RAZVOJ SISTEMA ZA UPRAVLJANJE SADRŽAJA ZA UČENJE BAZIRANOM NA OBJEKTIMA ZA UČENJE – SPORNA PITANJA I MOGUĆNOSTI

DEVELOPING LEARNING CONTENT MANAGEMENT SYSTEMS BASED ON LEARNING OBJECTS– ISSUES AND OPPORTUNITIES

Zoran Zdravev, Solza Grceva
Pedagogical Faculty "Goce Delchev" – Stip

Rezime *– Industrija za e-učenje je u očekivanju dana kada bi učitelji i učenici mogli da upravljaju e-učenjem "u letu". To pretpostavlja da se sadržaj učenja može personalizirati, skupiti i koristiti po potrebi. Razvojni timovi bi mogli da sa samo nekoliko klikova jednom kreiraju sadržaj, začuvaju ga u različitim elektronskim formatima i ponovo ga koriste. Ovo bi bilo moguće preko koncepta "Objekta za učenje". Prema nekim profesionalcima iz oblasti e-učenja taj dan je došao, ali prema drugima taj dan je u dalekoj budućnosti. U našem radu istražujemo ovaj koncept i činjenice "za i protiv".*

Abstract *– E-learning industry is looking forward the day when teachers and learners could manage e-learning "on the fly". It's supposed that learning content can be personalized, assembled and accessed on demand. Development teams would be able to build contents a single time, store it electronically in different formats and reuse it with a click on few buttons. This will be possible through using Learning Objects concept. According to some e-learning professionals the day has dawned, but to others it is still a distant future. In this paper we are examining this concept and facts "pro and con".*

1. INTRODUCTION

In [1] Robbins wrote: "*We're in the midst of an e-learning revolution, which brings rapid changes, a myriad of emerging technologies, and greater opportunities to generate significant business returns on e-learning investments. During this period, technology has progressed in a series of evolutionary stages, which have had an increasingly profound impact upon the speed, content ownership, cost, flexibility, and business benefits of e-learning solutions. Reviewing the last five years of market developments reveals the emergence of LCMSs as a platform of choice for many companies seeking fast deployment of e-learning."*

E-learning industry expects the day when teachers and learners could manage e-learning "on the fly". It is a challenge. It supposes that learning content can be personalized, assembled and accessed on demand. Development teams would be able to build contents a single time, store it electronically in different formats and reuse it with a click on few buttons. This turn of events has largely been the result of more affordable computer hardware and software, and, more recently, ubiquitous Internet penetration. Changes happen:

- The Internet is changing the way people work, communicate, interact, undertake business transactions, find information, and the way they teach and learn;
- Corporations have made transition from mainframes to client/server to networked computers;

- Large number of organizations are moving their training and education programs into the web environment;

But all changes have consequences:

- Knowledge workers spend more time sorting out information than actually using it to do their jobs better;
- A user who sets out to learn something that will truly increase productivity and provide the organization with competitive advantage often comes up empty-handed. This inability to access data usually happens for one of two reasons, either the information is improperly stored and indexed, or the user overlooks it among the clutter;

Thus, a solution has been found by developing Learning Object concept, Learning Object Metadata Standards and Specifications, Learning Content Management Systems and Learning Objects Repository. With the growing number of organizations moving their training and education programs into the web environment, there is an increasing demand on high-quality, reusable components – Learning Objects (LO). The demand comes from the realization that the development of high-quality LO is resource intensive and time consuming. There is a wealth of content available in public and private organizations, but either it is not accessible to external users, or it is difficult to find. For this reason there is a need to build Learning Content Management Systems (LCMS) based on Learning Object Repositories (LOR) aimed to establish an infrastructure for collections of high quality Learning Objects. Another issue being addressed at the same time is the development of standards for describing Learning Objects to enable and keep several attributes: portability, accessibility, durability and interoperability. To achieve these goals, each object must be tagged with metadata of information about its object. Metadata have to be standardized. The IEEE Learning Object Metadata (LOM) standard defines a structure for interoperable descriptions of Learning Objects.

