Searching and exposing learning objects from Moodle: The ODS experience

Siniša Tomić, Vlatka Paunović, and Kristijan Zimmer
Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia
sinisa.tomic@fer.hr; vlatka.paunovic@fer.hr; kristijan.zimmer@fer.hr

Abstract—**Learning Management Systems (LMS's) play an important role in technology-enhanced learning. Open source LMS Moodle is currently one of the most popular, due to its rich set of features, flexibility and compliance with IT and pedagogical standards and user needs. In order to adopt the exchange of learning materials with as little intervention from the course creators, two new Moodle plugins were developed. Their purpose is to enable teachers to search but also configure what is exposed, how and when, by providing mechanisms for automatic generation of validated LOM-based metadata for harvesting by the OAI-PMH harvesters. This research paper describes the method for searching and exposing learning objects from Moodle. Factors which will be taken into consideration include the ease of use from course creator's and Moodle administrator's point of view and how well the generated metadata match user requests as well as impact of the harvesting process to the Moodle installation.**

Index Terms—**E-learning, LMS, LOR, OER, OAI-PMH, automatic metadata generation, matching problem**

I. INTRODUCTION

WITH the growing usage of Learning Management Systems (LMS's) they are becoming an essential part of learning. More and more teachers are accepting this new way of disseminating knowledge and even more students are learning how to use this kind of technology. In Croatia these platforms were at first recognized at the university level as a way of providing additional knowledge to students. However, in the last few years they are becoming an important part of learning process in both primary and secondary schools. E-Learning has overgrown its initial usage of just an additional or specific knowledge provider and it is becoming an integral part of school curricula [1].

Today teachers are not only using already made materials but they are creating a lot of their own content as part of their teaching. This led to the creation of similar e-Learning materials by the teachers who use the same curricula. The same problem occurred in programming in the late 1960s

Siniša Tomić is with the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia (e-mail: sinisa.tomic@fer.hr)

Vlatka Paunović is with the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia (e-mail: vlatka.paunovic@fer.hr)

Kristijan Zimmer is with the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia (e-mail: kristijan.zimmer@fer.hr)

when lots of programmers began writing similar parts of code for different projects [2]. At that time a new programming paradigm was defined. It was called object-oriented programming. The same idea is now becoming a part of e-Learning. This new approach to e-Learning enables teachers to reuse parts of already existing materials (learning objects) in their newly created courses [3, 4].

A learning object can be any digital chunk of information. It can be text, audio, video, model, but it can also contain additional information such as simulations and assessment. It can be as small as one definition, but also as large as a complete lesson module. These chunks of information can be stored centrally or distributed between many different systems. The system that holds that kind of information is called Learning Object Repository (LOR).

There are many LORs available today, some of which are used more in comparison to others. One method of choosing the right LOR for a teacher is the number of indexed learning objects. Repository that indexes more objects can usually offer better search results and is therefore regarded as better. An example of such a large repository is Open Discovery Space, which currently indexes more than 800.000 individual learning objects [5].

Once found, learning objects can become a part of a new course that is created in LMS. Today, Moodle [6] is widely accepted as one of the top LMS, mostly because it, among other things, enables its users to easily create content by reusing the existing one and additionally customize it with built-in tools [7].

The idea behind the work described in this paper is to give Moodle users two additional enhancements: (1) Search the already available resources on the Open Discovery Space and (2) Share their own learning objects created or customized in Moodle with other users using OAI-PMH open standard [8].

For those reasons, two separate Moodle block plugins were designed. Both of them are designed in a way that even teachers who are not technically adept can use them. This approach should result in higher usage of developed plugins since more teachers will be able to use them.

The reminder of this paper is organized as follows. Section 2 describes the ODS Learning Object Repository with the possibilities it offers to teachers as well as the reasons for creating this Moodle integration. Section 3 presents the methodology of creating and using the proposed solution. The

final remarks are presented in section 4.

II. Background

Open Discovery Space is a socially-powered and multilingual open learning infrastructure to boost the adoption of e-Learning resources. One of the parts of the Open Discovery Space infrastructure is Learning Object Repository. Access to this repository is fully open for all teachers and students. The Open Discovery Space engages teachers, students and parents in a first of a kind effort to create a pan-European e-Learning environment to promote more flexible and creative ways of learning. It is also the Europe's largest collection of e-Learning resources, scenarios and activities [5].

