

Diplek: an open educational Platform that supports the composition of learning, management and communication services.

C. T. Rodosthenous^a, A. D. Kameas^b, P. E. Pintelas^a

^aDepartment of Mathematics, University of Patras, Greece, ^bHellenic Open University, Patras, Greece
chrodos@upatras.gr, kameas@eap.gr, pintelas@upatras.gr

Abstract – This paper presents Diplek, a Learning Management System (LMS) that addresses the needs of novice users, educators and students. The development of Diplek is based on a service oriented architecture. Among the many services offered by the platform, one can distinguish the innovative Video recording service and the Course creation service that enable instructors to import any type of Learning Object and associate it with metadata. Diplek offers a friendly user interface with dialogs and wizards that help users deal with difficult and time consuming tasks. The platform's architecture (not web-based) enables it to be deployed in both internet and internet-less communities.

I. INTRODUCTION

A Learning Management System (LMS) is a software program or integrated platform that contains a series of services and tools to support a number of activities and course management procedures [1]. Nowadays numerous LMS are available in the market; a few more, like Moodle, Sakai, Atutor, Claroline etc., are under development by the open source community. Despite the many tools and services offered by the LMS, a number of limitations and disadvantages were reported from users and researchers:

1)The platform complexity and difficulty of use require the continuous Information technology (IT) support and hence cause a significant increase of total spending in new technologies [2].

2)Lack of tools for proper monitoring the students' activities throughout the session and course duration [3].

3)The dependence on internet and web technologies most of the platforms have, obstruct the deployment of distance learning services to internet-less communities and institutions

A variety of LMS/CMS have already been adopted by educational institutes worldwide; some prefer free and open source solutions and some others rely on proprietary software solutions that come with guaranteed support and helpdesk. The need for standardization led a lot of community developers to pursue a way to standardize most of the LMS services. The results of these efforts are reflected in : a) standards of e-Learning architecture (e.g. the IEEE LTSA, Learning Technologies Standard Architecture), b) description of learning objects meta-data based on shareable XML-based data structures (e.g. through the IEEE LOM specification) and c) the assessment and evaluation of user performance (e.g.

through the IMS QTI, Question and Testing Interoperability Schemas). The above specifications enable the common description of learning units, questions and tests, learner profiles, etc, so that they can be easily interchanged between different applications [4].

A further study of the above specifications led to four main categories of services a LMS should offer to its users. These categories include services for:

- Communication between learners and instructors
- Adaptation - Personalization - Extensibility
- People Grouping and General course Coordination
- Monitoring learners' achievements and progress during a course

The purpose of this paper is to describe the design and services of Diplek, an educational platform that uses to support the needs of educators with reduced IT competence throughout the main phases of course management lifecycle. Most LMS simplify only the services that relate to the content management process; nevertheless, educators have additional needs, such as, to monitor a student's progress with means that can be easily handled by a typical non IT specialist teacher and to communicate with students in real time. Diplek offers a special tool for monitoring purposes, which records a student's learning session in video format; this recording can be interpreted at a later time by the educator to extract conclusions about the student's progress and the course's contribution in achieving its purpose. Moreover, the system can be operated without an internet connection or a web browser. This flexibility comes in handy in situations where the equipment is old and the connection between workstations is limited to a LAN. Services that require internet connectivity like "My mail" and "Live chat" are automatically switched to LAN functionally so that communication between users can be conducted normally at local level.

This paper is structured as follows. In the next section, the architecture of Diplek is described. Then, the way the system encompasses Learning Objects and the other services it offers to its users are discussed. Finally, the evaluation services are presented in a separate section.

II. DIPLEK PLATFORM ARCHITECTURE

The Diplek platform adopts a 3-tier architecture "Fig. 1,". In order to simplify the overall process, the platform operation is

composed of group of services offered by several autonomous components that cooperate with each other and give the user the look and feel of a modern classroom. Users type their credentials and authentication service processes them. Each user role has a different access level; users are classified into students, educators and administrators.

