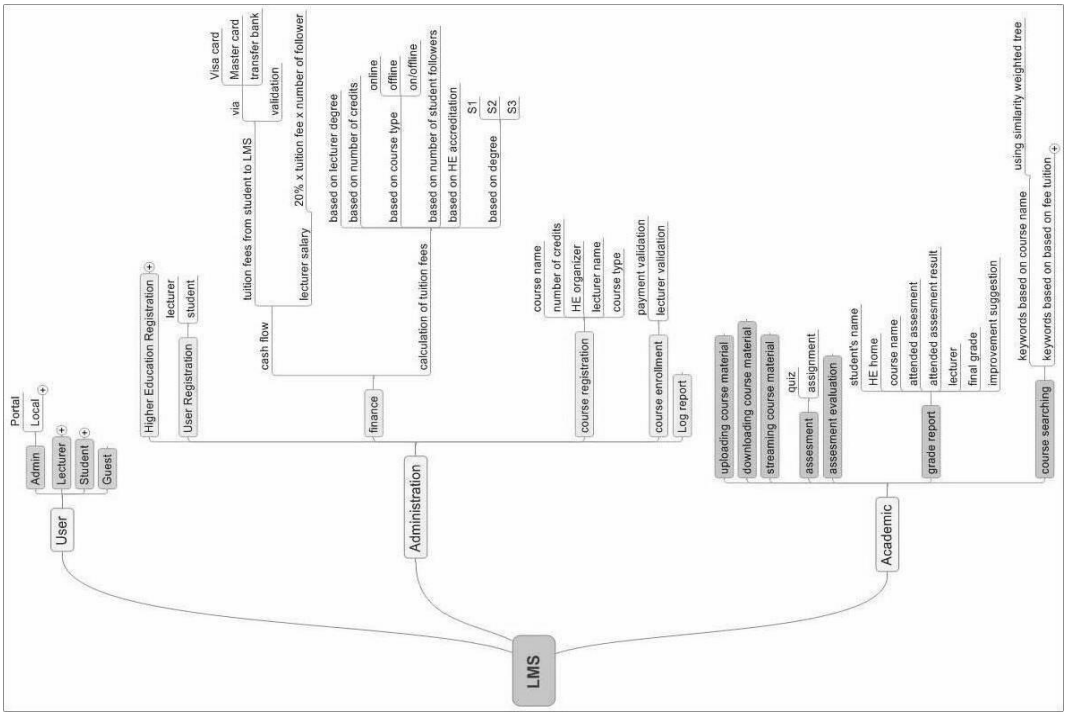

Fig. 1. Design of LMS

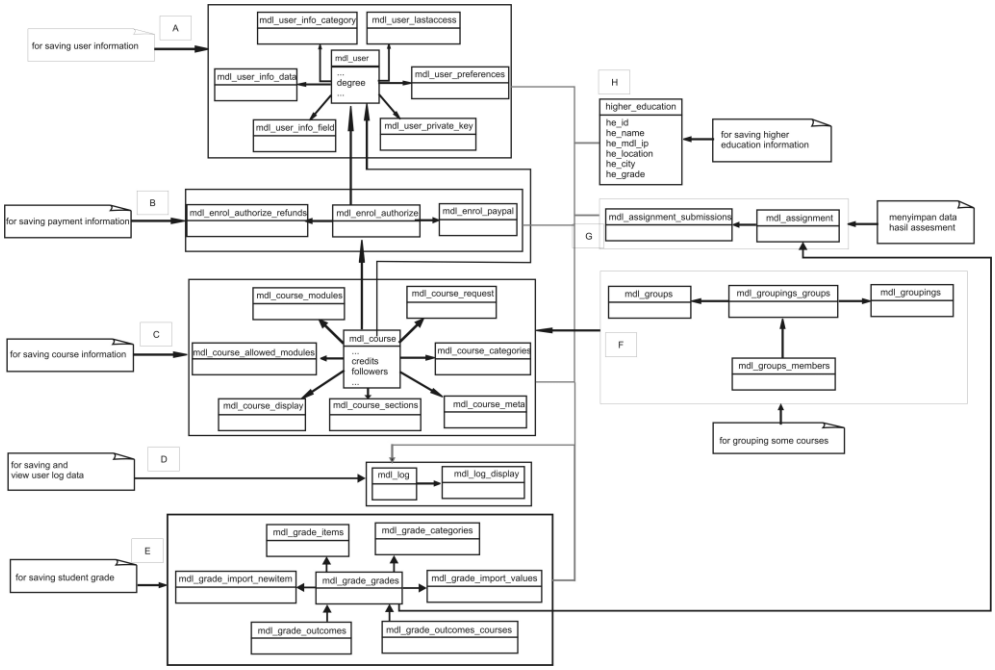

Fig. 2. Moodle database relationship

C. Design of LMS Interoperability

Referring to the concept of E-learning grid [24], the design of HE LMSs interoperability connectivity is shown Figure 8. Users interact with the local LMS that is connected to a central server. Users do not need to know the processes that occur on the server. Users only need a web browser to access the LMS.

There are two layers used in this concept. They are portal layer and local LMS layer. Local LMS only contains web services, while data services are on the portal. User must login with a username and password that they have so that they can access the portal LMS through local LMS. System will find HE where username and password comes, then verifies them. If the login is successful, the user is registered and listed in mdl_log. If a user searches for the desired course, the system will find

the course storage and display the search results. If users want to access the course, it will check the user's role as a lecturer or student. If the user is a student then it will check the completeness of a course requirement (payment).

