ENHANCING LEARNING MANAGEMENT SYSTEM THROUGH WEB ACADEMIC LIBRARY INFORMATION SYSTEMS

Marton D., Bednar S., Modrak J.[*]

Abstract: Successfully implemented e-learning system brings several advantages into management of educational process if the used methods are implemented correctly and understandably for end users – students. For that purpose, various open source e-learning applications have been developed in last decade. They can be installed easily and offer choices of many accessories and possibilities. This paper discusses an interactive learning management system ILIAS and its interconnection with existing faculty web-based library information service (LIS) in order to offer students a possibility to work on-line using learning content and appropriate literature sources.

Key words: distribution centre, enterprise, SME.

Introduction

The historical development of distance education can be divided into five time periods. They are, Correspondence Study Era, Broadcasting Era, Open Universities Era, Teleconferencing Era and Internet Era (Moore and Kearsley, 2005). The most prominent feature of the fifth period is so called web based technologies. Web-based e-learning can be characterized as the method of teaching management based on the Internet that provides teachers with a learning environment enabling them to efficiently learn and collaboratively share their professional expertise. Thanks to these features, the web-based e-learning method gradually becomes a trend in education (Chen and Shi, 2002). The development of information technology has changed interpersonal communicative relations and has also substantially increased the pace of life. For this reason, everyone involved in the education might be able to acquire knowledge in the shortest period of time. Traditional distance learning management methods restricts a learner's time and space that can cause learners to become disengaged from the learning (Chen and Huang, 2011; Cruz-Cunha et al., 2010; Friedman, 2007; Golding and Catz, 2008; Rovai et al. 2007). In this context, Volery and Lord (2000) emphasize that higher education institutions that do not keep abreast of technological developments will be left behind in the race for globalization.

E-Learning technology market offers plenty software products supporting teaching and learning management via the World Wide Web. According to Massy (2004) and Leeder and Lonn (2014), there are more than 250 providers of commercial Learning Management Systems (LMS) and more than 40 open source LMS that

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can be tailored to the needs of Universities and Higher Education institutions. Some of the most well known are Moodle, ILIAS, Eduplone, Claroline and SAKAI.

In this paper, our intent is to describe specific features of implementation of ILIAS Web Learning System (WLS) integrated with the faculty's library information system (LIS) at Faculty of Manufacturing technologies (FVT). The rest of this paper is structured as follows. In the next Section, we describe some features of WLS based on ILIAS platform. Subsequently, the development of pilot learning modules is outlined. Finally, the conclusions are summarized.

Description of tailored WLS to support students of study program Manufacturing management

University students of external form of education often get into trouble when finding the right study literature for specialized subjects. On the web there are plenty information sources but each teacher wants to provide students with what is required by society as a whole. Therefore, practically each autonomous high education unit has a good reason for introducing a convenient WLS platform that students can use to interact with tutors, keep track of their assignments and give their feedback.

WLS makes the work easier not only for teachers but also for students by offering a wide range of learning resources. Moreover, WLS enables administrators or even teachers to manage student groups and their activities and gives students a tool to manage their study plans by creating links between courses and to create a repository of learning materials.

Faculty of Manufacturing Technologies is a part of Technical University of Kosice (TUKE) that uses two open source platforms of Learning Management Systems the Moodle and ILIAS. Moodle has been obtained from the university project with financial support of the European Social Fund under the Operational program Education entitled Package of innovative features for educational reform at TUKE. Subsequently, this LMS has been introduced at 4 faculties and 7 departments. ILIAS only operates at Faculty of Manufacturing Technologies that is that is located out of main University campus. Further, we illustrate some characteristics of Moodle and ILIAS.

Moodle stands for Modular Object-Oriented Dynamic Learning Environment. It is a software package on an open source platform. Numbers of modules are available here: forums, lessons, tests, chat or SCORM support. Moodle is able to manage courses, seminars, and study materials in the form of HTML files, accessible only to registered users. One of the great advantages of Moodle is a huge community able to answer any questions about the work on platform.