The main problem is that many teachers who use Moodle are not aware of this repository. In some cases, even when acquainted with it, they are sometimes not completely sure how to use the data in their Moodle course.

Currently, if a teacher uses Moodle and wants to search LOR for some learning objects to use in a course, they should first recall the information they are looking for, then open a new browser window, enter the correspondent keywords and try to find the learning object that would be the most appropriate for their course.

The main problem in this scenario is that the teacher must constantly mentally switch between two completely different contexts: first the Moodle, where new content is being created, and then LOR, where the existing content is being searched for. Visually and contextually, these two environments are completely different. This results in teacher using the search only as a last resort or when they know exactly what to look for. The correct approach would be to use learning objects not as a solution but as a part of design process. That way they would provide new, fresh ideas and solutions based on experiences from other teachers.

The idea behind the proposed solution is to provide the teacher with an easy and accessible tool for making search queries to the LOR. This brings LOR into a known environment and teacher can use it as a part of design process. By using existing learning objects new course can be designed and created much faster.

Once the course is created the teacher may like to expose his work to others. They can show a complete course or only a part of it. This decision can also be a part of school policy in which all created courses must follow the same exposure and licensing rules.

Default Moodle installation does not have a method for easy exchange of information with other systems. In order to expose learning objects, the teacher must first export the course and then repackage it by using additional tools. This task requires a lot of technical knowledge and can be considered as a complex one.

If a teacher is not able to easily expose the created content to others, they might decide not to do it at all. Therefore some valuable information might not be exposed only due to lack of technical skills.

Besides the tools needed for exposing the data, the teacher should also be supported by an infrastructure that can handle this kind of information. ODS LOR can include results from remote locations if they expose their data using OAI-PMH standard, which is an Open Archives standard based on XML and six defined verbs. It enables remote services to query the data stored on data provider and to retrieve all required metadata. By using internationally recognized standards ODS LOR enables all learning object providers to be harvested and indexed in the same manner after which exposed data is made available to all other users.

The developed plugin enables the teacher to easily expose all content from their Moodle course just by specifying certain data. This action requires no technical knowledge or background, and gives the teacher a complete sharing control and view over exposed data. Moodle system administrator is able to enforce any school policy by defining global settings applicable for all courses, not allowing teachers to change those settings but only to view them. These settings must be available to all learning object Repositories able to harvest data provided through OAI-PMH interface.

Currently, there are more than 1000 plugins available [9]. Many of them are distributed from the official Moodle plugin site. Using the officially distributed plugin ensures users that this product is independently tested for compatibility with their system and no information loss or leak should occur. Official plugins repository also provides means of notifying the system administrator of all updates to the software.

The idea behind the proposed solution is to be available as a part of official Moodle plugins repository and thus to allow full verification by anyone. This is the only way for the solution to be completely safe for both teachers and students to use.

III. Approach

Moodle has several types of plugins that developer can create [10]. One of the available types used to expand Moodle functionality is the block plugin. The block plugin was chosen for this solution because once added in a course it is available on all its main pages. With the block plugin developer can present short and simple information for teachers such as status of the exposed data or simple search field.

This plugin supports a full screen view so the teacher can have full attention on the content, which is most notable in the case of search results. First, user enters the query in a search box that is a part of the course page, and then results are displayed in a larger view.

The block plugin allows two types of configuration: global and local. A system administrator can configure the plugin globally and thus enforce school policy regarding the exposure of learning objects. Using local configuration, the teacher can set sharing options for each course separately.

Two separate Moodle block plugins were developed as a part of the proposed solution. First one provides teacher with easy search access to large LOR and second one enables teacher and system administrators to easily expose the content.

A. ODS Search block plugin

Search plugin enables teachers to make direct search queries from Moodle to ODS Learning Objects Repository. ODS LOR will reply with a list of all found learning objects containing links to them.

System administrator can install the search block using the standard Moodle installation of block plugins. A teacher can add the block plugin using the standard Moodle method of enabling the block plugins.