The LO, LCMS and LOM don't exist in a vacuum; they are three interdependent components, linked into an indivisible chain [3] (Figure 1).

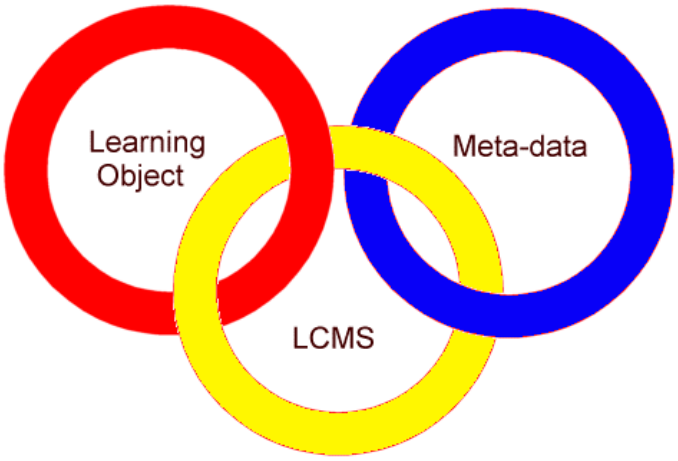

Figure 1

In this paper the basic idea of Learning Content Management System is described. In the next section we provide a view of the evaluation of LCMS. The third section explains the components

of LCMS, and the differences between LMS and LCMS. In the fourth section the concept of Learning Objects is shown. The importance of metadata standards and specifications (LOM and SCORM) is given in the fifth section. Section 6 concludes the paper and gives aims for the future implementations.

2. EVOLUTION OF THE LCMS

Four stages of evolutions were identified [1]:

- Stage 1: Generic content libraries
- Stage 2: Learning management systems.
- Stage 3: Outsourced e-learning platforms
- Stage 4: Learning content management systems.

Before these companies delivered e-learning via CD-Rom or mainframe computers, Companies have created e-learning material with authoring tools which is used up to today.

The growth of the Internet enabled companies to start the development of large, Web-based e-learning content libraries: **"Generic content libraries".** Using a subscription model, companies could subscribe to an entire learning library that would be available 24/7 to all employees. An employee who needed to learn a new skill rapidly could take a Web-based self-study course. Course libraries eliminated the need for distribution of CD-ROMs or paper manuals as resource materials. Also, learners didn't have to wait until the course was available in a classroom format. But these libraries can't provide delivery of a wide range of training solutions.

When companies became aware of the potential for technology-based learning delivered via the Internet, a second class of systems evolved in the marketplace **"Learning management systems".** This system enables companies to plan and track the learning needs and accomplishments of employees, customers, and partners. An LMS can link organizational goals, provide a catalogue of available courses, books, and training events and deliver content in classroom-based or e-learning formats. The system also has the ability to register learners for courses and for other learners' activities. LMS doesn't guarantee that a company will actually deploy e-learning. Many organizations use the LMS to enroll learners in classroom-based events, manage face-to-face training, and report on progress. The LMS will typically launch a library of custom or generic e-learning courses, but is does not provide any mechanism and it is not easy to create and deploy internally developed courses.

Recognizing the inability of many companies to create and deploy e-learning courses with proprietary content, other companies launched and offered **"Outsourced e-learning platforms".** These companies take an organization's learning content, create it, host it, and manage Web-based courses. They provide the outsourcing services to "Webify" course content on their software platforms rather than license the software platform to the user. Because of the dependence on suppliers, organizations using these platforms lack the capability to quickly change content and deploy proprietary content using internal resources. And many companies lose ultimate ownership of their course materials, which, once developed in a Web-based format, become the product of the supplier.

As a forth stage **"Learning content management system"** appears. LCMSs were initially developed for higher education. These systems are designed to enable subject matter experts with little technology expertise to design, create, deliver, and measure the results of e-learning courses

rapidly. LCMS applications fundamentally change the value and economics of e-learning content delivery by offering organizations a scalable platform to deliver proprietary knowledge to individual learners without bearing a prohibitive cost burden.