ILIAS is LMS offering number of useful features within the package. It runs on web platform with boundless possibilities of teaching. System creates online course with or without subscription to certain class, course. Individual students are continuously supported by chat and e-mail communication. It is possible to create

bulletin boards, evaluations, testing's and add different links in the form of wiki files and attachments. ILIAS supports Shareable Content Object Reference Model (SCORM).

The content of WLS is depicted in Figure 1. Such WLS is able, e. g., to assemble and deliver learning content rapidly or allows the personalization of content and knowledge reuse.
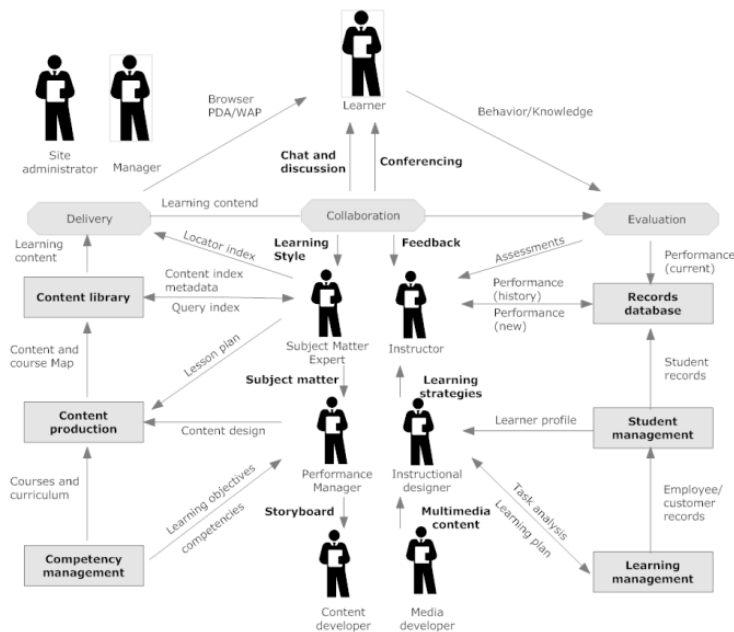

Figure 1. Scheme of typical Web Learning System

Hardware configuration of the LIS at FVT is compatible with chosen software platforms like MS Windows, Linux and applications running on these operating systems as Internet Information Services (IIS), MySQL, library - information system Clavius and proprietary RFID Software. Library document records are stored in MySQL database server. Web server is used in this system to serve clients by providing access to the Database and Library Document Reservation System. In order to enhance the security of stored library document records, the database server is connected to the application server directly by separate LAN connection. This information connection flows exclusively through the second network card of application server with just one open port used for communication furthermore secured by password. Data stored on the hard disks are either mirrored by use of RAID1 mode or parity is shared on all disks in RAID5 mode. This hardware configuration of disks enables hot plug-in and plug-out of defective disks and reduce server off time during the maintenance. Firewall is also inherent part of this configuration. Technical and hardware configuration of the LIS is shown in the

Figure 2. Besides the server itself, hardware configuration includes intranet switch, touch terminal for easy access of clients to the Library Information System, RFID printer and wireless barcode/RFID reader used for fond revision. Finally, RFID readers/writers supplement the whole configuration. The library RFID readers/writers operate on 13.56 MHz band. The reason why this technology was used originates from the following reasons:

− Students and teachers identification cards operate on this frequency,
− Tags on this frequency operate up to 10 cm so on accidental tag reads can occur,
− This frequency readers and tags are widely spread and are quite cheap,
− This readers are already described in ISO/IEC 14443-4 (2008),