At local LMS layer, content is assumed as web service because it is an API Web (Application Programming Interface Web) that is accessed by http. The first step, a user must be authenticated by the LMS through a login process. After has been successfully authenticated, user can log in to LMS and connected to the portal. Users can search for desired courses. Searching process will be done through the fuzzy. This searching method was chosen because it is expected to show the courses related to the keyword search by name and/or fees. Furthermore, the LCMS will find related courses to HE LMS and display them . Then, students can perform various activities such as courses enrollment, discussions, downloading materials, uploading assignments, doing assesments, and following streaming courses.

D. Design of Interface

Interface for this research was being adjusted for Moodle interface by adding new few forms that support the LMS interoperability needs. They are HE LMS registration, user account registration, course registration, course search, payment of tuition, instructors' salaries list obtained from the LMS, and grade report. Fig. 3. depicts grade report interface.

IV. CONCLUSION

From the explanation above, we can conclude that there is probability to make interoperabilitys among HE LMS based Moodle. To be able to make interoperability, additional tables and fields in Moodle is required. Besides LMS interoperability, this paper also proposes Moodle improvement in tuition calculation system.

If the previous tuition fees are determined subjectively (no reference to the determination of tuition fees), in this study tuition fees are calculated based on lecturer education, course taught by teams or individuals, the number of credits, types of classes (online, offline, or on/ offline), accreditation of universities, and the number of enthusiasts. This study also calculates the financial results of the distribution of tuition payment. Tuition payments can be paid via credit card or bank transfer.

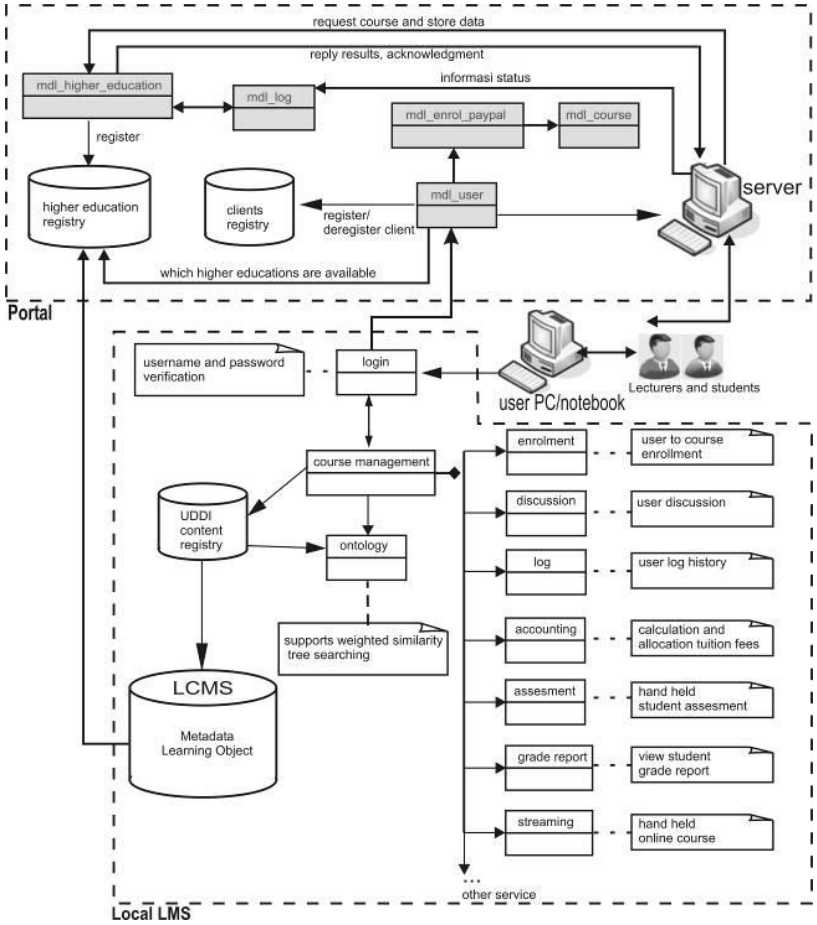

Fig. 3. Design of LMS Interoperability

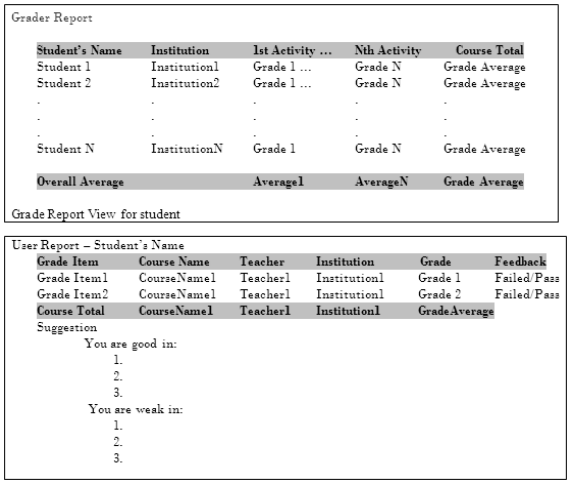

Fig. 3. Grade Report Interface

A user who logs into the HE LMS where he/she comes from is also login to the LMS server and connect to other universities. Students were also allowed to join courses in other universities and his/her grades will be transferred to the HE LMS he came from.

Making LMS interoperabilitys among HEs is designed to have two layers. They are local LMS layers (in each HE) and portals (central server). Local LMS only serves as a web service that provides an interface for user interaction with the system. While the portal serves as a data storage center.

This research is still a design that has not been implemented yet. This can be used as a reference for future research. Because Moodle is php-based, implementation of the LMS interoperability HE is better to develop based on PHP or XML.

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