The LCMS also can provide and offer:

- certification and tracking for individual learners,
- direct measurement and reporting of the results of e-learning performance,
- create and deploy learning in different ways, and flexibility to incorporate those different types of materials, learning methods, and schedules into the learning process.

3. WHAT IS A LEARNING CONTENT MANAGEMENT SYSTEM

In the IDC white paper [4] a Learning Content Management System (LCMS) is defined as a system that is used to create, store, assemble, and deliver personalized e-learning content in the form of learning objects.

LCMS is different from a Learning Management System (LMS). LMS focuses more on the student than on the learning content. LMS schedules and registers students for full online and offline courses, launches e-learning courses and tracks a student's progress through a course. LCMS manages the creation of learning content, manages the personalized delivery of learning content to students and provides more extensive tracking of the student's interaction with learning content.

The components of a Learning Content Management System are shown in Figure 2.

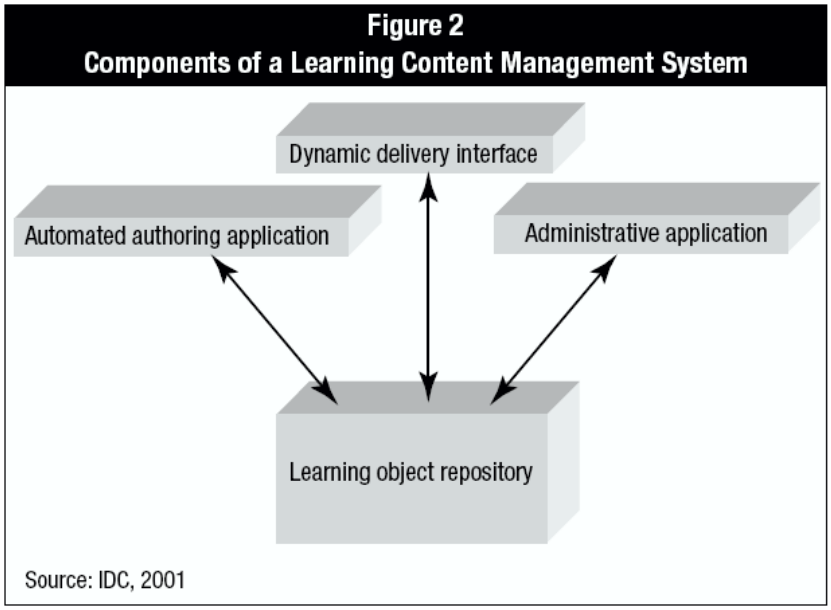

Figure 2

Learning Object Repository: A learning object repository is a central database which stores and manages learning content that has been created by multiple authors. Learning objects from this repository can be delivered individually to learners or assembled into larger learning modules or full courses.

Automated Authoring Application: An automated authoring application is used to create reusable learning objects that are managed by the repository. Templates are typically provided to authors that incorporate instructional design principles.

Dynamic Delivery Interface: A dynamic delivery interface is used to serve up learning objects based on learner profiles, pretests and/or use queries. It also typically provides user tracking, links to related sources of information and supports multiple assessment types with user feedback.

Administrative Application: An administrative application is used to manage students records, launch e-learning courses from course catalogs, track and report student progress and provide other basic administrative functions.

Often users and learners have a feeling that an LMS and an LCMS are the same [14]. Both an LMS and an LCMS can manage course content and track learner performance. Both tools can manage and track content at a learning object level, too. An LMS, however, can manage and track blended courses and curriculum assembled from online content, classroom events, virtual classroom meetings and a variety of other sources. Although an LCMS doesn't manage blended learning, it does manage content at a lower level of granularity than a learning object, which allows organizations to more easily restructure and repurpose online content. In addition, advanced LCMSs can dynamically build learning objects based on user profiles and learning styles. The following chart summarizes the capabilities and differences between the two systems [14].

