

# Architecture of OERs-MS: the System of Open Educational Practices

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**Abstract** - Integration of learning management systems and open educational resources (OERs) into practice through learning activities leads to a new learning approach known as Open Educational Practices (OEP). This paper aims to propose the technological structure of an Open Education Resources Management System (OERs-MS), and to study the expert's opinions on the OERs-MS developed. The study was divided into 5 stages: 1) analysis and synthesis of documents related to development of OERs-MS, 2) design of the technological structure and architecture of the system, 3) system development, 4) implementation, and 5) study the expert's opinions of the OERs-MS by 8 specialists in related fields. The findings consists of 2 parts; Part 1, the technological structure and architecture of the OERs-MS consisted of 3 components: (1) resources repository; (2) retrieve & retain tools; and (3) content sharing & collaborative tools. Part 2, the expert's opinions of the OERs-MS based on the evaluation by 8 specialists, indicated that result regarding congruity of OERs-MS developed was at the highest level which OERs-MS has been developed to support teaching and practicing activities through the use of OER.

**Keywords** - System Architecture, Open Educational Resources (OERs), Open Educational Practices (OEP)

## I. INTRODUCTION

The advancements in information technology have materialized immense changes and driving forces in education, influencing teaching activities as well as students' learning processes. Self-directed learning through educational resources extensively available on the information network is considered an emerging approach of education beyond borders; and also a new dimension of "Lifelong Learning". Access to learning contents in the digital age has accommodated e-Learning in a variety of technology systems suitable to transfer the knowledge. These include systems such as CMS, LMS, or LCMS [1], and Open Learning whose accessibility to content knowledge and open educational resources in various formats help expand learning opportunities for all learners. This is in line with UNESCO [2], stating that "Open Educational Resources champions the sharing of knowledge worldwide to increase human intellectual capacity." Correspondingly, according to Thailand's 15-year framework for higher education vol. 2 (2008-2022) [3], a policy has been carried out to enhance the quality of tertiary education in Thailand in terms of

learning infrastructures under a “Lifelong Learning” framework. Set out to encourage and motivate universal learning, it promotes the sharing of materials taught in higher education into public domain via the Internet, known as Open Courseware. In addition to naturally improving the quality of teaching materials, the attempt will contribute to learning innovations encompassing: 1) an open system of teaching materials, enabling students to prepare themselves before class anywhere – anytime and 2) an opportunity for learning materials of excellent quality to be distributed and used nationwide, rather than being limited to only a handful in the classroom. This will be immensely beneficial, in particular to educational institutions deprived of such media.

The development of a knowledge repository and a learning resource system is the concept that strongly supports and facilitates teaching and learning through the use of ICT tools. Wang et al. [4] conducted a study on the processes and technologies to form a case-based reasoning and knowledge repository which supported knowledge in the community. Community members were able to learn and solve their problems by applying the lessons based on current situations. The process and results of the evaluation were drawn from participatory learning in order to raise the level of integration of technology with teaching and learning by instructors, students, and educators. Furthermore, the use of other educational resources, both physical and virtual ones, can effectively provide life-long education for everyone.

This paper presents a guideline for the development of educational resources for learning with an emphasis on optimizing the use of open educational resources through the potential of technology in order to exchange and share knowledge and information which will be of mutual benefit. The study will propose the architecture of Open Educational Recourses Learning Management System (OERs-LMS), and its quality assessment by experts in the field. It is firmly believed that the system will be useful to students, instructors, as

well as educators. As a powerful tool in collaborative learning, it is a new approach to integrate technology with teaching and educational resources in order to efficiently develop and enhance the quality of education.

## **II. LITERATURE REVIEWS**

### ***A. Learning Content Management System***

Learning Content Management System (LCMS) is a system that integrates Content Management System (CMS), distinguished for management and transfer of contents, and Learning Management Systems (LMS) that focuses on the management of teaching and learning activities. In LCMS system, there are tools to create and manage learning contents and to assist instructors in the development, production and management of the contents that can be adjusted [5-6]. These allow knowledge repository, information, and media resources to be produced; and learning activities to be managed [7]. LCMS is characterized by one of its feature to enable students to have access to a variety of contents and learning resources in order to meet teaching objectives prescribed [1]. Contents are stored in a central database. While being searched and retrieved, these contents and resources will be tagged for advanced search in the central database. The contents thus can be adjusted and reused, involving students to participate in the creation of knowledge. In brief, LMCS is considered an ideal tool for OERs-MS.

