

KUZEM LMS: A new learning management system for online education

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Abstract

E-learning has made rapid strides in recent years thanks to the advances in educational technology. Many educational institutions have started e-learning. In e-learning, there is a need for administration, documentation, delivery of the course content and tracking students' performances all of which are done by the help of a software called Learning Management System (LMS). A robust LMS is a requirement for achieving the goals of the institution providing e-learning. There are basically three kinds of LMS: open source, commercial and institution-based (self-developed). All of them have advantages and disadvantages. Choosing the type of LMS to be used by any institution depends on the decision makers of that institution. Decision makers in Kirikkale University chose to develop its own LMS depending on the individual needs of its distance education center. In this study, a new learning management system called KUZEM LMS, created by the software development team of Kirikkale University and used in the Distance Education Center of the same university is aimed to be introduced. The features of the KUZEM LMS are given in detail and a comparison of it is made with the other LMSs.

Keywords: E-learning; Learning Management Systems; LMS design; LMS Comparison
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1. Introduction

E-learning has rapid strides over past 20 years. At the beginning e-learning was not accepted as an alternative to traditional learning but in time e-learning proved to be successful at least the traditional one [1]. Today, the use of e-learning has been increased with the tendency of universities and institutions stating to provide this kind of learning model [2] and

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e-learning has been widely used by universities in recent years [3-5]. In Turkey, for instance, most of the universities offer online graduate programs and hybrid courses to their students. E-learning depends basically on internet technologies that are mostly web-based [6]. The number of internet users all over the world has been increased at a level of 380% and reaches 1.7 billion users between 2000 and 2009 [7]. According to recent statistics, internet usage ratio all over the world has reached 30.2% percentage (Internet World Stats, 2011). E-learning will be the dominant education model in the future with the driving force of the advances in information technologies [8]. E-learning has many advantages including students' access to lectures without any limitation in terms of time and place, their easy communication with the teachers and benefitting from enhanced lecture materials [9].

Online education consists of two main parts which includes necessary software to reach participants at distant locations and rich course content. Student, tutor, computer, internet, necessary software tools and learning materials are all integral parts of e-learning delivered by Learning Management Systems (LMS). One of the purposes of LMSs is to coordinate those items, manage sustainable learning process and get necessary statistical reports and outcomes [10]. Since online learning is carried out at different locations and times, the participants are isolated and separated from each other. Because of the requirement to carefully conduct this learning process, organized team working is required and LMSs should be well designed [11]. In design, learners' expectations such as functionality, acceptable system response time and user friendly software should be taken into consideration [12]. LMSs are available at three different ways:

Open source: Over 50 small and large scale open source LMS solutions have been developed and distributed worldwide [13]. Moodle, Ilias, Sakai, dotLRN, Claroline and Atutor are examples of the commonly used LMSs and have approximately thousands of installation worldwide. All the solutions have advantages over other but none of them can provide a complete satisfaction in e-learning [13]. Although open source solutions are easy to use, manage and deploy, there are remarkable obstacles. Despite the expectation of zero cost from the open source LMS, IT experts are needed for maintenance and installation [14]. Stating that open source solutions have a power of creating, deploying and managing robust systems is hard [15].

Commercial products: There are well designed LMS solutions in the market [8] including many global software corporations such as IBM and Oracle. Due to the dynamic structure and the urgent need to focus on bugs while using these LMSs in the e-learning, they do not satisfy customers well. Additionally, expensive license fee, maintenance costs and the other obstacles such as fixing reported bugs timely and making additions to the system immediately when needed are the undesired parts of these commercial software's.

Institute-based or Self-developed products: Institutes that have qualified and adequate Information Technologies employees can design their own LMSs meeting their own needs. Developing an LMS from scratch is, however, the most difficult choice since it requires system analysis, database management, code implementation and system test phases. This kind of LMSs constitute %13.1 of all the market according to observations conducted on 1932 organizations in 2008 [14]. Besides, according to a survey, self-developed systems are regarded favorable by institutes when institutions have enough computer mediated specialists to constitute LMS according to the needs of the institution. The same survey, conducted on 35 of 113 European Institutions, determines that self-developed LMSs are preferred because of the high cost and complex structure of commercial LMSs, not allowing local changes or upgrades easily [16]. However, such a self-developed LMS can be developed considering the needs and policies of the institution and meet the urgent needs of that institution during the

implementation process. Since the perspectives of the tutors in the institution and the expectations and needs of the university differ from those of others, in online education, it is essential to develop your own know-hows [15].