	LMS	**LCMS**
Who benefits?	All learners; organization	Content developers; learners who need personalized content
Provides primary management of	Learner performance; learning requirements; learning programs and planning	Learning content
Manages e-learning	Yes	Yes
Manages traditional forms of training, such as instructor-led	Yes	No
Tracks results	Yes	Yes
Supports learner collaboration	Yes	Yes
Includes learner profile management	Yes	No
Allows HR and ERP systems to share learner data	Yes	No
Schedules events	Yes	No
Offers competency mapping/skill gap analysis	Yes	No
Includes registration, prerequisite screening, and cancellation notification	Yes	No

Creates test questions and test administration	Yes	Yes
Supports dynamic pre-testing and adaptive learning	No	Yes
Supports content creation	No	Yes
Organizes reusable content	Yes	Yes
Includes workflow tools to manage content creation process	No	Yes
Develops content navigation controls and user interface	No	Yes

4. LEARNING OBJECTS

Concept of Learning Objects is crucial for function of the LCMSs. As practice is evolving, a number of different definitions for Learning Objects have emerged [13].

Definition given by IEEE LTSC (Learning Technology Standards Committee) [6] is “Learning Object is defined as any entity, digital or non-digital, that can be used for learning, education or training”. Albert Ip, Alison Young and Iain Morrison [7] define Learning Object as “A computer mediated or delivered module or unit, that stands by itself, which provides a meaningful learning experience in a planed learning context”. Most alternative interpretation is given by Stephen Downes: “Learning object must be, at least, a digital resource. It must contain pedagogical intent. And finally, that what makes something a Learning Object is not what it is, but rather, how it is used.”

We use David Wiley's definition [12] : ”Learning Object presents any digital resource that can be reused to support learning.”

According to this definition, Learning Objects are digital resources, modular in nature, that are used to support learning. They can vary in size, scope and level of granularity. Because the focus of Learning Objects research and development has been on maximizing reusability, Learning Objects are generally understood as digital resources. (Most non-digital resources, known as "rival resources", cannot be used by more people at a time). Digital resources available on a computer network or on Internet can be used simultaneously by many people ("non-rival resources"). Example: book from the library can be checked only by one person, another person cannot use it; but, file available on a website can be used by many people at one moment. Being digital resources, Learning objects can include, but are not limited to simulations, animations, text, Websites, tutorials, quizzes, multimedia, video clips, sounds, pictures, illustrations, diagrams, graphs, maps, charts and assessments.

All that digital resources are vast collection of data, bits and bytes of information [10]. Therefore, a clear distinction should be made between data, an information object and Learning Object. Data are stored in databases and have meaning in relation with other data in the database. An information object is a digital resource that does not include instructions (example: short video clip without information about who developed it, how to use it, what is shown, why it is shown, what does it outcome, assessments etc.). Information objects are usually stored in digital libraries.

Learning Objects often are confused with information objects. True Learning Objects include learning objectives and outcomes, assessments, and other instructional components. Most Learning Object Repositories and digital libraries contain a mix of Information and Learning Objects. In fact, there is no clear distinction that separates the two.

Visual metaphors help to illustrate the relationship between Learning Objects and the instructional context. Formerly, LO was compared to the versatile children toy: LEGO blocks. LEGOs can be assembled into imaginative wholes by anyone. LEGOs are portable, sharable, durable, and interoperable. They are standardized. But, this is a "dangerous" simplistic comparison [11]. He proposed the more sophisticated metaphor of the atom. Unlike LEGOs, not every atom is combinable with every other atom. Assembly requires expertise and design strategy – to make sense. He spoke about something like "learning crystal" in which individual Learning Objects are combined into useful structure.

What constitutes a Learning Object? What is the acceptable size and scope of the Learning Objects? Those are the questions critical to creating a usable, scalable database (repository) of objects. Instructional designers have to build small instructional components that can be used a number of times in different context. Consequently, LO are self-contained learning components, and they are stored and accessed independently, LO can be re-assembled to create new courses to form individual learning paths. To success this idea, "the size of a Learning Object is defined as a meaningful division of learning that can be accomplished in one sitting" [9].