Once plugin is installed and enabled, the teacher can access the Search Moodle block from any course page as presented in Fig. 1.
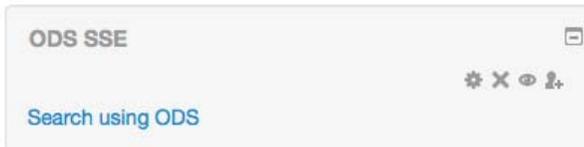

Fig. 1. Example of Moodle Search block plugin when part of page

After selecting the link "Search using ODS", teacher can enter any term and the ODS LOR search response will be displayed inside Moodle. By using search plugin the user does not leave content creation context since all the operation is done using the known Moodle environment as presented in Fig. 2.
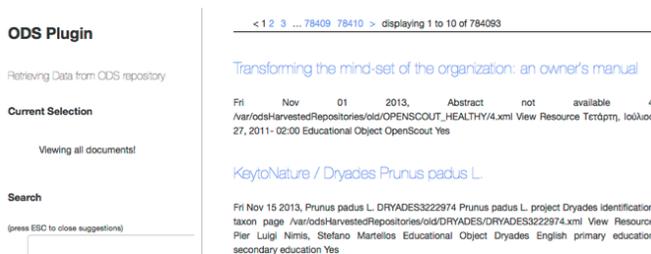
Fig. 2. Example of search results page of Moodle Search block

Search plugin is aware of teacher's course and course content since it is the integral part of Moodle. This allows for plugin to use course title, keywords, description and metadata while searching for learning objects. A profile for the teacher can be made by using that additional course data and metadata. That profile supports better matching between the teacher and the searched content. For example: if the teacher is searching with just the keyword "network", the search plugin can use the available course metadata and decide if the course is about IT or social science. In the first case the correct learning objects would be about computer network, and in the second case it should retrieve objects related to social networks. This is an important part of the matching process between what a teacher requested and automatically generated metadata regarding the learning object from another teacher.

The complete message exchange between user and ODS LOR using Moodle and search block plugin is presented in Fig. 3.
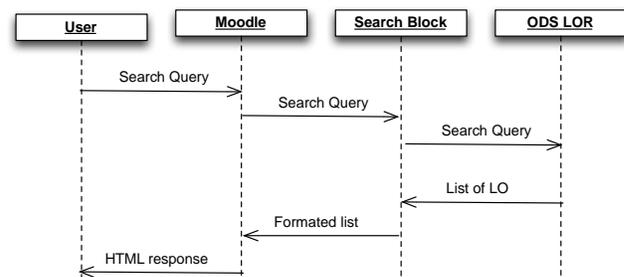

Fig. 3. Search query message exchange

By using the ODS search block plugin, the teacher does not leave the course environment. This enables the teacher to look for new course materials more often since it is much easier to access search.

Some teachers were granted access to the plugin during its development phase. This encouraged them to be more open to the idea of exposing their own content, since they were able to see how useful the plugin is and wanted to contribute to its growth by adding more searchable content. In some cases, the teacher who exposed learning objects got matched with other teachers who used a similar learning methodology, which opened a new communication between them.

B. OAI-PMH sharing block plugin

OAI-PMH sharing plugin enables teachers and system administrators to define rules for exposing all or some of the course metadata. By using this plugin it is not necessary for the teacher to know anything about the method of exposing data to ODS LOR or any other LOR that can harvest OAI-PMH structured data, or anything about creating the learning objects [11]. All the work is done automatically in background by this block plugin.

Sharing block plugin was designed to automatically detect many formats used internally by Moodle. During the process of indexing, it scans through each course instance. The plugin checks if the course metadata can be exposed to other users. If a teacher allows the data to be shared, the OAI-PMH sharing block plugin is going to expose all found learning objects and create all required metadata for all of them. All parts of the process are done automatically and with no required additional information provided by the teacher. At any moment, the teacher can check what metadata is exposed and change sharing settings.

One of the main features of the plugin is the type of contents license, which can be specified for each course separately by a teacher or for all courses on Moodle by a system administrator. All metadata to be harvested is cached so the process of harvesting by a remote system is not noticeable to normal Moodle operation. A system administrator can also limit the access of OAI-PMH target to the selected systems so even high number of OAI-PMH requests can be handled with virtually no impact on server performance.