### ***B. Open Educational Resources***

Open Educational Resources (OERs) is regarded a current approach to promote lifelong learning. Its starting point and transformation were derived from David Wiley's [8] concept in 1998 on Learning Object, proposing open-content knowledge. In 2000, Stallman announced Creative Common license known as GNUFDL. In 2002, Creative Commons [9] launched its first set of copyright licenses to the public. In a similar vein, The United Nations Educational, Scientific and Cultural Organization (UNESCO) has partnered with Massachusetts Institute of Technology (MIT) to develop and disseminate

Open Courseware (OCW), providing all the details of the taught courses on the Internet. Their purpose was for developing countries to use these materials without charge and restrictions on use. Following The William and Flora Hewlett Foundation [10], OERs consisted of 3 key elements: 1) learning contents, 2) tools, covering the ones used to develop, improve, and disseminate learning contents, content management system, teaching contents, and online learning community, and 3) implementation, including the copyrights of intellectual property in disseminating the tools. McGreal [11] has also identified features of OERs which included searching, quality control, requesting, maintaining, retrieving metadata, submitting OERs, storing, gathering of metadata, and distributing of metadata.

### III. RESEARCH OBJECTIVES

1) To study and develop technological structure and architecture an Open Education Resources Management System (OERs-MS).

2) To study the expert's opinions on the OERs-MS developed.

### IV. RESEARCH METHODOLOGY

The population and the sample group to assess the quality of the system were:

1) The population included specialists in Management Information System, Software Development Life Cycle, Educational Technology, and in the use of information and communication technologies for instruction.

2) The sample group consisted of 8 specialists chosen by purposive sampling technique with the criteria of being qualified professionals with no less than 5 years of relevant expertise or academic performance.

This study was divided into 5 stages as follows:

1) Analysis and Synthesis of documents related to the development of OERs-MS: Relevant concepts, theories, and research were

reviewed to formulate a conceptual framework used in developing the system. The topics studied included e-learning, Open Educational Resources, and the 4R's openness framework. Characteristics of the system were examined. The use of tools complying with the requirements and objectives of use were analyzed.

2) OERs-MS System Analysis and Design: The data obtained from the literature review was analyzed to design OERs-MS system based on the elements explored. This stage involved a design of System architecture, a flow chart and dataflow diagram, and a use case diagram, with both function design and module of tools to cater to operational requirements according to the features previously analyzed.

3) Development of OERs-MS: OERs-MS was developed primarily employing LCMS technology as a core system. Preparation was made concerning server space, host, and domain to install plugins and modules such as Metadata, Group Activity, and Advance Search; consistent and compatible with the purpose of use as analyzed and designed. Meanwhile, a trial operation using a small sample group was conducted. 5 college students were recruited to test the designed tools and their functions in order to find out any defects of the system. The results were then used for revision of the system developed.

4) Implementation of OERs-MS: The implementation of OERs-MS system was carried out by a medium-sized group consisting of 15 undergraduate students who were competent users of computer and information technology. These trial users were asked to find any faults and to identify the efficiency of the system. Their opinions and satisfaction towards the system were reported. Recommendations from the inquiry and the satisfaction survey were used to improve efficiency and stability of the system.

5) Study the expert's opinions of OERs-MS: The expert's opinions of OERs-MS were assessed by 8 qualified experts who were

experienced and/or specialized in, or with scholarly works in Information Management System, Software Development Life Cycle, Educational Technology, and the use of information and communication technologies for instruction. The issues criteria were: 1) the design of the screen displays and the navigation menus, 2) the contents and resources in the system, and 3) implementation and tools to support learning in the system.

## V. RESULTS

The findings consists of 2 parts: Part 1 (A) the technological structure and architecture of the OERs-MS in Higher Education and Part 2 (B) the expert’s opinions of the OERs-MS developed. The details are as follows:

### A. The Technological Structure and Architecture of Open Educational Resources Management System (OERs-MS)

1) OERs-MS are divided 3 main technological structure supporting consisted:

- *Resources Repository*: Repository to storage of courses materials, learning materials, media, and learning resources.

- *Retrieve & Retain Tools*: Technology for Supplementary modules are also developed to support specific features of OERs, for example, Metadata module is utilized to define the scope, characteristics, and information of the resources and contents. Users can upload resources by identifying their scope and main index following metadata standards. Another module available is Advance Search module, from which users can easily search and retrieve resources for learning activities in detail.