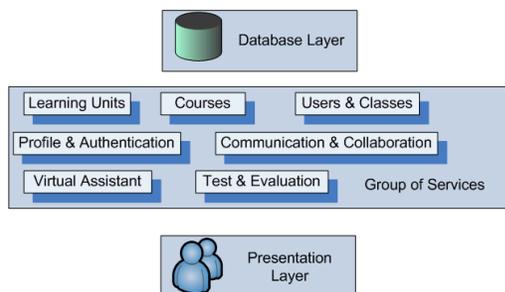


Figure 1- Layer Schema

A. Platform installation and deployment

Diplek is intended to be installed in both organizational-educational environments and home environments. In the first case, a server is needed to host the platform’s database where the educational material and user data are stored. This database can be made available through the internet so that the client workstations can connect to it from any point in the world. This kind of installation is suitable for schools and universities, where students are divided into classes and each class is assigned to a group of educators. Each user (student & educator) can connect to the platform through a local area network or through the Internet. Each client workstation needs to have a Diplek client installed in order for the platform to function properly.

In the second case, where Diplek is installed in a home environment, the users’ workstation acts both as a client and a server. That means that the platform is installed locally and can serve users connected to that workstation only. This kind of installation is suitable for users who cannot gain access to a permanent network connectivity.

Diplek comes with an automated configuration utility that helps the system administrator to perform easy platform installation.

B. Diplek Layers

Diplek is using a service oriented architecture [5]. This design enables the transparent addition of extra functions after the platform is deployed thus offering users new tools and services.

The services layer is the connecting link between the database and the presentation layer. Before content is displayed to the user, it’s filtered and rearranged by the different group of services that intervene.

Platform services are made available to users according to the user level they have. The authentication service is responsible for distinguishing which user runs what service and sets the level of functionality of the service.

III. LEARNING OBJECTS & METADATA

A Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional context [6]. One of Diplek’s key functions is the storage and cataloging of educational material. Instructors can import Learning Objects into Diplek’s main repository and accompany them with metadata.

The capability to associate metadata with Learning Objects makes Diplek a powerful tool for easy search and indexing. Metadata [7] are conventionally defined as data about data, information about information, and are used to describe document contents and structure, and to provide information about accessibility, organization of data, relations among data items, and the properties of the corresponding data domains.

Diplek uses IEEE LOM standard for its learning object repository. The reason for choosing LOM among many other well defined and documented standards is that it fully describes both the educational and technical aspect of a Learning Object. Although LOM contains a large number of attributes, Diplek requires only a small set of basic attributes to be inserted in order to allow a Learning Object to be catalogued. In this way, educators are not obliged to fill the complete form and hence can save time. The use of IEEE LOM makes Diplek Learning Object repository easy transferable, interoperable and searchable.

A. Importing Educational objects into the platform

Before creating a course, educators need to insert educational material to the learning object repository. Diplek provides an easy to complete wizard for novice users, which is divided into four steps according to the categories of metadata schema; general, life cycle, educational and technical attributes. After completing the wizard the final step is the inserting of the Learning Object. Educators can insert any type of educational material, like multimedia presentations, sounds, WebPages, applications, archives, games e.t.c . Diplek accepts all file formats. One of the main advantages of the platform is the ability to import any kind of material or even software, as long as the appropriate viewer is installed on the client’s machine. In this way, all educational material can be used without any modifications or limitations.

Diplek is not an educational material creation software; it is a platform that utilizes all the available educational material in order to present it to the trainees or students. So importing the educational material is just the first step of creating a course for learners to use it. The second step is finding the appropriate material that will be presented to learners. To do so, a search tool is available that queries the platform’s learning object repository using criteria based on learning object metadata (type, difficulty, level of education, language, keywords, topic e.t.c.). All Learning Objects that match the required criteria can be selected from the list. When a Learning Object is selected, it is copied in a new list. This list contains all the candidate educational material to be used for the course presentations.