Distance Education Center of Kirikkale University preferred to develop its own LMS taking into account the needs of its Distance Education Center (KUZEM). The aim of this study is to introduce the LMS development process of Kirikkale University.

2. LMS model of Kirikkale University

2.1. Infrastructure of the system

For programming environments, *Asp.Net* has been chosen. This web programming language has various advantages over others like PHP and Perl. One of the benefits of asp.net is that it gives much server side built-in functions that are wrapped and called. *Net framework* and is fully object oriented language. Framework architecture has been continuously developing and now 4.0 version of this Framework by Microsoft is used in our system.

Mssql, a database, is used because it has native connections properties to asp.net and it is robust, reliable, fast and able to overcome huge amount of data. Microsoft Sql Server 2008 version is preferred and has been used in the system successfully. It is clear that when a web page needs data pulled from server side database, asp.net must be first choose [17].

Web site programming consists of web pages that are independent from each other and makes distinctive operations. At our site (www.kuzem.kku.edu.tr) more than 50 web pages each of which are responsible for one task such as login, messages, forums, chats, exams and etc. are used. Database which are formed by relational database design standards, also has 28 tables including course definitions, course contents, logs, forums, chats, exams, student's tracking data, tutors and other data.

2. 2. Current LMS statistics:

Kirikkale University has started e-learning in 2009 in the Department of Computer Programming with 150 students. In 2011 fall semester, there are more than 2000 students attending nearly 50 distance courses in 10 departments. At near future, there will probably be more than 10000 students attending 250 courses at all departments.

3. LMS activities, learning tools

LMS supports learning activity main tools as shown in Table 1. These tools are crucial for LMS and the modules may also have sub-modules that enforce the learning process such as messages consisting of sub-modules of unread pending messages, read messages, posted messages and sending new message.

Table 1. LMS Modules

LMS MODULES	
Login and LMS URL	Exams
User Main menu page	Course Content page
Messages	Course content preparation and design
Assignments	Course registration
Forums	Course statistics
Chats	Admin Panel

3. 1. Login

Enrolled students, tutors and administrative staff can use the web site address

www.kuzem.kku.edu.tr (Default.aspx page of site is in Fig. 1.) for accessing the LMS main menu. Every person with right to access to the site has a username and corresponding password is stored in database and all related information about successful connections is saved in the database and user login process has several security properties for hackers' attacks such as sql injection and brute force (at server site more than 5 incorrect connection attempts with the same ip in 2 minutes is obstructed for 15 minutes).



Fig. 1. Kuzem.kku.edu.tr start page.

3. 2. Main Menu Page

LMS has a user main menu page that includes nearly all the necessary shortcuts of activities. At this page, menu items, short cuts, synopsis about last login, news, announcements, calendar, problems notification, survey and user comments can be reached. When the page in Fig.2 is loaded, user must choice one of the enrolled lessons, then, main menu becomes active. This page consists of the following parts:

Last login information: At this part, user's last login date, time, new messages sent by tutor or other students, assignments not unexpired and average grade of older assignments are shown.

Announcements: Administrative or course oriented information messages are shown here. With this, students are informed about the latest news.

Surveys: Tutors or administrators give some multiply choice survey to students about course content, university facilities or others. Students can give a feedback about courses and LMS activities.

Problem notification: Users report system bugs, any obstacles for efficient program use or suggestions including efficient and intended use of e-learning system. It is especially important that e-learning users be immediately satisfied when they encounter any problems and this is one of the main factors affecting the quality of LMS [18].

Calendar: This function is important for users to be informed about particular events without any stress of memorizing [19]. Users make events for exam date, assignments' deadline, meetings date, virtual classroom date and etc. When the system reaches one of the scheduled dates, it posts alert message to users' e-mail addresses and display warning message at the main menu page.