- *Content Sharing & Collaborative Tools*: The system also includes a Group Collaborative module to support cooperative learning activities, knowledge sharing, educational media resources, and brainstorming, through management system of OERs-MS.

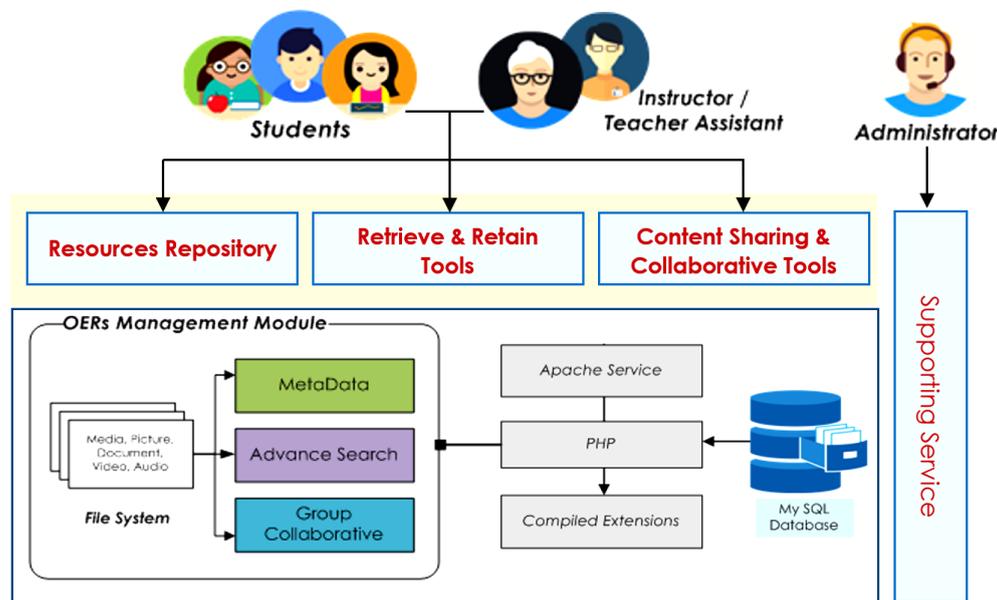


Fig. 1 Architecture of OERs-MS

From Fig. 1, OERs-MS Technological tools consists of 3 components as follows: 1) Resources Repository, 2) Retrieve & Retain Tools, and 3) Content Sharing & Collaborative Tools. In addition, the supporting service of OERs-MS supports learning activities. Its

implementation begins with activities leading to the course, lesson contents and educational resources, and collaborative teaching activities designed and created by the instructor, with supporting service provided by the system such as system usage support tools and teaching

activity support ones, etc. Additional supplementary plugins and modules can be added by the administrator for future learning activities.

2) Use Case Diagram of OERs-MS:

OERs-MS takes into account 3 main components: namely, 1) system technological structure design, 2) specific features and tools of the system, and 3) the ability to respond to the use of the system. The system was subsequently developed based on the relevant studies, analysis, and design. As shown in the Use Case diagram in Fig. 1, implementation of the system involved individuals at 4 levels which are: 1) instructor, 2) teaching assistant, 3) students, and 4) administrator. Details regarding the relationships of system users were as follows:

- *Instructor*: Creates and manages courses; provides course contents and learning resources, prepares group learning activities through OERs usage, controls, monitoring, follows up learning progress of the students, as well as adds-drops students in the course.

- *Teaching Assistant*: Assists in the instructor's performance such as supervision of the course, contents, lessons, learning resources, and group learning activities; assist in the implementation of OERs activities on the plan.

- *Students*: Participate in learning activities of the course as determined by the instructor; open educational practices in the activities - find, select, and share learning resources by uploading or downloading the media as needed; participate in knowledge-sharing group activities set up by the instructor.

- *Administrator*: Is able to manage the entire course and learning resources in the system; add-drop the courses in the system; manages membership of all levels; manages media resources available in the system;

manages tools and plug-ins to accommodate and support the instruction and the use of educational resources for learning.