B. Creating powerful presentation from Learning Objects

Course presentation is the final step of preparing a course. These presentations must not be confused with the usual slide show presentations. A course presentation is an organized structure of learning units categorized in such a way so as to serve the group's educational needs. All educational units used to form the presentation can be accessed by double clicking the mouse on their icon. These presentations are assigned to groups or specific students. The ability to distinguish what each user is viewing-using is a vast advantage since the educator has the ability to alter a presentation/course according to each user special needs.

Diplek supports the creation of course presentations with an easy to complete wizard.

First, educators fill up the general course details like title, description e.t.c. These details are shown to the student as an introduction text when the presentation is selected.

Next, follows the creation of learning units. Each learning unit is a set of Learning Objects. So, a learning unit can be a book chapter, a lab experiment, e.t.c . It's up to the educator to choose how to present a course. In this form, educators simply define the learning units by entering the title of their choice

The final stage is the distribution of Learning Objects to the corresponding learning units. A Learning Object can be used in one or more learning units or presentations. Each educational object assigned in a presentation is represented by an icon "Fig. 2,". Depending on the type of object, each icon has a different image (a generic icon is used to represent object types not recognized by the filesystem).



Figure 2- Main Presentation Screen

A presentation can be deleted or reused. Reusing a presentation can take many forms. One can reuse a presentation to teach the same course or alter the presentation to fit a different educational domain. The presentation created by an educator can be used by other educators as is or altered. Learning Objects that are copyrighted are protected since copyright information is stored in the LOM metadata set.

IV. OTHER SERVICES OFFERED TO USERS

User services relate to platform services available to all course users but which are not related specifically to course learning material (e.g., messaging between learners/instructors, calendar, live chat, and document exchange services etc) [8].

Diplek includes a number of tools to enable learners with organizing time, organizing personal workspace, checking course grades e.t.c. These services run as components and can be configured by the instructor. All tools use a common UI and

use simple command buttons to perform an action. The design of these tools was made taking into account the difficulties a novice user faces when using them. The following tools are meant to be used both by learners and instructors.

- Profile Manager
- My Calendar
- Sketch book
- My Grades (GradeBook)
- My documents (e-portfolio)
- My mail
- Live chat

Even though, the most frequently used communication tool is e-mail and it is mainly used for personal correspondence among the students [9], there are other communication tools like instant messaging, live chat and discussion forums. Diplek offers three kinds of communication tools: integrated messaging tool, live chat and email.

A. My Calendar

Calendar is a powerful feature that allows students and faculty to manage both academic and personal events. A learner must be given the ability to schedule lectures, tests, assignments and other learning processes during a week/month/year.

Instructors need to mark important dates and schedule learning activities. This tool comes in handy in case of the student users who can schedule their lectures, tests and assignment delivery. The calendar service is directly connected to the virtual assistants' services to inform user with upcoming events.

B. My Documents

Diplek supports personalization of learning and encourages users to have their own personal workspace where they can store files. These files can be anything from a single text file to an interactive multimedia game. All documents (files) can be extracted with a single click of a mouse and can be transferred to another user of the platform or even a student or instructor of another system.

C. Sketch book

Another tool that follows the learning personalization logic is the "sketch book". The use of this tool provides user with a place to enter information found from different sources (internet, educational objects, chat e.t.c) and stores them in a container that is always available during a session. Learners can search information from the web and insert it to the sketch book. This information can be saved as formatted text combined with images, and other multimedia features like sound, video, animation e.t.c. The layout of the window resembles that of an exercise book and all actions can be performed either from the top menu or by right clicking the mouse on a word or other text.

Diplek provides several other useful tools that can be used to assist learners like a calculator, a drawing tool and a web browser for internet access. Another category of tools provided by the platform are the collaborative-communication tools.

