# Supporting synchronous communication services and delivering SCORM lessons in the Greek language through open source LMSs

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*Abstract:* - Nowadays, open source e-learning applications are complete and reliable solutions that are in no case inferior to the commercial ones. Though gratis, they offer unique advantages such as support of various operating systems and the chance to experiment with their source code. Additionally, there is a vast community of developers willing to aid users in installing or using these systems. Besides the fact that they are of excellent quality, open source Learning Management Systems (LMSs) such as Dokeos, Moodle, ILIAS and ATutor can be easily adapted to new demands and challenges thus gaining popularity. This paper initially presents an authoring methodology of SCORM lessons in the Greek language which can be applicable to any of the aforementioned systems. Moreover, it focuses on Dokeos and proposes a new extension of this system in order to meet synchronous communication requirements such as videoconferencing and streaming video.

*Key-Words:* - Learning Management Systems, Localization, SCORM, Streaming Media.

## 1 Introduction

E-learning is blossoming into the most effective paradigm for conveying knowledge among distributed heterogeneous audiences. Mainly due to its worldwide acceptance and popularity, the World Wide Web is the natural vehicle for this kind of knowledge dissemination, as it can be inferred by looking at the growth of distance learning programs offered by universities and colleges all over the world. Learning Managements Systems (LMSs) stand for the applications controlling the management, observation and transmission of educational material through the Internet. So far, numerous lecturers in complex academic environments have successfully developed educational websites through the utilization of the aforementioned systems. In order to develop a LMS effortlessly and quickly while keeping costs at a low pace, many instructors tend to use off-the-shelf applications, that is freely and openly distributed software. Applications such as Moodle [1], A-tutor [2] and Dokeos [3] abide by the latest standards in e-learning, thus allowing learning content reusability and parameterization of several user interface attributes (language, appearance, services). In an effort to both address the needs of University of Macedonia's multimedia lab and experiment on learning objects and their specifications, the authors decided to install and operate a modified version of the Dokeos LMS.

This paper initially describes the theoretical framework of modern standards and specifications in e-learning. The distinct features of Dokeos that led to its selection are then highlighted, followed by an introduction to the problems that occurred after its installation. Section 5 focuses on applications for synchronous communication in learning environments and section 6 illustrates the actions carried out in order to enhance Dokeos with these functionalities.

## 2 E-learning standards - SCORM

The current most widely acclaimed e-Learning standards development organizations are:

- Aviation Industry Computer-Based Training Committee (AICC).
- Instructional Management System Global Learning Consortium, Inc. (IMS).
- Institute of Electrical and Electronic Engineers (IEEE).
- Advanced Distributed Learning (ADL) initiative.

Recent development of innovative specifications and standards has played a vital role in the reproduction of many drastic LMSs. Their common feature is the fragmentation of learning material into pieces called Learning Objects (LOs) [4]. LOs contribute in the production of interoperable, accessible, durable and most importantly re-usable

course elements [5]. Reusability equals to portability across diverse LMSs and discoverability among content consumers, provided that said standards are widely adopted.

The Sharable Content Object Reference Model (SCORM) is one of the most acclaimed e-learning specifications and is therefore supported by most modern LMSs. Established in 1997 by the American Department of Defence in collaboration with a number of American universities and firms, ADL [5] introduced SCORM aiming at encouraging and supporting small, reusable, sharable course content, discoverable via metadata descriptors [6]. The SCORM metadata information model is a reference to the IMS learning resource metadata information model, which itself is based on the IEEE LOM standard [4]. The SCORM metadata also adheres to the IMS learning resource metadata XML binding specification and provides an XML representation for the SCORM metadata information data model.

# 3   Dokeos LMS

## 3.1 Features
Seeking an integrated e-learning solution, we have decided to focus on open source software mainly because of its unique experimentation capabilities. In order to opt for an open LMS that was both user friendly and SCORM compliant with Greek language support, we evaluated a series of applications including ATutor[2], Dokeos[3], MOODLE [1] and ILIAS [8]. Dokeos was finally selected because it is a system that offers easy management and maintenance along with rich documentation. Furthermore, it is platform independent, SCORM compliant and exceptionally user friendly when it comes to authoring or viewing.