5. METADATA STANDARDS AND SPECIFICATIONS

Because many Learning Objects are non-textual (animations, pictures, video clips, audio) Locating Learning Objects within a digital library can be a daunting task without the help of metadata. Metadata is information about an object, whether it is physical or digital. As the number of objects grows exponentially the lack of information or metadata about objects places a critical and fundamental constraint on ability to found, discover, manage and use objects.

5.1. LOM

Standard for Learning Object Metadata (LOM) addresses this problem by defining structure for interoperable description of Learning Objects. IEEE Learning Technology Standards Committee defines this Standard as a multi-part standard that specifies LOM. A metadata for Learning Object describes relevant characteristics of the Learning Object to which it applies. Such characteristics are grouped in these categories: general, life-cycle, meta-metadata, educational, technical, rights, relation, annotation, and classification.

Standard for Learning Object Metadata (LOM) does not define how a learning technology system represents or uses a metadata instance for a Learning Object. The purpose of this standard is to facilitate search, evaluation, acquisition, and use of Learning Objects, for instance by learners or instructors or other automated software processes. This multi-part Standard also addresses the possibilities for sharing and exchange of Learning Objects. It is performed by enabling the development of catalogues and inventories while taking into account the diversity of cultural and lingual contexts in which the Learning Objects and their metadata are reused.

5.2. SCORM

Sharable Content Object Reference Model - SCORM is a collection of standards and specifications adapted from multiple sources to provide a comprehensive suite of e-learning capabilities that enable interoperability, accessibility and reusability of Web-based learning content.

The organizations supporting current efforts to implement LO concept were organized by the US Department of Defense (DoD) and the White House Office of Science and Technology Policy (OSTP). In 1997 these two organizations launched the Advanced Distributed Learning (ADL) initiative whose mission is to accelerate large scale development of innovative learning methods to meet the learning needs of the military, as well as the nation's commercial workforce. Their goal is to maximize human performance and effectiveness through advanced learning technologies while simultaneously reducing development and delivery costs. To accomplish their mission, the Department of Defense established the ADL Co-Laboratory (Co-Lab) in Alexandria, Virginia. Its role is to integrate progress being made in the fields of knowledge management, e-learning, and performance support for "research, development, and assessment of common tools, standards, content, and guidelines" in support of the ADL initiative (http://www.adlnet.org/).

In addition to the initial Co-Lab in Alexandria, two other labs have been established. First in Orlando (primarily to promote collaborative ADL efforts with DoD components and military services) and second one with the University of Wisconsin and the Wisconsin Technical College System to promote collaboration among **academic institutions**.

The **Sharable Content Object Reference Model (SCORM)** is a set of guidelines composed of interrelated specifications for technologies and practices that, when implemented consistently by technology vendors, content owners, and content users, will achieve the goals of the ADL. These standards describe the necessary conditions for content created by different organizations to be interoperable with delivery systems created by different technology companies. Visit http://www.adlnet.org/ for a more detailed description of the SCORM.

SCORM is not a theoretical model but it is a specification that bridges the gap between research and development activities and practical usage in industry. In the process of creating the evolving SCORM, the ADL is working closely with **international standards bodies** that play an important role in the development and implementation of advanced learning practices. Some of them are:

- Alliance of Remote Instructional Authoring & Distribution Networks for Europe (**ARIADNE**)
- Aviation Industry CBT (Computer-Based-Training) Committee (**AICC**)
- IEEE Learning Technology Standards Committee (**IEEE LTSC**)
- IMS Global Learning Consortium, Inc. (**IMS**)

Large organizations including Sun Microsystems, Microsoft and Cisco have already adopted the SCORM standards for their on-line training programs and Microsoft, Oracle, IBM and other technology industry leaders are implementing SCORM standards in a number of their applications. Microsoft's PowerPoint and FrontPage versions support the SCORM standard (starting from Office-XP).

6. VISION

On 20th October, 2006 ADL released the latest version "SCORM 2004 3rd Edition". That was one of the reasons to continue work on this issue. We were glad to see that things are moving forward.

"The vision predicts large repositories of interoperable, context-free, reusable content and management systems to handle the content. The practicality is that "most customers aren't in a position to take advantage of [the technology] today. It represents a big mental shift." says Mortimer in [3].