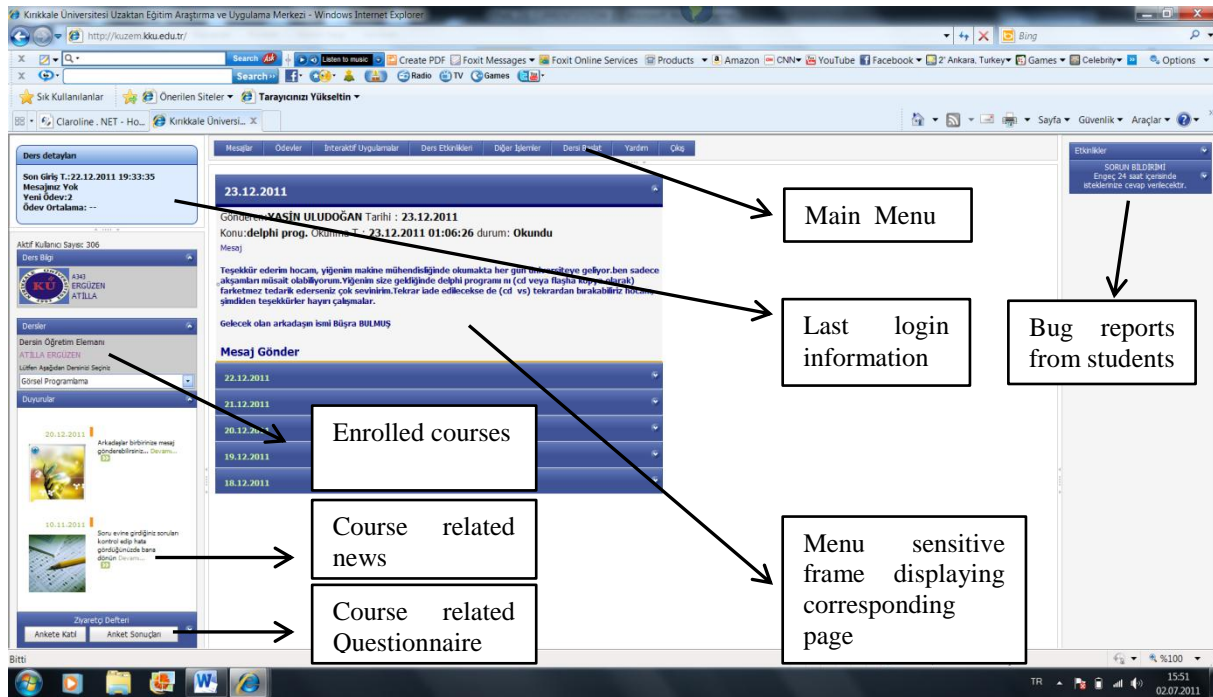


Fig. 2. Main menu page.

3. 3. Messages module

One of the essential parts of LMS is messaging activities through which participants send opinions, questions and confirmation messages to each other. The interaction between participants (student, tutor) has positive effects on intended distance education benefits that lead to high student motivation and comprehensive feedback for tutor [20]. Lack of communication between the actors of learning process has yielded decline in the intended characteristics of education [21]. One of the latest surveys indicates that students' perspectives for course related activities are vital for efficient LMSs [22]. This message module enforces course activities and let participants get necessary information from tutor or other peers. Message module differs from e-mail messaging system in that senders get information on posted message whether the message is read by recipient and which ip is used as client machine. In addition, this system supports e-mail messaging system. This module is used at various activities: when assignment is put and graded by the tutor, when a message is posted to the forum about the subject related to student. In addition messages attached to the content can be seen by other students studying the course content. Another important part of this tool is that it is used for feedback which is a significant part of LMS [8]. In assignment module, when message module has a posting, it immediately sends the copy of it to corresponding e-mail addresses. At this page, users have several menu options including unread messages, read messages, posting new message and list of all posted messages. All messages have identifying attributes such as posting date, reading date, posting ip and status (read, unread) and these attributes are changed by server automatically without any user intervention. Senders are therefore able to know the status of the message whether it is read or unread. With this facility, students can easily check their message boxes regularly to know about tutor's recommendations, new ideas about course content and feedbacks from tutor or other peers. Message module has also the capabilities of multimedia support, rich editing and uploading files options and message is sent to server as HTML format by using client side HTML editor.