Dokeos offers all the features of a typical LMS such as:
- Network services
  - User authentication (user registration, security settings)
  - Role and permissions management (discrimination between administrator, tutor, assistant tutor, moderator and student)
  - Website management (creation of units, module categories, student groups, announcements)
- User community tools
  - Activities agenda
  - Fora, Chat
  - E-mail incorporated services supporting bulk e-mail to student groups
  - Reference section with links to webpages
- Course preparation and uploading services
  - Course authoring by tutors, import of SCORM courses
  - Learning path builder
  - Questions authoring for the creation of tests
  - Real-time presentation of learning material (courses and tests)
  - Monitoring of student submitted coursework and assignments
- User activities tracking and logging services
  - Tracking of course learning paths followed by students
  - Tracking of elapsed time in each course unit by students
  - Results of student evaluation tests
  - Maintenance of user profiles

## 3.2 Setup
Dokeos is an open source LMS accompanied by Free Software Foundation's [7] [10] General Public License [9]. It is implemented in PHP and requires Apache acting as a web server and mySQL as a Database Management System. These requirements where satisfied using the open application EasyPHP which installs and sets easily both Apache and mySQL in a system running Windows 2003 Server.

An adjustment that had to be performed manually regarded the maximum size of files to be uploaded. Since the used educational material (presentations, course notes etc.) extended the default setting, we had to increase it to 100 MB through altering the "php.ini" file in the "conf_files" folder. Optionally, someone could also alter the default mySQL passwords so as to increase security.

Unfortunately, Greek characters were not displayed properly in all browsers after installation (Figure 1). In order to address this imperfection, we had to perform the extensive substitution of the "htmlentities" function with "htmlspecialchars" within the source code of 56 files. This extra task can be readily performed with the aid of numerous text editors. Finally, the user interface had to be customised in order to correspond to the university's website layout (background, logos, headers, footers etc.).
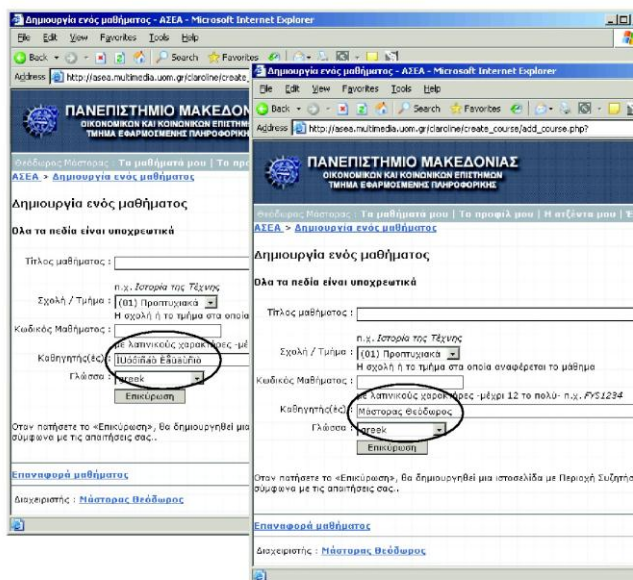
**Figure 1.** The problem of Greek characters in displaying

## 4  Addressing SCORM problems

### 4.1 Localization

Compared to the rest of the evaluated LMSs, Dokeos was the sole system displaying both course contents and the LOs (also called SCOs in the SCORM specification) tree structure on the same single screen. This structure acts as a user-friendly navigational tool specifying the student's learning path.

Dokeos is not fully SCORM compliant, therefore tolerant enough to courses created in different SCORM versions. At the same time, it supports the tracking of numerous course elements referring to the time spent in a course section, to the score achieved in a test and to whether a section was successfully completed.

### 4.2 Authoring problems

The selected authoring software for the preparation of SCORM courses was Reload [11], a powerful and open application also recommended by ADL. However, as Reload does not support the creation of self-assessment tests, a divert application had to be employed. Trivantis Lectora [12] proved to be the most eligible tool for this purpose. Lectora allowed the generation of tests in the form of small autonomous SCORM courses that were included into the main course by Reload.