Proprietary software development could be easier carried out by the staff due to familiarity with 13.56 MHz RFID technology.
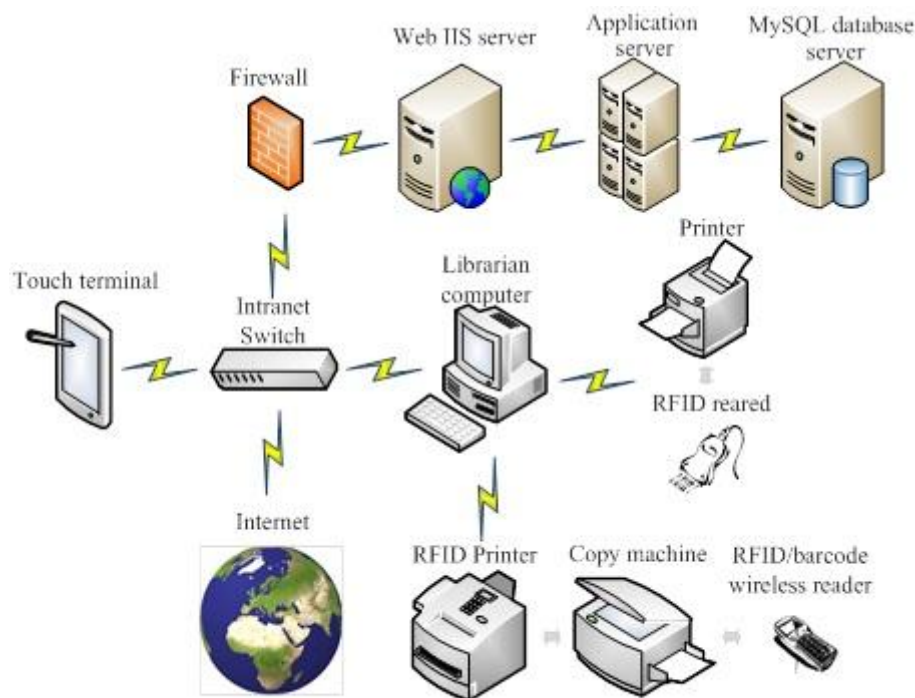
Figure 2. Technical and hardware configuration of the LIS

Accessibility and structure of the physical library fond

The content of a physical library fond of The Library of Manufacturing Technology and Management (LMTM) is accessible from the internet web or from a local network by use of touch terminal through clicking on the logo of library, or

hypertext link to appropriate ILIAS learning module. The Library IS includes a location and availability of the given document in the library and in Google books together with cover page with possibility to get link to the amazon.com. Besides the mentioned option for searching of library documents, there is also another given option to access the library items by A-Z index. The A-Z index is available from the initial page by clicking the author of subject without specifying any author or subject. The content structure of physical library fond titles was strictly adjusted to a curriculum of the Manufacturing Management Study Program that is a branch of Manufacturing Engineering. Accordingly, book and another document titles has been divided in the library classification systems into five basic fields A to E concerning the distance web-based education through learning module (see Table 1). For further details of the web based library, see the reference Modrak and Knuth (2012).

Table 1. Basic knowledge domains of the web based library

A Manufacturing management	B Environment science	C Informatics and information technol.	D Manufacturing technologies
Production management	Occupational safety and health	Radiofrequency identification RFID	Mechanical engineering
Mfg. systems design	Recycling technologies	System simulation	Material mechanics
Design of experiments	Renewable energy	Optimization	Industrial engineering
Organizational design	Waste management	Antennas	History of technology
Project management	Ergonomics	Database systems	Material sciences
Quality management	Environmental engineering	Operations systems	E Logistics
General management	Environmental protection	System engineering	
Macro and microeconomics		Artificial intelligence	Manufacturing logistics
			Supply chain management

ILIAS-LMS structure and environment

ILIAS is an effective Learning Management System (LMS) developed for today's highly topical web-based e-Learning. The system has been developed the way that every customer is allowed to implement his own modules, settings, etc. It is free of charge and is published under the General Public License, version 2.0. The latest version of ILIAS is numbered 4.3.4. All other older versions are fully supported and are taken care of.