3. 4. *Assignments*

Traditional tutor-centered learning processes are becoming into student-centered learning in which problem based learning, discussions about specific topics and assignments are involved [23]. Assignments are one of the best activities that make learning process student-centered and more active and they place responsibility on peers for their own learning. Coursework reinforces students' understanding of course topics, and inspires them to get higher grades compared to stand alone examinations without any assignments at up to 12% [24]. Another research results show that students prefer assignment activities ranging from quizzes and forums to advance knowledge and assignments make the students learn better [25]. At our LMS, lecturer gives assignments to students according to course topics, 3 times at average. Each assignment is stored in LMS and seen on student's main page with properties such as subject, related topics, deadline, group or individual work. Each student receiving assignment must submit it before deadline with help of message module described earlier. All submissions are collected in tutors' assignment inbox for analysis and grading. The system automatically sends status messages that assignment is received and graded. Graded documents have a positive effect on the motivation and success of the learner since assignments not having reward and punishment options do not arouse interest on the students. [26,27]. Immediate and regular feedback has crucial effects on students' perception of educational outcomes and goals [24,28]. With assignments tutors can get feedback about the level of the students [29]. Tutors can, therefore, intervene in the learning process, if needed, and change the type of the teaching or give additional materials to the students.

3. 5. *Forums*

All LMS solutions (open source, commercial and self-developed), actually, should have forum tools for students to discuss, explain and facilitate the learning process via internet based tools [3]. The main factor behind forum structure is that participants get detailed knowledge about hard to understand topics, to discuss problems each other, to explain or to share covered topics to others. Forum structure generally has asynchronous mechanism, that is, if someone posts a message to other participants for help about course or any other related topics; he/she has to wait some time for one of the receivers write back. In face to face education model, student-instructor interactions is performed very well, but this is not the case in student-student interaction. However, in forums, student-student interaction is supported by the system itself [30]. The main theme of forums is learning activities of participants with each other and when activity level increase better learning outcomes can occur. This is the fact that forums supply suitable conditions in which participants is active through learning [31]. Forums are beneficial, easy to use and make learning process effective with interactive tools in LMSs environments [32,33,34,35]. In comparison to traditional or on the phone learning, online interactive activities contribute to efficient learning outcomes and many participants feel that they advance their learning abilities [31,5]. Conversations and discussions create an opportunity for students to explain their regards and offer a clear consistent, constructivist learning method [36,37]. Due to the dynamic and interactive structure of forums, students prefer this tool as a second important one after the quizzes [25]. However, despite it is used by students as a second tool, participants in the forum make a posting at average less than one in a week, which seems to be developed and to be made more exciting for participants to contribute to forum discussions by the LMS designers [30]. To overcome this drawback, a new forum structure is developed in which forum links are also embedded in course content, resulting in more interactive discussions [3]. This new approach

is successfully implemented and used in our LMS course content structure as shown below. At this framework, course content may have several forum link buttons according to tutors' educational perspectives and each link shows only related forum discussions to the content part which prevents student reading many messages unrelated to that part of the content.

3. 6. Chat rooms

One of the gaps constantly criticized by many researchers is that online education lacks face to face and instant chat between student and teacher. However this obstacle is overcome by the use of instant messaging between teachers and students. All the participants' can see all posted messages immediately and participants may send messages to others about the chat subject. In addition, when web cam, microphone and audio devices are added to chat mechanism, participants have the opportunity of talking face-to-face. On the internet, there have been a lot of chat programs that for LMSs to construct their chat utilities and it is important to say that properties and capabilities of chat programs are continuously evolving [38]. Chat activities have resulted in the following educational outcomes:

- Make participants more social, it is time to say that e-learners has self-oriented attitude [39]
- When tutor is participated in chat session, this has motivation on students for attending the course [39]
- Participants get knowledge of class's learning level [38]
- Participants discuss and learn unknown blind spot topics about course topics
- Participants should have more incorporated in learning activities by means of using chat module

At our LMS chat rooms are started by tutor at any time and participants are involved in chat session. Start and close actions are performed by tutor and any open session is available for participation until it is closed. At any time for open session, when a new participant involves in session, all previously text messages are read from server, giving an opportunity for the newcomers to have a historical view of posted messages.