Nevertheless, these courses still failed to display Greek characters due to the declaration of UTF-8 as the codepage encoding (Figure 2). The solution to this problem requires two separate steps following course authoring:

- The available answers in the Lectora multiple choice tests should contain only their corresponding number (e.g. "1", "2", "3" etc.). Greek characters should either be avoided or placed in separate floating text boxes.
- The "imsmanifest.xml" file created by Reload is UTF-8 encoded and therefore has to be converted to ANSI. This can be achieved by replacing the tag <?xml version="1.0" encoding="UTF-8"?> found in the file's first line with <?xml version="1.0" ?>. Finally, the file must be saved with the encoding attribute set to ANSI.
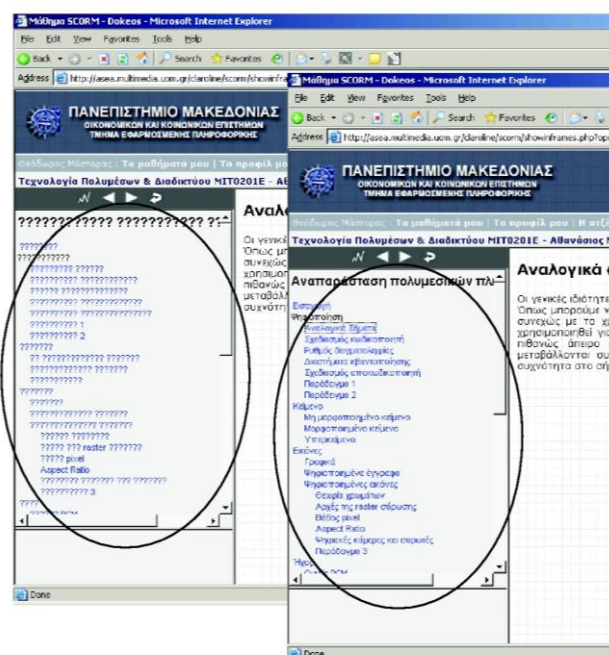


**Figure 2.** Greek characters displaying in SCORM

## 5  Synchronous communication in e-learning

E-learning systems are mostly based on asynchronous communication granting students and teachers with time and space independence.

However, this type of communication can sometimes become a burden for services such as e-fora, e-mail etc. due to possible long time intervals. These communication interruptions can lead to poor learning experiences. On the other hand, synchronous communication can overcome this

problem, enhancing the learning process. The most obvious advantage of 'real-time' communication is that students are able to pose questions and receive feedback in real time. They do not have to wait for long periods and as a result the learning process is not constantly interrupted.

The most obvious inadequacy of synchronous communication is that both sides (teachers - students) are no longer time independent as the time of logging into the system must be specified in advance. Another reoccurring problem regards the time interval between the teacher's reply to questions posed by students. Occasionally, this time can be longer than expected, therefore leading the students to the wrong conclusion that the teacher is no longer taking part in the chat. In order to perform this sort of live chats successfully, certain rules should be followed by all participants.

Facilitating streaming audio and video technologies proves to ameliorate the situation. Though demanding in terms of both technology and expertise, streaming is considered as one of the most effective means for delivering a lecture through the World Wide Web. Traditional lecture delivery remains a widely used teaching method that can be applied to a vast number of courses. Several times lecturers are trying to explain some rather complex subjects aided solely by a slideshow. When it comes to the Web, video streaming technologies become the only technological medium for implementing this traditional yet quite efficient course delivery method.

The use of audio and video streaming, although demanding in terms of bandwidth, is the best vehicle towards delivering a lecture through the web in an effective way. Streaming media minimize the client's waiting time since the transmitted material does not have to be downloaded completely for viewing.

# 6    Integrating synchronous communi- cation services in Dokeos

## 6.1 Data streaming
Windows Media [13], Real Media [14] and QuickTime [15] are the most widely accepted streaming technologies. The proposed system utilizes Microsoft Windows Media platform mainly because the latter was included in the Microsoft Internet Information Server (IIS) which was already in use.