First of all we need to understand the structure of the system and its composition.. These components are divided into modules and services. Different modules may be added to the repository, e.g. chat, forum, survey, glossary, course, etc. Services are the general functions applicable and covering all the modules, respectively, e.g. role permissions are applicable in all defined modules specified by administrator.

ILIAS is an object-oriented course management system that runs on Apache, PHP, MySQL, etc. Every potential user should be able to run the software on a common combination of external systems mentioned above. ILIAS home page offers wide range of server options to the clients. It is able to run on different platforms, e.g. Debian, RedHat, Fedora, OpenSuse, SLES. The list is not limited and not even tested on other platforms yet.

Every component of ILIAS includes number of user interface and application classes, respectively. Graphical user interface is responsible for processing input and generating output, calling methods of the application layer and generating output with template engine. On the other hand application layer is responsible for access to database to insert, update or delete data and for calls to other applications to perform desired tasks.

ILIAS allows creation of learning modules and learning units in effective ways. Different learning modules can be further arranged to courses with forums, chats or other objects at any time.

There is a linkage with Test and Assessment feature where the sponsor of a module allows kind of a check-up of previously presented knowledge. The teacher is also able to track the learning process, e.g. course attendance or test state and results, respectively.

Test and Assessment is an integrated environment allowing creation of test and subsequently its assessment. This way one can easily monitor the whole learning process as a teacher or module sponsor. There is a choice of different types of questions, e.g. "search image to click on" question, closed questions (free text or select box), single or multiple choice question, etc. Question are created in question pools, subsequently they are linked to desired test. A single question may be used in more than one test at the same time, which can be useful in case there is more than one group in a course. The results of test per student are then visible in "Statistics" tab and they can be further exported in *.xls or CSV formats in order to evaluate the data with statistical processing.

The above mentioned features and their efficiency were one of the reasons for choosing the ILIAS e-learning as LMS tool at FVT, Department of Manufacturing Management.

Development of a pilot learning modules

Explanation of initiation phases

Understanding the basic concept, structure and the most important features of ILIAS was the first step before the creation of e-learning modules. In this chapter, we are going to describe the process of learning module creation in real conditions of our department.

Adding a learning module was an important part of project adoption into external form of education at Faculty of Manufacturing Technologies, specifically at Department of Manufacturing Management (DMM). The process consisted of several stages. At the very beginning of the project, even before the creation of modules, it was necessary to create and revise a list of subjects provided by the Department of Manufacturing Management in current academic year 2013-2014. The final list is depicted in Figure 3. Based on the Figure 3 we can see that DMM at the moment provides 30 subjects in external form in all three levels of education (Bachelor, Master, Doctoral). Each subject has its own curriculum, approved

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content of lectures and exercises and they have been adapted to a time schedule of external students at DMM. It means that students of external form are only present for lectures, courses or exercises of different subjects once a week and therefore we had to merge and adapt multiple courses to be able to present the whole content of a subject, to perform all planned exercises, as well as testing and assessment.
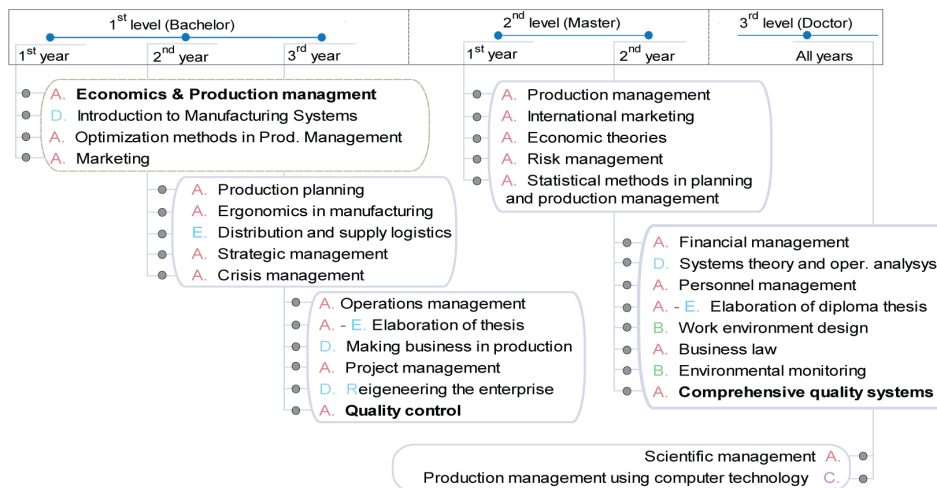