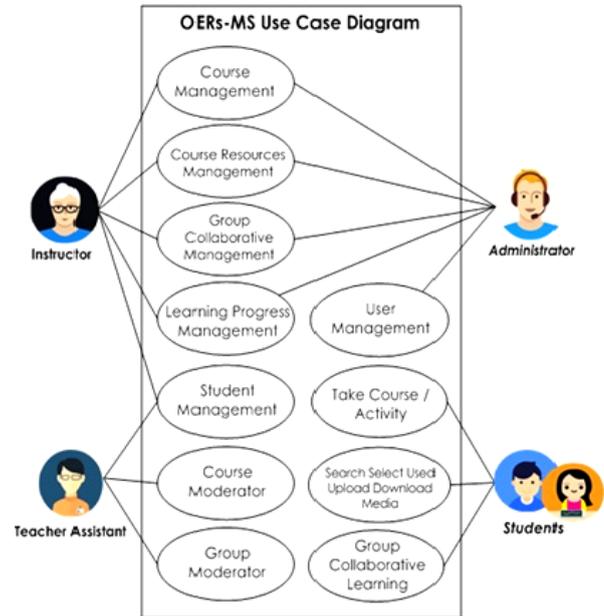


Fig. 2 OERs-MS Use Case Diagram

**B. The Results of Expert Opinions on the OERs-MS Developed**

The results of opinions on the OERs-MS by the 8 specialists are shown in Table I. As an overall result, the expert's opinions was rated at the highest level (mean = 4.64, SD = 0.48). All 8 experts agreed that the screen displays and graphics; the structures and sequences of content presentation; links, interactions, and navigation menus; course management tools, lesson contents and learning resources; learning support service; as well as other elements of the system were at the most appropriate level. In regards to tools used to search, upload, download, and retrieve learning resources; as well as communication tools in the system such as discussion boards and chat rooms, the experts have rated them highly suitable.

**TABLE I**  
**RESULTS OF THE OERS-MS ASSESSMENT BY THE EXPERTS**

Lists of Evaluation	Results		Level of Suitability
	Mean	S.D.	
1. Screen displays and graphics	4.88	0.35	Highest
2. Structures and sequences of content presentation	4.75	0.46	Highest
3. Links, interactions, and navigation menus	4.63	0.52	Highest
4. Tools used to manage the course, lesson contents, and learning resources	4.63	0.52	Highest
5. Tools used to search, upload, download, and retrieve learning resources	4.50	0.53	High
6. Communication tools in the system such as discussion boards and chat rooms	4.50	0.53	High
7. Collaborative learning support tools such as Wiki boards, forums, mind maps, etc.	4.63	0.52	Highest
8. Suitability and concordance of other elements of the system such as online membership, information, newsfeed, and supporting service	4.63	0.52	Highest
<b>Summary</b>	<b>4.64</b>	<b>0.48</b>	<b>Highest</b>

## VI. DISCUSSION AND CONCLUSION

OERs-MS system has been developed to support teaching and learning activities and the use of open educational resources to enhance higher order thinking skills. OERs-MS tools consists of 3 components as follows: 1) Resources Repository, 2) Retrieve & Retain Tools, and 3) Content Sharing & Collaborative Tools. It was designed for users at 4 levels: 1) instructor, 2) teaching assistant, 3) students, and 4) administrator. Its implementation begins when the instructor creates a course in the system, provides learning activities in open educational practices through OERs usage, uploads and publishes learning resources, assigns permissions of use to students. The teaching assistant helps carry out teaching activities, focusing on using OER to practice to the activity plan. Students participate in learning activities through active search on OERs, select learning resources to use, contribute in creating and enhancing skills from group activities, create new knowledge through learning media, return the knowledge back and retain into the system. The administrator, meanwhile, is responsible for supervise, monitor, and support learning activities.

OERs system provides a tool to transfer content knowledge from the instructor to students. By using available tools and technologies through the use of open educational resources (OERs), students will be

trained to apply their cognitive processes into practice by contributing to educational activities through group interaction and interactive learning tools in the process of use, exchange and collaboration. This concurs with Yin and Fan [12] in that the use of OERs would contribute to Open Educational Practices (OEP), the approach which put more emphasis on the process of learning and learning experiences rather than just the contents students were expected to learn. Students are assisted in developing their own intellectual strategies and self-directed learning. Instructors' roles should change accordingly. Rather than merely producing and delivering teaching materials, they should act as a coach ushering students through more learning experiences. The essence of OEP relies on working together; namely, monitoring, collaboration, and contribution. Production and use of OER is thus a social activity demonstrating the potential to create and customize learning resources available on the Internet.

## VII. ACKNOWLEDGEMENTS

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**(Arranged in the order of citation in the same fashion as the case of Footnotes.)**

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