Microsoft Windows Media Server enables users to record the transmitted content with high quality, which proves to be quite beneficial to students attending an online lecture.

The Windows Media platform consists of three parts:
- Windows Media Tools for content preparation (audio and video),
- Windows Media Services for transmission and
- Windows Media Player for playback.

The key features [16] of Windows Media Technologies can be summarized as follows:
- Wide bandwidth range and multiple bit rate encoding. A different bit rate can be encoded according to the individual need.
- Intelligent streaming. Media server can monitor and automatically adjust the bit rate of each client stream according to current bandwidth so that end users receive the highest quality stream.
- Built-in multicast service.
- Wide availability for end user due to their support of both Internet Explorer and Media Player.
- On-demand / Live Presentation.

## 6.2 Previous services
Dokeos facilitates synchronous communication through the "conference" and "chat" services. However, both services present several limitations. For example, instant messaging through "chat" is rather slow as it requires the continuous and almost annoying refresh of screen information. Additionally, "chat" supports only text messages. As for video streaming, it is up to the instructor to define a link to some streaming server without any further assistance or denote a link to the available on-line video lectures. Finally, transmitted video appears in a new window which overlaps the system's user interface, thus causing frustration on users.

## 6.3 Extending Dokeos
In order to cope with the aforementioned problems, we had to modify the source code of the "conference" section. In particular, the files located in the "claroline\online" folder were altered so as to support the following functionalities:
- Video-conference. After installing the video-conference server CUseeMe [17] on a separate computer, we have appended an additional link responsible for the automatic launch of a video-conference to the "conference" section. Each

learning module has its own virtual conversation room for the students to choose from (Figure 3) provided that they have the CUseeMe client already installed on their computers.
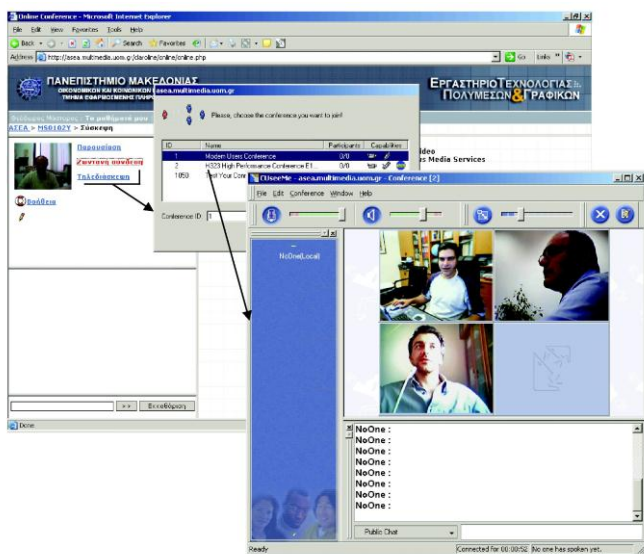


**Figure 3.** Video-conference under the Dokeos environment

- Delivery of video lectures through streaming. Showing a streamed lecture within the Dokeos window (Figure 4) requires the employment of a computer running Microsoft Windows Media Services. We have inserted an additional link to the "conference" section's configuration panel, leading to the administration page of the Media Server's repository. Instructors can then add a publishing point, i.e. a reference to a camera or a video file stored in a shared folder. There is a corresponding shared folder for any lesson created in the Dokeos environment. Following the previous steps, the assignment of a specific publishing point to a lesson becomes an effortless task.