In the past few years there were different opinions and comments. They are still present. Some say that Learning Objects concept is only for large systems. Other say that the concept is wrong and those who have opportunity (budget and power) creates whatever they like about e-learning. Others are suspicious those efforts will have no results for many years, and that would mean that companies will not have profit.

More believe the concept will function, but it needs more time for implementation. The first need is a transition of "knowledge providers" and "knowledge consumers" from using traditional learning technology to e-learning technology. It means the use of Internet and Web technology must be dominant, but most of the companies are not prepared for the challenge of using Web for e-learning. In the end everything is an economic issue.

We support the idea that the issue of Learning Objects and the promises of the e-learning industry and LCMS vendors from technical point of view can be realized. But is it useful and will it be implemented? It depends from company to company. Some of them are ready, but most of them are not. Those who are ready to accept this concept should be prepared for hard work and a "long ride". Generally speaking, the above mentioned is feasible but problems appear with its localization in non-English speaking regions and areas that need repository for small number of users. Thus the work will be even harder and the ride even longer for the people who will work on such localization.

REFERENCES

[1] Shelley R. Robbins, "**The Evolution of the Learning Content Management System**", Learning Circuits, April 2002, http://www.learningcircuits.org/2002/apr2002/robbins.htm, last visited 22-01-2007

[2] Ryann K. Ellis, **"LCMS Roundup"**, Learning Circuits, August 2001, http://www.learningcircuits.org/2001/aug2001/ttools.htm, last visited 22-01-2007

[3] Lori Mortimer, **(Learning) Objects of Desire: Promise and Practicality**, Learning Circuits, April 2002, http://www.learningcircuits.org/2002/apr2002/mortimer.htm, last visited 22-01-2007

[4] Michael Brennan, Susan Funke, and Cushing Anderson, **The Learning Content Management System: A New eLearning Market Segment Emerges**, An IDC White Paper, May 2005

[5] Zoran Zdravev, Solza Grceva, **"Developing Learning Objects Systems through implementation of Learning Object Metadata Standard",** The Second International

Conference on Informatics, Educational Technology and new Media in Education, Sombor, Yugoslavia 2005, Proceedings of papers, volume 1, pages 273-279

[6] IEEE LTSC, **Standard for Learning Object Metadata (LOM),** IEEE1484.12.1

[7] A. Ip, A. Young, I. Morrison, **Learning Objects - Whose are they?** *Proceedings of the 15th AnnualConference of the National Advisory Committee on Computing Qualifications, 2002,* ISBN 0-473-08747-2 Pages 315-320

[8] Mow Joanne, **Learning Objects and Instructional Design,** 2002, The Herridge Group, http://www.herridgegroup.com/pdfs/Learning Objects & Instructional Design.pdf, last visited 23-01-2007

[9] Metros E. Susan, Bennett Kathleen **Learning Objects in Higher Education**, EduCause, Center for Applied Research, Research Bulletin Vol. 2002, Issue 19 www.educause.edu/ecar/

[10] Ontario, Canada, Ministry of Education **White Paper for a Learning Object Repository (for Discussion Purposes),** 2001, http://oknl.edu.gov.on.ca/eng/pdf/1_3_13_1.pdf

[11] Wiley David, **The Post-LEGO Learning Object**, 1999, http://wiley.ed.usu.edu/docs/post-lego.pdf, last visited 23-01-2007

[12] Wiley David, **Learning objects - a definition**. (2002) In A. Kovalchick & K. Dawson (Eds.) *Educational Technology: An Encyclopedia*. Santa Barbara: ABC-CLIO. http://wiley.ed.usu.edu/docs/encyc.pdf , last visited 23-01-2007

[13] Zdravev Zoran, Grceva, Solza (2003), **Creating Learning Objects**, *Annual Miscellaneous Collection, Pedagogical Faculty "Gotse Delchev" - Shtip*

[14] Leonard Greenberg, **LMS and LCMS: What's the Difference?,** Learning Circuits, December 2002, http://www.learningcircuits.org/2002/dec2002/greenberg.htm, last visited 24-01-2007