D. Live chat

Live Chat (or instantaneous mail) allows a real time discussion between all members of the platform. This is an exciting way for students to communicate directly with each other in real time, and a unique way for instructors to hold office hours. Live chat discussions can be archived for later review. Most of the people are familiar with the terms chat and internet channels. For those that are not, live chat is a tool used to simulate a room with people talking "Fig. 3,". Diplek does not require complex setup of chat space and the tool is ready for use when a user selects the chat option. All conversations in the room are public so that everyone can watch and participate.

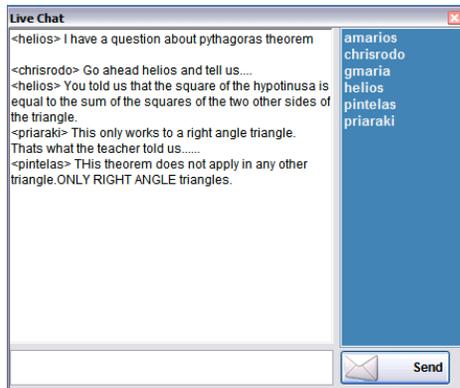


Figure 3- Live chat Window

A teacher can use this tool to give guidance to students from distance while they are watching a presentation or working on a project. This way, all students get the same information and can ask questions that everyone can see. The use of this tool is needed in order to build a collaborative community that each user learns from the other.

This tool is not recommended to be used for personal messages since every one that is in the room can see the message. For that purpose another tool can be used called 'My Mail'. This tool is a simple messaging system for all the users that have access to the platform.

E. My Mail

A less exciting but still as useful as the live chat tool, is the 'My mail' service. This tool is needed for users to communicate with each other in private. The way this tool works is similar to that of the email service, but instead of email addresses, users only have to know the username of the user that they want to communicate with. Also, this tool does not require the existence of an internet connection since it uses the available LAN to deliver messages to users.

All communication logs are available to the user through a centralized system. This system gives the ability to the user to delete, create and check for new messages. A teacher has the ability to send a message to the whole classroom or to a specific user whereas student has only the ability to send a message to a specific user (student or teacher).

V. STUDENT EVALUATION AND ASSESSMENT

Byers [10] describes interactive assessment in learning environments as promoting dynamic feedback and course corrections on the fly. This part of the platform measures student performance against specified goals, using a variety of services ranging from multiple choice questions to complex assignment handling

There are many ways for evaluating a student's progress. The most common are tests, projects and assignments. In order to cover most of these evaluation methods, Diplek includes tools that automate the above procedures. An easy and intuitive wizard-based method is introduced in order for instructors to use them.

A. Multiple choice tests

Most LMS provide templates for multiple-choice questions, true/false questions, matching questions, or short answer questions [11]. Multiple choice tests "Fig. 4," are an easy way of assessment and evaluation. Nevertheless, it is also a way for learners to check their learning progress. To manage the creation of multiple choice tests, Diplek incorporates services for question and test creation, test delivery and test result analysis. Instructors can create a number of questions with the desired set of answers. Each question can be given a difficulty level and can be included in one or more tests and if the instructor permits it, it can be shared by other instructors on the platform. When the test is ready, it can be assigned to a student or a group. Multiple choice tests can be used both for assessment and self evaluation.

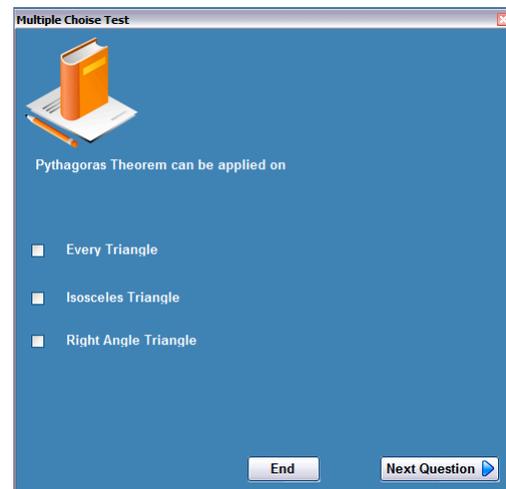


Figure 4- Multiple Choice Tests

When a test is finished, a log file is created. Instructors can view usage information by the use of the test results analyze tool so that they can determine if a test is suitable for a group or a student and make the necessary changes so that it fits the learning goals.