Video transmission is utilized for the implementation of two novel course delivery models:
- "Virtual Classroom" (live video) and
- "On Demand delivery" (pre-recorder video)

The student watches the video stream as it is transmitted through the Media Server. The latter receives the encoded video live from the lecturer's office or the actual lecture hall.
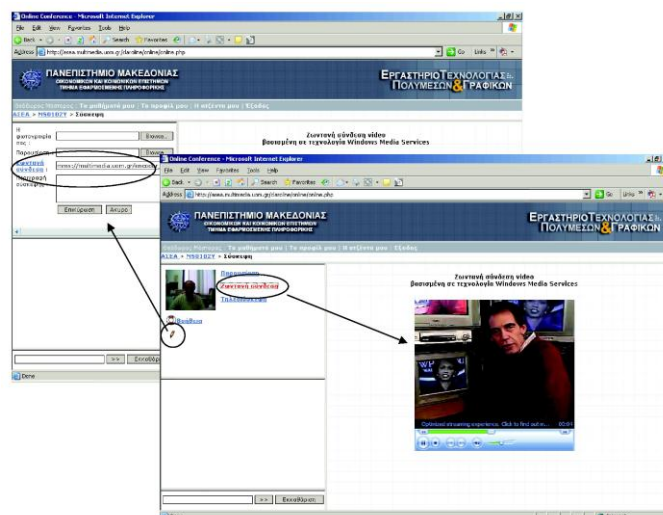


**Figure 4.** Showing streaming video inside the Dokeos window

## 7 Conclusion – Future work

This paper illustrates an extension of the Dokeos LMS, based on identified shortcomings that limit its functionality. We have endeavoured to adapt the system's appearance and behaviour to our custom needs, while successfully addressing the hellenization issue. Moreover, the proposed extension provides direct support for synchronous communication services, namely video-conference and delivery of video lectures through streaming.

Additionally, we have presented a way to confront the problems of system customization and localization by modifying the application's source code and SCORM courses "imsmanifest.xml" file in order to display Greek characters correctly.

The prepared courses are platform independent due to their SCORM format. The experience gained so far from working with Dokeos, enables us to deal, if necessary, with similar issues in different LMS.

Dokeos has been serving the needs of two academic courses, "Introduction to Multimedia Systems" and "Introduction to Computer Graphics" respectively for over a year, receiving satisfactory feedback from both instructors and students. This positive response has led to the development of more advanced SCORM lessons which are expected to become available in the next academic semester. We intend to automate the creation of groups of video-lectures and virtual conference rooms so that tasks currently performed by the administrator could be done either automatically or by the corresponding lecturer. Future plans include further extension of Dokeos with the addition of more functions,

followed by the conduction of an evaluation of the proposed system.

*References:*

[1] Moodle, 2005. Available from http://moodle. com

[2] ATutor Documentation, 2005. Available from http://www.atutor.ca/atutor/docs/index.php

[3] Dokeos Documentation, 2005. Available from http://www.dokeos.com/documentation.php

[4] LTSC/IEEE, "final 1484.12.1 LOM Draft Standard", 2002. Available from http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf

[5] ADL, Advanced Distributed Learning, "Sharable Content Object Reference Model (SCORM) 2004 2nd Edition", 2004. Available from http://www.adlnet.org/downloads/70.cfm

[6] Semrau Penelope, Boyer A. Barbara, "Venturing Into SCORM With a Government Project", Proceedings from the *19th Annual Conference on Distance Teaching and Learning*, 2003. Available from http://www.uwex.edu/disted/conference/Resource_library/proceedings/03_45.pdf

[7] Open Source Initiative, 2005. Available from http://www.opensource.org/docs/definition.php

[8] ILIAS, 2005. Available from www.ilias.uni-koeln.de

[9] General Public License, 2005. Available from http://www.gnu.org/copyleft/gpl.html

[10] Free Software Foundation, 2005. Available from http://www.fsf.org/

[11] Reload, "Metadata and Content Packaging Editor", 2005. Available from http://www.reload.ac.uk/tools.html

[12] Trivantis Lectora, 2005. Available from http://www.lectora.com/

[13] Microsoft Windows Media, 2005. Available from http://www.microsoft.com/windows/windowsmedia/default.asp

[14] Real Media, 2005. Available from http://www.realnetworks.com/

[15] Apple Quick Time, 2005. Available from http://www.apple.com/quicktime/

[16] Bill Birney, "Streaming from a Web Server", Microsoft Corporation, June 2003. Available from http://www.microsoft.com/windows/windowsmedia/howto/articles/webserver.aspx

[17] CUseeMe, 2005. Available from http://www.cuseemeworld.com/