3. 7. Online examinations

Examinations are important in assessing the learning process of the students. Exams have been used for assessment in traditional education and online education in order to obtain enough information on current education level of students and have positive effects. [40]. With the advances in information technologies, exams can easily be processed in an attractive manner [41]. In the literature, there have been a lot of surveys focusing on exam types and their educational perspectives [28]. LMSs should have exam modules in order to facilitate learning, assess what is learnt. At our LMS multiply choice questions are asked to students before the course topic (pre-test), after the course activity (post-test) and as a general one. Immediate detailed feedback is given for each of these tests and grades are seen in a whole class list.

3. 8. Course content activities

Course content activities are as important as course content preparation or LMS being used. No matter how good enough the course content, offering an effective, user-friendly and interactive format is obviously important. Course content is evolving from text based format to multimedia supported rich text format [42] in which students read, see, hear, imagine, discuss, get or send messages, take quizzes, visit the predefined links and so on. All the multimedia functions that is aimed to facilitate the learning process should be carefully inserted into LMSs content manager screen without making any complex technical obstacle with unnecessary frames and links [42]. Nearly all LMSs use navigation tree menu for course subjects that are categorized by semester, week or related topics.

Course Content is generally received from server at HTML page format which is stored in

course directory with describing unique page name when users select from the navigation tree. There are two alternatives to get the content from the server: first is that generating a HTML page stored in server with that name and second one is that requesting the selected content from the server via AJAX properties. The second one is rarely used since it requires extra database design works, database commands. HTML page solution is easy to implement, however, when the number of the students and courses increase, it creates the following difficulties:

- For each course, the stuff of LMSs has to deal with creation, opening and managing the associated folders.
- Internet service provider requires extra search and loading operations to find requested page from hundreds of folders leading the need for extra loading time depending on the database method used.
- Reconstruction of any document is quite difficult, decreasing the reusability of the LMS.

Database scenario means that all course topics are stored in database with identifying primary index topics and a generic handler responsible for client request is used to send petition data via AJAX architecture. When user clicks a course topic, script responsible for ajax immediately sends asynchronous HttpRequest message to the server and when get the message, it displays on the screen, course navigation tree and content are displayed with embedded forum links.

At our LMS, the following properties most of which are included in other LMSs course content are;

- Instant messaging property which online users make chat on course content
- At each course subject related to curriculum week, there is question bank in which students ask questions or make comments.
- For each course, there is a question house in which students prepare questions and have a test from other students' questions.
- For each topic for tutor, there is a course content editing functionality. By using this property, tutor can make any changes on content.
- A forum link can be integrated in course content. This structure is different from other LMSs' forum module that has separate forum links. At our system, tutor can insert forum links for each topic associated to questions or homework.
- All courses and related topics are stored in database that is easy to manage.
- Full AJAX implementation is used to get necessary data from server.
- At each course, students create self html page and can view all the other students' pages.
- For each topic, there are pre-tests and post tests and if pre-test is not finished, client system disables the current topics until the test is finished.

4. Comparison

As previously mentioned there have been a lot of LMSs in the world but a few of them are widespread and popular. Two of the mostly used LMSs are Blackboard, a commercial product, and Moodle, an open source. Following comparison tables (Table 2 – Table 8) conducted by Ralf Otto of Ruhr–University, Bochum in Germany includes nearly 100 criteria and is also published by Thibault [43]. Our LMS is included in this comparison with some adaptations.