Figure 3. Scheme of subjects provided by the DMM ant their library basic fields

The aim of the project is to transform all the mentioned subjects into ILIAS learning modules so that external form of education will only "run" through distance E-learning system, which is actually ILIAS. Students of external form will have to access the content of a selected subject through ILIAS platform in order to fulfill the subject requirements.

Since we are in the early stage of project, in first step we started with pilot subject TQS-Total Quality Systems (see Figure 3 in the line with gray background) which is the master level, second year subject.

The content of the subject is very similar to one of the three compulsory state exam subjects to pass for Master degree. This was the reason for choosing TQS as a pilot subject to be implemented. External students in traditional learning form have obligation to attend 18 lessons (one lesson takes 45 minutes.) only for this subject.

By adopting distance e-learning system offered by ILIAS, lessons will be used as a platform for discussion of various issues, which are relevant to the subject content. Texts of individual lectures have been corrected for outdated information and the latest findings in each area have been added.
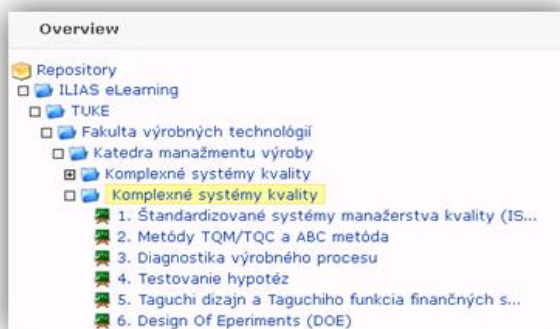
Figure 4. Newly created categories in repository sidebar of ILIAS

Adding a repository category

After a successful access into ILIAS teachers are getting to their personal desktop. By clicking on "Repository" in the main menu teachers are in Repository where all the ILIAS content is located, including courses, categories, tests, etc. They will see a repository structure sidebar automatically. Here, they can create a desired structure of categories. In the very end of creation of the learning module, teachers are able to get a path to any course. To add a category, first click on "Add New Item" button on the right side of the window and then click "Category" to create it. Fill in the Title and the Description of new category and "Add Category" to save it. This way tutor or administrator can create category (or folder) on any location or level to get the desired folder path structure. Any change made in repository structure is visible on the left side bar by clicking "Refresh" button. Since we are working on a pilot module, totally new structure paths have been created for this purpose.

Adding a course and its content

If the desired category structure is completed, adding courses follows. For this purpose, 6 innovative topics in our pilot subjects have been created based on previous research results and other materials (see, for example Arsovski et al., 2012; Cunha and Putnik, 2005; Grabara et al., 2011; Hloch and Riggiero, 2013; Modrak, 2009; Modrak and Marton, 2014; Modrak and Knuth, 2010; Modrak et al., 2002;). We have created a new course modules just the same way as the category, e. i. click on "Add New Item" button on the right side of window, then click "Course" to add a course. In order to complete pilot subjects, we had to add relevant content for them. We added content by opening a course and clicking on "Text/Media Editor" button below the menu tab of current course. For that purpose click on the plus in the middle of active rectangular and choose one way of insertion for part of the text or even for the whole course content.

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It looks more professional and nicer if we choose different way of insertion for plain text and different way for data table or for division, etc. We could have chosen from the following: text, resource list, image or media, section, data table, different types of tables, code, tabs, map, etc. Choose one of the insertion way and click save to view your insertion the way your student will see it, eventually add another text blocks, tables or information. When finishing, click back on the course menu bar to leave text editing mode. The rest of the courses have been completed and filled in the same way with up-to-date information revised by the course tutor.