B. Project - Assignment Management System

Another method used for assessing a student's performance is the project assignment service. This is a very common method used in many educational institutions. Students are involved in a search and learn procedure guided by their

instructor. At the end of the day they present a document with their findings. Diplek supports this assessment method with the use of the project management service. This service can be used for the creation of an assignment, delivery and evaluation.

Teachers can create or import projects through a user friendly wizard, where they are asked to insert the guidelines, instructions to students, relevant files and deadline. After that, they can assign the selected projects to groups or individuals. Students are notified for the new assignment by either the teaching or the virtual assistant service. When the project finishes, students deliver it to the teacher by using the platform delivery tool. Teachers evaluate the project and mark it as checked. All checked projects are available to both the student and the teacher with added comments and corrections.

C. Grading system

'My Grades' tool provides the educator a list of all students attending a course where he/she can assign a grade to each one of them. Student's have access to their grades and can see them as a list. Sometimes it is more convenient to just have a printed list of all students and their grades to be published in the announcement board or delivered as an email. 'My grades' tool gives teachers the option to do that with an export tool that saves a list of grades as a spreadsheet.

Teachers can get statistics for each group or course regarding their grades assigned to students enrolled in the specific class or course. Statistical data are separated to grades per course and grades per group.

VI. USER GUIDANCE AND SUPPORT

Diplek offers besides the standard online and printed manual documentation, two additional ways of helping its users.

Teaching & Virtual Assistants

The large number of settings and services offered by the platform may prove counterproductive for the user who just wants to do some simple tasks. That's why Diplek incorporates such a tool called the 'Teaching Assistant', which is available to all students and educators.

This assistant provides information to the user about new messages, new project assignments and things to do from the calendar. User can enable and disable this feature with the click of a button so that it doesn't take space when not needed.

In addition to the Teaching Assistant, a second assistant that has a friendlier look is available to the student user. The Virtual Assistant has the form of a wizard and shows up after a successful login. It provides information about date and time of day and informs the user about new messages, projects or tests assigned to him. This information comes with instructions of how to get access to the appropriate item so that user won't have to ask how to do that.

A. Session recording service

LMS gather large logs of data of student activities during courses and usually have built-in monitoring features that enable the instructors to view some statistical data, such as a student's frequency of login, time taken on a course or a test,

the number of messages the student has read or sent, marks achieved in tests, etc.

Instructors may use this information to monitor the student's progress and to identify potential problems. However, tracking data is usually provided in a tabular format, is often incomprehensible, with a poor logical organization, and is difficult to follow. As a result, Web log data is used by only few skilled and technically advanced distance learning instructors [3].

The session recording service is an innovative approach to logging students progress and learning achievements through a session. The use of this service provides the teacher with video feedback of a student's session. This feedback consists of all student actions, conversations, mouse movements, services used e.t.c. All these are recorded and saved in a video file which can be played in any video player.

Educators can view these recordings on a daily, weekly or monthly basis. By analyzing each students file, a general conclusion can be exported about the student's progress. This procedure brings a great help to the early diagnose of some of the educational difficulties that occur to students.

Session recording service can be activated for selected users or groups and is by default deactivated since it consumes a lot of system resources and is not always needed.

VII. CONCLUSIONS

Diplek is a service oriented LMS that was designed to help novice educators to get involved in e-learning technologies. There is a plethora of LMS out in the market that can be used with a lot of great features. Diplek is not trying to compete with other LMS. More likely Diplek is intended to be used in smaller educational domains where computer experts are hard to find and the need for an easy to use LMS is prominent. The use of Diplek is recommended in situations where a continuous monitoring is needed i.e Students with educational difficulties and learning disorders.

Diplek will be distributed under an open-source license by summer 2009.

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