4.1. Content comparison

Table 2. Comparison of Content Functionality

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Files	yes	yes	yes
Directories / Folder	yes	yes	yes
Create / extract file archives	yes	yes	yes
Blank Page / Page	yes	yes	yes
HTML-Editor	yes (formula editor)	yes (with LaTeX filter)	yes
Multilanguage filter	no	yes	no
External links	yes	yes	yes
Internal links	yes	yes (no separate feature, but Moodle uses permanent links)	yes
Audio	yes (embedded QuickTime-Plugin, Internet Explorer uses WM-Plugin)	yes (embedded Flow Player)	yes (embedded QuickTime-Plugin, Internet Explorer uses WM-Plugin)
Video	yes (MPG + WMV in all Browsers with installed QT-Plugin, Internet Explorer uses Windows Media-Plugin FLV + MP4 are not supported)	yes (FLV embedded FlowPlayer in all browsers MPG only with Internet Explorer and installed Plugins WMV only with Internet Explorer and installed Plugins MP4 only with Internet Explorer and Chrome)	yes (MPG + WMV in all Browsers with installed QT-Plugin, Internet Explorer uses Windows Media-Plugin FLV supported, MP4 are not supported)
S.C.O.R.M.	yes	yes	no
IMS-Content-Package	yes	yes	yes
Question bank integrated into content*	no	no	yes
Topic summary*	no	no	yes
Students contribution integrated into content *	no	no	yes
Forum integrated into content *	no	no	yes
Student grading the Tutorial content* (LMS automatically generate codes)	no	no	yes

*Item is added by the researcher to represent the additional properties of the system in question (KUZEM LMS).

4. 2. Assignment comparison

Table 3. Comparison of Assignment

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Upload a single file	yes (assignment)	yes	yes
Upload multiple files	yes (assignment)	yes	no
Online text	yes (quiz)	yes	yes (assignment)
Offline activity (create a gradebook item)	yes	yes	yes

4. 3. Tools

Table 4. Comparison of LMS Tools

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Glossary	yes (only editable by the instructor)	yes (participants can also add entries) + glossary block	no
RSS Feeds		yes (database, forum, glossary)	yes (exams and question bank only)
Blogs	yes (course-bound)	yes (system-wide and within a course)	yes (within the course)
Graded blogs	yes	no	no
Lesson	yes	yes	yes
Self and Peer Assessment	yes	yes (Workshop)	yes
Survey / Feedback	yes	yes	yes
Address book / contacts	yes	yes (messaging system)	yes (enrolled students for each course)
Calendar (course) database	yes	yes	yes
Adaptive release / restrict access	no	yes	no
	yes (scheduled, depending on grade, depending on total course grade, depends on access to defined content, define your own rules)	yes (scheduled, depending on grade, depending on total course grade, depends on access to defined content/activities)	no
File storage / exchange	yes (instructors can use the file area, students can use file exchange in their group)	yes (my private files, students can use the database activity)	yes instructor and students share the same area
Plagiarism check	yes (Safe Assign integrated)	not integrated, but there is an API for such services	no
Search files (course)	only with a corresponding building block (e.g. Search XL)	no (only global search development!)	yes
Journal	yes	no	no
Graded journal	yes	no	no
Activity completion	yes	yes (content is marked as completed when accessed or participants are allowed to mark content as completed by themselves)	yes (for each content duration time is stored)
Wiki	yes	yes	no
Graded wiki	yes	no	no
Voice tools (Mail/Recorder/...)	only if Wimba Voice Tools are installed	no (NanoGong implementation for 2.0 ?)	no

4. 4. Forums

Table 5. Comparison of Supported Forum Properties

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Forum:	yes	yes	yes
- Anonymous posts	yes	no	no
- Attach a file	yes	yes	yes
-Participants can create threads	yes	yes	no
-Tutor make comments and grade posting*	no	no	yes
- Subscribe forum	yes	yes	yes
- Subscribe threads	yes	no	no
- Moderate a forum	yes	no	yes
Graded forum	yes	yes	yes
Search forums	yes	yes (block)	no
Course Announcements / News forum	yes	yes	yes
Group management	yes	yes	no
Group selection	yes	no (Groupchoice implementation for 2.0 ?)	no
Group tools	email, blog / wiki / journal / discussion forum (graded), chat, tasks, file exchange	wiki, forum, glossary, database, chat, test, choice, workshop, lesson, assignments	forum, chat, instant messaging, question bank

4. 5. Test and Communication

Table 5. Comparison of Test and Communication

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Pools / question bank	yes	yes	yes
Export test results	yes	yes	yes
Export submissions (answers)	yes	no	yes
Send emails	yes	yes, using the messaging system, Quickmail implementation for 2.0 ?	yes
Send messages	yes	yes (using the participants block or using the messaging system)	yes
Chat	yes	yes	yes
Discussion board / forum	yes	yes	yes
Change type of forum	yes (by configuring e.g. single discussion)	yes (standard, question and answer forum, single discussion, each person posts one discussion)	yes (tutor responsible for type of)