Providing literature sources through the LIS

In order to provide students with supplemental literature sources, each course module will encompasses a list of recommended literature including categorization of each items purpose we developed coding system with a code structure described in Figure 5. This code conveys useful information not only for student but also for library staff, e.g. to identify a location of item(s). Students are able to search in the library database very fast using available hypertext link to the web-based library. After a selection of documents and checking their availability students can send order to the librarian through the email reference service.
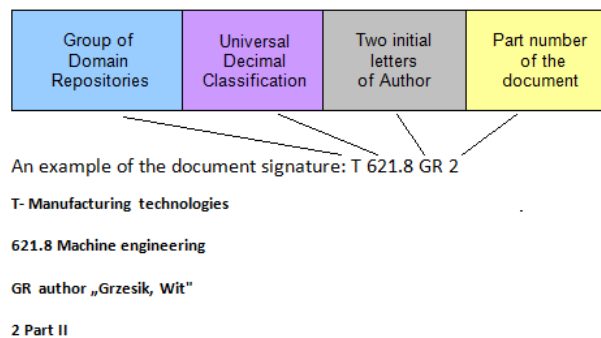

Figure 5. Code structure (signature) of library documents

Conclusion

University or faculty libraries are rarely integrated into their institution's LMS due to several reasons. One of the reasons is that librarians are seldom involved in the administration and management of courseware (Mestre et al., 2011). Moreover, librarians must often negotiate with faculty to be given permission and access to a course website, and are often required to adapt pre-existing LMS roles such as instructor, graduate student instructor, curriculum support staff or administrator (Stefanovic et al., 2010).
Our first focus in developing Web Learning Management System integrated with the faculty's library information system was to improve distance teaching and learning in combination with on-site teaching and learning management at our

institution. A positive precondition for implementation of the innovative WLS at the faculty was an existence of modern faculty library focused also on manufacturing management and engineering domain. Then it was not necessary to eliminate barriers at higher levels of the university administration. After the testing of all individual components and overall WLS for the pilot study program, we are intending to offer the implementation to other study programs at our faculty.

Acknowledgement

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POPRAWA SYSTEMU ZARZĄDZANIA NAUCZANIEM POPRZEZ SIECIOWE SYSTEMY INFORMACYJNE BIBLIOTEKI AKADEMICKIEJ

Streszczenie: Wdrożony z powodzeniem system e-learningu wnosi wiele korzyści do zarządzania procesem edukacyjnym, jeżeli stosowane metody są realizowane prawidłowo i zrozumiale dla użytkowników końcowych – studentów. W tym celu, w ostatnim dziesięcioleciu opracowane zostały różne aplikacje e-learningowe open source. Mogą być one instalowane w sposób łatwy i oferują wybór wielu akcesoriów i możliwości. W artykule omówiono interaktywny system zarządzania nauczaniem ILIAS i jego połączenia z istniejącymi wydziałowymi bibliotecznymi internetowymi serwisami informacyjnymi (LIS) w celu zaoferowania studentom możliwości pracy on-line z wykorzystaniem treści nauczania oraz odpowiednich źródeł literaturowych.
Słowa kluczowe: centrum dystrybucji, przedsiębiorstwo, MŚP.

完善的管理網絡，通過學術圖書館信息系統的學習

摘要：成功實施Elearning系統帶來了許多好處，教育過程的管理，如果方法正確執行和理解的最終用戶
學生。為此，在過去十年中，各種應用程序已經開發了電子學習開源的。他們可以很容易地安裝，並提供各種配件和選項。本文討論以提供學生有機會與使用教學內容和相關文獻資料工作的上線互動式學習管理系統ILIAS及其與現有的部門的圖書館在線信息服務（LIS）連接
關鍵字：配送中心，企業，中小企業