Teachers can select which Moodle plugins and modules are harvested for each course. This information is available to them at any time together with licensing information. ODS OAI-PMH block plugin has predefined values for all Creative Commons licenses. However, the teacher can also choose a commercial or custom license. The plugin allows the teacher

to specify his own custom license that will be provided with all course learning object metadata.
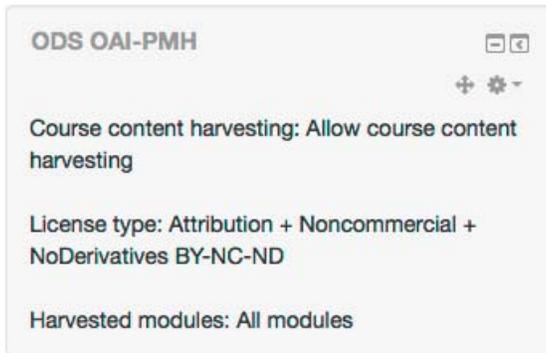

Fig. 4. Example of Moodle Search block plugin as a part of page

The ODS OAI-PMH block is available through official Moodle Plugins repository. This enables all users to confirm the validity of developed block plugin and to be able to easily install and update plugin. Third parties can check the source code since it is fully available on GitHub which allows all developers to contribute to the plugin. Currently, this is the only actively supported OAI-PMH Moodle extension and the only one that supports IMS/IEEE LOM standard for defining data for harvesting.

IV. CONCLUSION

Currently, teachers are still not using as many learning objects from LORs as possible. There may be plenty of reasons for this, with the main one being that search is still too hard for them to perform because of the constant need to switch between two contexts: creating content and searching for content. Both of these contexts are currently executed in two completely different environments with different design patterns and user experience. Therefore teachers are using Learning Object Repositories only if they know exactly what kind of learning object they want to find, and they are still required to know exact keywords in order to find the desired content.

We propose the usage of an integrated ODS Search Moodle block plugin which resolves this problem and can be further expanded with information about the existing course structure which contains information the teacher is looking for. This extended information can be further used to define more queries and provide teacher with better matching instead of simple search that uses keywords.

The sharing of created content is still not simple enough for many teachers. As a result, even the content that teacher would like to expose is not shared since they lack the required technical knowledge to do that.

We suggest the integrated ODS OAI-PMH Moodle block plugin that automatically checks all available learning objects inside each Moodle course and, as per teacher's instruction, exposes the used learning objects metadata to any OAI-PMH compatible harvester. Thus the teacher has a complete control over this process and can check what data is exposed at any given moment.

This work described two different Moodle block plugins: one that enables teachers to search for new content directly from Moodle and then allows them to use that information as a base for new ideas and teaching methods; the other that enables teachers to expose their work to other teachers in a secure and highly accessible way that has virtually no impact on Moodle performance.

Future work will focus on enhancing queries to the ODS LOR with knowledge on Moodle metadata information of the user, simplifying the process of exposing courses, and also on enhancing the process of automatically generated metadata for learning objects that is provided to OAI-PMH harvesters.

REFERENCES

[1] Capay, M.; Magdin, M., "Lifelong learning of teachers at primary and secondary schools with the support of e-courses,", *Interactive Collaborative Learning (ICL), 2012 15th International Conference on, 26-28 Sept.2012*, pp. 1-6.
[2] O'Regan H, (2012), "A Brief History of Computing", Springer
[3] Polsani, Pithamber R. (2003), "Use and Abuse of Reusable Learning Objects", Journal of digital information, Volume 3, Number 4, Article No. 164, 2003-02-19.
[4] Noor, S.F.M.; Yusof, N.; Hashim, S.Z.M., "Creating granular learning object towards reusability of Learning Object in e-learning context", *Electrical Engineering and Informatics (ICEEI), 2011 International Conference on, 17-19 July 2011*, pp. 1-5.
[5] ODS, (2015) Open Discovery Space [Online]. Available: http://www.opendiscoveryspace.eu
[6] Moodle, (2015) Moodle [Online]. Available: http://www.moodle.org
[7] Arteaga Sanchey, R.; Duarte Hueros A. (2010), "Motivational factors that influence the acceptance of Moodle using TAM", *Computers in Human Behavior, November 2010, Vol. 26(6),* pp. 1632-1640
[8] Open Archives Initiative, (2015), Open Archives Initiative Protocol for Metadata Harvesting [Online], http://www.openarchives.org
[9] Moodle, (2015) Moodle Plugins [Online]. Available: http://plugins.moodle.org
[10] Moodle, (2015) Moodle Plugin Types [Online]. Available: https://docs.moodle.org/dev/Plugin_types
[11] Najjar J.; Duval E, (2006) "Actual use of learning objects and metadata-an empirical analysis," *TCDL Bulletin, vol. 2, no. 2*.