4. 6. Supportive Tools

Table 6. Comparison of Supportive Tools

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Course reports	yes	yes	yes
Grade center / grades	yes	yes	yes
Early warning system	yes	no	yes
Customization / settings (Name, duration, enrollment, language, guest login, availability)	yes	yes	yes
Course formats (forum, topics format, weekly format)	no	yes	no
Meta-enrollment	only if Community System is installed	yes	no
Manage course menu	yes	restricted (course menu gets built from existing content)	restricted
Customize course style	yes (menu, banner and theme)	yes (course theme, use label resource to add a banner)	restricted
Folder structure	yes	only for files	yes
Manage Tools	yes	yes	yes
Course backup / export	yes	yes	yes
Course import	yes	yes	yes
Course restore	yes	yes	yes
Import content/features from other courses	yes	yes	yes
File management	yes (course-bound)	yes (user-bound / course-bound)	yes
File quota	yes (course-bound)	yes (user-bound)	yes(course - bound)
Activities occurs at the same course page*	no	no	yes
Course week design Html based*(full)	no	restricted (predefined style)	yes

*Item is added by the researcher to represent the additional properties of the system in question (KUZEM LMS).

4. 7. Home Page Properties

Table 7. Comparison of Home Page Properties

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
RSS Feeds	no	yes	yes
Announcements / News forum	yes	yes	yes
To do list / Upcoming Events (block)	yes	yes	yes
Messages	no	yes	yes
Report card / quiz results	yes	yes (block)	yes
Online users	yes (Pronto Instant Messenger)	yes (using messaging system or online user block)	yes
My calendar	yes	yes	yes
Navigation	yes, using MyPlaces to navigate to your courses	yes, using navigation block to navigate through: My Home, Blogs, courses, topics, participants, ...	Restricted using menu bar
Download of complete course content	no	no (resource download implementation for 2.0 ?)	yes
Personal information / profile	yes	yes	yes
Create a downloadable list of participants	yes (using the grade export: name, define additional columns)	yes (using the grade export: name, email, university id)	yes
Un-enroll form a course	yes (E-merge un-enrollment tool)	yes (un-enroll self from course)	yes (un-enroll self from course)

4. 8. Permissions and roles

Table 8. Comparison of User Roles

Features / LMS	Blackboard 9.1 SP3	Moodle 2.0.1+	KUZEM LMS
Pre-defined roles	instructor, teaching assistant, course builder, grader, student, guest	Site administrator, manager, course creator, editing teacher, teacher, student, guest, user, frontpage	Site administrator, course creator, teacher, student
Edit existing roles	yes	yes	no
Define new roles	yes	yes	no
Switch between trainer & participant	yes (editing off = participant view)	yes	yes

5. Conclusion

There have been many LMS used in e-learning environment in the world. In this study, a new LMS developed according to the need of our university is introduced. Differences between two well-known LMSs and ours are quite low. These differences exist in themes and user roles. In addition to being a robust LMS, Kuzem LMS is especially rich and effective in terms of content presentation. The content in KUZEM LMS is interactive and includes many properties such as forum and instant chat embedded in the course content. Moreover, students can add to the content, ask questions and grade the quality of course content prepared by the tutors [44, 45]. In addition, all these are arranged properly with navigation tools in order to ease learning. When considered the time spent by the students in content page, such features making the content interactive and effective are actually one of the most important parts of LMSs. KUZEM LMS is rapidly evolving depending on the needs of the Distance Education Center of Kirikkale University. The most important aspect of the development of LMS is that institutions should have the opportunity to modify and rearrange the system. By developing LMS with your own potential has following gains:

- Save financial resources of the universities
- Make a competition to reach better LMS products in short time
- No need to look forward to latest upgrades
- Immediate solutions to system crashes or problems and easy maintenance
- Design LMS easily by participants feedback

Since the needs of the developing an LMS from scratch is probably the most effective solution to meet these needs. In this study, KUZEM LMS is introduced and development process and modules of this new system is explained in detail which can also be used as an example by other institutions wanting to develop their own LMSs.

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